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ORIGINAL ARTICLES

Chatting with DALL-E in a Postdigital Architectural Classroom

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Abstract

Technological innovations, and most notably the use of GenAI, have increasingly become part of the contemporary architectural classroom. Alongside such developments, numerous ethical dilemmas have emerged, around the pedagogical and social organisation of the learning spaces, as well as questions around how such innovations are shaping student learning activity and outcomes. With a focus on using GenAI as a co-creator in teaching and learning, this article explores the learning opportunities, compromises and challenges that emerged with the seamless integration of digital and analogue forces in a postdigital architectural classroom. The paper argues that the idiosyncrasies of human interpretation, responses and critique are an integral component of a creative, positive, and collaborative postdigital future.

Keywords Architectural education · Agency · DALL-E · ACAD framework · Postdigital learning design · GenAI

Introduction

Architecture is, at heart, a speculative profession which calls for practitioners and students to creatively imagine and resolve contemporary spatial issues for a projected future. Forsler et al.'s (2024: 2) characterisation of the future postdigital classroom

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as the 'ongoing materializations and enactments of new formats for the technological, pedagogical, and social organization of learning spaces' provides an opportunity to consider how current postdigital learning spaces, and the forces that govern them, may be intentionally *designed* for an emerging future. In many respects, architects (practitioners, educators, and students) are well-positioned to imagine such a future as they operate within a discipline that situates design at its core. In fact, as Macgilchrist et al. (2024a: 10) and others agree, design and particularly design critique 'need[s] community and is best cultivated in collective places for debating, contesting, and co-designing'. Contemporary architectural classrooms have historically, and for the most part continue to be, largely modelled on the atelier model of the studio, which is a pedagogical and spatial framework premised on a shared arena for learning through community (Schön 1992, 1985; Potts 2000; Cuff 1991). Despite predominantly integrating this informal and collaborative approach to teaching and learning, architecture schools are also moving away from traditional studio spaces to hybrid studio-classrooms, integrating digital technologies within more traditional frameworks (Brown 2023). Attention to GenAI use within an architectural classroom has typically been placed on understanding and regulating students' use of AI-powered design tools (such as Canva AI, Microsoft Designer, Midjourney, DALL-E and Stable Diffusion) or on considering the implications of technology replacing human endeavour (Cudzik et al. 2024).

This paper shifts this focus to examine the ethical and social limits of integrating GenAI as a co-educator within a creative disciplinary arena. Christina Pazzanese quotes Michael Sandal's identification of three primary areas of ethical concern for society around the use of AI. These are 'privacy and surveillance, bias and discrimination, and perhaps the deepest, most difficult philosophical question of the era, the role of human judgment' (Pazzanese 2020). The implication of these arenas within education are evaluated here through a discussion of how human and nonhuman actors and agents are shaping future educational spaces, educational outcomes and the emergent architectural profession.

The purpose of this paper is to draw on our experience of designing for architectural learning, as we embraced GenAI as a pedagogical partner, and to reflect upon the ethical tensions—notably questions of agency, control and visibility—that became apparent through this process. A key question guiding our research was: how can educators embrace GenAI as a pedagogical partner in ways that encourage critical and creative thinking within architectural education?

This paper examines these tensions through discussion and analysis of an exploratory learning exercise, which we will call 'Chatting with DALL-E'. The exercise was conducted in 2023 and 2024 and integrated GenAI text-to image software (i.e. DALL-E 2.0, DALL-E 3.0) into the learning activities of undergraduate architecture students. Our aim was to extend the students' visual and verbal vocabulary and to experiment with GenAI as a co-teacher within the classroom.

Our reflections on the Chatting to DALL-E exercise, and the GenAI images and interactions it fostered, led us to consider the implications of using GenAI as a pedagogical partner in teaching and learning. Does the shift in power—through the sharing and shaping of knowledge from conventional institutions and their governing concepts/models to the entrepreneurial concepts/models of major technology companies—signal a shift in creative, inventive and unique processes and products? With this larger tension in mind, two key questions about the possibilities for the future emerged from our experiences in a contemporary postdigital classroom and are the subject of this paper. We wondered: what impact might GenAI have on the kind of architects that such a future postdigital classroom generates? How can we ensure the idiosyncrasies of human interpretation, responses and critique continue to be an integral component of a creative, positive, inclusive, equitable, and collaborative postdigital future?

To better answer these questions, we analysed the design of the Chatting with DALL-E exercise through the Activity-Centred Analysis and Design (ACAD) framework and the ACAD wireframe (Goodyear et al. 2021). ACAD is a useful framework for the analysis of complex relations between multiple elements (including GenAI) in an architectural postdigital classroom, as it allowed us to explore the multiple layers and dimensions of design that influenced what happened as learning activity unfolded. Analysis according to the ACAD wireframe enabled us to identify some of the ethical tensions inherent in the integration of GenAI in the co-creation of knowledge. These tensions, and their implications for shaping the future are evident in the politics, pedagogies and practices that can emerge in a postdigital future classroom.

