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Teaching in the Age of AI: A Case Study in Restructuring Undergraduate Technology Education for Responsible AI Integration

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Abstract

The rapid proliferation of Generative Artificial Intelligence (GenAI) presents a disruptive challenge to traditional paradigms of teaching and assessment in higher education, raising significant concerns regarding academic integrity and the development of essential critical thinking skills. [1] This paper presents a comprehensive case study of the CY305 "Cyber Foundations" course at the United States Military Academy, a large, required technology course for undergraduate students not majoring in engineering or computer science. In response to the challenges posed by GenAI, the course underwent a systemic pedagogical redesign, moving beyond a simple policy adjustment to a holistic restructuring of its instructional and evaluative framework. The intervention is built on three core pillars: (1) a principled AI usage policy that permits GenAI as a tool but mandates student-led problem decomposition and meticulous documentation of all interactions; (2) a shift to an active learning, flipped classroom model that prioritizes pre-class preparation and in-class application; and (3) a strategic rebalancing of assessments to favor authentic, supervised, in-class evaluations that provide direct evidence of student competency. Analysis of institutional assessment data, course documents, and student performance metrics reveals that this integrated approach successfully maintained academic rigor, with students meeting or exceeding all established Student Learning Outcome (SLO) benchmarks. Furthermore, qualitative reports indicate the new model enhanced student engagement, accountability, and independent problem-solving skills, effectively mitigating the academic integrity risks associated with unsupervised AI use. This paper concludes that the CY305 framework offers a structured, scalable, and data-validated model for other institutions seeking to responsibly integrate GenAI, demonstrating how a synthesis of established pedagogical best practices can transform a technological challenge into an opportunity to cultivate more resilient, ethical, and future-ready learners.

Introduction: Navigating the New Frontier of AI in Higher Education

The advent of powerful and publicly accessible Generative Artificial Intelligence (GenAI) models represents one of the most significant technological disruptions in the history of modern education. Tools like OpenAI's ChatGPT have been adopted with unprecedented speed, with studies indicating that the vast majority of students and teachers now use AI in their academic work. [2] This rapid integration has positioned GenAI as a dual-edged sword for higher education institutions. On one hand, it offers transformative opportunities to create personalized learning experiences, enhance classroom efficiency, and provide students with powerful tools for inquiry and creation. [3] AI can serve as an intelligent tutor, [4] a research assistant [5], and a creative partner [6], promising to become a widely used tool.

On the other hand, this same technology poses a profound and existential challenge to the core tenets of academic work. The ability of GenAI to produce sophisticated, human-like text, code, and analysis on demand directly threatens traditional models of assessment and academic integrity. [1] Concerns abound that unchecked use of these tools could lead to a decline in students' foundational cognitive skills, such as creativity, critical thinking, reasoning, and problem-solving, as the difficult process of learning is outsourced to an algorithm. [3] This has created an urgent dilemma for educators and administrators worldwide: to prohibit the use of AI, thereby creating a sterile academic environment disconnected from the tools shaping the professional world, or to permit its use, risking a potential erosion of academic standards and the very skills education is meant to cultivate.

This paper argues for a third path: a strategic and holistic pedagogical redesign that neither bans AI nor passively accepts it, but actively integrates it into a re-engineered learning environment. It posits that the challenge of AI cannot be met with a standalone policy statement; it requires a fundamental rethinking of how knowledge is taught, practiced, and assessed. To explore this thesis, this paper presents an in-depth case study of CY305 "Cyber Foundations", a core technology course at the United States Military Academy. The institutional context of a service academy, where the development of ethical leaders is a primary mission and academic integrity is held as a paramount virtue, provides a unique and high-stakes environment for examining this challenge. Faced with the rise of GenAI, the course directors of CY305 implemented a multi-faceted intervention that combined a principled AI usage framework with a transition to a flipped classroom model and a decisive shift toward authentic, in-class assessments.

