DREAMWORLDS: A CASE STUDY PRESENTING THE POTENTIAL OF TEXT-TO-IMAGE AI IN PRODUCT DESIGN EDUCATION

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ABSTRACT
This paper presents a two-part case study on the "Dreamworlds" project conducted with first-year BA Product Design Students. It explores the integration of Generative AI tools within a five-week design project, focusing on its role in speculative world-building and subsequent toy design. Part One involved collaborative exploration and creation of speculative worlds in teams of 3 – 4 students over two weeks. Leveraging Text-to-Image AI, students produced a 5-minute video presenting their visions, showcasing AI-generated visuals that enhanced artistic direction. Part Two shifted focus to designing toys for children aged 4-5, using the speculative worlds from Part One as inspiration. Unlike Part One, Part Two was carried out individually, emphasising consideration of materials, safety, and cultural sensitivity. This case study contributes to the discourse on integrating AI in design education, offering insights into its roles in world-building and practical design. The "Dreamworlds" project serves as a practical example of AI application in both speculative and practical design education.

Keywords: Product design education, text-to-image AI, worldbuilding, toy design, speculative exploration

1 INTRODUCTION
In the quickly advancing landscape of Design and Design Education, the integration of generative AI as a design tool represents a paradigm shift, offering freedom and creativity in speculative exploration. The decision to employ Generative AI in the "*Dreamworlds*" project, a five-week design project, focusing on the role of speculative design as world-building and the subsequent design of children's toys, was driven by the desire to go beyond conventional design practises and explore the transformative potential these technologies might have within a BA Product Design undergraduate curriculum. *"Worldbuilding is the process of constructing a complete and plausible imaginary world that serves as a context for a story"*[1] The *"Dreamworlds"* project aimed to foster imaginative world-building through collaboration in addition to challenging conventional design methodologies, in the hope that it would provide valuable insights into the application of AI technologies in design education, enriching the student experience and learning with a dynamic challenge, allowing budding designers to think beyond traditional boundaries.

2 METHODOLOGIES
2.1 Project Outline
The "Dreamworlds" project was designed to combine emerging technology and practical skills through a two-part process. Part one, called "*worldbuilding*", involved students working in small groups to imagine and create detailed fictional worlds emphasising creativity, collaboration, and speculative thinking through generative AI tools. Part two transitioned into practical "toy design", where students worked individually to design toys inspired by the worlds they had developed in the first part, focused on applying practical design skills, from abstract concepts to tangible products, employing techniques such as sketching, prototyping, and CAD software. This pedagogical approach incorporates collaborative and project-based learning throughout the entire process, and hybrid learning experiences combining both online and offline activities providing students a well-rounded educational experience.

	Week One	Week Two	Week Three	Week Four	Week Five
Monday	Project Launch - Text to Image AI Introduction	Tutorials and Submission guidance for P1	Tutorials focussed on Design Direction	Tutorials focussed on Design Development	Tutorials and Submission guidance for P2
Tuesday					
Wednesday	Concept Development				
Thursday	Concept Review - Introduction to Further Tools for Narrative Building	Part One - Deadline	Lecture from Toy Designer & Rapid Ideation Workshop	Concept Review	Part Two - Deadline
Friday	Adobe Rush Tuition				

Figure 1. "Dreamworlds" Project Outline

2.2 Part One: World Building

During "Part One" of the project, students worked together, fostering a collaborative learning experience, through Project-Based Learning [2] This methodology was influential in nurturing a diverse range of ideas and perspectives, attempting to go beyond the superficial, 'aesthetically pleasing' aspects of design and delve into the core of what makes a product captivating, educational, and enduring through the narratives of worldbuilding. The use of AI as a tool in "Part One" was not only a technological exercise to introduce emerging technologies; it was a means to enable students' understanding narrative construction, artistic direction, and thematic development within a group. The AI-generated outcomes created throughout the project served as a springboard for deeper discussion and evaluation, prompting students to consider various design elements and storytelling techniques that could be applied to their projects. The emphasis on speculative exploration within the first part was crucial in allowing students to experiment with abstract concepts and scenarios, pushing the limits of their creative thinking. The imaginative worlds created by the students were not just artistic expressions they were conceptual frameworks synthesising their ideas into coherent and visually compelling narratives through a video output that would later inform and inspire the practical aspect of toy design in the subsequent "Part Two" of the project.

