



Immersive Writing Ecosystems: AI as Co-Regulator in Academic Legal Writing Education

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Abstract. Academic legal writing is a cornerstone of higher legal education, yet students often see it as one of the most difficult skills to master. Large cohorts, diverse entry levels, and limited contact hours restrict opportunities for personalized feedback. At the same time, generative AI is rapidly reshaping writing practices. Students already use AI tools, often without guidance, raising concerns about responsible integration. This work-in-progress extended abstract introduces the conceptual design of an AI-empowered immersive learning ecosystem for legal writing. We reframe writing education not as isolated skills training but as an ecosystem where human and AI actors interact as co-regulators. This aligns with Morgado's reconceptualization of AI as participant rather than tool, a framing we adopt throughout this paper to position AI as co-regulator within the learning ecosystem. The design integrates diagnostic entry tests, personalized learning routes, and iterative cycles of AI and instructor feedback. AI functions as peer, coach, and process monitor, complementing rather than replacing instructors. Expected outcomes include increased student agency, scalable feedback processes, and transferable insights for other disciplines. Our contribution is threefold: (1) a theoretical synthesis positioning AI as co-regulator within immersive learning theory, (2) a conceptual argument that immersion can be realized in text-based academic practices beyond XR, and (3) a concrete case design for legal writing education that operationalizes these principles.

Keywords: Immersive Learning, Generative AI, Academic Writing, Legal Education, Co-Regulation.

1 Introduction and Relevance

Academic legal writing is a core skill for law students at research universities. Large language models (LLMs) are particularly capable to produce complex texts, causing a serious disruption to the core business of the legal profession. It is therefore crucial that law students already at early stages of their education learn how to responsibly use LLMs, especially in academic legal writing courses [1]. The goal is to foster critical AI literacy, not to automate writing.

Students often perceive academic writing as a difficult and high-stakes component of their education. The emergence of generative AI adds further complexity. Students already use AI tools, mostly without proper guidance and with a low level of AI literacy. This raises concerns about plagiarism, superficial learning, and over-reliance [2-3]. At the same time teachers face pressure to deliver high-quality skills training under conditions of limited contact hours and rising student numbers. AI can help manage workload in supervision and evaluation [4]. Research shows that students value the immediacy of AI feedback but still trust instructor feedback more [5]. This suggests complementarity rather than substitution: AI can play a supportive role but requires structured integration.

Current academic legal writing education does not provide structured opportunities to engage with AI in a safe and responsible way. Building on Nemerovski's [1] analysis of generative AI in legal writing, which implicitly frames effective legal writing as the outcome of a series of deliberate, context-dependent choices, we argue that students must be trained to make metacognitively informed decisions about when and how to engage with AI at each phase of the writing process. This framing structures our learning design, particularly our use of AI as a regulatory agent within variations of writing tasks. In doing so, our design mitigates several ethical and pedagogical challenges for instructors and students. Instructors are for example not burdened with delivering instant feedback but can focus on coaching students in further developing their writing skills. Students are not

only trained on critical reflection on their use of AI, but also in how to effectively and responsibly use AI for specific writing tasks.

We therefore argue that legal writing education can be reconceptualised as an immersive learning ecosystem in which students, instructors, and AI participate. By framing the learning experience through the dimensions of system, narrative, and agency, and by explicitly recognising AI as a participant with its own agency, we operationalize Morgado's [6] concept of AI as participant, positioning AI as co-regulator within the learning environment. Moreover, positioning AI as a co-regulator in the writing process can possibly enhance the student's immersive learning experiences by an adaptive way of scaffolding preventing cognitive overload [7].

AI was used for several tasks during the writing of this paper. First, it was used to identify relevant references, which were subsequently screened for relevance with the support of AI. The selected references were then studied and analyzed by the authors; during this process, AI was occasionally used for clarification or brainstorming purposes. Second, AI was used as a brainstorming partner to test and further refine our ideas. Finally, AI was used to support translation, as English is not our native language. We used the following AI tools: Consensus, ChatGPT 5.2 Pro (Thinking and Instant), Gemini 3 Pro, and Claude Pro (Opus and Sonnet 4.5).