Although cadets are enrolled in a traditional undergraduate program, their learning context more closely resembles that of adult, nontraditional learners due to the immersive, experiential nature of military education and its direct connection to professional leadership responsibilities. Cadets operate within a high-stakes environment that integrates academic study with applied decision-making, ethical accountability, and real-world consequences, making pedagogical approaches such as experiential learning, inquiry-based problem solving, immersive instruction, and performance-based assessment particularly effective. The CY305 redesign intentionally leverages these methods through flipped instruction and authentic, supervised assessments that mirror professional practice. In doing so, the course treats cadets as developing professionals rather than passive recipients of instruction, offering insights applicable to broader educational contexts that serve learners whose academic experiences are shaped by professional identity, responsibility, and transition to practice.

A Data-Driven Impetus for Change

The decision to restructure CY305's assessment strategy was not a sudden reaction to the release of ChatGPT. Instead, it was rooted in a culture of continuous, data-driven curriculum improvement. The course is subject to a rigorous annual assessment process designed to monitor student achievement of learning outcomes and identify areas for refinement. A review of historical assessment data from this process had already revealed two trends. One, the course average has been raising over the past few years and although this is inherently good we wanted to understand why. Two, cadets consistently performed better on out-of-class assessments compared to in-class evaluations.

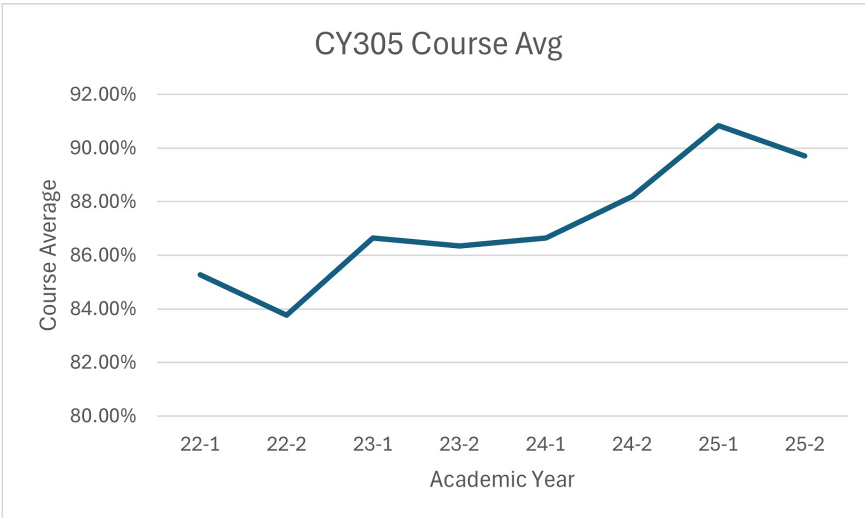

Figure 1: CY305 Increasing Course Average Semester by Semester

These trends raised fundamental questions about the reliability of out-of-class work as an authentic measure of individual competency. It suggested that unsupervised assignments might be reflecting the influence of external assistance rather than a student's true understanding and skills. While this was a concern prior to 2023, the explosion of powerful GenAI tools transformed this latent issue into an urgent institutional priority. The technology exacerbated the existing problem by making sophisticated, unauthorized assistance instantly and universally available. Therefore, the subsequent redesign was not an ad-hoc response to a new technology but rather the accelerated implementation of a pedagogical shift that was already justified by the institution's own internal data. The institution's mature assessment cycle had identified the vulnerability; GenAI simply provided the catalyst to address it decisively.

The central thesis of this paper is that the successful integration of Generative AI into undergraduate education requires more than a standalone usage policy; it demands a systemic redesign of pedagogy and assessment. By combining a principled AI framework with the established strengths of the flipped classroom model and authentic, in-class evaluations, institutions can foster responsible AI partnership, ensure academic rigor, and prepare students for the complexities of an AI-driven professional world. This study will demonstrate that such an integrated approach can not only mitigate the risks of AI but can also leverage the technological disruption as a catalyst to build a more engaging, effective, and accountable learning environment.