Context: Architectural Teaching in a Postdigital Classroom

Architectural education and practice are deeply enmeshed, perhaps more so than most other professions. Many architectural students start working in an architectural practice, and conversely, many practitioners teach in the tertiary sector. Consequently, the contemporary postdigital architectural classroom is a bridge between formal academic spaces and professional ones within the built environment sector. In fact, as Ostwald and Williams (2008: 10) point out, 'the prestige of the architectural profession is intricately connected to the status of the educational system that supports it'. Architecture, both in practice and in education, sits at the nexus of rational and creative problem solving, demanding precision outcomes in an arena which also celebrates design innovation and clear communication (Ostwald and Williams 2008). As a result, architectural education fosters creative and imaginative thinkers where effective communication through text and image are central to successful architectural outcomes.

Over the last 50 years, architectural practices and processes have, as with many other disciplines, evolved to accommodate technological developments and reflect new ways of living, learning and working in a postdigital society—where digital platforms are a constant part of our everyday living (Knox 2019; Jandrić and Knox 2022). In preparation for their future roles, as architects and global citizens, students need to learn how to integrate architecturally specific content and knowledge, whilst navigating multiple and evolving digital and materials assemblages, and mindfully engaging with others (Ostwald and Williams 2008; Clayton 2017).

Amongst the many technological developments that have shaped architectural practice and architectural education, the recent influx of artificial intelligence (AI) has been noted as a key disruptor, as with contemporary society more broadly (Williamson and Eynon 2020). In higher education, AI has been characterised as a source of anxiety for educators, but also an opportunity for new pedagogical, social and educational innovation (Bozkurt et al. 2024; Lodge et al. 2023; Markauskaite et al. 2022). In this context, generative AI (GenAI) has been used in numerous ways: to provoke reflections and provide students with advice for organisational structure, to brainstorm ideas, to summarise text and explain jargon, to analyse data, to improve readability and fix grammar, to generate content (text, images, videos) and many other tasks (Liu et al. 2023). However, there have also been some concerns about GenAI in education, including the fear of students becoming over reliant on these technologies, using them as shortcuts to complete tasks without learning the ability to complete the tasks for themselves. The speed of execution when using technology in this way, such as when students are searching for quick answers, and prioritising speed instead of deep reflection, means that they are also by-passing opportunities for a deeper engagement, for engagement with the necessary cognitive processes that would lead them to more elaborated synthesis of knowledge (Bozkurt et al. 2024). For students and practitioners of architecture, speedy execution of work may come at the expense of the iterative cycles of creative thinking that typically signal creative and imaginative approaches to problem-solving associated with architectural knowledge (Cesal 2024). This, along with questions over what may constitute creativity in the era of machine learning and concerns over the role of the individual as a creative agent, is central to emerging concerns around GenAI in architecture (Leach 2022).

It is therefore crucial to create opportunities in architectural education for students to learn how to engage with GenAI critically and creatively in postdigital classrooms, or in other words, to learn how to use GenAI to scaffold ideas, rather than as a replacement of intellectual efforts (Bozkurt et al. 2024). As Duffy and Hutton (1998: xxi) observe, 'architecture, in effect, is an inherently idea-hungry, project-based, solution orientated discipline, open-ended and systemic, capable of connecting anything with anything, in any order, as long as new solutions can be formulated for as yet hardly articulated requirements, both practical and cultural'. Thus, the future postdigital classroom provides an opportunity to speculate, through architectural education on the opportunities and limitations of a pedagogical future which situates creativity at its core.

Case Description: Chatting with DALL-E

The Chatting with DALL-E exercise at the centre of this discussion, formed part of an undergraduate course (Introduction to Architecture and Enabling Skills) in the Bachelor of Architectural Studies at UNSW Sydney (Australia). The course introduces first year students to foundational architectural principles and concepts, canonical works of architecture and scholarly architectural enquiry, and it is designed to equip students (some of whom have never participated in creative projects or fine arts) with the foundational knowledge needed to understand and analyse architecture. Chatting with DALL-E was an exercise envisioned for a studio space but taught informally in a hybrid-classroom setting. It was intended to foster peer-to-peer learning (which occurs through the informal interactions and discussion of students adjacent to the shared task) and to replicate or model the iterative cycles of design/critique/review that are part of a studio teaching. The exercise was undertaken in hybridised studio-classroom which draws analogue and digital modes of working together as a form of postdigital studio.

In the 2023 and 2024 instances of the Chatting with DALL-E exercise, students worked in groups and were invited to verbally describe an architectural image based on their knowledge of discipline specific-vocabulary, terms and details. This description was entered into DALL-E and the GenAI software returned a corresponding image based on its understanding of the textual prompt (see Fig. 1). Students were then tasked with critically evaluating the differences between the two images, their original photo of a case study and DALL-E's image based on their description, to refine their visual and verbal vocabulary, revise their prompt and see if they could generate a more precise output from DALL-E. The exercise was designed with the intention of fostering students' visual and verbal architectural vocabulary through the process of verbally describing the case study and visually analysing it. Critical reflection was facilitated through the iterative analysis students undertook of DALL-E's outputs.

