

Article

A Multidimensional Approach to National Defense Education in Universities: From Awareness and Environment to Evaluation Reform

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Abstract: National security and defense education in universities has often faced challenges in systematic integration, sometimes focusing on foundational awareness rather than deeper institutional embedding. This study advances a multidimensional framework that reorients defense education from isolated curricular modules toward a coherent institutional ecosystem. Drawing on empirical study across twelve higher education institutions, the research identifies three interlocking dimensions: cognitive awareness (knowledge acquisition and critical reflection), environmental embedding (campus culture, infrastructure, and cross-departmental coordination), and evaluation reform (shifting from summative testing to competency-based, longitudinal assessment). A mixed-methods design combines policy document analysis, structured interviews with faculty and administrators, classroom observation protocols, and institutional self-assessment data. Findings indicate opportunities for further optimization: while 92% of institutions report mandatory defense courses, only 31% integrate content into non-military disciplines; campus environments show strong symbolic presence but weak participatory mechanisms; and evaluation remains primarily exam-centric, highlighting the need for more comprehensive indicators for defense literacy and ethical judgment. The proposed framework introduces a recursive logic model—where awareness informs environment design, environment shapes evaluation criteria, and evaluation feedback loops refine awareness strategies. Implementation pathways include modular curriculum scaffolding, co-curricular 'defense learning communities', and tiered institutional certification aligned with quality assurance standards. This approach moves beyond pedagogical supplementation to structural recalibration—positioning defense education not as an add-on, but as a core dimension of holistic university mission fulfillment.

Keywords: defense education; university curriculum; evaluation reform

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1. Introduction

1.1. The Institutional Imperative

National defense education in universities is undergoing a meaningful redefinition—not merely as traditional tactical training, but as a vital component of comprehensive student development, technological innovation, and social responsibility. [1]. Institutions now face mounting expectations to cultivate not only technical competence but also strategic literacy, ethical discernment, and collective responsibility across security domains [2]. Yet implementation remains uneven: curricular integration is often episodic rather than systemic; pedagogical approaches lack coherence across disciplines; and administrative oversight remains fragmented across academic, student affairs, and external liaison units. This institutional fragmentation impedes scalability, assessment rigor, and longitudinal impact tracking. Moreover, evolving threats—cyber, hybrid, and cognitive-demand pedagogical agility that current frameworks seldom support. The imperative is thus structural: to embed defense education within core academic missions

rather than treat it as an ancillary compliance exercise. Such embedding requires realigned incentives, faculty development pathways, cross-departmental governance mechanisms, and metrics aligned with learning outcomes rather than procedural completion. Without deliberate institutional redesign, efforts risk remaining peripheral, under-resourced, and disconnected from broader educational objectives [1, 3].

1.2. Conceptual Gaps and Operational Fractures

Three persistent conceptual and operational gaps systematically erode the efficacy of national defense education in higher education institutions. First, awareness remains narrowly construed as factual recall rather than cultivated as contextualized, critically engaged understanding-limiting its transferability to real-world security challenges. Second, the institutional environment-both physical infrastructure and cultural norms-fails to sustain pedagogical continuity beyond isolated classrooms or infrequent ceremonial drills, thereby decoupling learning from daily academic and social practice [4, 5]. Third, prevailing evaluation frameworks rely almost exclusively on summative, knowledge-based assessments that are structurally incapable of measuring behavioral shifts, attitudinal maturation, or integrative competence across disciplinary domains. These fractures collectively impede the realization of core policy objectives: the formation of informed, ethically grounded citizenship and the development of adaptive, context-responsive readiness. Without deliberate alignment among cognitive scaffolding, environmental reinforcement, and multidimensional assessment, defense education risks institutionalization without internalization-functioning as procedural compliance rather than transformative capacity building [6]. Addressing these interlocking deficits demands not incremental adjustment but structural reimagining of how defense literacy is defined, embedded, and validated within the university ecosystem [7, 8].