Institutional Context and Participant Population

The institutional setting is a critical component of this case study. The United States Military Academy has a distinct dual mission: to provide a broad undergraduate education and to commission leaders of character for the military. This mission instills a profound emphasis on ethics and integrity, which directly informs the institution's approach to academic challenges.

The CY305 "Cyber Foundation" course is a mandatory component of the Academy's core curriculum, taken by an average of 745 cadets each academic year. The participant population consists primarily of third-year (junior) cadets who are not enrolled in accredited engineering or computing majors. This diverse student body, representing a wide range of academic disciplines, requires a course that can deliver foundational computational thinking, data analysis, and cybersecurity skills to a non-specialist audience. The ultimate goal is to equip all future Army officers, regardless of their career field, with the confidence and critical mindset to evaluate and leverage emerging technologies responsibly in dynamic operational environments. This leadership development imperative provides a unique lens through which to analyze the integration of AI in education.

This paper will proceed as follows. First, a review of the relevant literature will establish the theoretical foundations for AI-integrated pedagogy, covering the challenges of GenAI, the principles of the flipped classroom, and the theory of authentic assessment. Next, the methodology section will detail the single-case study design and the data sources used for the analysis. The findings section will then present a detailed account of the CY305 redesign and its quantitative and qualitative outcomes. Following this, the discussion section will interpret these findings, arguing for the scalability and effectiveness of the CY305 model. Finally, the conclusion will summarize the paper's contributions and offer a forward-looking perspective on educating ethical and effective leaders in the age of AI.

Literature Review: Theoretical Foundations for AI-Integrated Pedagogy

The Generative AI Disruption: Opportunities and Perils

The integration of GenAI into higher education presents both significant opportunities and substantial risks, creating a tension that institutions must understand to respond effectively. [1]

Among its primary benefits is the potential for highly personalized learning. AI-driven adaptive platforms can tailor content, adjust difficulty in real time, and provide customized feedback, enabling students to progress at their own pace while helping bridge learning gaps and sustain engagement across ability levels. [3] GenAI also offers efficiency gains by automating administrative tasks such as grading [7], assignment instructions creation [8], and preliminary lesson planning [8], allowing educators to focus on mentorship, higher-order discussions, and individualized support. In addition, AI-enhanced instructional tools—such as gamified activities and dynamic simulations—can increase student motivation and improve learning outcomes. [9]

These opportunities are accompanied by substantial risks, most notably threats to academic integrity. GenAI's ability to produce plausible academic work with minimal input undermines traditional assessments and creates new avenues for plagiarism and cheating. [1] This challenge is exacerbated by the unreliability of AI-detection tools, which are susceptible to false positives and circumvention, rendering purely technical enforcement approaches ineffective. [10] Beyond misconduct, scholars warn that over-reliance on AI for summarization, problem solving, and argument structuring may erode core cognitive skills, including critical thinking, analytical reasoning, and independent problem-solving. [3] In addition, AI adoption raises ethical and privacy concerns, as the large volumes of student data required for AI systems introduce risks related to data protection [11], while opaque "black box" algorithms pose questions of fairness, accountability, and bias. [12]

In response to this complex landscape, higher education institutions have adopted a broad range of AI policies, from near-total prohibition to full integration of AI as a collaborative tool. [13] Many institutions—including Cornell University, Carnegie Mellon University, and Florida State University—have issued flexible, course- or assignment-specific guidelines that provide faculty with frameworks rather than prescriptive mandates. [10] These policies commonly stress clear communication, appropriate attribution when AI use is allowed, and student accountability for the accuracy of AI-generated work. [13] The diversity of institutional responses reflects the lack of consensus and highlights the need for evidence-based models of responsible and effective AI integration.

