Prompt-Craft Cards: A Toolkit for Developing Design Judgment Through Reverse Prompt Engineering

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Abstract: The integration of generative AI into design education poses a critical challenge beyond technical skill: cultivating design judgment. Students often struggle to externalize their tacit knowledge into the explicit language of prompts, a process essential for developing the analytical capacity to make well-substantiated design choices. This paper introduces Prompt-Craft Cards (PCC), a tangible toolkit and pedagogical framework designed to address this gap. Using a Research-through-Design methodology, PCC frames Reverse Prompt Engineering (RPE) as a simulator for practicing design decisions at specific expertise levels. The toolkit features a differentiated system of three card decks, each scaffolding a different stage of expertise and knowledge transfer based on established learning theories. The Foundational Deck targets compositional judgments, the Adaptation Deck focuses on navigational choices, and the Reflection Deck encourages critical, metacognitive inquiry. The toolkit's efficacy will be evaluated through a multi-stage study employing think-aloud protocols within an Action Research design. This structured process transforms prompting into a form of deliberate practice. By engaging with the ambiguity between their intent and the AI's output, students are compelled to articulate, reflect, and refine their design decisions. Ultimately, I argue that this structured, reflective practice moves beyond teaching prompt engineering as a technical skill, transforming it into a powerful pedagogical method for cultivating the critical visual literacy and metacognitive thinking essential for professions and practices that relies on interpreting and creating visual media in the age of AI.

Keywords: Generative AI, Design education, Knowledge transfer, Pedagogical toolkit, Research through design

1. Framing the Challenge: Design Judgment in the Age of AI

Bringing generative AI into the design classroom requires a pedagogical shift away from teaching the tool itself and towards cultivating deeper critical and conceptual abilities. While this offers novel opportunities, it also introduces a complex spectrum of pedagogical stances among educators. These range from prohibiting GenAI's use in the classroom, due to concerns that students may become dependent on the tool before developing foundational skills, to designing projects that emphasize responsible use and human-centred abilities that AI cannot replicate (Aysel, 2024). This divergence highlights a central question for design education: How can we leverage this technology to cultivate the core competencies of design expertise? For this, I address a fundamental aspect of this expertise: the development of design judgment.

Developing design judgment is a critical, yet under-supported, area in various design disciplines (Demiral-Uzan & Boling, 2024). However, a gap remains in the literature concerning pedagogical tools specifically designed to cultivate this skill within the context of learner-AI interaction. To address this gap, I propose Prompt-Craft Cards (PCC), a tangible framework designed to scaffold the process of Reverse Prompt Engineering (RPE). This paper details the design of a new toolkit grounded in design expertise, and knowledge transfer theories. This toolkit is intended to transform prompting into a structured practice for supporting the development of design judgment. To build this pedagogical system, I draw upon three interconnected theoretical domains: models of design expertise, theories of knowledge transfer, and the principles of constructive alignment.

Established theoretical frameworks characterize the development of design expertise as a structured advancement through several levels of competency. Following the skill acquisition model, learners move through distinct levels, from novice to expert (Dreyfus & Dreyfus, 1986). Novices typically rely on explicit rules and struggle with the ambiguity inherent in design problems, whereas more competent designers can navigate complexity through intuition and experience (Lawson & Dorst, 2005). The PCC toolkit is differentiated to match these developmental stages, acknowledging that a one-size-fits-all pedagogical approach is ineffective. As Spessard (2025) notes, structuring prompts according to specific purposes can minimize unnecessary cognitive load and encourage meaningful engagement, a principle central to the deck system.

This differentiation is further informed by models of knowledge transfer, as the process of learning design involves converting tacit, embodied knowledge into explicit, communicable forms (Polanyi, 1969). To guide

this process, I adopted Chen and McQueen's (2010) model, which provides a direct framework for the pedagogical progression of our toolkit. The toolkit operationalizes this progression: the *Foundation Deck*, for instance, scaffolds the structured copy process, while the *Reflection Deck* encourages the unstructured fusion required by more competent students.

