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Framework for Graphic Design Education and Tool Development

Muhammad Ahmad Khan
Institute of Computing, MNS University of Agriculture Multan, Pakistan.
Israr Hussain*
Institute of Computing, MNS University of Agriculture Multan, Pakistan.
Muhammad Shakeeb Ul Hassan
Institute of Computing, MNS University of Agriculture Multan, Pakistan.
Shagufta Abbas
Institute of Computing, MNS University of Agriculture Multan, Pakistan.
Abdul Razzaq
Institute of Computing, MNS University of Agriculture Multan, Pakistan.
Ramsha Ahmad
Institute of Computing, MNS University of Agriculture Multan, Pakistan.

****Corresponding author: Israr Hussain (**israr.hussain@mnsuam.edu.pk**)***

Article Info

Abstract

This paper addresses the under representation of tacit intuitive knowledge, experience-based insight—in graphic design tools and education. Despite the rise of intelligent systems and digital plat- forms, current environments often overlook the non-verbal reason- ing that distinguishes expert designers, such as aesthetic judgment and user empathy. Synthesizing findings from twenty contemporary research articles, this study identifies key gaps in existing systems, including limited support for intuitive reasoning, lack of adapta- tion to personal styles, and inadequate mechanisms for conveying expert decision-making. In response, we propose a three-stage framework—Capture, Analyze, and Teach—that records designer behavior and rationale through integrated logging and annotations, categorizes these through AI-assisted analysis, and embeds the re- sulting insights into adaptive tutorials and visual overlays. This approach fosters experiential, feedback-rich learning and positions AI as a reflective partner rather than a creative substitute. Our framework supports the preservation and transfer of expert-level design knowledge, offering a human-centric strategy for developing intelligent, inclusive, and educational design tools.

Keywords:

Tacit Knowledge, AI in Design, UX/UI, Design Education, Graphic Design Tools, Graphic Design Learning.

1. Introduction

The rapid evolution of artificial intelligence (AI) and digital automa- tion has redefined the landscape of graphic design. Tools like Figma, Adobe Firefly, and Canva are increasingly embedded with intelli- gent features such as layout optimization, generative content, and real-time feedback mechanisms. These innovations offer unprece- dented convenience, speed, and scalability to creative workflows. However, they also risk diminishing an essential component of de- sign practice: tacit knowledge. Tacit knowledge refers to the deeply intuitive, experiential, and often non-verbal understanding that ex- pert designers develop over time—manifested in subtle yet critical choices involving spatial balance, visual hierarchy, emotional tone, and user-centered decisions.

While traditional design education focuses heavily on explicit knowledge—codified principles, structured tutorials, and technical operations—it often fails to transmit the deeper, instinctive rea- soning that distinguishes novice outputs from expert-level work. For example, a beginner may learn how to align text using grid systems, but not when or why to break those grids for expressive effect. This gap is especially pronounced in digital environments, where automated tools prioritize output generation over process transparency. Research reviewed in [2],[4], [5], and [20] reveals that current systems lack the capability to capture or explain the con- text and rationale behind expert decisions, leading to a disconnect between tool proficiency and creative maturity.

Moreover, design education remains largely static and non-adaptive. Although video tutorials, critique sessions, and collaborative projects aim to provide exposure to expert workflows, they are inconsis- tent and difficult to scale—particularly in asynchronous or remote learning contexts. [2] confirms that while tutorials improve skill ac- quisition, they seldom convey the underlying design logic. Similarly, [20]'s detailed mapping of over 120 instances of tacit knowledge in professional practice emphasizes how much expert thinking remains undocumented and inaccessible to learners.

To address this systemic issue, our paper introduces the CAT framework—Capture, Analyze, and Teach—a structured approach for integrating tacit knowledge into design tools and curricula. Drawing on qualitative insights from twenty research articles and grounded in real-world design behavior, this framework enables the preservation and transmission of intuitive knowledge through behavioral logging, AI-assisted pattern recognition, and adaptive educational modules. For instance, the framework proposes embed- ding screen and voice recording into design software to track user decisions, applying natural language processing and visual pattern detection to analyze rationale, and converting these insights into interactive, feedback-rich tutorials.

