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Blending Seamless and Seamful Tactics to Nurture Practical and Reflexive AI Competences in Design Education

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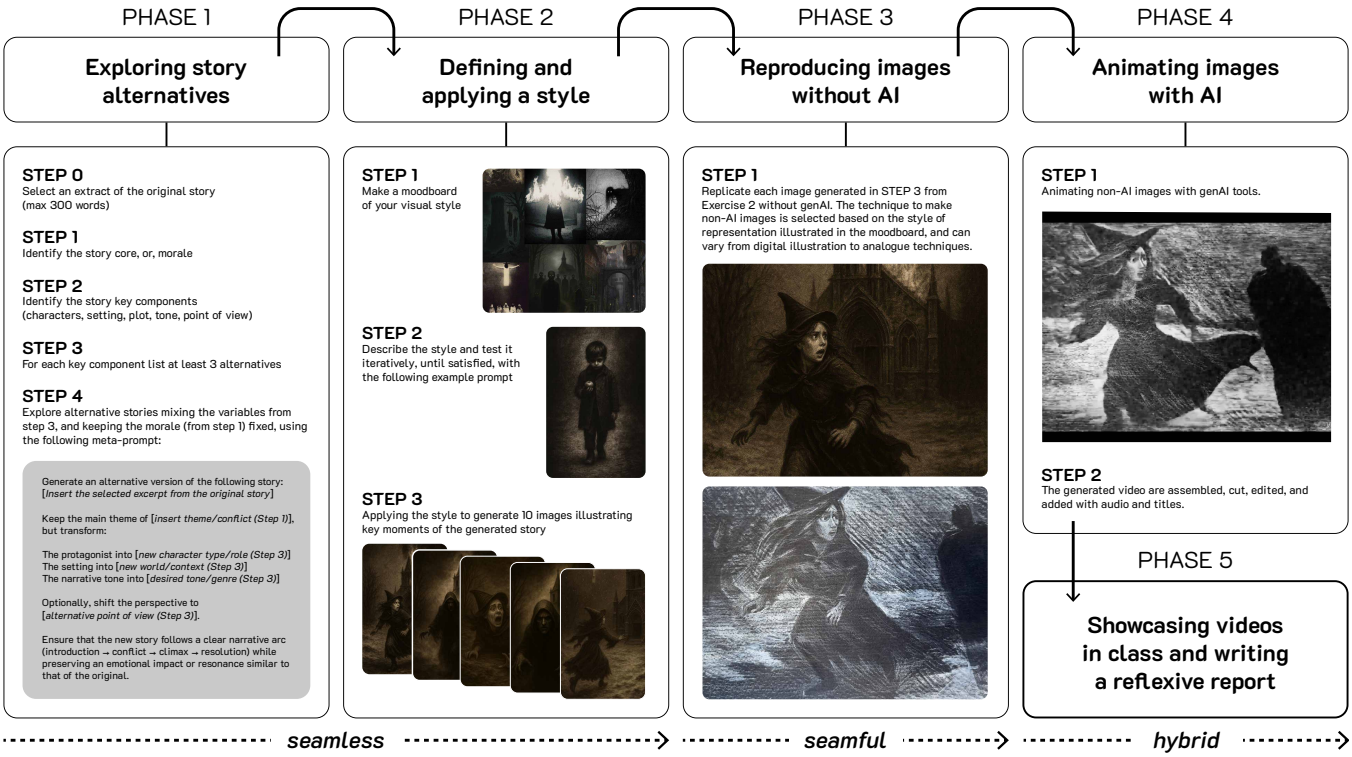


Figure 1: Overview of the pilot program, which combines seamless and seamful exercises to develop practical skills in designing with generative AI while encouraging critical reflection on the societal implications of these technologies.

Abstract

The rapid integration of generative AI into design education generates tensions between innovation and pedagogy. This paper presents a pilot program that combines structured spaces for practical learning and critical reflection on generative AI. Implemented within a large undergraduate Storytelling and Animation course, the program combined seamless AI-based creative exercises with a deliberately seamful activity intended to disrupt automation and foreground human agency. By analysing student reflections collected through written reports, we find that this pedagogical program can foster diverse critical positionings, enabling students to negotiate authorship, question tool dependencies, and reappropriate creative processes. Rather than adopting or rejecting generative AI uncritically, students developed nuanced understandings of its role in their design practices. The main contribution of this work is to foreground the combination of seamless and seamful activities as a pedagogical tactic for teaching practical competences while encouraging critical reflexivity about the integration of generative AI into higher education.

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CCS Concepts

• **Social and professional topics** → **Computing literacy**; • **Human-centered computing** → **Interaction design theory, concepts and paradigms**.

