Re-imagining and Reaffirming Design Pedagogy in Response to Generative AI Tools

Abstract: This paper considers how we can adapt higher education (HE) design pedagogies in response to the emergence of generative artificial intelligence (GenAI) tools. We focus on the authors' own HE institution and describe our work through the first half of 2023 to understand the impact of these tools on how our students approach their work, and to adapt our design pedagogies in response. This paper includes accounts of student attitudes to these tools, and the outcomes of our own experimentation with contemporary GenAI tools (ChatGPT4 and MidJourney v5). We identify 10 challenges for design pedagogy that span assessment, student learning and teaching delivery, foregrounding the unique ways GenAI tools could disrupt the learning that takes place in a student design project. In response we present the adaptations adopted by our institution for the coming year, and speculate about how future pedagogic design projects could be structured to best support student learning augmented by GenAI.

Keywords: design pedagogy, generative ai, design studio

1. Introduction

Whilst the concept of generative design (also referred to as algorithmic design) emerged in the 1970s, the proliferation of accessible Generative AI (GenAI) tools since late 2022 has resulted in a period of extensive disruption, particularly with respect to multiple aspects of education. As with many other educators, the authors engaged with various initiatives over the past nine months to understand the power of these tools, their implications for our teaching, for student learning, and for the development of our programmes going forward. In the Summer of 2023 the emerging picture of educational policy from UK-based HE institutions and bodies (e.g. Russell Group, QAA) appears to have reached consensus in two respects. Firstly, that GenAI tools are here to stay, and will become increasingly integrated into the tools and practices of work. Secondly, that teaching and assessment approaches will need to adapt significantly to accommodate the increasing use of these technologies by students in the immediate term.

For Design educators, the adaptation to the era of ChatGPT and other GenAI tools may be especially challenging, and especially rewarding. GenAI has truly transformative potential within design practice, supercharging the generation of novel ideas, the exploration of visual languages, the prototyping of experiences and the synthesis of research. This is balanced by the potential for these tools to displace designers, their expertise and the work they do.

In the context of design education, GenAI tools may radically disrupt how students learn to be designers. Where once a student needed to gradually develop their abilities in research, thinking, and making, they now have vast synthetic, rhetorical and creative power at their fingertips from the very start of their studies. Throughout their studies students will be at risk of allowing their work to be dictated by their tools, or even defined by it, rather than learning to exploit these tools to enable better design practice. As the quote attributed to Marshall McLuhan highlights, *"We become what we behold. We shape our tools and then our tools shape us"*. This risk is present for students of many disciplines, but particularly acute for students of Design, as design practice is both explicitly generative and intentionally permeable to external ideas. Students of design are learning to navigate the ambiguity surrounding a new design challenge or project; balancing their own creative intent against the constraints, needs and expectations of clients, employers, communities and cultural conventions, and the potential to introduce radical and disruptive ideas. GenAI tools offer a persistent, low-cost means to enhance any such design project, but bring with them the potential to undermine the learning needed to successfully strike this balance in real-world design projects.

From 2023 onwards, students of Design will need new capabilities that allow them to actively manage the role of GenAI in their design practice and in their learning. In this paper we describe our attempt to be proactive in developing pedagogic principles and structures that will facilitate students' ability to use GenAI effectively, resisting adopting detrimental applications of GenAI in their learning. The work presented was undertaken by staff within the School of Design at [HE Institution], drawing on extant literature, dialogue with students and our own experimentation with GenAI tools. The result is a series of challenges and recommendations, adopted by the School of Design for the coming year.

2. Context

In this section, we intend to provide some context for the ideas presented in this paper. It should be noted that this is not intended to be a comprehensive review of literature relating to AI in general, or Generative AI specifically, nor of the responses within the education sector or Design education. This is an extremely fast-moving domain, and we are intending to provide only a snapshot to provoke questions about the current challenges for Design Education.