Unlike current AI systems that act as generative agents, the CAT framework positions AI as a reflective companion—one that learns from and amplifies human creativity rather than replacing it. It addresses the pedagogical shortcomings noted in [3],[11], and [16], and offers an educational model that supports both reflection-in- action and reflection-on-action. In doing so, it responds not only to a technical need but also to an ethical imperative: ensuring that human design intuition is respected, preserved, and shared in the age of intelligent systems.

The sections that follow will explore related work in design ped- agogy, interface usability, and tacit knowledge capture; detail our synthesis methodology; and present the CAT framework supported by

design research and practitioner insights. Our ultimate goal is to enable a new generation of tools and curricula that blend machine intelligence with human-centered creative wisdom.

2. RELATED WORK

Our review of 20 design research articles reveals a strong collective focus on improving design education, evaluating digital interfaces, capturing creative workflows, and identifying gaps in communi- cation and media literacy within design. Although many works indirectly touch upon the presence of technology, the core emphasis across these studies is human-centered–highlighting educational methods, visual problem-solving, and user-centric design improve- ment.

A major strand of literature focuses on design learning at various levels, from vocational training to higher education. [2] discusses the development of video tutorials for vocational school students using the Borg and Gall R&D model. The study finds that such tutorials enhance media validity and practical application, though they are limited by sample size.[18] echoes this by confirming the effectiveness of tailored video tutorials for improving design understanding but stresses the need for more student-centered models.

[3] utilizes the ADDIE model to design a web-based digital mod- ule that improved learning outcomes in visual communication de- sign. However, the study identifies a need for better digital infras- tructure and broader accessibility. [16] contributes a theoretical lens by calling for interdisciplinary, lifelong learning models for future designers, advocating for curriculum flexibility in an evolv- ing digital world. Together, these works reflect a common need for modular, reflective, and scalable design education methods.

[19] and [20] offer detailed insight into design thinking. [19] tracks 37 students and maps their creative processes while design- ing advertisements. The study identifies four common patterns and provides evidence for how design behavior manifests across phases of ideation, iteration, and composition. [20] complements this by interviewing 10 professional designers and analyzing 123 examples of tacit, unspoken knowledge embedded in graphic choices. The authors develop a framework for this "hidden knowledge," empha- sizing how much of expert design intuition remains undocumented yet critical for learning.

These findings reveal how creative design knowledge often es- capes conventional instructional methods. They support the ar- gument that design tools and curricula need to go beyond visual outputs to engage students in process-based reflection, behavior tracking, and narrative construction around their decisions.

Several articles focus on interface design and communication in modern platforms. [1] presents a comparative UI analysis of food delivery apps in Indonesia, using observational methods to assess the visual effectiveness of GoFood, GrabFood, and ShopeeFood. The study finds that while some apps are clean and others functional, they collectively lack consistent UX research.[9] examines how animation and motion graphics enhance function and accessibility in interface design. Using Figma prototypes and survey analysis, the authors show that animated visual feedback improves user efficiency but recommend future work on emotional resonance.

Further, [11] (Smashing UX Design) and [12] (Learn to Match networks for visual tracking) suggest structured design models but note outdated coverage or limited adaptability to new media formats. [13]'s classic manual, "Architectural Graphics", serves as a foundation for spatial design logic but is limited in digital transla- tion, prompting calls for better 2D/3D tool integration.

Broader cultural and communication issues are examined in [14]and [15]. [14] discusses journalism and media in the 21st cen- tury, arguing for stronger global media literacy within design and communication studies. [15] reviews over 350 applied research the- ses to identify gaps in digital automation literacy and proposes standardized frameworks for cross-disciplinary tech integration. These perspectives complement visual design work by situating it within larger sociocultural and policy-driven systems.

Across these diverse contributions, one core challenge persists: while instructional systems and creative outputs are well studied, the intangible process–tacit decision-making, iterative reflection, and embodied visual thinking–remains largely uncaptured. [19] and [20] explicitly expose the gap between what is taught and what is practiced. [2], [2], and [18] propose improved tutorials and modules, but they lack integration with real-time workflows. [1] and [9] show that visual enhancements improve interaction but do not preserve the logic behind design choices.

This reveals a systemic need for educational frameworks and tools that make invisible design thinking visible–not through AI generation, but through thoughtful capture, analysis, and teach- ing of human decision paths. Our work builds on this gap and con- tributes a methodology grounded in real-world design research–not automated outputs–focused on human experience, peer learning, and process transparency.