From an epistemological, pedagogical, and social perspective, the exercise was largely successful. Most students acquired the intended learning outcomes from the exercise, developing their vocabulary, their capacity to interpret spatial relationships, demonstrating critical evaluation and working collaboratively in groups. Yet, the visual quality of the outputs that DALL-E generated, regardless of which

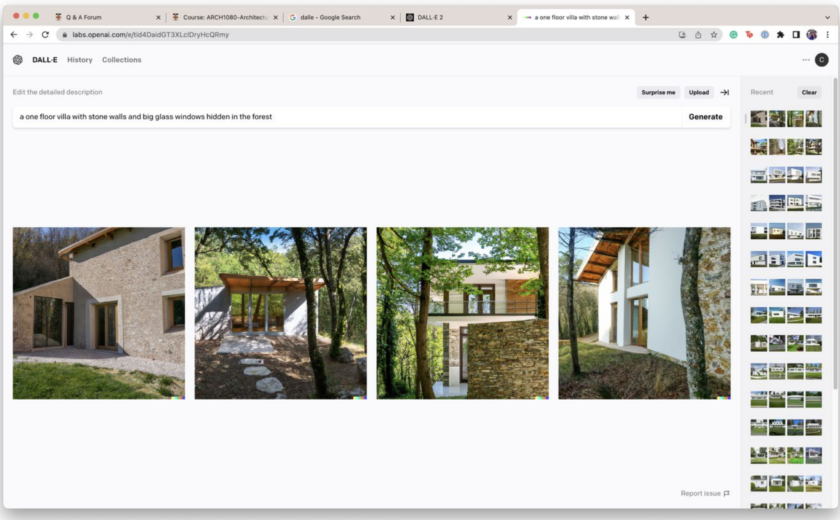


Fig. 1 An example of verbal prompt and DALL-E's visual images. Screenshot by Cristina Garduño Freeman (CC BY 4.0 DEED)

students prompted them, displayed an aesthetic homogeneity at odds with the individualised, creative signature that is central to an architectural education. DALL-E's images seemed to reflect a dominant cultural and visual sensibility. The students were all given the same instructions; however, the student cohort was demographically diverse, with disparate levels of proficiency in English language, and a range of familiarity with architectural terminology and vocabulary. As a consequence, the verbal prompts to DALL-E varied in their accuracy and detail. Yet despite this, the images generated by DALL-E in response to the prompts were very similar, often employing repetitive visual forms, colours and similar arrangements so that many of the outputs were almost indistinguishable from one another (see Fig. 2).

The banality of these images, as expressive, creative or visual touchpoints intimated at a central concern regarding the use of GenAI as a potential teaching partner in architecture. The limited nature of DALL-E's outputs highlighted several questions which form the basis of our analysis and discussion that follows. Namely, what happens when GenAI becomes the reflective guardrail against which students' creative, visual and verbal vocabularies are tested? What impact could these images have on the developing aesthetic sensibilities of architectural students? If students are immersed in images and architectural visual language shaped by GenAI, who is curating this visual language? What role can (and should) different agents and actors play in shaping postdigital future classrooms? And what responsibility or agency do we as educators, and designers of learning tasks, have in shaping a postdigital future classroom?

To understand our spheres of influence within the design of the Chatting with DALL-E learning task and beyond it, we turned to the Activity-Centred Analysis and Design (ACAD) framework and ACAD wireframe (Goodyear et al. 2021) to map the task design and its implications at multiple scales.

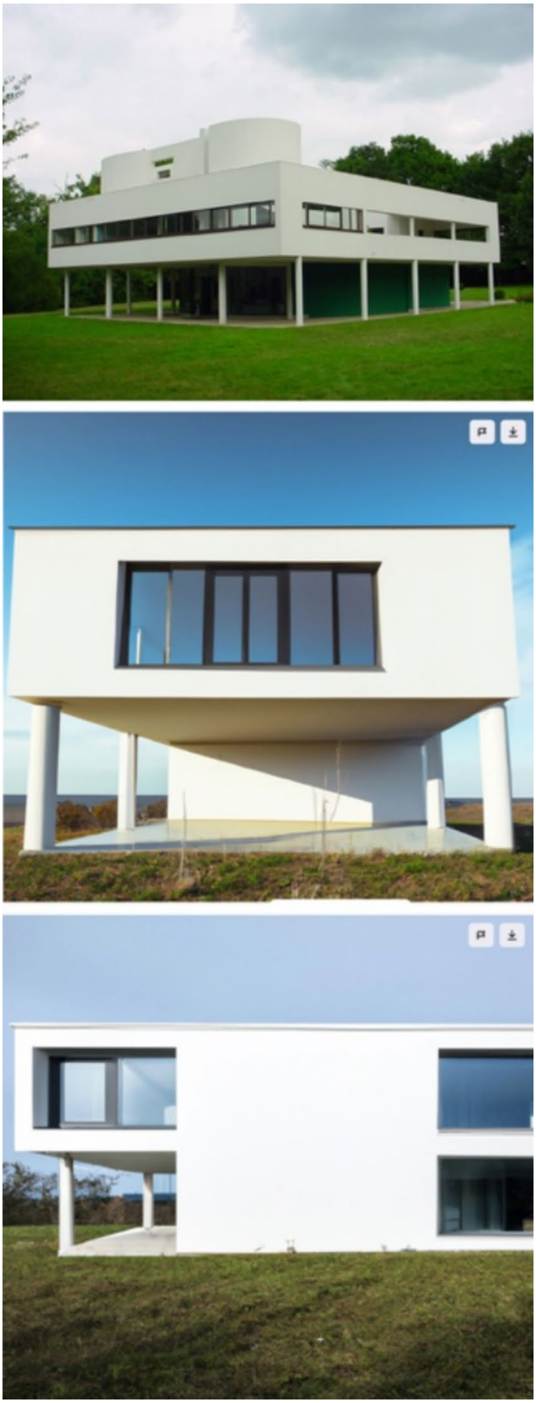
Analytical Methodology: The ACAD Framework and ACAD Wireframe

The Activity-Centred Analysis and Design (ACAD) framework (Goodyear et al. 2021) helped us to simultaneously consider both analogue and digital contexts that shaped the Chatting with DALL-E exercise. Furthermore, it enabled us to see relations between multiple elements across the spatial, social and pedagogical dimensions of the exercise.