Keywords

design education, critical AI, generative AI, storytelling, video making, seamfulness

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1 Introduction

The integration of Generative AI (genAI) into higher education curricula appears as a pressing challenge for educators [Yusuf et al. 2024], yet it also raises concerns and sparks a strongly polarised debate [Lupetti et al. 2025a]. On one hand, enthusiasts celebrate these tools as transformative technologies that enable unprecedented opportunities for learning [Figoli et al. 2022; Lim et al. 2023], such as personalised support, immediate feedback, and new creative possibilities [Hwang and Chen 2023; United Nations Educational and Organization 2023]. On the other hand, critical perspectives raise profound concerns about matters of academic integrity, tool dependency, and the erosion of foundational skills [Cotton et al. 2024]. This tension has translated into divergent institutional responses: some universities initially banned the use of genAI tools for any educational purpose, while others fully embraced them in teaching and learning processes [Chan 2023]. Banning policies were subsequently criticised as unsustainable and counterproductive for cultivating AI-literate citizens [Lodge et al. 2023; Rudolph et al. 2023], leading many institutions toward more nuanced approaches that leave usage rules to individual instructors.

In design education, this polarisation takes on particular connotations. Programs must navigate a tension between the imperative to prepare professionals competent in tools increasingly prevalent in the creative industry and the responsibility to protect the development of design skills that require time, deliberate practice, and the opportunity to fail [Fremantle and Kearney 2015; Kolodner et al. 1998]. Yet both uncritical integration and precautionary rejection share a fundamental gap: these create *a lack of structured pedagogical spaces where students can both acquire practical competences as well as critically reflect on the implications of genAI for our discipline*. Without such spaces, students remain passive consumers of tools whose values, limitations, and implications remain largely unexplored.

In this paper, we present a pedagogical approach that addresses this gap, which was run as a pilot module part of a larger bachelor's course on "*Storytelling and Virtual Animation*". The program was attended by 207 students, divided into 3 parallel tracks. As a central practice in our pilot program, we first introduced a series of guided AI exercises that allowed students to explore the seamlessness of working with genAI for creative practices, and then introduced a seamful exercise as a way to provoke reflection and encourage reappropriation over the creative process. We evaluate the effects of this tactic by conducting a deductive thematic analysis [Clarke and Braun 2017] of structured reflective reports submitted by the students' groups at the end of the course, after finalising an AI-generated video of 30 seconds.

2 AI literacy pedagogies for designers

Research on AI literacy has evolved from revisiting literacy from a set of technical competencies to treating it as a critical capacity involving the evaluation of AI systems and the interrogation of their implications. Long and Magerko [2020] defined AI literacy as the set of competencies that enable individuals to critically evaluate AI technologies and use them as tools across diverse contexts. However, recent work reveals that knowledge alone is insufficient: Li et al. [Li et al. 2024] demonstrated that while high school students understood that Large Language Models can generate inaccurate information, this awareness did not consistently translate into hallucination mitigation behaviours, a knowledge-behaviour gap already familiar from HCI research on security and health. We share with these authors the need to move beyond awareness-building, but we see a fundamental difficulty: *there is a lack of pedagogical structures that guide students in critically interrogating their own experiences with genAI tools*, transforming declarative knowledge into critical positioning informed by practice.

In this regard, HCI and design education have increasingly engaged with practices aimed at *fostering reflection*. Empirical studies around the introduction of genAI in creative contexts, in fact, underscore why critical reflection is particularly urgent for design education. Through their taxonomy on "*AI design and magic*", Lupetti and Murray-Rust [2024] illustrate how designers, and design students especially, are subject to the enchanting power of AI technologies and, as a consequence, tend to develop projects that further emphasise supernatural and magical thinking around them, while obfuscating the mechanisms needed by these systems to function. Relatedly, Wadinambiarachchi et al. [2024] found that genAI can increase design fixation during ideation, limiting the exploration of alternatives. A problem echoed by Li et al. [2024], who documented how experienced UX designers fear skill degradation and creative exhaustion for junior professionals. Together, these studies underscore the need for pedagogical structures that help students develop critical perspectives around the use of genAI in their creative work, not just technical competence.

In response, the HCI and design education communities increasingly engaged with foundational theories around reflection in design, such as Schön's [Schon and DeSanctis 1986] notion of reflective practice, which emphasises how design is itself a practice that allows one to make tacit knowledge explicit through structured inquiry. The conceptualisation of design as a reflexive practice, however, can be extended and intentionally emphasised. In this regard, Sengers et al. [2005] developed Reflective Design: a methodology that invites designers and users to interrogate the unconscious values embedded in technological artefacts, making visible assumptions that would otherwise remain implicit. Current reflective practices around genAI in design education relate to these approaches with programs that, along with a focus on mastering tools (i.e., teaching how to formulate effective prompts and how to obtain quality outputs), start to encourage reflections on the values that these systems embody: questions of authorship, creative control, and style homogenization. Murray-Rust et al. [2024], for instance, attempted to address the need for both technical competencies as well as critical and reflexive capabilities in students, offering a range of short exercises. Lupetti et al. [2025b], in an experimental summer

school program, combined history-grounded speculative design activities with genAI experiments as a way to critically reflect on contemporary impacts of AI in various aspects of our lives. Related, yet distinctively focused on data collection, labelling, and model fine-tuning, other recent research has approached genAI integration in design education as a site where algorithmic uncertainty and unpredictability can become a means for self-reflection [Arzberger et al. 2024], and an opportunity to regain agency over the creative process [Van Der Burg et al. 2026].