Presented as a *work-in-progress extended abstract* within the track OpenEU Pathways to Immersive Societies: AI-Empowered Learning Ecosystems for Digital Education, this paper outlines a conceptual design that is not yet fully implemented, but that has clear pathways toward practice. The paper is structured as follows. Section 2 presents the theoretical framework, drawing on immersive learning theory and co-regulation of learning to position AI as a participant within educational ecosystems. Section 3 describes the case context and design, including an illustrative scenario from legal writing education. Section 4 outlines expected outcomes at the student, instructor, and ecosystem levels. Section 5 discusses ethical challenges, instructor-AI complementarity, and transferability. Finally, Section 6 concludes with concrete next steps toward pilot implementation.

2 Theoretical Framework

Our conceptual design builds directly on the immersion framework of Beck and Morgado [8], who argue that the Immersion Cube and Immersive Learning Brain provide a shared language to describe and enrich immersive learning environments. Importantly, their conclusion is that immersion is not confined to XR or game-based contexts but can extend to any educational setting where system, narrative, and agency interact. This aligns with our claim that legal writing education, although text-based, can be framed as an immersive learning ecosystem. In our case, the system is realized through adaptive learning technologies, the narrative through authentic legal challenges, and the agency through students' ability to navigate personalized routes and integrate multi-source feedback.

Moreover, Morgado [6] introduces AI participants, providing the conceptual foundation for our co-regulation model. Our proposal operationalizes this extension: AI functions as co-regulator in different roles, namely as a virtual peer, as a coach, and as a process monitor. In this way, our design both applies and extends Beck and Morgado's conclusions by demonstrating how immersion can be realized in non-visual domains and how AI agency can be embedded in co-regulated learning practices.

2.1 Immersion as System, Narrative, and Agency

Morgado [6] builds upon the framework introduced by Nilsson, Nordahl & Serafin [9] in their landmark "Immersion Revisited" paper. Morgado conceptualizes immersion in learning environments through three interconnected dimensions. First, system immersion describes the technical and structural configuration of the environment. Second, narrative immersion involves the storyline or framing that situates the learner's activities and provides meaning. Third, agency immersion (formerly 'challenge immersion') concerns the capacity of learners to make meaningful decisions and shape their learning experience. Traditionally associated with XR or game-based environments, this framework also applies to non-visual or non-spatial contexts when system, narrative, and agency interact to create a sense of involvement and presence.

2.2 AI as Participant and Co-Regulator

Morgado [6] extends this model by introducing AI participants: artificial agents that not only deliver information but also act within the learner's ecosystem, supporting decisions and shaping the learning process. This reframing shifts AI from "tool" to "co-regulator". In this paper, agency is understood as the capacity of an actor to meaningfully influence learning processes and decision-making within a structured environment. Drawing on Bandura's [10] conception of proxy and collective agency, which emphasizes agency as distributed across actors and mediating systems, agency is conceptualized as functionally and relationally distributed rather than

autonomous. Applied to AI, agency does not imply autonomy or intentionality, but rather functional and relational involvement in the learning ecosystem. The AI system exercises functional agency by initiating feedback actions, suggesting revisions, and visualizing progress, and relational agency by being positioned as peer, coach, or process monitor. We define these roles as follows: as *peer*, the AI offers alternative perspectives and engages in simulated dialogue; as *coach*, it suggests strategies and provides formative guidance; as *process monitor*, it tracks progress and prompts planning. These roles structure all subsequent discussion of AI's function in the ecosystem. Moreover, this agency is intentionally bounded: AI does not replace instructor judgment or student responsibility but supports co-regulation of learning within clearly defined pedagogical and ethical limits.