The ACAD framework is an analytical methodology that was created to support the analysis and design of complex learning situations, such as those emerging in postdigital classrooms. ACAD differentiates between three types of designable elements. The term 'set design' refers to digital and material tools that make up the spatial dimensions of a classroom. 'Epistemic design' includes the pedagogical goals, and the details of what students will be asked to do in a learning task. 'Social design' relates to actors/learners and social arrangement, where students work individually or in groups. Each of these have implications for a current (and indeed future) postdigital teaching approach.

Figure 3 illustrates the three design dimensions of the ACAD framework, and Fig. 4 maps the Chatting with DALL-E exercise on to these same dimensions.

Fig. 2 Le Corbusier's Villa Savoye case study prompt shown above two images generated by DALL-E in response to verbal prompts from differing student groups. Image generated by Cristina Garduño Freeman (CC BY 4.0 DEED)



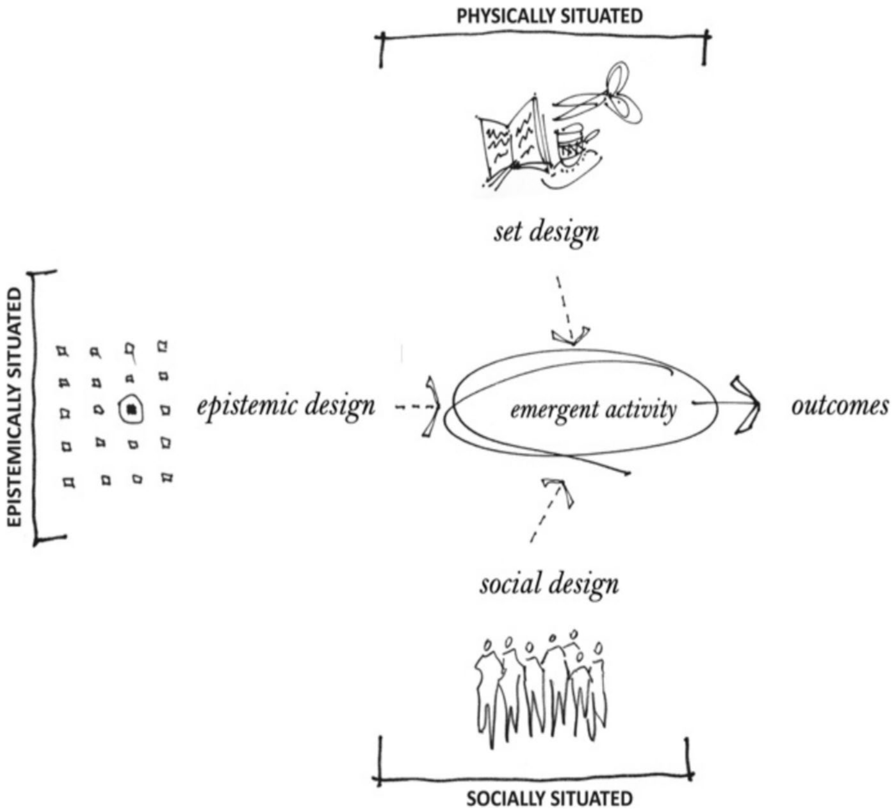


Fig. 3 ACAD framework dimensions. Image: Cristina Garduño Freeman (CC BY 4.0 DEED)

It is important to note that the learning activity is positioned centrally and that learning outcomes are only indirectly shaped or influenced by the designable elements in the three dimensions of design (set, epistemic and social) that surround it. This is to represent the idea that although educators make certain choices about the digital and material tools, the learning task and the social arrangements for their students, the students themselves have agency to how they will interact with the assemblage of design elements that their teachers have put together.

Yeoman's (2015) ACAD wireframe is an extension to the ACAD framework (Table 1), which allows educators and researchers to map the ACAD dimensions of design (set, epistemic and social) across different levels of granularity: micro, meso and macro. The wireframe acts as a matrix that can enable educators to identify which dimensions of the design of a learning situation are influenced or limited by systems beyond their control, and conversely to clarify what small, but significant elements that remain within their sphere of influence may be (Goodyear et al. 2021).

Table 1 identifies the numerous parameters operating at macro, meso, and micro scales, (many of which are beyond the control of the educator) that can