2.1 The rise of Generative AI

Technologies and tools which fall under the wider banner of artificial intelligence have been deeply embedded in our social and educational contexts for some time. Algorithmic

processing and machine learning has led to the development of tools such as Google Translate and search engines, prediction models such as that used by recommender systems like Spotify, and routine embedding of autocorrect and spell checking in word processing and typing applications. As, Authors (2020) have highlighted, however, there is a 'definitional dualism' which exists in considerations of 'AI'; while the term is used to refer to the mundane usages previously described, it is often the speculative and futuristic visions of general intelligence such as killer robots and the singularity that dominate discourse on AI. This may explain why we are often slow to react to the implications of seemingly mundane AI tools and services. In recent years, a new class of AI tools which use learning models to create novel texts or images has begun to emerge, called Generative AI. Tools such as DALL-E (launched by OpenAI in 2021) allowed experimentation with creating images in response to prompts. In late 2022 OpenAI launched their ChatGPT tool to the public, followed shortly by Google releasing their Bard AI chatbot. These tools were rapidly adopted, with ChatGPT attracting one million users within the first five days (Marr, 2023), growing exponentially to over one hundred million active monthly users within sixty days (Wu et al., 2023). Suddenly, these new powerful tools based on Large Language Models (LLMs) were widely available for a range of uses that did not previously exist. Many speculated that this would be a key tipping point for these technologies (Mollick & Mollick, 2022).

The regulation and ethical use of AI technologies is not a new topic of discussion. A myriad of guidelines, legislation and research exists internationally (Jobin et al., 2019). However, while there is significant existing research relating to responsible AI (Dignum, 2019) and the ethics of using these emerging technologies in relation to prediction and decision making, much less relates specifically to GenAI. As attention is now turning to the philosophical and ethical implications of GenAI and LLMs (Floridi, 2023) this is still very much an emerging conversation.

2.2 The use of and response to AI in education

There has been an immediate and rapid response to these tools being introduced into the education context. As Gillard and Rorabaugh (2023) note, no pedagogical testing was undertaken before the development or release of these tools. A key concern is that the use of these tools by students might enable academic misconduct (Oravec, 2023). It has been demonstrated that ChatGPT, for example, can rapidly produce convincing text that might be submitted as a student assignment, or even an academic paper (King & ChatGPT, 2023). This is a double-edged sword, as not only may students use this maliciously to attempt to cheat, but they may see it simply as a new tool to support their learning and be unaware that this could leave them open to accusations of plagiarism.

Initial reactions to GenAI included nationwide bans on accessing or using GenAI in Italy, China and Russia (McCallum, 2023). Some institutions and organisations also chose to ban the use of these tools completely, such as the New York City school system (Rosenzweig-Ziff, 2023). An 'arms-race' of AI plagiarism has already begun (Oravec, 2023) with new AI detection tools already being rolled out to existing academic plagiarism detection tools such

as Turnitin (Turnitin, 2023). Nevertheless, there has been some criticism that these tools are ineffective, with serious consequences in the case of both false negatives and false positives (Liang et al., 2023). Some reject the need for policy, instead addressing their concerns to students about what exactly they want to take from study and whether AI will be able to help them achieve that goal (Zimmerman, 2023). Others have instead proposed that there may be positive impacts to the use of ChatGPT in education contexts. Mollick and Mollick (2022) suggest for example that the use of an AI system can benefit the transfer of concepts to learners, if they are asked to check and correct how an AI applies a concept to a new situation.

Some have taken a moderated policy approach that does not disallow the tools but also cautions that action is needed to mitigate their potential harms. The UK's Russell Group of universities released a set of principles (Russell Group, 2023) including support for AI literacy in staff and students, and the adaptation of teaching and assessment to incorporate GenAI. Precisely how this should take place or whether there are discipline specific concerns is not specified in their document.

3. Our Response to GenAI

As Design educators working towards a new year teaching in Autumn 2023, we found there was a lack of clarity about how to positively address GenAI in practice within our teaching. In response, the School of Design at [HE Institution] formed a working group in early 2023 to address growing challenges being posed by GenAI in the context of Design education. This working group brought together staff with broad experience of design teaching, academic integrity processes, and with research interests in AI, machine learning and related technologies.