Co-regulation is distinguished from self-regulation where it provides temporary scaffolding to support the student's mastery of a task, prompting the student to move from external regulation to autonomous self-regulation [7, 11]. Research on social regulation of learning indicates, however, that co-regulation may become limiting to the learning process when regulation remains asymmetrical or is dominated by a single regulating agent. Panadero and Järvelä's review of socially shared regulation of learning (SSRL) [12] suggests that such imbalanced forms of co-regulation can restrict shared responsibility and reduce opportunities for joint cognitive and metacognitive regulation. SSRL on the other hand has been associated with more productive collaboration, because it is characterized as a joint regulation of students' (meta)cognition, motivation, emotion, and behavior.

However, particularly in distance learning contexts where peer collaboration is difficult to sustain, implementing SSRL remains challenging. In this context, AI agents introduced as co-regulators may mitigate some of the limitations of traditional co-regulation by providing non-hierarchical, consistent, and adaptive regulatory support that scaffolds planning, monitoring, and reflection without replacing and possibly even enhancing learner agency. Furthermore, technology can strengthen co-regulation. In her discussion paper, Chan [13] synthesized multiple studies on co-regulation of learning in computer-supported collaborative learning (CSCL), showing that technology-supported regulation, particularly regulation of social processes such as monitoring shared understanding and group progress, is positively related to learning outcomes: students who regulate more also learn more. These findings provide a case for future research on the conceptual design of AI as a co-regulator to enhance the students' skills to co-regulate their learning process.

2.3 Theoretical Synthesis of Co-Regulation and Immersive Learning

The project contributes a conceptual and practical framework for embedding AI participants in immersive learning beyond XR contexts. The primary innovation of this framework lies in the theoretical synthesis of co-regulation and immersive learning theory. While immersive learning theory traditionally focuses on sensory or spatial stimuli, and co-regulation focuses on human-to-human scaffolding, this project merges these perspectives. Based on the idea that academic writing is a process consisting of several smaller tasks [1], we argue that immersion in a cognitive process such as legal writing, is not just a technical state, but a socially mediated state of engagement.

Operationalizing AI as co-regulator requires training the AI participants with specific pedagogical and domain-specific frameworks. Rather than relying on generic language processing, the AI participants are informed by specific legal writing rubrics ensuring that the AI's functional agency is aligned with formal academic standards and legal reasoning requirements. By feeding the AI with principles of co-regulation versus self-regulation and socially shared regulation, we ensure that the AI will provide temporary and tailored scaffolding that intentionally triggers the transition to student autonomy. This ensures that the AI's behavior as a co-regulator is not just reactive, but pedagogically purposeful. Lastly, we structure the AI interaction with the student's work to foster student feedback literacy, prompting students to critically evaluate, justify or refute the AI's suggestions.

2.4 Application to Legal Writing Education

Applied to our case of legal writing education, the following reflections could be made on the three dimensions of an immersive learning ecosystem where AI acts as a co-regulator.

First, system immersion is established through an online learning environment integrated with *Slim beken* (which translates as *Smart Feedback*), an AI-feedback tool, connected via Learning Tools Interoperability (LTI) for scalability. This system provides the technical infrastructure for continuous, just-in-time feedback and co-regulation by the AI system.

Second, narrative immersion is achieved by framing structured writing tasks as authentic professional challenges. Within this narrative, the AI functions as a co-regulator (e.g., as peer reviewer or senior partner). AI engagement allows for iterative revision cycles that mirror peer feedback. By forcing students to engage in "meta-reflection" on AI-generated suggestions during key decisions points, this design prevents over-reliance on AI-output [3]. Moreover, it ensures that students still experience academic ownership of their products.