Active Learning and the Flipped Classroom Model

The flipped classroom is a pedagogical model that reverses the traditional allocation of classroom time and homework by shifting direct instruction—such as lectures—to the individual learning space through pre-recorded videos or assigned readings completed before class. [14, 15] This shift frees in-class time for interactive activities in which students apply concepts, collaborate on problem-solving, and receive instructor guidance. [14]

The model aligns closely with the revised Bloom's Taxonomy. Rather than devoting class time to lower-order cognitive tasks and assigning higher-order thinking as homework, the flipped approach requires students to engage with foundational content independently before class, reserving in-person time for applying, analyzing, evaluating, and creating with immediate peer and instructor support [16].

Research consistently shows that effective implementation of the flipped classroom increases student engagement, motivation, and responsibility for learning. [15] It also enhances the quality and frequency of student–teacher and peer interactions by centering class time on discussion, collaboration, and feedback. [14] Collectively, these benefits support the development of self-directed learning, critical inquiry, and collaborative problem-solving skills, making the flipped classroom a strong pedagogical foundation for responsible AI-integrated curricula.

Authentic Assessment as a Cornerstone of Academic Integrity

Authentic assessment represents a shift away from traditional, decontextualized testing toward tasks that are meaningful, realistic, and representative of challenges students will encounter in professional and civic contexts. [17] Rather than assessing isolated recall, instruction is intentionally aligned with complex real-world tasks, ensuring students develop the knowledge and skills required to perform them successfully. [17]

A systematic review identifies three core dimensions of authentic assessment: realism, cognitive challenge, and evaluative judgment. [18] Realism situates tasks in real-world contexts, such as debugging code or developing data-driven solutions. Cognitive challenge emphasizes higher-order thinking, including analysis, synthesis, and evaluation. [18] Evaluative judgment engages students through transparent criteria, feedback, and revision, fostering the ability to assess the quality of their own and others' work. [18]

Research shows that authentic assessment improves learning depth, motivation, autonomy, metacognitive development, and employability by directly engaging students in workplace-relevant problem-solving and decision-making. [18]

In the context of GenAI, authentic assessment provides a pedagogy-based response to academic integrity concerns. Unlike unreliable AI-detection tools, supervised authentic tasks offer direct evidence of students' ability to apply knowledge without unauthorized assistance. [17] By emphasizing thinking and problem-solving processes rather than easily generated final products, authentic assessment supports a resilient evaluation model that upholds academic standards while preparing students for complex, technology-rich environments.

Methodology: A Case Study of Curricular Redesign

This study employs a qualitative, single-case study design to conduct an in-depth examination of a significant curricular and pedagogical redesign. The "case" under investigation is the CY305 "Cyber Foundations" course at the United States Military Academy. The "unit of analysis" is the comprehensive process of restructuring the course's pedagogy, assessment strategy, and technology use policy in response to the proliferation of Generative AI, and the subsequent outcomes observed during the Academic Year 2025 (AY25). This approach was selected for its ability to provide a rich, contextualized understanding of a complex, real-world phenomenon, allowing for a detailed exploration of the interplay between institutional context, pedagogical theory, and practical implementation.

The Anatomy of the Redesign: A Multi-Pronged Pedagogical Intervention

The transformation of the CY305 course was a deliberate and data-informed process. The findings reveal a multi-layered intervention that systematically addressed pre-existing pedagogical challenges, which were then brought into sharp focus by the rise of Generative AI. This section details the impetus for the change, the specific components of the pedagogical redesign, the principled framework for AI engagement, and the quantitative and qualitative outcomes of this comprehensive overhaul.