All these critical and reflexive approaches to the integration of genAI in creative education represent virtuous examples of how alternative and meaningful pedagogies can be instantiated. Yet, a gap remains between programs that focus more on preparing skilful professionals to be ready for a job market that requires genAI practical competencies, and the ones that alternatively focus on taking up our moral responsibility towards society to address AI impacts. Our argument here is that these two approaches can, and should be blended, as both goals are valid and urgent. We believe that it is possible to do so by blending both seamless and seamful tactics in our educational programs, as a way to *nurture students' practical competencies while encouraging critical reflexivity around genAI use in design.*

3 An experimental program on AI for Storytelling and Virtual Animation

To validate our assumption that *seamful activities with structured moments of reflection can nurture both practical and critical thinking skills in the classroom*, we developed a pilot program where we introduced AI tools and exercises to bachelor's design students. The pilot consisted of a program lasting 10 hours and was run as part of a broader bachelor's course on "*Storytelling and Virtual Animation*", part of the Bachelor's Degree in Design and Communication at Politecnico di Torino, in Italy. In this pilot program, genAI was introduced for the first time within these activities, in a variety of modalities, from generative text, text-to-image, text-to-audio, and image-to-video. genAI tools were approached not only to provide a creative alternative to traditional tools, but also to encourage a critical view [Florida 2019; Østvold Ek et al. 2024].

3.1 Program structure and context

The course requires students' groups to produce a 30-second animated video based on a specific brief, using storytelling methodologies, digital 3D modelling and animation tools. The assignment focused on reinterpreting two classic works of children's literature: *Alice's Adventures in Wonderland* and *Pinocchio*.

The objective of reinterpreting a narrative structure may initially appear, from a disciplinary perspective, distant from a methodological design framework. However, within an educational and cultural dimension of the design project [Musso 2002], and through the adoption of an exploratory approach, students are encouraged to construct a solid state of the art defined by clear boundaries — plot, characters, context, historical period, and literary style — that serve as a starting point. This condition aligns with the principles of exploratory design [Fallman 2008]. Accordingly, the course introduces tools for analysing narrative structures, drawing on the models proposed by Propp [Propp 2010], as well as tools for identifying character archetypes [Tillman 2019]. As part of the course output, students are required not only to conduct an analysis of the story, but also to reinterpret it following a defined narrative structure and to redefine its characters starting from archetypal frameworks. Additional design tools include the development of stylistic moodboards [Cassidy 2011] to visualise and maintain a coherent chromatic, figurative, and animation language. The production of a storyboard [Truong et al. 2006] is also required, serving both to describe the animated scene and to visualise the design process in a way that is comprehensible to other stakeholders [Van der Lelie 2006]. Finally, embryonic versions of the video, commonly referred to as animatics [Swenberg and Thorén 2024], are used to explore framing, timing, and dynamics relevant to the final production. Blender is employed for the production of the short animation [Hess 2013; Villar 2021], initially as an educational tool and subsequently as an operative one [Hattori et al. 2020].

The module revolved around five main phases (see the overview in Figure 1):

(1) exploring alternative story versions (n= 3) using a text-to-text genAI tool and changing the story variables, i.e., the role of the protagonist, the narrative context, and the narrative genre;
(2) developing a moodboard, capturing an illustration style and applying it using a text-to-image model, first to a text prompt and then to portions of the new story divided into 10 textual passages;
(3) recreating each of the ten frames 'manually' using the illustration style and technique captured in the moodboard, refining or modifying details where considered necessary;
(4) animating the frames using image-to-video models and assembling a thirty-second short animation, inclusive of audio and sounds that were either AI-generated or gathered via online creative commons sound repositories.
(5) showcasing the videos in class and producing a report of a maximum of 1,200 words, articulating a critical reflection about their process and the modifications, adaptations, or reinterpretations they went through for developing the assignment, as well as their opinion on the role of genAI in creative practices.

3.2 Instruments and resources

The course was supported by the use of the collaborative digital whiteboard *FigJam*, where the authors prepared canvases for each exercise described in Figure 1. The other main instrument recommended to students in the course was *Gemini*, the AI assistant by Google. Both *FigJam* and *Gemini* were selected because of their affordability. In fact, both platforms offer free education accounts with institutional email. During the design of the course, the authors aimed to use genAI platforms specifically designed for creative tasks, and video making in particular, such as *MidJourney* and *Runway ML*. The procurement of educational licenses for such a large course, however, proved to be more expensive than expected, with *MidJourney*, for instance, offering 50 yearly Pro or Mega Plan subscriptions for $28,800.00 and $57,600.00 respectively (all before applicable taxes). The use of other platforms was also encouraged,