The pedagogical foundation of this toolkit is built upon the principles of Constructive Alignment (CA) (Biggs, 2014) by developing a systematic link between the intended learning outcomes (ILOs), the teaching and learning activities (TLAs), and the assessment tasks (ATs). In our system, the primary ILO is the development of design judgment. The PCC and the RPE process constitute the core TLA, designed specifically to target this outcome. To ensure this alignment is effective across different expertise levels, our approach integrates two key theoretical models. First, I use the Dreyfus model of skill acquisition (Dreyfus & Dreyfus, 1986) to define the learner's developmental stage. Second, I adopt Chen and McQueen's (2010) knowledge transfer model to structure the learning activities, aligning structured copy for novices, unstructured adaptation for advanced beginners, and unstructured fusion for competent learners.

Finally, to operationalize these activities, each prompt on the cards is designed as a measurable task using action verbs derived from Bloom's Taxonomy. For instance, the Foundation Deck uses verbs like *describe* and *identify* while the Reflection Deck uses verbs like *critique* and *formulate*. As Spessard (2025) also notes, aligning prompts with such cognitive frameworks is crucial for minimizing cognitive load and transforming AI into a pedagogical partner. This multi-layered framework ensures that the toolkit offers a purposeful, structured, and scaffolded path toward supporting the acquisition of higher-order thinking skills, in this case design judgment.

2. Prompt-Craft Cards: An Intervention Framework and Tool Development

I employed a Research-through-Design (RtD) methodology (Frayling, 1993) to investigate how a pedagogical toolkit can support the development of design judgment in the context of GenAI through RPE. In this approach, the designed artifact—the PCC toolkit—is not merely a final output, but a central method of inquiry. Through iterative development and testing, this toolkit generates new, practice-based knowledge about teaching and learning with generative technologies. The pedagogical stance of this project reframes the researcher’s role from an expert to that of a facilitator. The toolkit is designed not to provide answers, but to create a structured platform for self-paced, reflective learning. The PCC serve as mediating tools that scaffold the learner's own process of inquiry, guiding them to articulate their tacit knowledge according to their developing expertise.

To rigorously evaluate the efficacy of the Prompt-Craft Cards, a multi-stage empirical study is planned for Fall 2025. The research protocol has received full ethical approval from the İzmir University of Economics Social and Human Sciences Ethics Committee (Approval No: E-97429853-050.04-101381). The evaluation will be conducted in two main phases:

- **Formative Evaluation with Experts:** I will assess the pedagogical and practical validity of the toolkit through semi-structured interviews with 8 to 10 design academics and industry professionals spanning the research process. These experts, selected through purposive sampling based on experience and specialization, will provide feedback on the toolkit's conceptual framework, clarity, and potential for integration into curricula and professional workflows.
- **User Testing with Students:** The core of the evaluation will employ an Action Research (AR) design to assess the toolkit's impact on students' design judgment within practical contexts. The process will begin with a pilot test involving 4-6 students to refine the study protocol and evaluate usability. I will analyze and interpret the results with the expert feedbacks to develop strategies for design and framework iteration.

Subsequently, the main study will be conducted with a larger group of approximately 15-20 undergraduate students from various design disciplines. This main study will follow a pre-test, intervention, post-test procedure.

- Pre-test: Students will first be asked to perform a design task without the PCC toolkit.
- Intervention: Students will then be introduced to the PCC toolkit and use it to complete a similar RPE task.
- Post-test: A final task will be performed to observe any changes in their approach or judgment process.