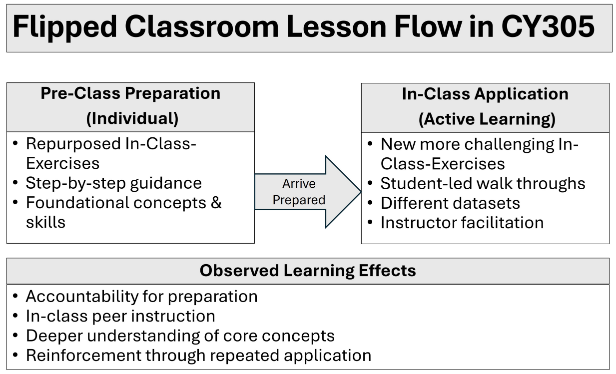

Figure 2: Flipped classroom lesson flow in CY305 illustrating the sequencing of structured pre-class preparation and in-class active application, and the associated observed learning effects.

The Flipped Classroom in Action

At the heart of the CY305 redesign was a fundamental shift in instructional philosophy, moving from a traditional, instructor-centered model to a student-centered, active learning approach based on the principles of the flipped classroom. This involved a comprehensive restructuring of both pre-class preparation and in-class activities (Figure 2).

Previously, class time often consisted of instructors leading step-by-step demonstrations while students followed along—a method that, while structured, was observed to foster "passive learning" and limit deep engagement. The new model completely inverted this dynamic. The old in-class exercises (ICEs) were repurposed as required, though ungraded, pre-class preparation assignments. These exercises provided students with starter files and step-by-step guidance to ensure they arrived in the classroom with foundational exposure to the key concepts and skills for that lesson.

This pre-class work enabled a complete transformation of the classroom environment. In-class time was no longer used for basic instruction but for active application and problem-solving. New, more challenging ICEs, often using different datasets to prevent simple replication, were embedded directly into the lesson slides. A key innovation in this active learning environment was the implementation of student-led problem-solving. Instead of the instructor demonstrating a solution, students were randomly called upon to share their screens via Microsoft Teams and "walk the class through their problem-solving process". This practice served multiple pedagogical functions simultaneously. It held students accountable for their pre-class preparation, fostered a collaborative learning environment through peer instruction, and provided the instructor with real-time insight into student understanding. Official course assessments concluded that this combination of structured pre-class work and in-class application "enhanced cadet readiness, increased participation, and fostered a more interactive and engaging learning environment".

Figure 3: Expansion of In Class Assessment between 25-1 and 25-2 semesters

A Shift to Authentic, In-Class Evaluation

The capstone of the CY305 redesign was a strategic and decisive shift in the assessment strategy to prioritize authentic, supervised, in-class evaluations. This change was the most direct response to the challenge of verifying individual competency in the age of AI. The course deliberately rebalanced its grading scheme to increase the weight of assessments where student work could be directly observed and authenticated, as shown in Figure 3.

This re-balancing involved not only changing grade weights but also re-purposing out-of-class assignments. Comprehensive projects that had previously been graded events were transformed into practice exercises designed explicitly to prepare students for the high-stakes, in-class evaluations. This ensured that out-of-class work remained pedagogically valuable while minimizing its potential to compromise the integrity of the final grade.

A Principled Framework for AI Engagement

The pedagogical shift was complemented by a clear and principled framework for student engagement with Generative AI. The course policy did not ban AI but instead embraced it as a tool for learning, contingent on a set of strict guidelines designed to uphold academic integrity and promote critical thinking. This approach reflects the course's fifth learning outcome: to "Possess the confidence and critical mindset to evaluate, adopt, and integrate emerging technologies responsibly". The policy's rules of engagement are detailed in Table 1.

Table 1: AI Use Policy

Policy Component	Acceptable Use (Examples)	Unacceptable Use (Examples)	Documentation Requirement
Problem Solving	Using AI for brainstorming, refining search queries, or getting a verbal explanation for a specific point of confusion.	Copying and pasting an entire assignment prompt into an AI tool; using AI to generate the complete solution to a problem.	Students must perform their own problem decomposition and use AI tools only to support specific, discrete tasks.
Content Generation	Using AI to debug a specific segment of code, check grammar and style in a written response, or generate examples to illustrate a concept.	Submitting any AI-generated content as one's own original work; generating the final solution for any graded event.	The student's own work must represent the preponderance of the effort on the assignment.
Attribution	All instances of AI assistance must be clearly and specifically documented.	Failing to document any use of AI that does not qualify as "common knowledge" as defined in the syllabus.	Within the specific question response in the learning management system (Canvas), students must document the exact prompt used with the AI tool and explain how the output was used.