2.3 Part Two: Toy Design

Transitioning from the speculative to the practical, "Part Two" focused on applying the conceptual worlds to the design of mono-material toy(s) for children aged 4-5. The outcomes had to be designed and inspired by the imagined world created in "Part One" and encourage imaginative play, allowing young minds to embark on their own creative adventures, fostering open-ended exploration and storytelling. This shift of transferring the emphasis of storytelling from design method to design specification highlighted the versatility of imaginative worldbuilding in design education, demonstrating its utility in both abstract and emergent ideation methods in conjunction with traditional and tangible product development. In contrast to "Part One", "Part Two" was carried out by individuals and encouraged students to consider, materials, safety, cultural sensitivity, and environmental consciousness. These considerations needed to be at the forefront of the toy design, ensuring a wholesome and enriching play experience. The project's outcome showcases how Generative AI can be used in collaboration with design processes as a powerful tool in nurturing the next generation of designers.

2.4 Data Collection & Analysis

The choice of methods—observation, documentation, and reflection—was guided by the need to understand the impact of AI tools on student learning and creativity. These methods were selected to provide insights into the educational experience and effectiveness of AI integration. Data was collected from first-year BA Product Design students at Nottingham Trent University. A total of 34 students participated, divided into groups of 3-4 for Part One and working individually for Part Two. Qualitative data was analysed to identify themes and patterns related to the use of AI tools in design education.

3 PEDAGOGICAL APPROACHES

3.1 Collaborative Learning

"Collaborative learning is an educational approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or create a product" [3]. Throughout "Part One", students engaged in speculative "*world-building"*, collaborating to conceptualise and develop *"imaginative realms".* A core benefit of Collaborative Learning is its active engagement of students in the learning process, fostering the development of a social support system and learning community [4]. Allowing students to form their own groups, enabled them to leverage existing relationships and collaborate confidently, ensuring equal participation within the collaborative space. Shared ownership of work and student-centred instruction further contributes to students' self-esteem and sense of accomplishment [5]. Despite the individual nature of "Part Two", students continued to foster a collaborative approach through tutorials, concept reviews, and in-studio interactions.

3.2 Project – Based Learning

Project-based learning (PjBL) is a method that centres around students working on projects that are complex and meaningful. Here, students actively explore real-world problems, develop solutions, and create tangible outcomes. *"It involves students in inquiry, investigation, and collaboration, creating opportunities for them to construct knowledge and develop critical thinking skills"* [2]. PjBL is central to both project parts, further fostering active participation and collaboration [2]. In "Part One", students were challenged to go beyond traditional design tools and leverage AI-generated visuals to develop cohesive *"speculative worlds".* In "Part Two", students collaborated through tutorials, concept reviews, and in-studio collaborations, mirroring real-world design processes and experiences. This empowered students to navigate challenges such as material selection, manufacturing processes, and cultural sensitivity, fostering autonomy and self-directed learning. The *"Dreamworlds"* project demonstrates how PjBL can promote collaboration and prepare students for professional practice.

3.3 Hybrid Learning

"Hybrid or blended learning is defined as a pedagogical approach that includes a combination of face-to-face instruction with computer-mediated instruction" [6]. A hybrid learning environment was established using physical and digital learning spaces throughout the project. Complementing traditional face-to-face workshops and group discussions, digital tools were incorporated. Students were provided with support to use these digital platforms, expanding their creative processes, and giving them the tools to enhance project outcomes. The digital nature of tools such as MIRO -an online collaborative whiteboard- proved advantageous, allowing students to engage in individual work on their personal devices within a shared physical space. The integration of virtual collaboration tools allowed students to work as teams across physical boundaries, enabling them to collaborate effectively regardless of their geographical location. This integration of physical and digital learning components fostered an enriched educational environment that allowed for enhanced engagement, collaborative learning, and innovative problem-solving.

4 RESULTS AND DISCUSSION

4.1 Part One: World building

4.1.1 Working in Groups

"Part One" tasked students to engage in collaborative exploration and creation of "*speculative worlds*" in groups of 3-4 over two weeks. The decision to conduct "Part One" in groups was driven by several considerations. As previously mentioned, the group work predominantly aimed to encourage collaborative learning among students. Professional Product Designers often work as teams and so simulating this through project work helps to simulate this experience whilst in an educational environment. The hope was that by working in teams, students would be able to share perspectives and ideas, leading to more innovative and creative outcomes. At the end of the project, students were asked to give feedback on which "Part" they enjoyed the most and why. With several commenting on the group work being a contributing factor to project enjoyment. *"Creating the world was fun and a good team building experience"; "All working together and putting thought"* It was also clear from responses that students saw the value of working collaboratively, recognising that working as a team was "*productive"* and that "*ideas were shared".* In addition to the benefits of collaborative learning, the project directly followed an individual summative assessment point and was carried out in the lead-up

to the Christmas break, offering students a project that was enjoyable but not overly demanding, and more importantly an opportunity for social engagement at the end of term. Moreover, due to the introduction of unfamiliar AI tools during the project, authors felt a group setting would be more supportive than having students navigate these individually, meaning students could learn from each other without the pressure of having to individually produce outcomes. This approach aimed to encourage a confidence in AI tools from the outset.