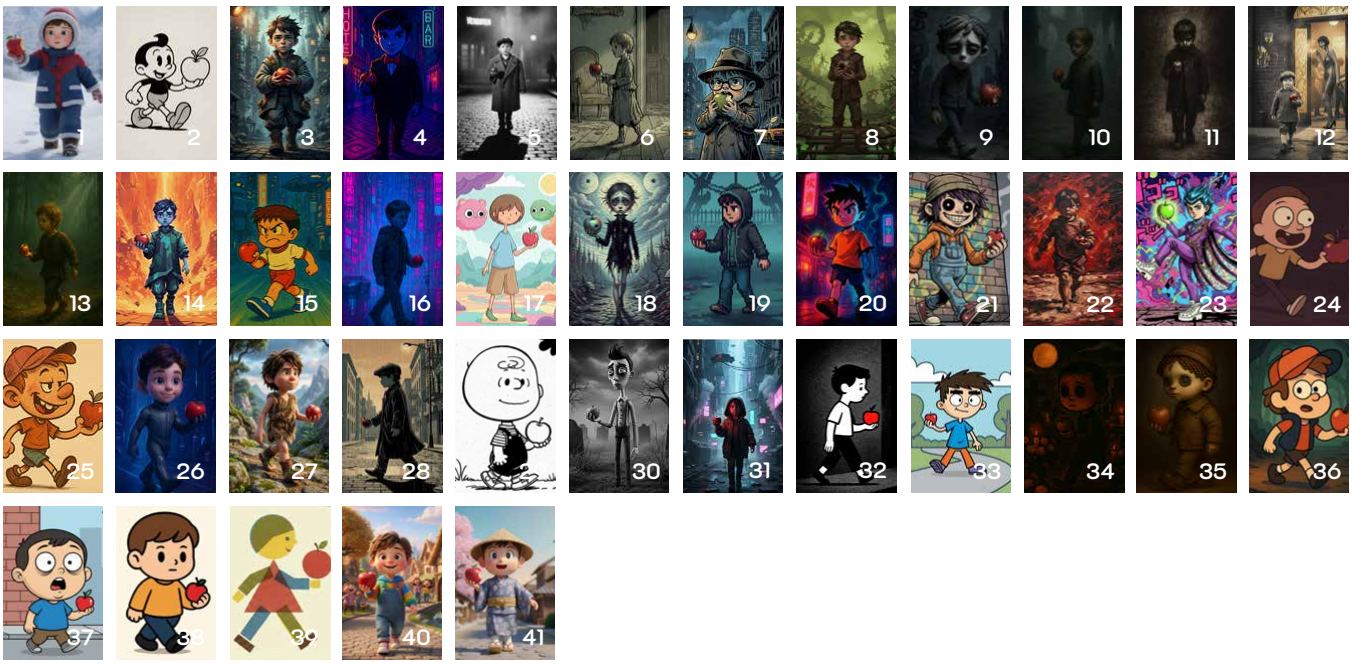


Figure 2: Visual stylistic references used by each group for the project. The image was developed by each group as a way of testing their visual style, previously defined through a moodboard.

Table 1: Division of students' groups across the two stories selected for the course: Alice in Wonderland and Pinocchio

	Alice in Wonderland	Pinocchio
Group numbers	1, 4, 7, 11, 12, 14 17, 18, 20, 22, 23 24, 26, 30, 31, 32 34, 35, 36, 41	2, 3, 5, 6, 8, 10 13, 15, 16, 19, 21 25, 27, 28, 29, 33 37, 38, 39, 40

especially to experiment and learn about possible differences across different genAI tools. These include *ChatGPT*, *DeepSeek*, *MetaAI*, *ClickUp AI*, *Copilot*, *Flow*, *Pixverse*, and *ElevenLabs*.

3.3 Participants

The program was attended by 207 students (F=85, M=122) enrolled in the second year of a bachelor's program in "*Design and Communication*" at Politecnico di Torino. The students attended the course divided into three parallel tracks (each conducting the same activities), and worked collaboratively in 41 groups, each composed of either 5 or 6 students (with a few exceptions).

3.4 Data corpus and analysis

To investigate whether our approach, combining both seamless and seamful exercises, achieved our goal of nurturing students' practical competencies while encouraging critical reflexivity around genIA use in design, we conducted a deductive thematic analysis [?] of the 41 students' reports. The report was intended as a platform to provide a space for students to articulate reflections on the program process and their experiences when interacting with genAI. Students were not required to provide a description of what was done, but rather a discussion of observations and opinions on the value, limitations, and implications of using AI for creative activities. Specifically, the recommendation for students was to address the following aspects: 1) control; 2) authorship and impact on creativity; 3) emotional aspects of interacting with AI; 4) the role and dynamics of specific AI tools; 5) usefulness; and 6) risks. When familiarising themselves with the extracted text, the first author listed a preliminary set of themes, which were then discussed collectively among the authors to reach interpretative agreement. Each author then analysed the transcripts of all reports, focusing only on a subset of themes, about 3. The results were finally discussed for further interpretative alignment.

4 Findings

In the following, we discuss the main findings of our thematic analysis of the students' reports, where matters of control, authorship, novel design expertise and workflows, and risks for the discipline were complemented with spontaneous reflections around technical limitations, conceptualisation of AI itself, and perceived value of the educational program.