Third, agency immersion is realized through the AI's role in scaffolding the student's mastery. As a co-regulator, the AI exercises functional agency by for example visualizing progress, suggesting strategies for research and writing and providing detailed feedback on written products, while students exercise their agency by navigating personalized learning routes. This interaction aligns with legal-writing pedagogy that characterizes the writing process as a deliberate series of tasks and decisions [1]. In this perspective, academic legal writing education becomes immersive not through 3D graphics or VR, but through the co-regulatory interaction between human and AI participants, where the AI provides the temporary scaffolding needed to transition from external support to autonomous self-regulation.

This application illustrates a broader theoretical point. By synthesizing immersive learning theory with co-regulation research, we arrive at a novel position: immersion in cognitive-academic tasks is not merely a function of environmental stimuli (as in XR) or social scaffolding (as in traditional co-regulation) but emerges from the relational dynamics between human and AI co-regulators operating within a structured narrative of authentic professional practice. This synthesis extends immersive learning theory by identifying co-regulation as a mechanism for achieving agency immersion in non-spatial contexts. Although the design is still under development, with pilot testing planned for 2026-2027, the framework already offers clear pathways for measuring learning outcomes as well as immersion and agency markers.

3 The Case: Description and Design

The case design operationalizes the theoretical framework (Section 2) through three corresponding design principles: (1) system integration via LTI-connected AI feedback, realizing system immersion; (2) authentic task framing via professional legal scenarios, realizing narrative immersion; and (3) structured decision points where students exercise agency in dialogue with AI co-regulators, realizing agency immersion.

3.1 Case Description

The case originates in the Bachelor of Law at the Open Universiteit, where diverse entry levels often lead to misalignment between instruction and student needs. Furthermore, students report insufficient opportunities for personalized feedback, while instructors face heavy workloads in managing large cohorts. These challenges motivated the development of a new design that reframes academic legal writing as an immersive learning ecosystem.

Slim bekeken ("Smart Feedback") is an AI-supported feedback environment developed at the Open Universiteit to support academic writing instruction. In its initial pilot, the tool focused on assisting instructors by generating rubric-aligned formative feedback on student texts, while leaving final pedagogical judgment with the instructor. This pilot is documented in a Dutch-language book chapter scheduled for publication on 17 March 2026 [4]. Building on this earlier *Slim bekeken* pilot, the current project shifts the focus from instructor support to the student perspective and explicitly targets processes of co-regulation of learning, positioning *Slim bekeken* as part of a broader student-facing immersive learning ecosystem.

3.2 Case Design

The design integrates diagnostic entry testing with dynamically adapted learning routes, ensuring that each student follows a pathway suited to their skills and progress. This personalized organization is complemented by flexible scheduling, which enables students to start and complete modules at times that fit their individual study trajectories, thereby supporting the Open Universiteit's mission of accessible, place- and time-independent distance learning (agency immersion).

Within this ecosystem, AI is integrated in its three co-regulatory roles (see Section 2.2): as peer, coach, and process monitor. This framing allows the AI to be perceived as co-regulator. The AI's feedback combined with authentic academic writing tasks mirrors professional dialogue between peers, which allows deeper narrative immersion.

In this co-regulated model instructors provide expert, contextualized feedback complementing the routine AI-feedback. The AI system provides automated learning analytics and deeper insights into student progress and performance, allowing more targeted pedagogical interventions by instructors. This ensures that a human remains in and on the loop. The instructor's role shifts from a mere reviewer to a coach guiding students through the complexities of academic legal writing and responsible AI use. Moreover, the continuous interaction between students, instructors and the AI system regulates the functional 'behavior' and pedagogical and ethical boundaries of the AI co-regulator in the ecosystem.

3.3 Illustrative Scenario

To demonstrate how the case design stems from the conceptual framework, we provide a concrete illustrative scenario with criminal law. Consider a student drafting a defense plea for a client claiming self-defense. A writing task following the case design and conceptual framework operationalizes the co-regulatory roles and immersion markers as follows.