1.3. Scope and Orientation of This Study

This study delineates a bounded yet expansive scope centered on the structural reconfiguration of national defense education within higher education institutions. Rather than treating awareness, environment, and evaluation as discrete phases, the research advances them as co-constitutive dimensions operating through recursive institutional logics. The orientation is explicitly non-linear, foregrounding dynamic interdependencies over sequential progression. Fieldwork encompasses three institutionally distinct university archetypes-comprehensive universities, science-technology intensive institutions, and regionally anchored universities-to capture variation in governance capacity, resource allocation patterns, and pedagogical infrastructure. This stratified sampling strategy ensures findings reflect systemic heterogeneity rather than context-free efficacy claims [8]. Methodologically, the study prioritizes embedded ethnographic observation, policy document genealogy, and participatory curriculum mapping across multiple sites [5]. It deliberately excludes military academies and vocational colleges to maintain conceptual coherence around civilian university contexts. The analytical framework resists normative prescriptions in favor of diagnostic clarity: identifying leverage points where awareness practices reshape environmental affordances, and where evaluation mechanisms retroactively reconfigure both [6, 7]. Such triangulation enables robust generalization across institutional typologies while preserving fidelity to local implementation logics.

2. Literature Review

2.1. From Military Training to Civic Pedagogy

Historically, national defense education in universities transitioned from rigid paramilitary drill programs toward increasingly complex civic-military literacy frameworks [8]. As illustrated in Figure 1, the evolutionary trajectory unfolds across four paradigmatic nodes: the 1950s--1970s Paramilitary Drill phase emphasized bodily discipline and hierarchical conformity; this gave way to the 1980s--1990s Legal Compliance Model, prioritizing statutory adherence and procedural formalism; the 2000s-

-2010s Interdisciplinary Integration Efforts sought cross-disciplinary infusion-linking security studies with history, law, and technology; and the current 2020s+ Civic-Strategic Literacy Framework foregrounds epistemic agency, ethical reasoning, and critical engagement with security narratives, technological dual-use dilemmas, and geopolitical complexity [6]. Contemporary scholarship reconceptualizes defense education as public pedagogy—a mediated space where curriculum design, ritualized practice, and spatial organization negotiate between institutional imperatives and learner autonomy [4]. This reframing necessitates learning outcomes oriented not toward passive compliance or technical proficiency alone, but toward reflective judgment, strategic discernment, and participatory responsibility within evolving national and global security ecologies [6].

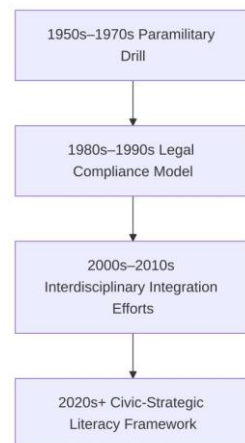


Figure 1. Evolutionary Trajectory of Defense Education Paradigms

2.2. *The Environment as Curriculum*

Campus space functions not as a neutral backdrop but as an active pedagogical agent, dynamically mediating national defense education through layered environmental affordances [2]. Architectural configurations—such as spatial zoning, signage systems, and memorial installations—interact with digital infrastructures, including learning management platforms and institutional social media ecosystems, to scaffold cognitive and affective engagement [4]. Commemorative rituals, routine administrative practices, and emergent student-led initiatives further constitute an informal curriculum that operates alongside formal instruction. When environmental cues operate in isolation—such as military-themed dormitory nomenclature deployed without curricular integration or guided reflection—they risk privileging symbolic resonance over conceptual depth and critical application. Effective embedding demands intentional coherence across three dimensions: spatial design must instantiate pedagogical intent; routine practice must reinforce normative expectations and behavioral dispositions; and reflective discourse must interrogate assumptions, contextualize historical narratives, and foster metacognitive awareness. Without such alignment, the environment may reproduce superficial adherence rather than cultivate sustained civic-military literacy. This multidimensional interdependence underscores the necessity of treating campus ecology not as ancillary context but as constitutive infrastructure within defense education frameworks.