4.1.2 AI Tool Selection

A key aspect of the "Dreamworlds" project was to give students an introduction to Generative AI Tools and exploring the potential role they play for creatives in the future. During the end of project survey, when students were asked about AI and its impact on their future academic careers, many raised a concern that AI would replace the need for Designers "*It will remove the need of designers, and projects will be completed fully by AI".* The "Dreamworlds" project aimed to tackle this perception by introducing Generative AI as a tool a Designer could use, rather than a replacement. Therefore, a variety of AI Tools needed to be integrated into the project, giving students confidence in them as resources for creative exploration. Generative AI Tools used within the project were Adobe Firefly for image generation, Runway ML for video manipulation, Eleven Labs for generative voiceover integration, Chat GPT for script creation, and Adobe Photoshop Generative Fill Tool for image editing. In using such a wide variety of tools, student groups were given opportunities for the conceptual development of their *"speculative worlds".* Introducing all tools over a short two-week period meant students had to learn quickly, particularly as most had limited previous experience. However, most adapted well, investing time as groups to understand the tools and their functions, in many cases beyond staff expectations. The selection of Generative AI Tools was guided by practical considerations, with students being limited to freely available software or software accessible through the university (Adobe Firefly & Photoshop). This approach ensured all students had equal access to tools throughout the project, giving all groups equal opportunities to participate. However, this also imposed limitations on the quality of the Generated AI and as such limitations on the *"speculative worlds"* themselves.

4.1.3 Access to Digital Devices

The project's reliance on digital tools meant that all students needed access to a computer, tablet or digital device. Whilst the vast majority of current students on BA Product Design at NTU have their own device, this is something to consider for future iterations of the project. There are computers available on campus, however, these resources are only accessible during opening hours and are an open resource for all students to use, which potentially creates a barrier to students' participation in the project. On occasions during "Part One", it was observed that some students were using a smartphone to participate, either because they had forgotten their digital device or it had run out of charge. This posed challenges in engaging fully with the project, as these devices either lacked the functionality needed to engage with the AI Tools or because of limitations in screen size. A variation in access and use of technology highlights the importance of digital equity and inclusion in a Generative AI Era. Barriers to access must be considered to ensure that education remains inclusive. As the use of AI Tools becomes more commonplace, educators need to consider the development of inclusive digital learning practices, accommodating a range of circumstances.

4.1.4 Project Outcomes

The final project deliverable for "Part One" was a video introducing each *"speculative world"* to the cohort, with a specification that all video content needed to be AI-generated. The aim of this was to challenge students to use Generative AI Tools within their design processes, pushing them to look beyond more familiar approaches. All student groups were invited to a screening of the videos, which served not only as a platform to provide feedback but also an opportunity to celebrate the end of "Part One". Students were encouraged to critically reflect on each video, not only for the benefit of the team that created the video but for themselves who would potentially be able to use the content in "Part Two" for inspiration in the toy-design element. In offering critique and insight into each video, students gained a greater understanding of each "speculative world", fostering constructive dialogue and sense of accomplishment amongst the cohort. The videos themselves showcased a combination of technical skill, creativity and a collaborative effort, demonstrating how well students had been able to leverage the Generative AI Tools for design exploration. Whilst instilled with comprehensive narratives, the

"speculative worlds" depicted in the videos showcased a significant level of conceptualisation, highlighting the effectiveness of AI-driven design processes. A key example was *"Washbucklers"* (Figure 2), a world developed around *"Sponge Pirates"*. This is just one example of how students' imaginative capabilities were able to be fully realised by Generative AI Tools, within the framework of speculative design.