A first critical decision point occurs when the student selects the most relevant jurisprudence (case law). The student, potentially guided by the instructor to ensure legal rigor, searches relevant databases, possibly with specific AI agents and selects the cases. Subsequently, the student uses the AI as a coach to analyze these cases and synthesize arguments regarding ‘proportionality’. During this process, the student must decide whether to follow the AI’s analytical path or pivot to an alternative argument. The student’s choices are captured via interaction logs.

The next step is structuring the defense plea. To mirror professional standards, the AI now acts as a virtual peer by proposing different structures for the plea. The student must evaluate these options, select one that best fits their legal strategy, and further develop it. While the AI provides routine feedback on grammar and legal terminology, the student remains responsible for the narrative’s persuasive flow. We measure the quality of revisions by comparing the draft’s structural coherence and legal logic before and after these AI-mediated choices.

During this writing task the instructor acts as a high-level mentor. While the AI handles routine scaffolding (structure and grammar), the instructor monitors learning analytics to identify students struggling with complex legal reasoning. For example, if a student consistently selects irrelevant jurisprudence, the instructor intervenes with expert, contextualized feedback.

4 Expected Outcomes

This conceptual design of an AI-empowered immersive ecosystem for academic legal writing is expected to yield outcomes at three levels: students, instructors, and the educational immersive ecosystem.

4.1 Enhancing Student Agency and Writing Quality

For students, the immersive ecosystem is anticipated to foster a stronger sense of agency through personalized learning routes and iterative decision-making in their writing process. By interacting not only with instructors but also with AI as a peer and coach, students are expected to experience writing as a more engaging and meaningful practice. This combination of adaptive pathways and multi-source feedback aims to improve the quality of their academic writing, while at the same time preparing them for a professional future in which AI literacy is essential [1].

4.2 Instructor Impact and the Human in the Regulation Loop

For instructors, the expected outcome is a transition from routine feedback delivery to complex and personalized guidance and high-level pedagogical coaching. This not only enhances student’s learning but may also increase job satisfaction. Moreover, this redefinition of the instructor’s role in relation to AI assists instructors in finding their way in an educational landscape which is disrupted by AI. The AI system’s automated learning analytics furthermore provide deeper insights into student performance allowing instructors to intervene more effectively. By keeping the “human instructor in the regulation loop” we ensure that this design remains pedagogically and ethically sound and that the AI’s “behaviour” is continuously moderated by professional legal standards.

4.3 Scalability and Institutional Learning

At the ecosystem level, the design is expected to generate outcomes that extend beyond individual students and instructors. First, the LTI-integrated architecture enables scalable deployment across courses that involve skills training without requiring substantial redesign, addressing a key institutional challenge: delivering personalized feedback at scale. Second, the design generates cohort-level learning analytics, providing instructors with aggregated insights into common writing challenges and decision patterns that can inform curriculum revision. Third, the explicit integration of AI as co-regulator creates an institutional model for responsible AI adoption: a structured template that other programmes can adapt, rather than relying on ad-hoc student use of AI tools.

5 Discussions and Implications

The conceptual design of an AI-empowered immersive writing ecosystem for legal education suggests that immersion in high-stakes academic tasks is a product of co-regulatory interaction rather than just technological presence.

5.1 Ethical Challenges: Balancing Performance, Creativity and Ownership

A primary concern in the integration of AI is the risk of over-reliance, where students might accept AI suggestions without critical evaluation. As noted by Mei et al. [14], while AI can significantly boost task performance, it carries the risk of diminishing the student's subjective experience of creativity and ownership, especially when AI becomes increasingly sophisticated. Our framework addresses this by positioning AI not as a "handy tool" but as a well-informed co-regulator. However, it is crucial that instructors adapt their teaching approach to support students in responsible AI use. Furthermore, based on the findings of Lin and Chen [15] the integration of AI must be carefully guard-railed to mitigate challenges such as creativity constraints, emotional disengagement and performance anxiety. This is particularly relevant in academic legal writing, which students often perceive as a high-stakes component of their education [4]. Lin and Chen [15] emphasize that AI systems can foster creativity, provided the AI challenges students with new ideas and engages students through interactive elements and problem-solving techniques. By embedding the interactions between students and AI within a "series of choices" the design forces students to maintain their executive agency. Furthermore, the ecosystem aims to mitigate academic anxiety by providing a predictable, scaffolded structure that fosters confidence while safeguarding the student's unique creative voice.