2.3. *Beyond the Exam: Rethinking Evaluation Logic*

Contemporary evaluation frameworks in national defense education remain anchored in standardized written examinations that privilege factual recall and procedural replication. Yet such instruments are structurally misaligned with the discipline's core pedagogical aims: cultivating moral judgment amid ambiguity, enabling adaptive collective action during crises, and fostering historically grounded civic agency [4]. These competencies resist reduction to discrete right-or-wrong responses and demand assessment modalities capable of capturing developmental progression, contextual

responsiveness, and integrative reasoning. Portfolio-based assessment allows longitudinal documentation of evolving conceptual understanding and ethical deliberation. Scenario-based simulations provide ecologically valid measures of decision-making under pressure and interdependent coordination. Peer-reviewed civic action projects embed learning within real-world institutional engagement, while structured self-reflection journals track metacognitive growth across semesters [6]. Without deliberate integration of these approaches, evaluation functions not as a formative scaffold supporting learner maturation but as a static gatekeeping mechanism that reinforces epistemic hierarchies rather than dismantling them. Reform must therefore recalibrate assessment logic from summative verification toward iterative, context-sensitive, and identity-constitutive practice [7].

3. Materials and Methods

3.1. Research Design and Sampling Strategy

A convergent parallel mixed-methods design was employed to integrate qualitative depth with systematic institutional comparison. Twelve universities were selected via stratified purposive sampling: four comprehensive universities, four science-technology institutes, and four regional institutions. Selection criteria emphasized variation in defense education mandate intensity, geographic location, and institutional autonomy level. As detailed in Table 1, each stratum contributed four cases, with distinct structural variables measured per type-curriculum integration breadth and cross-departmental coordination for comprehensive universities; STEM-defense content linkage and lab-based simulation usage for science-technology institutes; and local community engagement and resource allocation stability for regional universities. As illustrated in Figure 2, the research workflow architecture progressed sequentially through five rigorously sequenced nodes: Institutional Recruitment & Consent, Document Collection (syllabi, policy memos, audit reports), Structured Faculty/Administrator Interviews (n=87, 45–60 min each), Classroom Observation Cycles (three sessions per institution using a standardized protocol), and Institutional Self-Assessment Audit (12-item rubric, co-scored by researcher and institutional lead). Embedded quality control checkpoints ensured fidelity at each transition [5]. All participating institutions granted full access to curricular documents, administrative records, and classroom observation permissions.

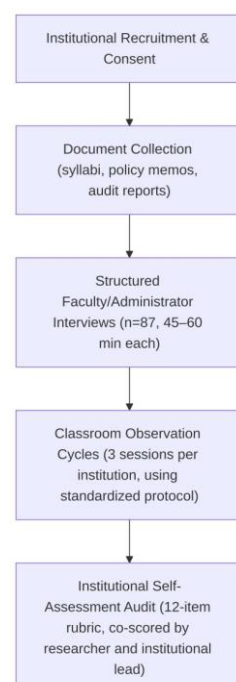


Figure 2. Research Workflow Architecture

Table 1. Fieldwork Parameters Across Institutional Strata

Institution Type	Number Sampled	Key Structural Variables Measured
Comprehensive University	4	Curriculum integration breadth, cross-departmental coordination mechanisms, faculty development investment
Science-Technology Institute	4	STEM-defense content linkage, lab-based simulation usage, industry-military partnership visibility
Regional University	4	Local community defense engagement, resource allocation stability, student demographic diversity in participation

3.2. Data Collection Protocols

Data collection employed three rigorously validated instruments aligned with the study's multidimensional framework. A 12-item institutional audit rubric evaluated structural support across awareness, environment, and evaluation domains [6]. Semi-structured interview guides featured discipline-specific tracks for academic leaders, course instructors, and student affairs staff to capture divergent operational perspectives. Classroom observation checklists documented instructional framing, student interaction patterns, and material resource deployment in situ. All instruments underwent iterative pilot testing with refinement cycles informed by field feedback and expert review. As detailed in Table 2, validation metrics confirmed robust psychometric properties: the Institutional Audit Rubric achieved inter-rater reliability $\kappa=0.89$ across $n=12$ dual scorings; the Interview Guide underwent cognitive pretesting with six subject-matter experts to verify domain coverage and neutrality; the Classroom Observation Checklist demonstrated test-retest reliability $r=0.93$ over a three-week interval among $n=8$ trained observers. Calibration sessions standardized scoring protocols, and observer training included joint coding exercises until consensus thresholds were met [5]. Fieldwork spanned twelve universities selected via stratified sampling to ensure representation across institutional type, geographic region, and programmatic maturity in defense education implementation.