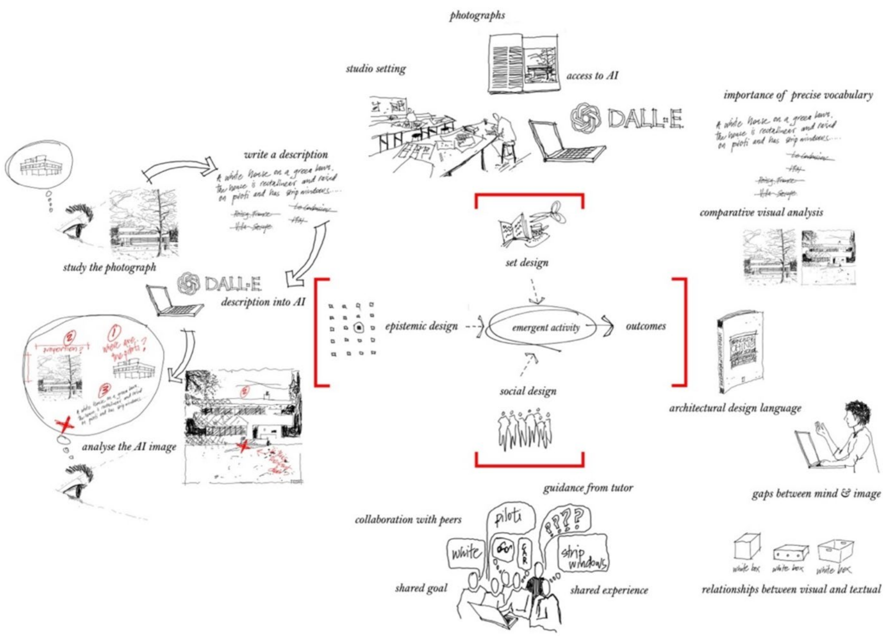


Fig. 4 Chatting with DALL-E mapped onto the ACAD framework. Image: Cristina Garduño Freeman (CC BY 4.0 DEED). The image identifies the different aspects of the Chatting with DALL-E exercise according the three primary dimensions of ACAD framework—set design, social design and epistemic design

influence or impinge upon education outcomes. These are made more complex in a postdigital educational context where digital technologies are seamlessly integrated into institutions at multiple scales. So much so, that it can be difficult to differentiate the digital from the physical and social dimensions of the institution. Educational outcomes are shaped by multiple human and non-human agents and actors making decisions that impact education in a variety of ways. For example, large tertiary education institutions now automate the allocation of resources (meso set design); they demand compliance with national educational standards (macro epistemic design); enrolments are determined and managed through online interfaces, and attendance and group sizes are driven by efficiency measures which impact their allocation into a cohort (micro social design). As a result, physical classroom allocation of spaces and lecture theatres may come to effect on an hourly schedule rather than for their appropriateness location or capacity to operate as ‘built pedagogies’. These kinds of automated decisions, driven by policy, economics or expediency, can come at the expense of personalisation—an individuated approach which can physically and metaphorically engender learning (Cleveland 2009).

ACAD then can become a means to identify the contributory factors that shape individual agency, so that educators can more reasonably exert control within their spheres of influence. Thinking about the design of Chatting with DALL-E through

Table 1 The ACAD wireframe (adapted from Goodyear et al. 2021: 457)

Philosophy	Set design Learning is… Physically situated AI impact on planet ecosystem	Epistemic design Learning is… Epistemically situated Value creation framework	Social design Learning is… Socially situated Capability Approach
Macro The global Level I patterns	Buildings and technology Digital and physical infrastructure to support AI discussions and technological advances	Stakeholder values Policies to support future education practices that involve AI Value creation cycles and indicators	Organisational structures Principles that connect human agency, well-being, inclusion and co-creation
Meso The local Level II patterns	Allocation/use of space and technology Technology provision and access Role of algorithms in education Rooms to gather and discuss	Curriculum Institutional rules for different future AI scenarios Speculative and forward-thinking methodologies	Community Schools, universities, community settings Learning networks
Micro The detail Level III patterns	Artifacts, tools and resources Technologies, post-its, paper, materials to facilitate design conversations	Selection, sequence and pace Use of AI future scenarios Techniques to facilitate collaborative work	Roles and divisions of labour Educators and students working together Humans & bots

the ACAD framework and the ACAD wireframe's macro, meso and micro scales helped us to estimate the limits of our own agency, to evaluate what was under our sphere of control and to consider where other forces also impacted on the learning activity.

Table 2 maps the Chatting with DALL-E exercise across scale levels of set, epistemic and social design. It becomes easy to see how aspects of the learning task (micro epistemic) are tethered to other specific details and influences. For example, students worked in small groups (micro social), used their laptops to interact with DALL-E (micro set), whilst conversing to figure out how to compose prompts that would describe a house, and as they analysed and critiqued the quality of DALL-E's outputs (micro epistemic). However, in the context of a postdigital classroom, it is important to also note how what unfolds at the micro level is influenced by other wider structural elements, over which educators might have less or no control. For example, in 2023, students used DALL-E 2.0, which afforded particular ways of working. By 2024, DALL-E 3.0 had been released (meso set), which impacted on the task in numerous ways. The software was no longer free, and it generated two rather than four images in each iteration. Changes such as these undermine the possibility of replicating this exercise design (see Leibowitz et al. forthcoming) as remaining familiar with technological change becomes a herculean task for educators. The learning task described above (micro epistemic) also directly connects to a particular architectural curriculum (meso epistemic), created to fulfil the needs of first year students who need to learn foundational concepts related to architectural language, before progressing their studies. This curriculum is also connected to wider principles and standards in the discipline (macro epistemic).

Understanding Chatting with DALL-E through the ACAD framework and ACAD wireframe highlighted many of the complexities of working in a *contemporary* postdigital classroom (Leibowitz et al. forthcoming). Challenges included the educators' lack of technological fluency, institutional resource limits (spanning from insufficient sockets to Internet connectivity, software paywalls, and computer access) and the pace of technological change. Many of these logistical conundrums are evidenced in the tiers of the ACAD wireframe and can be understood according to the inherent limits of task design.