4.1 Control

Control is the most recurrent and problematised dimension across the reports. Almost every group describes an initial phase marked by a *"sense of powerlessness"* (G1) and by the difficulty of *"fully managing the final result"* (G10): despite *"clear and detailed"* prompts (G16), outputs diverged from intentions, with unwanted elements,

excess limbs, stylistic drift and autonomous narrative reinterpretations, to the point of making the animations look like *"genuine hallucinations"* (G19). From this friction, groups derive a reconceptualisation of their relationship with the tool, no longer *"'commanding' the software to execute a precise order, but 'navigating' its probabilities"* (G1), in a relationship that *"was not limited to a simple command-and-execution relationship"* (G36) but took shape as "a real aesthetic negotiation" (G31). Control is thus reinterpreted as a design competence, *"based on dialogue with the tool and on understanding its limits"* (G10), one that grows with experience. Several groups report that *"the sense of control increased… because we had developed greater competence in dialoguing with it"* (G8). Strategies of reappropriation converge: manual redrawing functioned as a *"critical filter"* to *"re-establish a sense of creative sovereignty"* (G1), dual-frame input, or using one model to generate the prompts for another (G28). Yet a shared awareness remains that *"actual control was never total: there is always a component of 'surprise' that the AI introduces"* (G34), and that the result is often *"more guided by chance"* (G35) than fully mastered. The designer is thus redefined as the one who *"selects, interprets, modifies and guides the generated results"* (G36).

This trajectory, from initial frustration to conscious negotiation, shows how the seamful exercise pushed students to critically problematise the notion of control rather than take it for granted.

4.2 Authorship

Students' perception of their role shifted from being a *"maker"* to being a *"director of the making"*. Students talked about their work as a form of *"critical and managerial curation"* (G4). This view reinforces the students' perceptions illustrated about matters of control: the designer is no longer considered a solo author, but rather a creative director of a process that is not entirely in their hands. The configurations of these collaborations, however, varied. Sometimes this translated into a seemingly genuine collaboration between the designer and AI tools, where *"the final result was never completely attributable either to the AI or to us, but was born from a continuous process of mediation"* (G2). In other cases, this collaboration translated into students finding themselves *"chasing"* and modifying unexpected outputs that were inconsistent with what had been designed up to that point (G2). In the interaction with the AI tools, creative exploration was sometimes discouraged by repeatedly conflicting results, which pushed students, as they put it, *"to change direction and [...] take major deviations from the original idea"* (G34). In these cases, compromises overtook the creative will of the designers, opening up questions on who is truly in charge of creative decisions. In all this, AI errors played a central role. In some cases, error was perceived as a failure to adjust — even manually — requiring modification of the visual results and justification of the edits, often simply to achieve the desired visual output. This was sometimes understandable because of the *"instrumental and operational limits"* (G4), such as an inconsistency between the image generated and the desired aesthetic. In other situations, the error — even if initially considered a failure — was embraced and appropriated as a *"generative mistake"* (G.38) – a *"positive surprise"* that led students towards a *"creative direction not previously considered"* (G8).



Figure 3: An example of final representation where, despite the illustration may seem a uniquely human drawing, it is actually the result of a rich collaboration between the students and the genAI tool. The two images, the AI-generated on top and the hand-drawn at the bottom, show how students reappropriated the creative process and regained control over the images through drawing, which allowed them to curate–and fix– details as well as to add a 'human touch'.



Figure 4: An example of inconsistencies among various generated images: in the work by group 8, one of the main characters first appears with a hat (*left*), while later the jacket doesn't have a hat anymore (*right*)

4.3 Emotional experience

The emotional experience described in the reports is ambivalent. One group summarises it as *"an emotional rollercoaster"* (G1), another as *"a cycle of wonder, frustration, resignation and satisfaction"* (G13). There is a general agreement among students that the initial

phase was dominated by wonder: *"seeing a complex scene materialise in a few seconds generates an immediate, almost playful satisfaction"* (G1), up to an *"undeniable feeling of omnipotence"* (G30) and *"an undeniable 'wow effect'"* (G27). This instant gratification, however, quickly gave way to frustration: by far the most cited emotion. Frustration emerged *"when attempting to refine the result"* (G1) and intertwined with *"the powerlessness of not understanding why the machine misinterpreted a request"* (G30). Frictions associated with matters of access, such as limited credits and generations per day, amplified the tension, adding "*a layer of performance anxiety: every wrong generation was a lost opportunity"* (G27). Some groups also describe less predictable emotional outcomes: a *"resignation [that] was not a renunciation, but rather the recognition of the tool's limits"* (G22), or moments of hilarity in front of outputs *"often surreal or incoherent, [which] ended up being comical"* (G2). The arc nonetheless tends to close positively, since frustration *"was followed by a feeling of great satisfaction, given by the possibility of seeing realised what until then existed only in [their] minds"* (G21), and speed: *"once the technique is tamed, transforms effort into pure design fun"* (G28).