This policy structure is mutually reinforcing with the flipped classroom pedagogy. The requirement for students to engage with material independently before class forces an initial level of problem decomposition. The in-class, student-led demonstrations demand a level of process mastery that cannot be achieved by simply copying an AI's output. A student cannot succeed in this environment by using AI as a cognitive black box; the pedagogy compels them to engage in the very critical thinking and decomposition that the AI policy mandates.

Results: Outcomes of the CY305 Redesign

Quantitative assessment data indicate that the revised course design did not adversely affect student performance despite an increased emphasis on rigorous, in-class evaluation. Across both AY25-1 and AY25-2 offerings, average scores on in-class assessments remained consistently above the institutional performance benchmark of 80%, with means in the mid-80% range (Figure 4). Out-of-class assignments exhibited higher average scores, as expected, but the observed difference does not suggest that in-class rigor created a barrier to successful course completion .

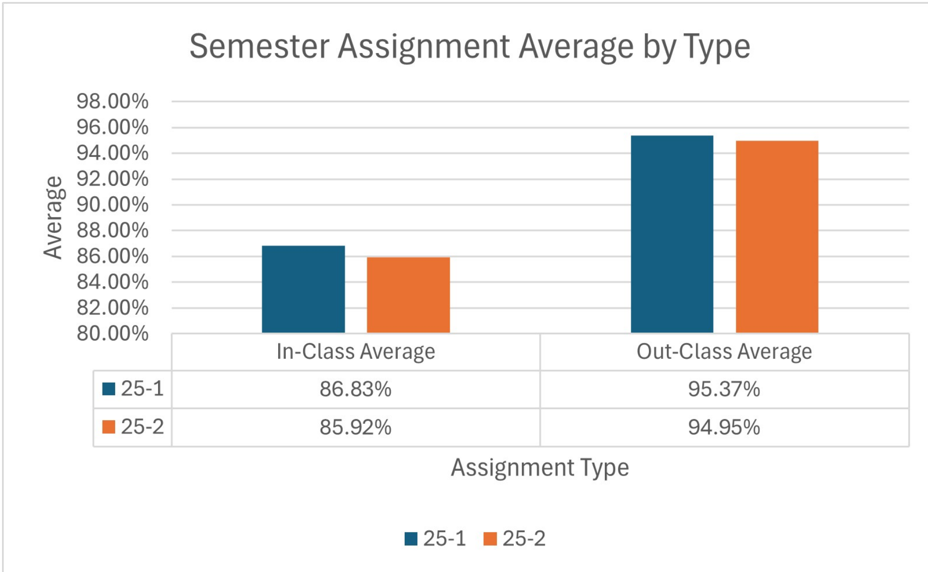

Figure 4: Average in-class and out-of-class assessment scores across two academic terms, with in-class averages remaining above the institutional 80% benchmark.

Student learning outcomes (SLOs) were evaluated using post-course survey data aligned to the five stated course objectives. Across all SLOs, the majority of respondents reported that their learning either "Increased" or "Greatly Increased" following implementation of the redesigned course model (Figure 5). Reports of decreased learning were minimal, and no SLO fell below institutional expectations. These results indicate that students perceived positive learning gains across computational thinking, data engineering and analysis, cyber domain fundamentals, ethical reasoning, and innovation. Collectively, the assessment and survey data demonstrate that students met established performance standards under the revised instructional approach. The combination of sustained in-class assessment performance and broadly positive self-reported learning outcomes suggests that the increased emphasis on structured, in-class evaluation was compatible with student success across all stated learning objectives.