Closely related are issues of academic integrity: students may be tempted to uncritically adopt AI-generated text, raising risks of plagiarism or dependency [2]. This is a serious risk particularly in high-stakes components of education such as academic writing tasks. Our co-regulation model mitigates this by requiring students to justify each choice they make in their writing process. This turns academic legal writing into a transparent and auditable process, ensuring that students remain the primary author and intellectual owner of their work.

Finally, questions of equity remain: ensuring that all students, regardless of prior knowledge or digital skills, can benefit equally from AI support is a key requirement for responsible implementation. By using LTI-integration we safeguard access to the AI system for all students within the learning management system, preventing a "digital divide" where only students with private paid subscriptions can access advanced AI writing support.

5.2 Instructor-AI Complementarity: The Human in the Loop

Another contribution is the co-regulation model that integrates human and AI feedback. Rather than positioning AI as a substitute for instructor input, our design acknowledges the complementarity between the two, allowing students to critically compare and reflect on multiple sources of feedback. This enriches the learning process by fostering metacognitive awareness and developing students' ability to make informed choices in their learning trajectory. The instructor-AI complementarity ensures that the "pedagogical heart" of the ecosystem remains human, while the AI manages the scalable, iterative and instant feedback loops that are otherwise impossible in large cohorts [4].

5.3 Transferability and Scalability

Although the current case is rooted in legal writing, the underlying principles of this immersive ecosystem are transferable to other disciplines. The transferable principles include: the framing of writing as a series of deliberate choices amenable to AI scaffolding; the three co-regulatory roles of AI (peer, coach, process monitor) which are not domain-specific; and the LTI-integration model, which offers a scalable blueprint for institutions looking to integrate AI as a co-regulator in their digital learning environments. Any discipline that requires complex synthesis, argumentative precision, and iterative revision, such as philosophy, public administration, or the social sciences could adapt this framework by substituting domain-specific rubrics and authentic task scenarios.

6 Conclusions and Next Steps

This work-in-progress extended abstract presented the conceptual design of an AI-empowered immersive learning ecosystem for academic legal writing. By framing the learning process through the dimensions of system, narrative, and agency, and by explicitly recognizing AI as an agentic co-regulator, we propose a shift from viewing writing instruction as isolated skill training to experiencing it as an immersive practice. The design aims to

empower students through personalized learning routes, iterative engagement with AI-scaffolding combined with expert feedback from instructors, and authentic tasks that mirror professional legal challenges. Instructors, in turn, are supported by AI in routine feedback tasks and by AI-automated learning analytics, which allows them to gain deeper insights into student learning trajectories and to focus on complex, high-value guidance.

In sum, this paper contributes: a theoretical synthesis of co-regulation and immersive learning theory, a conceptual argument for extending immersion to text-based academic practices, and a concrete case design that operationalizes these principles in legal writing education. Although the project is still in progress, concrete next steps can be defined. A pilot implementation within the Bachelor of Law is planned for the 2026-2027 academic year and will provide empirical grounding for the contributions. During this phase, we will develop and validate instruments to capture learning outcomes and indicators of immersion and agency, such as decision points reflections and the quality of revision after AI-mediated co-regulation as well as reflections on AI versus instructor feedback. By evaluating these pilots, we aim to provide a scalable and transferable framework for integrating AI agents as co-regulators in academic domains not traditionally associated with immersion, extending the iLRN discourse into the core of academic writing education.

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