3. METHODOLOGY

To construct a comprehensive framework for capturing and teach- ing tacit knowledge in graphic design, we employed a qualitative synthesis of 20 scholarly articles spanning UI/UX, AI-assisted tools, and design education. Our methodology comprised two core phases: literature content analysis and the development of a conceptual design framework based on identified research gaps.

3.1. Literature Analysis and Thematic Mapping

In our literature analysis, we extracted structured metadata–such as titles, methodologies, key findings, limitations, and recommendations– from each of the reviewed articles (see Table 1 in the appendix). Using thematic coding inspired by grounded theory, we identified four dominant areas of focus across the studies. The first theme, AI-enhanced design practice, emerged through discussions on the capabilities and constraints of generative tools in facilitating ideation and visual production ([4,5,6]). A second major theme, tacit knowledge in professional decision-making, highlighted the implicit, intuitive behaviors of expert designers, particularly emphasized in [20]. The third theme, user experience and educa- tional interface design, was evident in [1], [2], [3], [9], and [11], focusing on the role of interface clarity and interactive learning tools in shaping digital learning environments. Lastly, the theme

of human-centered learning and adaptive design thinking ([7,8,16]) underscored the impact of automation on creative learning and the importance of flexibility in instructional design. By applying Leximancer-

inspired semantic clustering and organizing the data through a Notion-based matrix, we uncovered recurring limitations in the literature, including lack of emotional depth ([4,7]), lim- ited scalability ([2,5]), and gaps in experiential validation ([18,20]). These patterns reveal crucial research opportunities in emotional design, scalable learning systems, and practice-informed knowledge capture.

3.2. Framework Development Process

Building upon the thematic gaps identified in the literature, we developed a three-stage pedagogical framework aimed at facilitat- ing tacit knowledge transfer in design education. The first phase, Capture, draws inspiration from [20] and [19] and involves us- ing screen-recording tools and contextual tagging–such as voice annotations or layer selections–to document real-time decisions made by designers in tools like Figma or Adobe XD. The second phase, Analyze, addresses critiques raised in [4] and [6], propos- ing the integration of AI tools such as Notion AI or Figma's Dev Mode to detect and interpret implicit decision points and contextual reasoning. Finally, the Teach phase transforms these annotated decision logs into interactive guided tutorials, structured around pedagogical strategies informed by [2],[3] and [11]. Collectively, this framework enables the transformation of expert intuition into reusable educational content, granting both novice and professional designers greater transparency and access to the unspoken logic embedded in creative workflows.

3.3. Tools and Evaluation Criteria

To support our synthesis and framework development, we em- ployed a suite of AI-enabled and design-oriented tools. Notion AI was utilized for summarization and efficient metadata management through database sorting, while Figma–along with its AI-powered plug-ins–served for interface mapping and high-fidelity mockup capture. To visualize semantic associations and theme strength, we adopted a Leximancer-inspired graphing approach, allow- ing us to represent complex interrelations among coded themes effectively.