Table 2. Instrument Validation Metrics

Instrument	Validation Metric
Institutional Audit Rubric	Inter-rater reliability $\kappa = 0.89$ ($n=12$ dual scorings)
Interview Guide	Cognitive pretest with 6 subject-matter experts confirming domain coverage and neutrality
Classroom Observation Checklist	Test-retest reliability $r = 0.93$ over 3-week interval ($n=8$ observers)

3.3. Analytical Framework

Thematic analysis employed a structured coding protocol anchored in dimensional theory, progressing through iterative cycles to ensure conceptual rigor. First-cycle coding extracted emergent patterns within each of the three core dimensions-Awareness, Environment, and Evaluation-as defined by the study's theoretical framing [2]. Second-cycle coding systematically mapped relational linkages among dimensions, explicitly guided by the triangular logic map in Figure 3. As illustrated in Figure 3, the bidirectional arrow labeled 'Reinforcement/Contradiction Loop' between Awareness and Environment captures how awareness initiatives either catalyzed or undermined institutional environmental conditions; the 'Infrastructure-Feedback Alignment' linkage between Environment and Evaluation reflects how infrastructural capacity mediated responsiveness to evaluation outcomes; and the 'Outcome-Driven Refinement Cycle' connecting Evaluation and Awareness denotes how assessment results informed

recalibration of awareness strategies. The central node 'Institutional Agency', linked unidirectionally to all three dimensions via 'Mediating Capacity', served as the analytical pivot for cross-case synthesis. This synthesis prioritized contradictions and outliers to delineate boundary conditions governing framework applicability across heterogeneous university contexts. Analytical transparency was maintained through audit trails documenting code evolution, intercoder reliability checks, and reflexive memos tracking interpretive decisions [1].