In addition to showcasing the present, the ACAD wireframe becomes a means to consider how we might design the *future* postdigital classroom. Forsler et al. (2024: 1) write that the 'postdigital classroom can be seen as the production site of educational futures'. They draw on the work of Spindler and Spindler (1987) to suggest that the classroom is the place where 'calculated intervention' takes place. The ACAD framework and ACAD wireframe provided us a means to better understand the nature and scope of these interventions from a micro to macro level in the present and to consider their implications for the future. This includes the global and national politics that underpin these interventions, as well as the role of and impact of 'the interaction of human and non-human agents in the classroom, including teachers, learners, management, and maintenance technicians as well furniture, devices, and infrastructures' (Forsler et al. 2024: 1).

Our analysis of Chatting with DALL-E revealed several questions about the contribution that GenAI can make to the shaping of student's epistemological

Table 2 The ACAD wireframe mapping the 'Chatting with DALL-E' exercise and key ethical considerations at each scale level

	Set design	Epistemic design	Social design	Ethical dilemmas
Macro	- Influence of Big EdTech Companies -University buildings - GenAI platforms	- Architectural principles and standards - Societal values over beauty, success, architectural cannon - Hegemonic language teaching	- Professional architects - Broader university community	- Economic (dis)advantage, e.g. production and use - Environmental impact—large data centre storage - Political/economic/agendas shaping development of technologies and their availability - Data governance, visibility and algorithm training
Meso	- WiFi connectivity - Studio setting - Version of DALL-E	- Studio pedagogy - University curriculum - Registration board - Professional conventions	-Wider network of architecture students, tutors and teachers -Architecture school community	- Social and cultural norms that shape learning attitudes and behaviours - Transparency of GenAI mechanisms operating within software
Micro	- DALL-E interface - Google - Photographs - Laptops	- Study photo - Write description - Input description in DALL-E - Critically analyse image	- Small groups (3–6 students) - Whole class discussion - In person attendance - Tutor led discussion	- Replacing skill with technology for greater efficiency - Impact on knowledge acquisition, competency or creativity - Access to resources - Technological fluency

frameworks through the production of certain kinds of images over others. Understanding the wider machinations that effect how/where these images are constructed is vital for understanding who is empowered and who is forgotten in the construction of this visual data set. Thoughtful and effective design of the future digital classroom should be shaped by an awareness of the forces that control the data and its organisation. The challenge of attempting to design for the future is highlighted by Dishon (2024) who argues that the future is inherently indeterminate and therefore difficult to predict. Mapping of learning tasks at a granular level reveals certain degrees of control or agency that are open to educators operating in a postdigital teaching context and can support their planning for the future.

In evaluating the efficacy of teaching design in this way, some potential challenges of the future postdigital classroom also became apparent as we consider the agents and actors shaping educational outcomes. In part, this begs the following questions—what do we anticipate the future role of education to be, how do we want this to be delivered and with what outcomes? What kind of architects do we want to produce for the future?

To understand these questions at differing scales, we added a fourth column to the ACAD wireframe (shown in Table 2) to highlight ethical considerations at all three levels of granularity. Considering these at multiple scales allowed us to acknowledge the role of macro entities such as political and commercial agents, the role of meso entities such as institutional funding and governance and the role of micro entities such as pedagogical design and social behaviours. More than that, the ACAD wireframe helped to identify the interconnected nature of these elements, (such as pedagogical outcomes shaped by macro entities). Understanding where these ethical concerns are manifest within a future digital classroom is essential for determining where and how GenAI can be designed into learning tasks. Through this analysis, the ACAD wireframe supported our understanding of part-whole relations in this architectural postdigital classroom, highlighting the impact of diverse elements on how the learning activity with students unfolded.

As one might expect, at the micro level, ethical aspects related to the Chatting with DALL-E exercise are considerably more readily within the control of the educators than the higher order agents evident in the meso and macro levels. Consequently, it is in the micro level that this discussion will primarily be focussed.

Discussion: Actors and Agents in Shaping a Future Postdigital Architectural Classroom

Much of the discussion in this paper is centred around the uncertainty of the possible implications of using GenAI as a co-educator within an architectural classroom. While this interaction happens as at a micro level, i.e. DALL-E is an entity that can shape students' understanding and learning, the potential consequences of this interaction, in shaping future architectural professionals, may in fact have implications that extend into meso and macro arenas. The Architectural Education and the Profession in Australia and New Zealand Report (2019) notes that architecture students need to learn, among other things 'critical thinking, problem solving, communication, time management and collaboration'. This begs the question—how are these skills impacted by the inclusion of GenAI within the classroom? While online and hybrid classes present a different kind of postdigital classroom, this paper is focussed on a learning experience contingent on integrating GenAI into the physical teaching space of an architectural classroom.