4.4 Impact on the design at large

Students observed that genAI reconfigures the design process by shifting its centre of gravity *"from technical execution to curation and artistic direction"* (G27). Such reconceptualisation recurs almost identically across the groups, with creativity moving *"from production to the ability to manage outputs"* (G22), the designer role shifting *"from creators to curators, or even mere supervisors"* (G30), signalling a strong interpretive convergence. Along this axis, groups recognise opportunities, especially around AI as an *"accelerator of ideas"* (G1) and a "brainstorming partner" (G13) that *"democratises access to high-fidelity visualisation"* (G37), enabling stylistic explorations otherwise precluded *"for lack of technical skills"* (G14, fil.1). This openness is countered, however, by the perception of an *"aesthetic homogeneity"*; an *"'AI look'"* (G13) tending towards an *"average aesthetic… international AI style"* (G1). The return to manual drawing then took on *"a central role in recovering the expressive identity of the project"* (G29). Thinking about their profession, groups oscillate between the fear of a *"skill atrophy"* (G1) and of job losses (G25). Some think in reassuring terms about how the designer's *"role does not disappear but transforms"* (G27): not *"replacing our creativity, but… enhancing it"* (G28). Within this transformation, prompting establishes itself as a new design competence, *"an integral and inseparable part of the creative process"* (G37), while critical thinking remains the human core, since AI *"can never replace human critical and creative thinking"* (G32).

4.5 Risks

The first risk that emerged across several reports is the worry of habituation to the tools' outputs due to the rapidity of the responses. This disuse of individual and collective cognitive effort is often described by the students as a way of *"getting too used to the tools delegating, slipping into intellectual and creative laziness"* (G25). Related to this is the concern that getting used to genAI practicality and speed would cause a systematic lowering in quality of the designed outputs. Small errors or narrative inconsistencies in image generation or video sequences don't go unnoticed, yet the tool's convenience leads students to overlook them, encouraging what some referred to as *"aesthetic laziness"* (G31). Further, even when aesthetic quality seems decent, or even high, there is an inherent risk in accepting genAI outputs as they are. Students, in fact, often mentioned how uniformity and standardisation became a common issue among the groups who noticed a *"risk of homogenization of representations"* (G27). Although the students used prompts as inputs with precise aesthetic indications, supported by moodboards as inspiration, the models often tended to normalise and clean up the outputs. This also happened in the generation of videos from hand-drawn drawings. From the elimination of asymmetries to the erasure of roughness, the uniformity of beauty often led to results far from that deliberately dirty and realistic effect that the course intentionally wanted to reintroduce. Last, students worried about how to claim ownership of designs that result from processes where full creative control is lost. Design processes are often described as opaque, which does not allow for a full understanding of how a result is generated, thus transforming the designer's choices into passive and *"automatic acceptances"* (G10).

4.6 Understanding AI

While recognising AI speed and lowering of technical barriers (i.e., AI *"bridged the gap between our ability to imagine and our ability to execute"* (G30), helping to deal with the *"blank page syndrome"* (G37), and *"to visualise artistic styles that… we could never have approached"* (G34)), many students also pointed at similar AI limitations. The most recurrent pertains to temporal and stylistic coherence. Students explain how the tools *"excel at creating complex textures and dreamlike atmospheres, but struggle with temporal and spatial coherence"* (G1), with characters changing appearance across frames (G16) and the need to *"repeat at every scene directives such as 'keeping the previously generated characters, setting, colours and style… '"* (G17). A second limit is about semantic understanding, since it brings out the *"AI's inability to fully understand metaphors and complex narrative contexts"* (G17), exemplified by the case in which, asked for an atmosphere with 'fear in the air', *"the AI literally wrote the word 'Fear' in the image"* (G18). A third node touches on training biases: *"inserting the word 'Pinocchio', the generators almost invariably produced a wooden puppet with colourful clothes, ignoring the prehistoric context"* (G27). The general impression is then that AI *"invents nothing new"* (G23); it *"does not create autonomously, but reworks inputs and indications provided by the human being"* (G2).

Because of these perceived capabilities, students often also provided their own definitions of AI. Some described it as an *"active, at times stubborn interlocutor, capable of influencing the creative direction as much as the original authorial intention"* (G1), a *"brainstorming partner"* (G28), an *"'other' entity"* with which the project becomes *"a genuine dialogue"* (G1). To these conceptualisations that underscore the positive capabilities of AI, other students opposed a remarking of the unreliability and asymmetry of the relationship. Here AI is rather described as *"a child"* one must *"constantly look after"* (G2), a *"rebellious and unpredictable collaborator"* (G31), or a *"slot machine"* where *"one inserted an input and hoped for a result coherent with what was imagined"* (G13). Last, some students critically remarked how *"artificial intelligence is not a magic wand that solves creativity, but a distorting mirror that challenges it"* (G1); *"a*

tool requiring conscious 'guidance'" (G16), that can turn *"into a cage if its intrinsic limitations begin to dictate the script"* (G31).