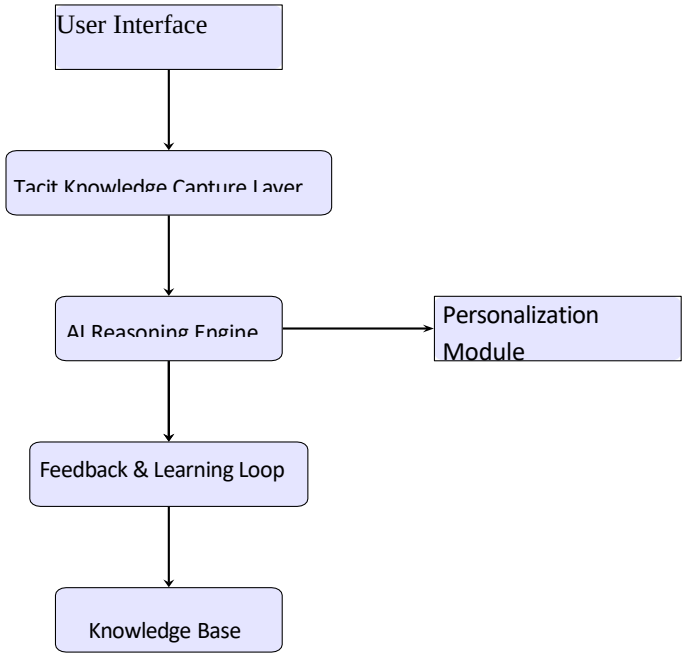

Figure 1: Proposed Architecture for AI-Supported Design Framework

Each article was evaluated using a set of three structured criteria. The Knowledge Transfer Relevance (KTR) metric assessed how well a study contributed to preserving or articulating expert design intuition. The Tool Applicability Index (TAI) measured the fea- sibility and scalability of proposed solutions within current design software ecosystems. Lastly, the Educational Depth (ED) criterion evaluated how directly the insights could be adapted into formal learning or instructional contexts. Based on these dimensions, our proposed framework was validated against observable gaps in the literature–particularly where tacit decisions were either lost during AI automation or inadequately documented ([6],[16],[20]).

4. FINDINGS

Our analysis of the 20 research articles uncovered overlapping gaps and emerging opportunities within graphic design educa- tion, AI integration, and tacit knowledge transfer. These findings were grouped into two primary categories: (1) Gaps in current educational practice and design tools, and (2) Opportunities for innovation through augmented frameworks and intelligent capture systems.

1. Tacit Knowledge is Underrepresented. Despite its central role in real-world design workflows, tacit knowledge remains in- sufficiently documented and inadequately supported in most de- sign curricula. Among the studies, only [20] dedicated its focus to implicit practices, highlighting signals such as mouse movement patterns, iterative feedback loops, and visual layer management as indicators of designer intent. In contrast, design tools and peda- gogical models in [2],[3] and [11] emphasized static outputs over dynamic reasoning or thought processes.

Example: [2] validated a video-based tutorial for vocational students but lacked embedded rationales to reflect expert intuition– failing to teach the why behind each design action.

2. AI Tools Lack Contextual and Emotional Sensitivity. [4],[5] and [6] examined the growing integration of generative AI in de- sign practice. While tools such as CreativeConnect ([5]) expanded ideation options, they struggled to align with emotional nuance and contextual sensitivity. [4] underscored this gap, noting that current AI-generated outputs often lacked alignment with human creative intent. Limitation: Existing AI systems prioritize automated out- come generation over interpretive and reflective processes, making them ineffective for capturing the subtle decision logic often found in tacit knowledge ([6]).

3. Design Education Remains Theory-Heavy and Non-Adaptive.

[7],[16] and [18] criticized the static and non-adaptive nature of de- sign education, which often privileges theoretical frameworks over lived creative experience. [7] highlighted how automation risks dis- placing human creativity, while [16] advocated for lifelong learning without presenting actionable strategies to support it. Concern: Pedagogical models still center explicit, visible knowledge while neglecting deeply embedded experiences that cultivate designer intuition.

4.1. Opportunities for Framework-Based Improvement

1. Capturing Design Decisions Using Over-the-Shoulder Tools. [20]'s interviews with expert designers–revealing over 120 tacit decisions–validate the effectiveness of observational methods. This opens up possibilities for design tools that integrate screen record- ing, annotation layers, and timeline-based playback to track rea- soning behind layout, composition, and tool selection. Proposed Feature: Embed real-time screen recording and voice annotation plugins within tools like Figma or Adobe XD to archive creative decision trails and enable retrospective learning.
2. Embedding AI in Design Tools to Surface Inspirations. Build- ing on [5]'s evaluation of generative tools and [6]'s critique of limited contextual sensitivity, an opportunity exists to augment design tools with AI that surfaces relevant past decisions or similar design cases. By embedding inspiration cues contextually–rather than through search or prompt-based querying–tools can better reflect how designers organically arrive at decisions.