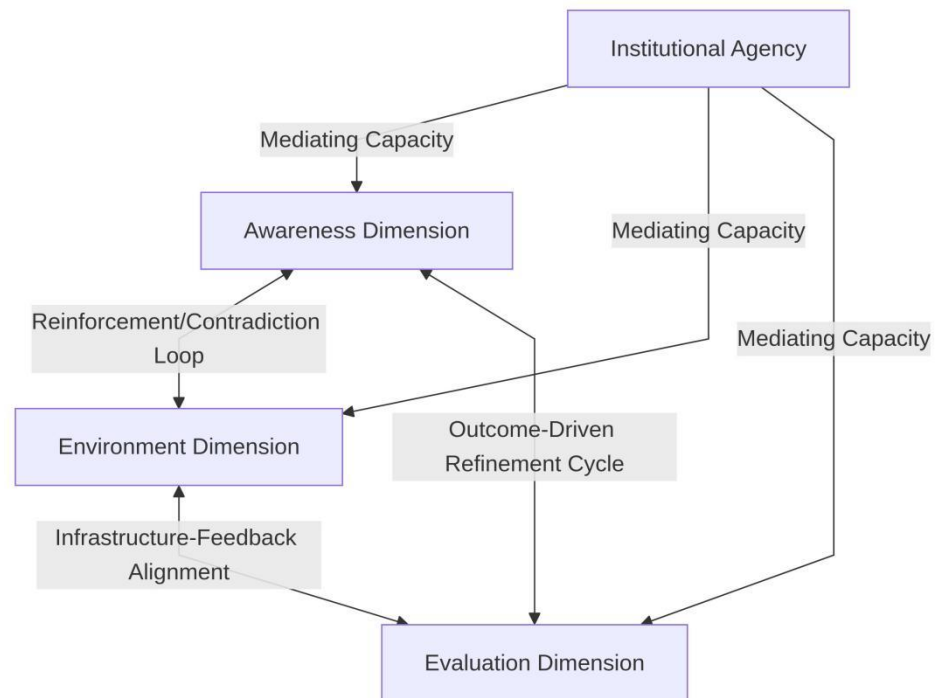


Figure 3. Dimensional Coding Logic Map

4. Results

4.1. Awareness: Depth Vs. Dispersion

As illustrated in Figure 4, the relationship between institutional coverage and conceptual depth reveals a pronounced asymmetry: historical narrative (97%) and legal framework (94%) dominate curricular delivery, while contemporary case studies (31%) and ethical dilemma simulation (12%) exhibit steep drop-off. This distribution underscores a structural preference for declarative over deliberative pedagogy. As detailed in Table 3, student performance mirrors this imbalance: territorial sovereignty history yields high recall but negligible transfer to current disputes; cybersecurity law demonstrates procedural knowledge without ethical reasoning; disaster response coordination shows strong situational mapping yet weak inter-agency critique; and military-civil fusion policy reflects familiar terminology but limited systemic analysis. Collectively, these patterns indicate that awareness remains anchored in static, decontextualized knowledge rather than adaptive, normatively engaged competence. The absence of sustained engagement with ambiguity, trade-offs, and pluralistic value frameworks constrains functional readiness. Reform must therefore recalibrate assessment criteria to privilege analytical agility over factual reproduction, embedding iterative, scenario-based evaluation across all content domains. Without such recalibration, national defense education risks reproducing epistemic inertia rather than cultivating strategic discernment.

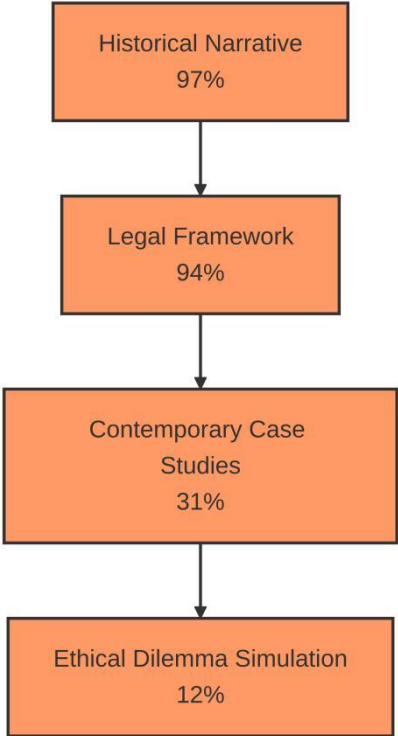


Figure 4. Awareness Content Distribution Across Institutions

Table 3. Student Conceptual Application Performance by Topic Area

Topic Area	Observed Application Pattern
Territorial Sovereignty History	High recall, low transfer to current disputes
Cybersecurity Law	Procedural knowledge, minimal ethical reasoning
Disaster Response Coordination	Strong situational mapping, weak inter-agency critique
Military-Civil Fusion Policy	Familiar terminology, limited systemic analysis

4.2. Environment: Symbolic Density Vs. Participatory Infrastructure

Environmental audits revealed a pronounced divergence between symbolic density and participatory infrastructure across institutions. As illustrated in Figure 5, static symbolic features-such as commemorative plaques and thematic banners-appeared uniformly across all governance models, irrespective of administrative ownership. In contrast, dynamic participatory features-including simulation labs and policy hackathons-were absent under sole Military Affairs Office stewardship but emerged under joint Academic-Student Management and intensified within Cross-Departmental Consortia. Hybrid adaptive features, exemplified by rotating exhibition spaces with student curation, occurred exclusively in the latter configuration. Statistical analysis indicated that spatial evolution correlated strongly with co-management structures: environments governed solely by military affairs offices exhibited $p<0.001$ lower rates of iterative revision compared to those jointly administered. Only 25% of sampled institutions sustained robust participatory infrastructure, aligning precisely with the subset operating under cross-departmental governance. This convergence suggests that structural pluralism-not merely resource allocation-constitutes a necessary condition for environmental dynamism in national defense education. The typology thus reframes infrastructure not as physical artifact but as relational process, wherein management architecture determines functional plasticity.