Figure 2. "Washbucklers" Concept Moodboard

4.2 Part Two: Toy Design

4.2.1 Originality

The project's start saw students tasked with designing mono-material toys for children aged 4-5, drawing inspiration from their collaboratively constructed worlds. The pedagogical choice to pivot from collaborative to individual projects was underpinned by the desire to investigate the generative AI's potential in sparking novel ideations. Interestingly, the transition to individual design projects, revealed a reversion to traditional ideation methods, side lining the generative AI tools engaged in the initial phase towards further idea generation, whereby 53% (18) preferred "Part Two" reflecting that "*AI was more supplementary rather than a focus*", "*I found in Part One you didn't really have to do any thinking for yourself just relied on AI to do everything for you*", and "*It felt like we had more of an influence over the design processes*". *"While a part of the industry encourages its [the use of AI], it doesn't feel like my own work"*, *"becoming too heavily reliant. People will lose their creativity and won't be as motivated"* generating a *"decreased individuality"*. This reflects an apprehension towards recognising AI-assisted design as 'original' work with a reluctance to present generated work as one's own, finding more value within independent creative thinking and design practise.

4.2.2 Ideation

Despite this shift, it was identified through weekly studio tutorials that the initial engagement with AI was used to bolster confidence in sketching abilities, evidencing an improvement in visual articulation inspired by AI-generated imagery. As students were able to directly observe generated images as inspiration and develop them further; resulting in less sketch work that was simply copying existing products from online research, Part Two *"allowed me to explore on top of the AI", "Using part 1 to create original designs"*. However, due to the nature of "Part One", worldbuilding naturally develops characters, so this enhancement veered the project's focus towards character-driven designs, inadvertently homogenising the creative outcomes, resulting in many similar outcomes, with one student reflecting; *"I struggled to think of more unique and fun designs in this project, I feel like a lot of projects were similar"*.

4.2.3 Mono-Material

The mono-material constraint was a deliberate imposition to steer students towards a sustainable design mindset, challenging them to uncover the latent potential within a single material to foster play and imagination. However, the imposition of a mono-material, though well-intentioned, manifested as a source of frustration for students, which students shared openly through tutorials, suggesting that the

constraint might have been overly prohibitive. This feedback underscores the delicate balance required in framing project parameters to foster creativity without impinging on the of young designers.

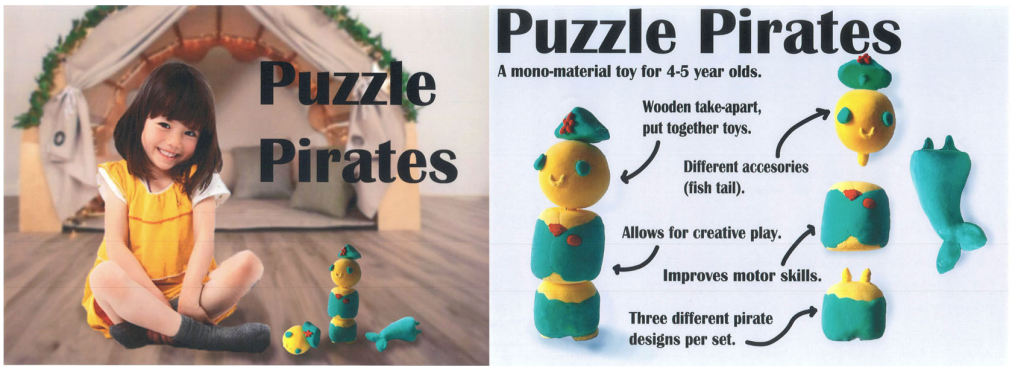

Figure 3. "Puzzle Pirates"

5 CONCLUSIONS

This case study *"Dreamworlds"* has illuminated the transformative potential of Generative AI in design education, affirming its role as a pivotal tool in the hands of first-year Product Design students. The majority of participants recognise AI as a functional asset, integral to enhancing task efficiency and creativity, notably, the consensus underscores the utility of Generative AI in ideation phases, highlighting its prowess in fostering novel creative insights. This project reveals a spectrum of perceptions towards Generative AI, ranging from enthusiastic endorsement of its innovative capabilities to cautious optimism. Furthermore, an overwhelming 86% of students acknowledge the tangible benefits of AI integration within the design process, pointing to a positive shift in the academic paradigm. The project's success is also reflected in the satisfaction with the accessibility and support provided by the teaching staff, rated positively across the board. Moreover, the project's trajectory and outcomes serve as ongoing professional development of educators, who, through reflective practice and engagement with emerging technologies like generative AI, continually refine their teaching methodologies. This case study not only navigates the complexities of integrating AI into design education but also illuminates the pathways for future pedagogic explorations, ensuring a dynamic and evolving educational practice that remains responsive to the advancements in technology and societal needs, catalysing a blend of traditional creativity with artificial innovation.

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