4.7 The course as a learning experience

Many students added in the reports some reflections on the very value of the pedagogical experience; considerations that credit the module with a formative value that extends beyond practical competence. Students pointed at metacognitive values, explaining how the process *"allowed [them] to develop a more critical gaze on AI, not as an automatic solution, but as a technology to be interrogated, understood and consciously integrated"* (G4). Some appreciated the course for making clear *"not only what AI can do, but above all what kind of critical, linguistic and creative competences it demands of those who use it"* (G29). Some also saw a value in the course for creating an opportunity for students to exercise their *"capacity to reflect on one's own role as designers"* (G10), to the point of triggering *"an internal debate on what it really means to 'create' something from scratch"* (G31). Learning is described as experiential, *"learning directly through the method of 'doing'"* (G23), considering *"the entire process, including errors and changes of course, as a fundamental part of our learning"* (G39). What students learned, according to their reports, is also transferable: *"we were able to put it into practice in projects across different disciplines"* (G21), taking home *"not just a video, but a working method"* (G16). Alongside values, however, the reports document significant contextual frictions. The most cited are access constraints: limited credits and generations *"transformed free experimentation into an economic calculation"* (G30) and *"made every error weigh more"* (G24), preventing an iterative *"labor limae"* approach (G5). Formal constraints also emerge, such as "the fixed 8-second clip duration" (G26), and the influence of *"politically correct"*(G28) practices resulting in AI that refuses to generate specific scenes. Finally, some students also underscored how the typical genAI interface design *"seems designed to facilitate individual work, without valuing group work"* (G34), a work dynamic that is instead central to their educational program, and –presumably–future profession. Interestingly, many of these frictions *"forced greater reflection before action"* (G30).

5 Discussion

The pedagogical experiment generated a rich array of insights on the value and challenges of integrating genAI in creative education, especially combining seamless and seamful tactics. In the following, we discuss the results in light of our initial intention, that is, to train practical competences around the use of genAI in creative practices, while also nurturing critical reflexivity.

5.1 Gaining practical competences

Looking at the results, the approach seemed to be effective in allowing students to develop practical competencies for using genAI tools. Students reported feeling increasingly more capable of interacting effectively with genAI, e.g., *"an integral and inseparable part of the creative process"* (G37). In particular, statements like *"the sense of control increased... because we had developed greater competence in dialoguing with [AI]"* (G8) point to how, despite genAI being largely understood as an unpredictable technology, students felt able to master (to a large extent) control over it. They reframed control as a skill: *"based on dialogue with the tool and on understanding its limits"* (G10), students developed practical strategies for using genAI more effectively, such as using two images as input for video generation, or generating prompts with one genAI tool to be used in another tool (G28). Interestingly, these strategies are reported by students as learned techniques ("learning directly through the method of 'doing'" (G23)), rather than accidental discoveries. This underscores how the hands-on nature of the course provided students with the necessary space to approach the use of genAI as a methodological practice space that, like other design skills, requires time, deliberate practice, and the opportunity to fail to be properly appropriated [Fremantle and Kearney 2015; Kolodner et al. 1998]. As such, the approach proved to be particularly well suited for welcoming failure as a positive learning experience, a key element that education literature underscores as central to an individual's growth [Arrington et al. 2021].

Students also learned how to manage and work around AI limitations. While acknowledging that collaboration with genAI often resulted in accepting 'good enough' outputs, they also acquired a strong sense of how co-creating with genAI is much about curating, editing, and reinterpreting. In particular, the *seamful exercise*– manually reproducing the images– appeared to be strengthening the results generated by the AI tools, such as by gaining higher control of detail inconsistencies and adding nuances and materiality to the style of representation. Students talked about this step of manual reproduction as a *"critical filter"* that allowed them to *"re-establish a sense of creative sovereignty"* (G1). The blending of seamless and seamful activities also seems to have encouraged students to: experiment with prompting in a structured manner, develop hybrid workflows (across diverse genAI tools, and moving back and forth between AI and 'manual' techniques), and iteratively refine and critically reflect.

Last, the overall experience was perceived as valuable for acquiring transferable skills. As groups wrote in the reports: *"the entire process, including errors and changes of course, [was] a fundamental part of our learning"* (G39), a learning that some *"were able to put it into practice in projects across different disciplines"* (G21). The approach, then, was successful in supporting students in gaining practical competences around genAI use in creative practices, and it was clear to students how the point here was *"not just a video, but a working method"* (G16).

5.2 Nurturing critical reflexivity

In line with our expectations, students moved beyond discussing AI as merely a useful or problematic tool, to critically interrogate their own relationship with AI throughout the process. This is evidenced by rich reflections regarding aspects of control, about which they discussed how collaboration with these tools requires extensive capacity of negotiation, adaptation and generative appropriation. Students describe these aspects as acts of *"navigating its probabilities"* (G1); *"a real aesthetic negotiation"* (G31) where *"actual control was never total"* (G34). The seamful exercise appeared to be particularly important in this, as manually recreating images exposed the limits of automation and encouraged reflections of matters of authorship and the changing role of creatives. Students redefined

themselves–and creative practitioners by extension– as directors, curators or mediators, as opposed to 'creators'.