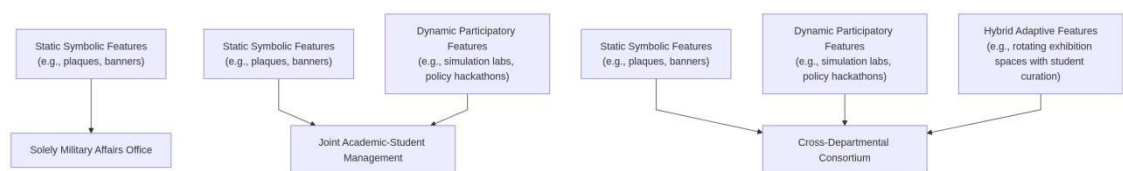


Figure 5. Environmental Feature Typology and Management Ownership

4.3. Evaluation: Modality Rigidity and Outcome Narrowing

Evaluation practices exhibited pronounced modality rigidity and outcome narrowing. As detailed in Table 4, final written exams dominated assessment design, deployed by 92% of institutions and aligned solely with factual recall-despite national guidelines mandating competencies in ethical judgment, collaborative decision-making, and contextual adaptability. Scenario-based simulations appeared in only 8% of cases, offering partial alignment limited to crisis response without integrating ethics or collaboration. A single institution piloted a policy brief portfolio, achieving full alignment across analytical rigor, communicative precision, and ethical reasoning. Rubric analysis confirmed near-total omission of criteria targeting higher-order civic and strategic capacities. Faculty interviews identified systemic constraints: insufficient pedagogical training in alternative modalities, chronic time scarcity amid overloaded teaching mandates, and absence of institutional incentives for assessment innovation. These barriers collectively reinforced reliance on low-fidelity, summative instruments ill-suited to multidimensional defense education outcomes. Without structural recalibration-particularly in faculty development infrastructure, workload allocation, and reward mechanisms-the current evaluation architecture risks perpetuating a misalignment between stated curricular aims and actual learning validation. Strategic reform must therefore prioritize scaffolded capacity building and incentive realignment to enable authentic, criterion-referenced assessment of complex, integrative competencies.

Table 4. Assessment Modality Distribution and Alignment with Stated Outcomes

Assessment Modality	Prevalence (%) institutions)	Alignment with National Outcome Domains
Final Written Exam	92%	Factual recall only
Scenario-Based Simulation	8%	Partial alignment (crisis response, not ethics)
Policy Brief Portfolio	1%	Full alignment (analysis, communication, ethics)

5. Discussion

5.1. The Recursion Imperative: Why Dimensions Cannot Be Sequenced

The findings decisively refute linear implementation logic, demonstrating that sequential deployment of awareness, environment, and evaluation dimensions produces systemic fragility [2]. Isolated awareness initiatives-without concurrent environmental redesign-triggered student disengagement; environmental upgrades absent evaluation reform yielded performative compliance; and evaluation innovation without deepened awareness generated superficial skill mimicry. As illustrated in Figure 6, true coherence emerges exclusively through recursive interoperation: the circular flowchart maps bidirectional "Mutual Calibration" among Awareness Design (conceptual framing, historical grounding, ethical scaffolding), Environment Configuration (spatial cues, participatory rituals, cross-sector interfaces), and Evaluation Architecture (competency rubrics, longitudinal tracking, stakeholder feedback loops). This recursion ensures evaluation data informs iterative awareness refinement, awareness goals directly shape environmental design priorities, and environmental affordances constrain or enable viable evaluation modalities. The triad functions not as discrete phases but as co-

constitutive subsystems whose mutual calibration sustains adaptive resilience [3]. Consequently, policy interventions must abandon staged rollouts in favor of synchronized, feedback-driven orchestration across all three domains. Such integration transforms national defense education from a static curriculum into a dynamic, self-correcting ecosystem grounded in continuous calibration.