3.1 Student perspectives on GenAI tool use

A key early source of knowledge about the impact of GenAI students came from our involvement in the summative assessment of students at the end of the 2022/23 year. In line with many HE institutions, [HE Institution] introduced no outright bans on the use of GenAI tools, and where there was a suspicion that students may have used GenAI in summative submissions, they were invited to interview as part of the investigation process. This was established practice for academic integrity investigations and not novel to GenAI-related issues, but nonetheless provided valuable anecdotal insights into the way students saw these tools in the first five months of 2023. Based on this we developed the following indicative categories of GenAI use by students, but it should be noted that there was also a tendency to use the GenAI in collaboration with their own writing and other pieces of software in a pipeline of tools, rather than the uses below categories representing discrete practices

Writing improvement. There can be a lack of confidence in written content, especially for students in the creative subjects (RCA, 2015), and some students used GenAI to improve their writing. Contemporary GenAI tools provided an alternative to more established tools,

such as the built-in functionality within word processing applications or other online grammar correction tools. Some students whose first language was not English also used GenAI to translate their own original but non-English writing in preparation for submission.

Study Aid. Due to the capacity of some GenAI tools to accept long textual prompts, some students used this functionality to upload personally-collected material (lecture notes, book chapters, reference material etc.) which was then condensed and transformed by GenAI tools into summaries.

Inspiration. Some submissions had smaller volumes of suspected GenAI content. Students told us that they were using the software to generate full responses, but then only taking the initial elements and expanding on that with their own original content. These submissions often included improvised attempts at referencing, prior to the generation of any accepted protocol, such was the pace at which students adopted the GenAI into their practice.

Plagiarism. Unfortunately there were a small number of students who copied and pasted GenAI output into their summative submissions. Some students claimed not to realise this would be seen as academic malpractice, whereas others admitted that they had intended to deceive assessors due to various reasons.

Search. Perhaps most surprisingly, a number of students reported that GenAI tools such as ChatGPT had replaced the previous uses of Google search. The students adopting this behaviour seemed largely unaware of the limitations of this approach in terms of accuracy, and found the speed and ease of finding general information via text-based GenAI tools preferable to traditional web search.

3.2 Experiments with GenAI Tools

In order to gather more intelligence about the capabilities of GenAI tools in the context of assessment within our taught programmes, we engaged in informal 'wargaming' activities to find out how readily false evidence of learning could be produced and identified. We selected a series of representative assignment briefs from all levels of our undergraduate programme and tried to produce responses to them using contemporaneous leading GenAI tools: ChatGPT 3.5 and ChatGPT 4 for text generation, and MidJourney v5 for image generation. We experimented with a number of approaches to prompt design, ranging from attempting to generate an entire essay from a single prompt to more gradual 'construction' of content over a series of iterative prompts. We evaluated the outcomes produced by feeding generated text into a range of AI-detection tools, and then by discussion between colleagues within the academic teaching team. The AI-detection tools used were the OpenAI text classifier, GPTZero, and Turnitin, and activities were conducted in May 2023, when all three detection tools were still available.

Essay Writing. Where briefs required students to review and describe existing literature, ChatGPT was very effective at producing plausible content. If we took the time to construct an essay, first generating ideas for topics, then generating a structure, then defining

requirements of the brief, before finally generating each section within that structure, the results were very convincing. Essays generated from a single prompt were far lower quality and often ignored key requirements of the brief. By contrast, essays produced over a series of 10-20 prompts with a curated structure and a number of specified sources were far better. Not only did the more developed essays read like the work of a strong student, but they were also classified with high confidence as human-authored by the AI-detection tools we used. Our findings in this respect agree with reports of other researchers and educators applying these tools to scholarly writing (King & ChatGPT, 2023; Lund et al., 2023).