Some students also reflected on the role and influence of genAI tools on authorial choices, mostly in negative terms. Several risks were identified, such as intellectual deskilling, aesthetic homogenisation, opaque decision-making, and loss of ownership. Students revealed being worried about *"slipping into intellectual and creative laziness"* (G31), which could result in *"automatic acceptances"* (G10) of generated results, and a consequent *"homogenization of representations"* (G27). In this, students spontaneously engaged with an important AI critique for the HCI and design communities, the one underscoring how these systems impose a corporate aesthetics that *"encroached as it is between techno-determinism and capital, has users, viewers and customers implicated in the perpetuation of the illusion of exponential progress"* [Donnarumma 2022].

Critical thinking around AI was also manifested by students' spontaneous conceptualisations of AI, especially through (some) unexpected metaphors. While some used metaphors to describe human-AI interaction that are quite established in HCI and design literature, such as the one of a brainstorming partner [English et al. 2026; Kim et al. 2024; Urmeneta and Romero 2025], others added less familiar nuances that emphasise the complexity of the collaborative relationship, such as a stubborn and rebellious collaborator, a slot machine, and a child requiring supervision.

Finally, even if not explicitly asked to do so, students reported seeing value in the program in allowing them to exercise critical thinking. Some students explicitly talked about the course as a space that allows them to *"develop a more critical gaze on AI"* (G4), where one should reflect on *"what kind of critical, linguistic and creative competences it demands"* (G29) and on their very *"role as designers"* (G10). Therefore, the pedagogical approach, and the seamful exercise in particular, appear to have reframed AI in students' eyes: *from an efficiency tool for speeding up projects, into an opportunity for critical reflection and developing personal approaches to it.*

6 Conclusions

This work set out to explore whether seamfulness can function as a critical pedagogical tactic for integrating genAI into design education. Our findings suggest that deliberately orchestrating an educational program that transitions from seamless to seamful exercises with genAI tools can create productive frictions and conditions for critical reflexivity, without sacrificing the acquisition of practical competencies. Rather than positioning critical reflection and technical proficiency as competing goals, our approach demonstrates how they can be mutually present and even reinforce each other.

Across student reports, a consistent experiential trajectory emerged: initial fascination with the speed and apparent creative power of genAI was soon replaced by frustration as limitations around control, consistency, and authorship became evident. Interestingly, it was not the mere exposure to these limitations that fostered critical awareness, but the pedagogical approach that asked students to confront them through manual reconstruction, curation, and post-production work. The seamful exercise—reintroducing human intervention after a phase of AI-driven generation—functioned as a moment of rupture that made visible what often remains unnoticed in seamless interactions: probabilistic behaviour, aesthetic homogenisation, and human adaptation to algorithmic possibilities.

In this sense, seamfulness operated as a reflective design tactic in line with Sengers et al.'s [Sengers et al. 2005] call to surface hidden values in computational systems. By experiencing breakdowns in style coherence, character stability, and narrative continuity, students were encouraged to articulate positions on authorship, quality, and responsibility that went beyond instrumental prompt optimisation. Importantly, these reflections were grounded in lived practice rather than abstract critique, addressing the gap between knowledge we have from critical AI literature and practical knowledge about these technologies in use. Students did not simply learn that genAI systems are opaque, biased and prone to hallucinating; they encountered these properties as design constraints that demanded negotiation. The findings also relate to dominant narratives around creativity and interaction with genAI. While genAI expanded ideation and lowered technical barriers, students (also thanks to the lectures) clearly recognised the risk of aesthetic homogenization and creative flattening. As a response, authorship was not diminished but reconfigured: from producing original material to selecting, adapting, and synthesising AI-generated outputs. This shift is not different from the broader transformation that is happening in the creative industries [el Kordy 2025], but the educational setting also opened up a space for students to reflect on whether such a redistribution of agency aligns with their values as emerging designers. The pedagogical structure, then, supported students in building a capacity to maintain intentionality and critical distance while engaging in hybrid human–AI workflows. From a pedagogical perspective, our results suggest that leaving genAI use to individual experimentation or focusing solely on seamless efficiency risks reinforcing passive consumption and dependency by these tools. Conversely, strict restrictions would preclude opportunities for situated critique. The approach presented here offers a middle path: designing curricular spaces where friction, failure, and repair are not obstacles to learning but its very substance.

Nonetheless, this work has limitations. The analysis is based on a narrow and specific disciplinary and cultural context. As such, not all findings can be generalised. For instance, the results about the emotional experience of working with genAI and the tactics to work around the limitations of these tools cannot be generalised to all possible genAI tools and course conditions. In fact, the choice of using Gemini, made for economic reasons and familiarity, surely affected aspects of control and aesthetic quality, especially if we compare it to the aesthetic and interactional possibilities offered by specialised tools like *RunwayML*. To investigate whether the same approach has consistent results across diverse genAI tools, future work will replicate the approach and activities, but employ specialised genAI tools in smaller course settings (i.e., with a limited number of students).

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