Qualitative findings were drawn from formal end-of-term instructor assessment reports submitted as part of the Academy's annual course review process. Instructors noted that the redesigned lesson flow led to "increased engagement, stronger independent problem-solving, and greater confidence among cadets". They also observed "noticeable improvements in motivation, engagement, and performance" that were attributed to the course's success in connecting content to the cadets' future roles as Army leaders. By demonstrating the real-world value of the skills being taught, the course fostered a powerful cycle of intrinsic motivation, leading to deeper investment in learning and a greater willingness to embrace challenges.

Discussion: A Scalable Model for Responsible AI Integration

The findings from the CY305 case study offer a compelling, evidence-based model for navigating the complexities of Generative AI in higher education. The success of this intervention is not attributable to any single element—not the AI policy, the flipped classroom, or the assessment

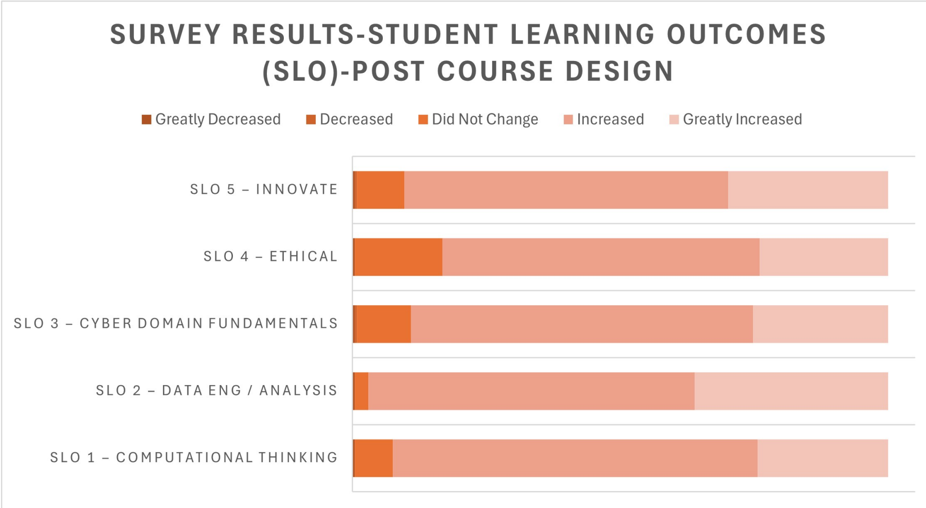

Figure 5: Student self-reported changes in learning across five course learning outcomes following the revised course design.

strategy in isolation. Rather, its efficacy lies in the systemic integration of these three pillars, which work in concert to create a resilient and pedagogically sound learning environment. This section will interpret the findings through the theoretical lens established in the literature review, exploring how the CY305 model addresses the core challenges of AI integration and offers scalable principles for other institutions.

How Pedagogy Drives Policy Adherence

An effective AI policy must be embedded within pedagogy rather than enforced solely through rules. The CY305 redesign illustrates this approach by creating an “ecosystem of accountability” in which active learning and flipped-classroom structures naturally discourage AI misuse. Requiring students to prepare independently and demonstrate their problem-solving processes live makes reliance on AI as a cognitive substitute untenable, as students must articulate reasoning, justify decisions, and adapt to new data in real time.

This structure directly develops the independent problem-solving skills the institution seeks to cultivate, while reframing students’ relationship with AI from dependency to collaboration. Framed as an “AI partnership,” the course encourages students to use AI to support brainstorming, debugging, and exploration without replacing their own reasoning. This approach emphasize AI as an enhancer of human creativity and critical judgment rather than a replacement for it. As a result, pedagogy functions as the primary mechanism for policy adherence, reinforcing responsible AI use through the same skills required for success in the course.