Design Project Documentation. Generating a textual description of an entire design project from a single prompt proved ineffective in our experiments, as the briefs we used required students to firstly explore a problem and opportunity space, then generate a design concept in response. As with the essays, this led us to break down the process of generating reporting from a design project into discrete stages; idea generation, ideation, concept development, then testing and evaluation. We were surprised to find how effective ChatGPT was at each of these separate stages, and repeatedly found that the ideas produced by ChatGPT were a good fit for briefs, creatively diverse and realistic. ChatGPT was also effective at producing false evidence for a range of primary design research activities: field notes from imaginary design ethnography, quotes from fictitious interviews with stakeholders and quantitative data from fabricated user testing studies. Where briefs required portfolios documenting the design process, ChatGPT could readily generate fictitious accounts of design ideation activities, critical commentary on decision making and reflective accounts of individual learning. When briefs allowed students to pursue a design project with known precedents (in methods, technologies, context or user needs) it was straightforward to generate text that represented all of the primary research data, design ideas and critical thinking required by the briefs we used. To create the prompts used in this process only generic descriptions of design process were needed, and while we could specify or select particular ideas to emphasise, we could also leave all of the design decision making to ChatGPT.

Design Visualisation. In our experiments, MidJourney excelled at producing one-off visualisations of environments, products and interactions. It was straightforward to specify the visual language of images (for example, product photography) and create high-quality visualisations that mimicked original illustration, 3D visualisation or photography. MidJourney could not produce accurate diagrams or accurate quantitative visualisations such as graphs or charts, although other GenAI tools can (e.g. Chartify.ai). In the context of a design project, MidJourney's strength was in generating compelling imagery to explore a design concept (e.g. Figure 1), and to facilitate visual research either by generating imagery in many styles around a term or description, or by describing found imagery. GenAI of this kind would be very helpful for rapidly prototyping ideas, and increasing the fidelity of prototypes with compelling original imagery. The most significant limitations we found in our experiments was in producing accurate imagery of existing objects and places,

controlling the precise visual form of objects, and maintaining consistent elements across multiple images.

Figure 1. MidJourney-generated imagery show an 'emotion sharing device' in the home

4. Implications and Challenges for existing Design Pedagogy

It is well-known that ChatGPT can be used to generate textual content for assignment submissions, allowing students wishing to cheat to avoid most of the work involved in producing an essay. From our experiments however, it is the potential of ChatGPT to generate the ideas within a design project that has far more important implications for design pedagogy. We found that the detection of AI-generated content (even if reliably possible in the future) was not a hugely relevant consideration, as GenAI tools can generate design ideas and data which are sufficiently discrete to be easily re-articulated or separated

from the context in which they were generated. If a student needs to produce discrete ideas (themes, insights, concepts, principles etc) during a design project they now have the option to generate these with the use of GenAI tools. This approach could be used by an unscrupulous student to produce a wholly fictitious account of a design project, or a student could engage extensively in their own design activities - primary research, ideation, critical analysis - and then use GenAI as a tool to evaluate, extend or unpack these ideas. A vast number of other permutations are possible, with lesser or greater dependence on GenAI tools, greater or lesser human design insights, and greater or lesser learning on the part of the student about design.

The issues raised so far in this paper intersect with profound philosophical questions about what it means to think, to use tools and to externalise intellectual work to non-human agents. These are well beyond the scope of this paper, and as design educators we are perhaps fortunate to have an explicit mandate for our teaching and assessment in the form of Learning Outcomes we need to enable our students to achieve and then reliably evaluate. We also need to deliver teaching and assessment largely with existing staff and resources. With this narrowed focus, we have identified 10 generalised challenges for our design teaching to address in the short term to help shape pedagogical choices across our teaching in the coming year:

4.1 Assessment

False evidence of learning activities. Students may use GenAI to generate descriptive text, literature reviews, research data or artefacts such as images, video or 3D models. Detection tools cannot be relied upon to accurately identify AI-generated content, and students may submit AI-generated content and claim it as their own original work.

Increased assessment burden on staff. Staff may be increasingly asked to judge the provenance of student work, expanding the demands of academic judgement far beyond pre-2022 requirements. GenAI tools are designed to present content, factual or fictional, in plausible ways that require time and diligence to unpack.

