

The Proficiency of Source Code: From Code in Textbooks to AI-Generated Code

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Abstract [\(should be within 1st page\)](#)

Code comprehension is a fundamental challenge in software development, as developers must constantly interpret code written by others whose complexity may exceed their own level of expertise. Although measuring developer proficiency is essential for aligning code complexity with developer capability, existing approaches rely on expert judgement that is subjective and difficult to replicate, leaving the field without a principled, evidence-based framework. This thesis aims to empirically validate the proficiency scale and its usability through four studies spanning from textbook-based evidence to AI-generated code, collectively establishing a data-driven foundation for measuring and applying code proficiency in practice. The first two studies examine textbooks as an empirical source for proficiency level validation and determination. Starting from validates existing proficiency level assignments against the pedagogical sequences of introductory textbooks, and scales the approach introducing the automated methods for determining proficiency levels, producing the most comprehensive empirically grounded framework to date. The remaining two studies then apply this framework to the context of AI-generated code. The third compares the code proficiency and structural quality of student-authored and LLM-generated code, uncovering a proficiency-quality paradox raising comprehensibility concerns. The fourth examines whether the natural language proficiency of a prompt influences the proficiency and correctness of LLM-generated code, finding that higher-proficiency prompts yield more correct but potentially less comprehensible solutions. Putting these studies together, I propose a framework for proficiency-aware code analysis with direct applications to code review assignment, newcomer onboarding, and educational scaffolding, while demonstrating that a measurable comprehension gap exists in AI-assisted development that cannot be resolved through prompt-level interventions alone.