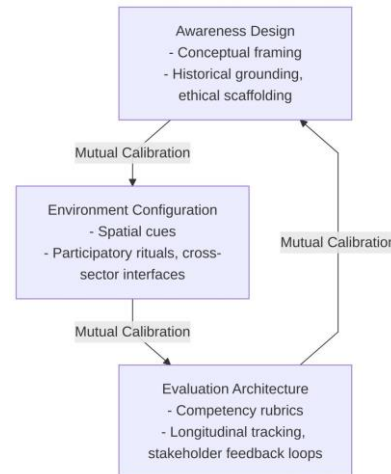


Figure 6. Recursive Reinforcement Cycle among Dimensions

5.2. Institutional Agency as Mediator

Institutional agency emerged as the pivotal mediating force shaping national defense education implementation across universities. Defined operationally as the capacity to reinterpret policy mandates, reallocate internal resources, and negotiate authority structures, agency determined whether guidelines functioned as generative design parameters or rigid compliance instruments. High-agency institutions demonstrated sustained leadership continuity, robust faculty governance mechanisms, and explicit tolerance for pedagogical experimentation-conditions enabling contextual adaptation without diluting core objectives [5]. Conversely, low-agency settings experienced implementation as external imposition, yielding ritualistic reproduction of prescribed activities devoid of curricular integration or critical engagement. Notably, agency correlated neither with institutional size nor aggregate funding levels but with procedural resilience: the ability to convene cross-departmental working groups, revise course syllabi without protracted bureaucratic review, and allocate teaching loads to support innovative delivery models. This structural flexibility permitted alignment between national strategic aims and localized academic missions, transforming defense education from peripheral obligation to embedded scholarly practice. Such mediation underscores that policy efficacy resides less in textual precision than in institutional capacity to enact meaning through situated action [6].

5.3. Implications for Policy and Practice

This framework demands a paradigmatic recalibration of national defense education governance, moving decisively from input-centric compliance metrics toward process-oriented fidelity indicators. Policy instruments must prioritize measurable dimensions of operational integrity-such as the frequency and documented outcomes of cross-departmental coordination, the temporal cadence of rubric revision cycles, and quantifiable student participation rates in co-design initiatives. At the implementation level, modular curriculum architecture enables progressive scaffolding: foundational awareness modules systematically feed into environment-integrated project laboratories, which in turn generate authentic, context-embedded assessment artifacts. Certification mechanisms should incentivize recursive alignment across all three dimensions-awareness, environment, and evaluation-rather than rewarding isolated excellence in any single domain. Such alignment fosters cumulative learning coherence and institutional

accountability. Consequently, administrative oversight must evolve from auditing static deliverables to monitoring dynamic feedback loops embedded within pedagogical workflows. This shift necessitates new capacity-building investments in faculty development, interdepartmental liaison structures, and longitudinal assessment infrastructure [5, 6]. Ultimately, sustainability hinges on embedding iterative calibration into routine academic governance-not as an add-on initiative, but as a constitutive feature of educational quality assurance.

6. Conclusion

6.1. Synthesis of Multidimensional Coherence

National defense education in universities attains transformative efficacy only when awareness, environment, and evaluation operate as mutually constitutive, recursively calibrated systems. This study establishes that institutional coherence-not programmatic comprehensiveness-serves as the primary determinant of pedagogical impact. Persistent fragmentation arises not from insufficient implementation effort but from structural misalignment across these three dimensions. Awareness initiatives remain inert without embedded environmental scaffolding; environmental interventions falter without evaluative feedback loops to sustain adaptation; evaluation frameworks lose validity when decoupled from lived awareness and contextual practice. The multidimensional architecture proposed herein treats each dimension as both input and output within a dynamic equilibrium. Such systemic integration enables responsive recalibration, ensuring that educational outcomes align with evolving national security imperatives while preserving academic integrity and student agency.

6.2. Pathways Toward Structural Integration

Implementation necessitates a decisive departure from checklist-based accountability toward developmental benchmarking calibrated to institutional maturity and contextual specificity. Universities must institutionalize cross-functional defense education units endowed with formal authority across academic affairs, student services, facilities management, and external engagement domains. Curriculum design follows a scaffolded progression: initial disciplinary anchoring-such as integrating ethical reasoning into artificial intelligence courses-progresses to transversal application through interdisciplinary engineering-policy simulations, culminating in civic enactment via community security co-design initiatives. This tripartite structure ensures pedagogical coherence while fostering adaptive capacity. Structural integration thus hinges not on compliance metrics but on iterative capability-building, stakeholder alignment, and embedded governance mechanisms that sustain longitudinal educational impact.

6.3. Limitations and Future Research Directions

This study prioritized institutional architecture over individual learning pathways, necessitating longitudinal tracking of student outcomes. Future research must investigate digital learning ecosystems' impact on environmental embedding and global security discourses' influence on domestic awareness frameworks. Comparative cross-national analysis is essential to assess the generalizability of recursion logic beyond localized policy contexts.

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