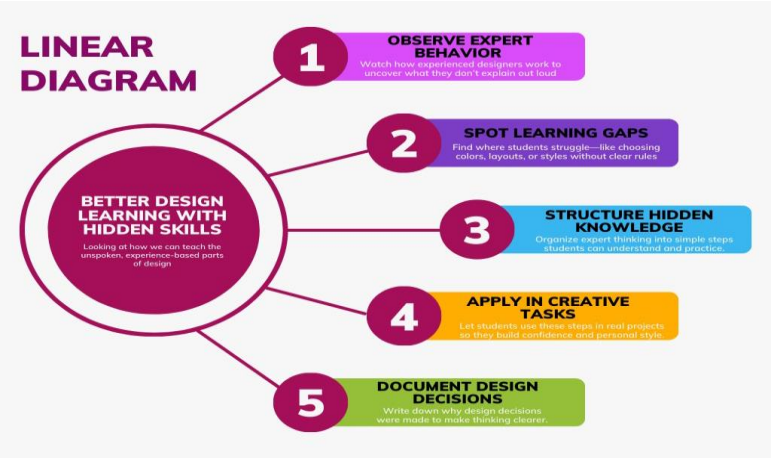

Figure 2: Flowchart illustrating the step-by-step progression of the process

5. PROPOSED SOLUTION: A TACIT KNOWLEDGE DESIGN FRAMEWORK

To address systemic gaps in capturing and transmitting tacit knowl- edge within graphic design, we propose a three-stage framework: Capture, Analyze, and Teach (CAT). This framework is designed to augment existing design tools and educational practices, enabling the structured and scalable transfer of intuitive and experiential knowledge.

Synthesizing insights from 20 scholarly articles, the CAT frame- work was developed to facilitate tacit knowledge transfer in design education. It draws on [20]'s emphasis on invisible design actions,

[5]'s insights into creative ideation with AI, [4]'s critique of AI- human comparison limitations, and the instructional shortcomings highlighted in [2],[11] and [16]. The framework aims to preserve expert decision-making during design workflows, analyze these behaviors into structured insights, and convert them into teachable resources–supporting both novice learning and expert augmenta- tion.

The first stage, Capture, focuses on recording real-time interac- tions with design tools. Tacit knowledge often emerges through micro-decisions–such as iterative spacing adjustments, frequent undo-redo cycles, or subtle layout refinements–that typically re- main undocumented. Techniques such as screen and voice

record- ing, mouse tracking, and metadata tagging of design layers are employed to log these behaviors, echoing [20]'s findings on instinc- tual yet consistent designer cues.

In the Analyze stage, captured behavior is transformed into ac- tionable insights. This phase utilizes natural language processing on voice annotations, computer vision for analyzing visual hierarchies, and pattern clustering to uncover design logic. Both qualitative coding and quantitative analysis are applied to surface the intent behind design actions. Unlike generative uses of AI, this stage uses AI interpretively– addressing contextual and analytical gaps identi- fied in [4],[5] and [6].

The final stage, Teach, translates these insights into dynamic educational content. Outputs may include interactive tutorials with embedded rationales, in-tool prompts offering design reasoning, or scenario-based learning modules derived from real-world cases. In contrast to static video modules discussed in [2] and [11], this phase emphasizes adaptive and feedback-aware learning resources– aligned with [16]'s call for personalized education systems.

The CAT framework is scalable across domains such as UI/UX, branding, and motion design, and is compatible with any design software supporting behavioral logging. By transforming tacit ex- pertise into reusable educational resources, CAT supports ethical AI co-creation rather than replacement. Unlike ideation-focused tools such as Creative Connect [5] or procedural instructional models in [2], CAT prioritizes reflective decision-making and intuitive rea- soning. It enriches design education by preserving hidden insights for ongoing learning, collaboration, and professional growth.

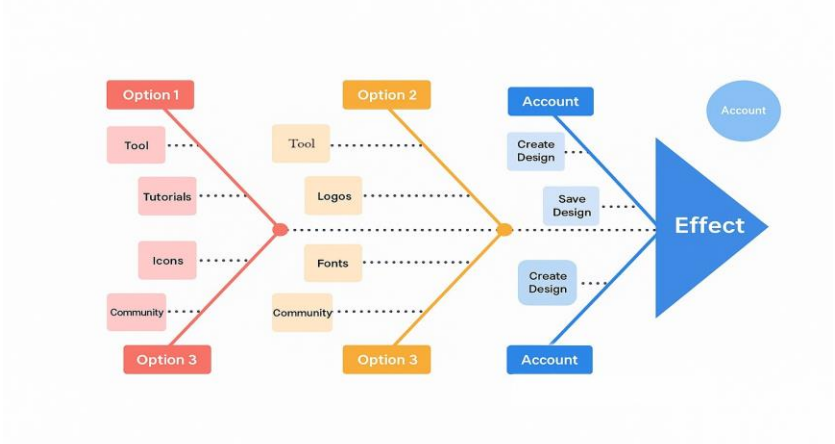

Figure 3: Three-stage framework for tacit knowledge transfer in design education.