Student vulnerability to academic integrity injustices. As GenAI tools become mainstream, students may be exposed to increased risk of injustice within educational institutions. Tools for detecting the use of GenAI tools have non-zero error rates, meaning that some students may submit their own work and have it falsely identified as being AI-generated. There may not be opportunities for fair adjudication, and poor standards of evidence may be accepted.

Disruption to assessment standards. We should expect the standard of student work to increase significantly if GenAI tools are used well, ‘raising the bar’ for assessment. It may be difficult for staff to fairly and consistently judge how good or poor a piece of work is, and students may not get the encouragement they need from successes or failures in their assessed work.

4.2 Student Learning

GenAI-mediated independent learning. Finding and synthesising textual information is quick and easy using tools like ChatGPT, and we have found that some students already favour GenAI tools over tools such as Google search. These tools are effective at providing summaries of topics, bespoke learning plans and examples, and may disincentivize more traditional ways of using texts and sources. Students will be able to quickly build up their general understanding of topics without engaging with detail, with critical commentaries or emerging issues.

GenAI-mediated creativity. The synthetic capabilities of GenAI tools makes them great at generating and iterating ideas in both textual and visual forms. This could be a valuable part of a student's creative process, or it could replace creative thinking on the part of a student. They may also feel pressure to use GenAI tools if they doubt their own creative abilities. Selecting a good topic for a project, generating ideas for a tutorial or asking a good question in a seminar could all be routinely externalised to GenAI tools. Students may choose to accept ideas generated by GenAI tools if they cannot develop or shape them, bypassing critical learning experiences.

Inequalities of access to GenAI tools. Costs, risks, geography and skills will limit access to GenAI tools for some students, while others will have no such limitations. This will heavily disadvantage students lacking access to these tools.

4.3 Teaching delivery

Use of GenAI tools during teacher-student interactions. Students may use GenAI tools to inform or shape their interactions with staff. The same tools that could produce assignment submissions could also be used to compose emails to tutors, prepare for tutorials, suggest questions to ask during seminars or coach a student during tutorials.

Peer effects. When collaborating on university work, or when interacting more generally, students will use GenAI tools in communicating with one another. As with staff, students may well lack the knowledge to identify this and may also lack the authority to call it out.

Staff expertise gaps. Even for the most AI-literate tutors it will be challenging to identify and appraise AI-generated material in student's work. As educators we are learning about these tools without being directly connected to the cultural knowledge students will develop and exchange about how to apply these tools.

5. Resisting and Adapting to GenAI in the Design Studio

Our immediate concern in the context of our pedagogy is that emergence of GenAI tools is disrupting existing methods and patterns of design pedagogy, in particular studio-based learning. Whilst this could be characterised as GenAI tools tempting students to produce false evidence of their learning, bypassing study and assessment activities, it is the potential of these tools to displace the creative and critical thinking of students that is perhaps a larger threat to design pedagogy and practice. The learning that takes place in a design

studio environment is reliant on a student engaging with the uncertainty, indeterminacy (Waks, 2001) and ambiguity (Orr & Shreeve, 2017) of design situations, all of which GenAI can all too easily displace with confident rhetoric, plausible answers and probabilistically-determined norms. Students facing the demanding, and even at times uncomfortable experience of practical learning within a design studio may choose to disengage from the creative and intellectual challenge this form of pedagogy depends upon.

This challenge is complicated by design studio pedagogy itself being heterogeneous in nature. Schön's notion of the 'reflective practicum' is widely used to explain how design studios function (Schön, 1987), but theory of this kind does not account for the complexity of real-world studio-based teaching (Mewburn, 2012). Studies of design studio practice highlight differences between disciplines and contexts (Cennamo & Brandt, 2012; Goldschmidt et al., 2014), and complex relationships between the spatial qualities (Corazzo, 2019), roles (Belluigi, 2016), and communities (Brandt et al., 2013) at play within successful design studios. Educators at work in design studios are likely to have undergone their own education as practitioners (and as educators) within studio environments (Waks, 2001), maintaining a pedagogical tradition that is based on tacit, situated learning about what works and what does not, the 'heuristic teaching' described by Schön (1987). How a design studio is constituted and what makes it work is a further source of ambiguity that can make it harder to adapt to new situations, such as the emergence of GenAI.