This is important for several reasons. In utilising DALL-E as a co-educator, DALL-E assumes an authoritative position within the learning activity that unfolds and, potentially, impacts the student's education more broadly as it becomes an entity against which student work is tested. The purported 'authoritative' nature of GenAI is reinforced by the process of interaction between students and DALL-E, a form of dialogue which is becoming a primary mode of deliberate interaction between individuals and GenAI more broadly (Escaño 2024) (hence the 'chatting') as opposed to the more seamless way in which AI is integrated into other technological platforms. The value of incorporating DALL-E as part of a learning task—clearly distinguishing GenAI's contribution to the exercise (from the exercise as a whole) is that it enables us to consider what are the opportunities and the limitations evident in this emergent relationship between DALL-E, educators and the students. The capacity of educators and students to evaluate the role of DALL-E and the limits of its graphic outputs during the exercise is reliant on a shared, collaborative teaching space. The need for face-to-face learning is particularly important for creative teaching environments, such as those in architecture, which despite decades of self-reform, still situates the studio pedagogical and spatial model as the basis for teaching and learning (Ostwald and Williams 2008).

The decision to include GenAI as an active actor within the classroom in the Chatting with DALL-E exercise occurred at a micro level. However, the images produced by DALL-E are based on the data set, algorithm and coding system that define the model. These are governed by agents and forces operating at meso and macro levels, over which there is little transparency. These are in part driven by dominant business models and surveillance capitalism (Williamson et al. 2023; Czerniewicz and Feldman 2023), but also by the methodologies that shape the accrual and organisation of data within the technology itself. Who or what controls and defines the information that GenAI (and in this case DALL-E) uses to teach students? How is this information being gathered, framed, interpreted and ultimately disseminated? Macgilchrist et al. (2024b: 14) challenges educators to consider the implications of 'hand[ing] over design decisions to dominant actors. These design decisions impact not only technicalities, but also how education —and thus the future—will be configured'.

Crawford and Paglen (2021) argue that the automated interpretation of images and the methodologies used to shape the development of GenAI platforms, and to generate data imaging, are inherently socially and politically constructed. They write:

> [t]raining sets, then, are the foundation on which contemporary machine-learning systems are built. They are central to how AI systems recognize and interpret the world. These datasets shape the epistemic boundaries governing how AI systems operate, and thus are an essential part of understanding socially significant questions about AI. But when we look at the training images widely

used in computer-vision systems, we find a bedrock composed of shaky and skewed assumptions. (Crawford and Paglen 2021: 1106)

They argue that the hierarchical classification structure around which the images are ordered and understood, and the relational way that their embedded meanings are assumed and attributed conforms to a partial and limited account of the world, one often shaped by the institutions that funded and developed the platforms—concluding that 'normative patterns of life are assumed, supported, and reproduced' (Crawford and Paglen 2021:1108).

For many people, the seamless integration of digital platforms into analogue contexts brings with them an assumption of neutrality, whereby GenAI has the appearance of impartiality, just as the Internet (as an entity) or Google (as a search engine) create the impression of proffering an apolitical framework from which to derive information (Czerniewicz and Feldman 2023). The lack of transparency around how platforms (such as DALL-E) garner their images means that the visual, social and political frameworks that are governing these platforms remain largely opaque. As a result, the assumptions and gaps that shape GenAI's positionality as a teaching entity are often obscured. Implicitly present, these assumptions and gaps become a postdigital manifestation of Bernstein's (2000) conceptualisation of a hidden curriculum.

Crawford and Paglen (2021: 1110) alert us to the case of ImageNet generated out of Stanford University where images were harvested 'en masse from image search engines like Google' often appropriating selfies and holiday snaps with or 'without their knowledge, and then labelled and repackaged them as the underlying data for much of an entire field'. While their analysis is looking specifically at classifications of people—their critiques of the partial and skewed way in which GenAI data is accrued, organised, categorised and disseminated is pertinent to discussions surrounding postdigital classrooms and questions of the efficacy of this resource for the future.

Increasingly digital platforms are becoming a vital and convenient way for students to access information and images that shape their learning. However, if the data set used within the digital platform is only composed of images taken from the Internet, then the scope and character of the data will be partial; people (and places) without access, means, familiarity or technical know-how are underrepresented or even absent from the dominant data that shapes GenAI's understanding and definitions of what things are in the world. Of course, all human educators teach from their own knowledge base and experience; however, understanding and disclosing this positionality is increasingly a necessary component of teaching (Rios and Patel 2023).

In a postdigital context, the pre-existing value set, which shapes digital knowledge, can become a de facto authority on what meanings might be tagged to what images. While there have been attempts to redress this situation, and to construct training sets which reflect greater variety, this lack of diversity (of culture, voices, languages) is increasingly raising questions about 'fairness' and ways of potentially 'mitigating bias', which are often shaped by economic and commercial imperatives (Crawford and Paglen 2021; Naik and Nushi 2023; Vice et al. 2024).

Not only are the datasets themselves potentially limited, but the way in which that data is organised and labelled is based on assumptions of meaning, thereby raising additional ethical questions for students, particularly for those in creative fields where meaning is part of the contribution. Architecture, in particular, is primarily communicated and represented through images laden with meanings (Rattenbury 2002). Text-to-image GenAI has little to no awareness of how this dynamic of 'meaning making' operates as it is largely trained to attribute meaning according to a framework which does not account for the way this can shift and change. As Rose argues (2016) meaning can be differentiated according to how the image has been produced, received or composed. One result of the organisational structure that governs how text-to-image GenAI currently operates is that it necessitates an apparently reductive and homogenous interpretation of language and descriptive terms. To optimise processes, the algorithms might exclude idiosyncratic phrases which might have divergent or unexpected meanings, forcing outputs to conform to the pre-existing categorical hierarchies. This 'smoothing out of difference' is evident in the way in which all of the images generated in the Chatting with DALL-E exercise conformed to the same visual vocabulary (regardless of who was inputting the prompts or in what order the details were composed). The images referenced a predominantly singular aesthetic (see Fig. 3). The ubiquitous outputs, particularly in architectural education, undermines the creative signature of an individual, sustaining the model's prescriptive vocabulary by further populating the Internet with its own easily recognisable generic images.