Throughout all task-based sessions (pre-test, intervention, and post-test), we will employ the Think-Aloud Protocol as the primary data collection method. Participants will verbalize their thought processes while creating prompts, and these sessions will be audio-recorded and supplemented with observational field notes. The collected qualitative data (transcripts, prompts, and notes) will be analyzed using a thematic analysis approach. Separately, the pre- and post-test data will be compared through a performance analysis to evaluate case-based learning outcomes. This comparative analysis will allow us to identify patterns related to the toolkit's impact on usability, cognitive processes, and evidence of design judgment. The analysis will specifically focus on how the toolkit (intervention stage) scaffolds distinct types of judgment as defined by Nelson & Stolterman (2012), in comparison to the pre-test stage.

Building on the theoretical framework outlined in the introduction, the PCC are designed around the core principle that ambiguity is not a system failure, but a fundamental property of the interpretative relationship between the learner, the GenAI, and the generated artifact. The RPE process deliberately leverages this ambiguity to make people engage in meaning-making process (Gaver et al., 2003). The card decks are designed to scaffold this conceptually deepening process of appropriation, through opearationally shifting from the descriptive characteristics to the overall experience (Buchanan, 2001).

The toolkit comprises three scaffolded decks, each designed to support a particular stage of expertise development by integrating key theoretical models. Each deck aligns a specific learner level with a corresponding knowledge transfer process (Table 1). This integration is visually summarized in Figure 1, which presents two sample cards from each deck to illustrate this progression in practice.

Table 1: The Differentiated Pedagogical Structure of Prompt-Craft Cards

Card Deck	Level of Expertise (Dreyfus & Dreyfus, 1986)	Knowledge Transfer Type (Chen & McQueen, 2010)	Design Judgment Type (Nelson & Stolterman, 2012)	Associated Action Verb Examples (Bloom's Taxonomy)
Foundation Deck	Novice	Structured Copy	Compositional, Appearance	Describe, Identify
Adaptation Deck	Advanced Beginner	Unstructured Adaptation	Navigational, Instrumental	Relate, Compare
Reflection Deck	Competent Learner	Unstructured Fusion	Core, Reflective	Critique, Formulate

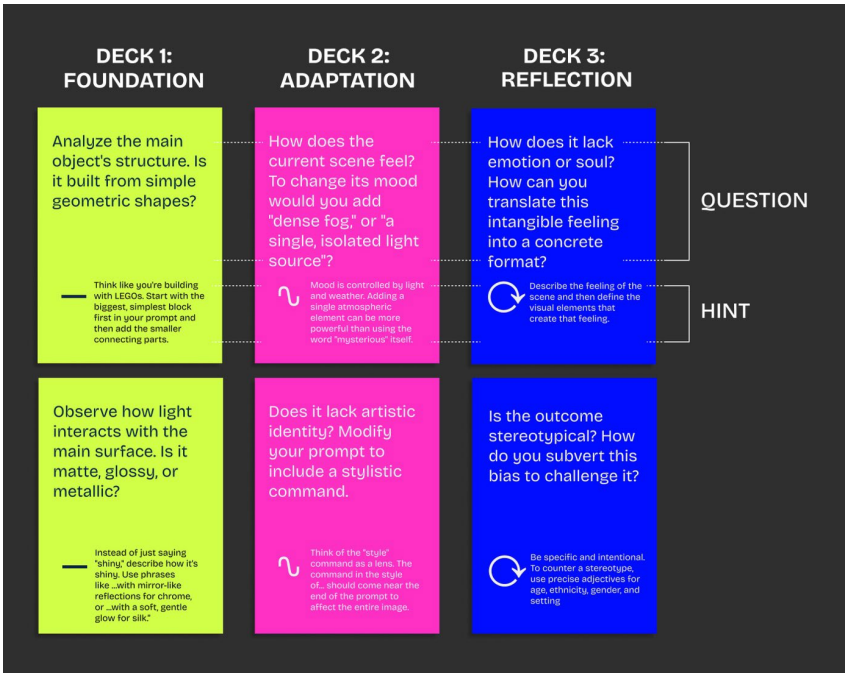

Figure 1: Sample cards illustrating the three-stage pedagogical progression of the PCC toolkit, from the Foundation to the Reflection deck

3. Discussion and Conclusion

The PCC toolkit is proposed not merely as a method for teaching AI literacy, but as a dedicated instrument for supporting students' acquisition of various levels of design judgment (Nelson & Stolterman, 2012). The process challenges the notion that design knowledge is solely explicit, engaging instead with knowledge that is inseparable from the knower, revealed only through the learner's actions and reflections.