Authentic Assessment as the Ultimate AI Countermeasure

The rise of GenAI has made many traditional out-of-class assessments vulnerable to academic dishonesty, prompting interest in AI-detection tools that the literature shows to be unreliable and ethically problematic. [10] The CY305 model instead adopts a pedagogically grounded alternative by shifting assessment weight toward authentic, in-class evaluations.

This approach verifies learning through direct observation of student performance in a controlled environment and reflects the principles of authentic assessment, which emphasize skill demonstration in realistic contexts over factual recall. [18] By assessing students' ability to analyze data, build models, or troubleshoot problems live and without assistance, the course provides clear evidence of competency. [17] These assessments are inherently more resistant to AI-enabled cheating than out-of-class assignments and reduce reliance on homework as proof of learning, as grades are driven by demonstrated independent performance. This strategy aligns with the core aim of authentic assessment: designing evaluations that are both meaningful and resilient learning experiences. [18]

Redefining AI Literacy for Leadership Development

The CY305 model redefines AI literacy beyond technical proficiency, emphasizing leadership-relevant competencies. While common discussions focus on skills like prompt engineering, this course fosters a broader, more durable framework. Problem decomposition trains analytical and critical thinking; documentation requirements instill accountability and process transparency; and a dedicated AI ethics lesson—anchored in military-relevant scenarios—promotes awareness of second- and third-order effects. The assessment structure, centered on verifying independent application, reinforces self-reliance and intellectual rigor.

This form of literacy transcends any single AI tool. It cultivates a critical mindset essential for military leadership: breaking down complex problems, leveraging technology responsibly, ensuring accountability, and performing independently under pressure. CY305 leverages the challenges of emerging technologies not just to teach AI, but to develop the foundational attributes of effective 21st-century Army officers.

Scalability and Adaptability

Although the military academy context is distinctive, the core principles of the CY305 model are scalable and adaptable across higher education. The framework relies on established pedagogy and widely available tools rather than proprietary technology. Its use of the Microsoft Office 365 ecosystem—including Teams, Forms, SharePoint, and Power BI—demonstrates that an AI-ready curriculum can be implemented using platforms already available at many institutions.

The underlying principles are broadly applicable. Institutions can benefit from:

1. **Integrating Policy and Pedagogy:** Aligning academic integrity policies with daily instructional practices rather than treating them as standalone rules.
2. **Prioritizing Active Learning:** Reallocating class time from passive lectures to problem-solving activities that foster durable skill development.
3. **Emphasizing Authentic Assessment:** Designing performance-based assessments that provide direct evidence of learning and are more resilient to academic integrity challenges.

By adapting these principles to local contexts and student populations, universities can apply lessons from CY305 to develop effective and responsible AI-integrated courses.

Conclusion: Educating Future-Ready Leaders

This paper presented a case study of the CY305 Cyber Foundations course at a service academy, which underwent a comprehensive redesign to address the challenges and opportunities of Generative AI. The results demonstrate that a proactive, pedagogically grounded approach can mitigate AI-related risks while simultaneously increasing engagement and academic rigor. Rather than reinforcing dystopian narratives about AI in education, the CY305 experience illustrates a viable path that embraces technological innovation without compromising academic integrity.

The findings support the central argument that responding effectively to AI requires re-engineering pedagogy and assessment, not merely revising policy language. Built on a principled AI policy, flipped classroom pedagogy, and authentic in-class assessment, the CY305 framework represents a structured, evidence-informed, and scalable model. It balances technological fluency with enduring academic values, including critical thinking, independent problem-solving, and ethical responsibility.

As Generative AI becomes increasingly embedded in professional practice, higher education's role is not to restrict access to these tools, but to develop students' capacity to use them wisely. The CY305 model demonstrates how AI can be treated as a collaborative partner while reinforcing human judgment, accountability, and analytical skill. In doing so, it offers a blueprint for preparing students not merely to function in an AI-enabled world, but to lead within it responsibly and effectively.

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