As DALL-E's ability to generate images outside of its formal structure and attribution system remains limited, visual representations and images assume a fixity of meaning that belies their slippery nature. This system can only understand images as generic outputs without the nuance of 'multiple potential meanings, irresolvable questions, and contradictions' that form the basis for critical and creative discussions around images and as evidenced by long-standing debates in philosophy, art history and media theory (Crawford and Paglen 2021: 1107). While prompt engineering may provide a means to counter this, proficiency at prompt engineering is its own skillset, requiring training in how best to extract more unique outputs from GenAI.

This may ultimately present a means to resolve some of the apparent limits of text-to-image software but to do so would require revisions of epistemological (curriculum), set (resources and access) and social (teaching proficiency) agendas. Commentators such as El Moussaoui and Krois (2025: 89) suggest that given the impact and pace of technological change, future architects should 'be trained not merely to use these tools but to pioneer their evolution, ensuring that technological advancements serve societal needs optimally'. Such an approach to a future postdigital classroom is centred around an ethically driven ideology.

Positioning technologies such as DALL-E as co-creators (in teaching) can impact the nature and scope of the architectural and visual vocabulary that students develop, the basis of which is necessary for their creative imaginings in their future work as architects. But more than that, the prescriptive classification system that shapes this vocabulary is at odds with the creative solutions and individual thinking that at times is also needed for architecture work. As Casakin and Wodehouse (2021:

2) note, design problems are typically ill-defined, complex, ambiguous, and unique and, 'therefore, cannot be completely solved using routine problem-solving processes, either manually or computationally'. They continue, 'because of the nonroutine and ambiguous nature of design problems, it is not possible to foresee what type of information will lead to what kind of solutions'. Hence, tackling design problems implies the generation of many different and potentially creative ideas and unpredictable solutions. It may be that the future of creative production for architects, is a movement away from the 'fetishisation of the image' as Cesal (2024) suggests, towards the 'complex reality of bringing designs to life', but arguably this recharacterises the role of architects from creative agents to pragmatic problem-solvers delivering design solutions shaped by GenAI (and its limited data set) rather than by the idiosyncratic imaginations of a human mind.

In addition to considering the epistemological implications for students, the analysis of our architectural postdigital classroom raised questions about implications for educators. In part this is based on a common assertion that educators should adapt to the technological opportunities offered by GenAI. The pace of technological developments meant that the learning design we reported here could not be easily replicated in the 2024 version of the course requiring several adjustments (Leibowitz et al. forthcoming). Indeed, educators' thoughts about how to best design can often be compromised by the unreliability of emerging technologies and the pace of evolving versions. This is not only about the way in which technology is often modified in unexpected ways and the difficulty in refining teaching approaches based on predictable static work conditions, it is also about the ways that political and economic interests (macro level) skew education in particular directions, affecting what can happen at the postdigital classroom (micro level). What is possible to achieve as the learning activity unfolds also can become compromised, as educators often have to revise and re-design tasks 'on the fly'. Learning intentions might need to be adapted, as what was planned in advanced with a version of a digital technology no longer applies or is possible, to what can be achieved with a new version, yielding unexpected results. In our scenario Chatting with DALL-E, we detected impact at both micro and meso levels of the ACAD wireframe (and beyond) where the available technologies, the access to the Internet or software may be limited.

Conclusion

In considering a future postdigital classroom we have asked: who are the actors and agents shaping our future educational spaces? What impact will these forces have—ethically and pedagogically—on the emergence of the future postdigital classroom and the students that may inhabit it? Through the lenses of the ACAD framework and ACAD wireframe, we explored the relations between multiple elements of a learning design, including across scale levels. This allowed us to analyse and better understand the potential of the future postdigital architectural classroom, in ways that challenged our pedagogical positioning, and helped us identify complex ethical constraints or considerations. These ethical constraints—most notably the biased data set that currently shape text-to-image GenAI—can be mitigated through the interventions and interactions between people, tools and activities. For example, critical evaluation of Chatting with DALL-E as an exercise, and more specifically encouragement to students to critically evaluate the outputs generated by DALL-E, were useful tools for the students and educators to consider the limitations of the GenAI output. Part of students' capacity to reflect on this is determined by the face-to-face interactions with human educators who can facilitate discussions in the tutorials. Working in isolation or online where access to resources is largely digital can undermine students' ability to do this. As a result, we suggest that spatial placemaking within the classroom is an important way to integrate GenAI while mindfully considering the limits of the imaginaries it may generate. The embodied learning contingent on peer-to-peer interaction led by a human instructor also highlights the limits of the interaction with DALL-E. The richness and value of the Chatting with DALL-E exercises were contingent on the postdigital learning space as a means of testing the future imaginaries. In fact, we see the success of the exercise as located in the gap between imagination and reality—between the projected sense of a building (representing a specific case-study house) conveyed by the student's verbal descriptions and the limited way in which DALL-E was able to represent the features and return the image.

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Declarations

Competing interests The authors declare no competing interests.

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