6. DISCUSSION

The CAT framework (Capture, Analyze, Teach) presents a new method for capturing and teaching tacit knowledge in graphic design by integrating reflection and reasoning into design tools. Unlike conventional platforms such as Figma and Canva, which focus on visual output, CAT introduces a reflective layer that logs designers' rationale, addressing limitations in usability and contex- tual reasoning as highlighted in prior studies.

This approach enhances professional workflows by enabling peer feedback, onboarding, and transparency, while also generating annotated decision data that supports the development of more

context-aware AI systems. For educators, CAT enables the inte- gration of expert workflows into instructional content, allowing students to engage in real-time, experience-driven learning. It ad- dresses key gaps in traditional pedagogy and supports adaptive, reflective learning models.

By turning implicit design knowledge into reusable educational content, the framework safeguards the value of human judgment in the face of increasing automation. It also addresses ethical concerns such as data privacy and authorship through an opt-in system that ensures secure storage and proper attribution of captured decisions. While developed for graphic design, the CAT framework is ex- tendable to other creative and knowledge-intensive domains. It supports the broader goal of making domain expertise visible and teachable across fields such as writing, software development, and architecture—contributing to scalable and human-centric knowl- edge sharing in digital environments.

6.1. Summary

The CAT framework complements and enhances existing tools and theories in design practice. It addresses a critical void in current literature by surfacing invisible knowledge and transforming it into structured insights. At the same time, it offers a human-centric response to the ethical risks associated with automation and AI, and proposes scalable applications that reach beyond graphic design. Its success depends not only on technical feasibility but also on its ability to authentically reflect and empower human creativity within digital environments.

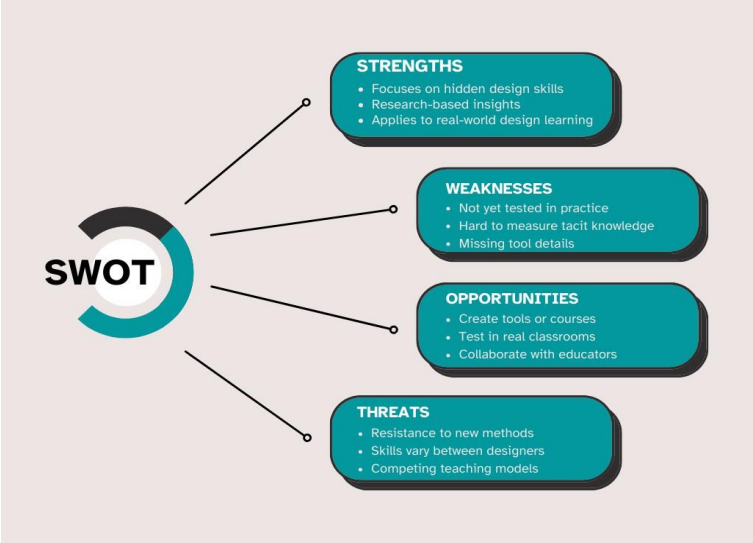

Figure 4: SWOT analysis of current design education tools.

6.2. Future Work

While our framework demonstrates substantial promise, several future directions can enhance its robustness and impact. The next major step involves conducting structured user testing across design schools and professional settings. This will allow us to measure learning outcomes, validate the knowledge transmission model, and refine our tool's usability based on real user feedback.

Another significant avenue involves deeper integration with industry-standard platforms such as Figma. We aim to develop a Figma plugin that not only assists in design creation but also prompts users with

tacit knowledge suggestions at contextually relevant stages. This plugin would act as a live design mentor, drawing from the database of tacit knowledge we have established. Additionally, while our current focus is on graphic design, the core methodology used–interviewing practitioners, coding their insights, and integrating findings into usable digital tools–can be extended to other creative and technical fields. Domains such as creative writing, user interface development, and even software engineering rely heavily on tacit knowledge. Our framework, once validated in design, could be adapted to these fields to enhance knowledge sharing and skill development.

Finally, we propose to collaborate with educators to integrate our findings into formal curricula. By doing so, the tacit knowl- edge that typically takes years of experience to develop could be systematically introduced to students early in their careers.

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∗Corresponding author.

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