This pedagogical approach is particularly potent in its use of what Gaver et al. (2003) term ambiguity of relationship. When a discrepancy occurs between the learner's intent and the AI's output, the toolkit becomes a psychological mirror. It confronts the learner with the tension between their subjective worldview and the AI's collective, statistical representation. This moment of reflection, scaffolded by the *Reflection Deck*, spurs students to 'question their [own] values and activities' (Gaver et al., 2003, p. 237), fostering a critical self-awareness essential for contemporary design practice. This structured, iterative exercise thus becomes a form of deliberate practice (Ericsson et al., 1993) aimed at developing this core design skill (Demiral-Uzan & Boling, 2024).

The contribution of this research is best understood by positioning the PCC toolkit within the context of existing AI-focused educational tools. While many valuable toolkits exist, they typically address different pedagogical layers. For example, tools like the AI Ideation Cards (Piet, 2020) focus on the divergent, brainstorming phase of identifying opportunities for AI. Others, like the Prompt Engineering Cards (AI Tinkerers' Cards, no date), provide a hands-on, modular system for trainers to teach the basic components of AI interactions.

Other approaches, more focused on skill acquisition, use gamification to teach the procedural craft of writing effective prompts. For example, the Prompt Engineering Game from the University of Birmingham (Westwood & Liu, n.d.) both provide structured elements like skill cards and power-ups to guide users in constructing better prompts. These tools are invaluable for building AI literacy by focusing on the syntax and composition of the prompt itself.

In sharp contrast, the pedagogical goal of PCC is not to teach the craft of the prompt, but to use the prompt as a medium to teach the craft of design judgment. Our core activity is not construction, but deconstruction and reflection through Reverse Prompt Engineering to facilitate the deliberate practice of formulation and decision-making in design activity through design judgment. This fundamental distinction shifts the focus of learning from the external artifact (the prompt) to the user's internal cognitive and judgmental process. The central question we ask is not 'how to write a better prompt?', but rather 'why did I make this specific design choice, and how can I articulate it?'. Therefore, PCC is positioned not as a replacement for these valuable tools, but as a necessary complement—a dedicated instrument that uses the act of prompting as a reflective simulator to cultivate the metacognitive skills at the heart of design expertise.

This study addresses a critical gap in design education: how to frame learning activities to support design judgment development in the age of GenAI (Demiral-Uzan & Boling, 2024). By proposing PCC I offer a pedagogical framework designed specifically to scaffold and provoke this essential skill. The toolkit serves as an initial prototype for iterative development. Future work will focus on two trajectories: transforming the tangible toolkit into an interactive digital platform for data-driven feedback, exploring cross-contextual adaptations for other disciplines and public workshops.

Ethics statement: All planned research activities involving human participants have been reviewed and received full ethical approval from the Izmir University of Economics Social and Human Sciences Ethics Committee (Approval No: E-97429853-050.04-101381). Prior to their participation in the upcoming expert interviews and student user tests, all individuals will be provided with an informed consent form detailing the study's purpose, procedures, their right to withdraw at any time without consequence, and the measures that will be taken to ensure data confidentiality and anonymity. Specific precautions will be implemented to mitigate any potential power imbalance in the researcher-student relationship. All procedures will be conducted in strict accordance with the approved protocol.

AI statement: During the preparation of this work, I used an AI language model (Google Gemini) to assist with proofreading, grammar checking, and rephrasing for clarity.

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