In response to these concerns, and the challenges highlighted in the previous section, we have developed a set of principles, policies and practices to guide our design pedagogy in the coming year. The rapid pace of change amongst GenAI tools and AI technologies more generally make a strong position difficult to develop, so our approach is to firstly enable staff and students to resist the potential negative impact of these tools, then to enable our institution and staff to consciously adapt our pedagogy across time. We have implemented many of these principles within our teaching for the 2023/24 year, and will be able to update conference participants on the outcomes during the presentation of this paper (if accepted).

5.1 Resisting Disruption to Design Studio Pedagogies

Human design experience and expertise. Emphasising in-person studio teaching brings together existing staff expertise with an engaging social context for students. It also affords (for now) some control over the role that technology plays during teaching; we can create design experiences and activities for students that are unmediated by digital technology. A regular in-person studio provides a way to ensure students engage with established human-driven forms of design, and dialogue about design with both expert tutors and peers.

Studio tutor interactions. Tutors within design studios can adopt different roles, ranging from authority figure to coach (Schön 1987; Goldschmidt et al., 2010; Belluigi, 2016). Here we emphasise the need for interaction between tutors and students about their work, and in particular, the content of their design process – their methods, data, concept development and selection. Tutors will need the ability to test the provenance of ideas and student understanding through formative dialogue and feedback in order to provide

accurate summative assessment, while also distributing this assessment burden across the duration of a studio.

Project scope and briefing. Independent project formats (Lee, 2009) give students the freedom to set their own brief, but may also invite students to build projects around what GenAI can do, rather than using these capabilities creatively. For example, if a GenAI tool produces a compelling artefact (image, video or object) that cannot be easily controlled and developed, a student may simply accept it and post-rationalise its role in their work. To address this we can adopt tutor-led project structures with narrow briefs as the default, requiring students to respond to a particular context in their work, and helping to usefully align elements of their work with the work of peers (Cennamo & Brandt, 2012).

Assessment of process. Although already a feature of our teaching, we can further emphasise the primacy of process in assessment. We can give low (or even zero) assessment weighting to designed outcomes, helping to communicate to students that the meaning of without coherent narratives of process is ambiguous in the era of GenAI tools. We will require students to continuously develop portfolios of process, and review these to provide formative feedback, further equipping enhancing dialogue between students and tutors.

5.2 Adapting Design Studio Pedagogies

Dialogue between staff and students. We will present a clear set of principles for students from the start of teaching, outlining the positive uses of GenAI we expect them to explore, and setting clear limits around deleterious uses of these tools (Figure 2). From this starting point staff and students will be encouraged to experiment with GenAI tools, forming a exploratory community of practice and discourse (Cennamo & Brandt, 2012), enabling staff and students to learn about the potential of these tools and shape future curricular and teaching.

Disclosure of AI usage. To enhance learning and protect students from false accusations of academic misconduct, we will require students to include an ‘AI Appendix’ with all submissions. This appendix will explicitly state all uses made of AI tools, promoting student reflection on these tools, personal accountability for their use, and helping staff to assess the role of such tools in student work.

Prioritising inclusion and equality. The emphasis on in-person teaching and assessment-relevant staff-student interaction across the duration of a project does raise concerns of inclusion and equality. Some students may not perform well within an in-person setting, and presentations are known to be stressful forms of assessment for students (Kent-Waters et al., 2018). These concerns, combined with potential inequality of access to GenAI tools, necessitate special attention to the impact of these changes on members of our student cohorts.

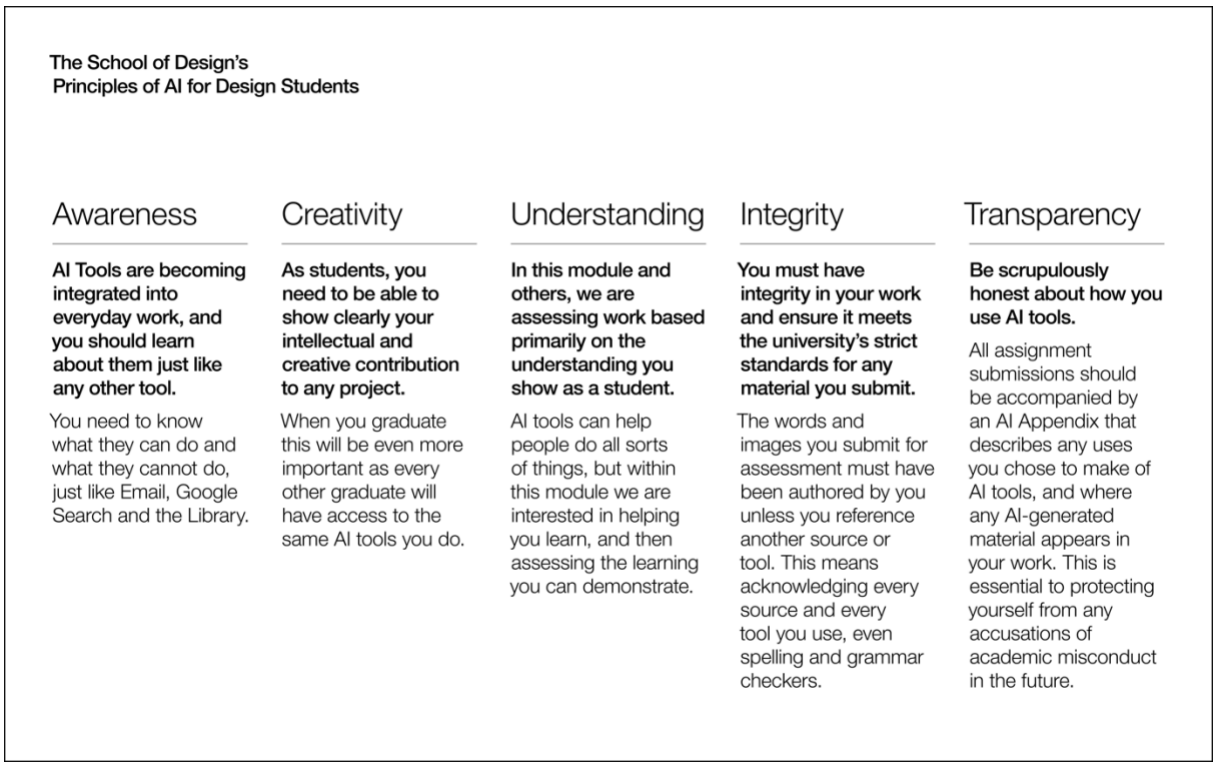

Figure 2. The 'Principles of AI for Design Students' used across all our teaching from Autumn 2023.

6. Conclusions

This paper describes initial investigations, policies and responses to the threat of GenAI tools to design pedagogies and design student learning. We identified 10 challenges for our design teaching in Autumn 2023, along with a practical proposal for adjusting design studio pedagogy. Our emphasis in this paper is ways in which the GenAI tools could undermine or distort student learning experiences, giving students low-cost ways to reduce the creative ambiguity of studio-based design projects, and so limiting their access to crucial learning experiences that are traditionally part of design pedagogy. In response, we propose a short-term approach of intensifying emphasis on in-person, studio-based teaching, increased student-tutor interaction, and adjustments to project and assessment formats. This is combined with an equally important medium-term approach to proactively engage with students about these technologies and their positive (and negative) applications within design.

Our interest in GenAI as educators was motivated by the pace of change in GenAI tools, and a desire to respond proactively to best support our students and ensure the quality of our teaching. Even during the drafting of the paper much has changed in the landscape of GenAI tools, and as such many of the ideas in this paper may soon be outdated. For example, our emphasis on in-person studio experiences is reliant on student-AI interactions being visible to tutors in a studio setting, something that is unlikely to be true in the near future. The paper highlights the need for an evolving GenAI research agenda ensuring design education remains relevant, effective, and engaging in the midst of rapid technological change.

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