

Students' Experiences with Generative AI for Programming Tasks and Independent Problem-Solving

How does the use of GenAI during programming tasks shape the way computer science students engage with independent problem-solving?

1. Background

Generative AI (GenAI) tools such as ChatGPT are now widely used by computer science students for code generation, debugging, and concept clarification, and are reshaping programming education.

They make tasks faster, but programming education exists to build the reasoning skills that this very efficiency risks bypassing. Excessive reliance may reduce engagement in the analytical reasoning, debugging, and independent problem-solving the discipline aims to cultivate.

Lenses framing the study:

- **Pólya's four stages** of problem-solving: understand, plan, carry out, look back.
- **Scaffold vs. crutch** — support that fades as competence grows vs. support that never does.
- **Cognitive offloading** — handing effort to a tool, driven by judgements of one's own ability.

Gap: little is known, from the student's own perspective, about how GenAI reshapes engagement at each stage — and whether reliance reflects lost ability or shifted motivation.

3. Results & Discussion

Reflexive thematic analysis produced **two themes** describing how GenAI shapes engagement with independent problem-solving.

Theme 1 — GenAI Reliance as a Deliberate Choice

Reliance is by choice and self-governed. Students tried problems first and used the tool as a limited, self-directed fallback, distinguishing "choosing not to" from "not being able to." (*Own Stages 1–2.*)

Confidence in skill retained, practice delegated. Ability felt intact even while coding and information look-up were handed over; the core reasoning and final judgement were kept. (*Own 1–2; delegate 3–4.*)

Theme 2 — Reduced Willingness to Persist Through Difficult Tasks

Lowered threshold to start. An in-the-moment instinct to hand a task over before engaging with it, triggered by tedium, fatigue, or low interest rather than genuine difficulty.

Gradual decline in motivation over time. A settled habit of reaching for the tool on the hardest or longest work, recognised only in hindsight.

Discussion

- Refines the "dual role" of GenAI: **scaffold and crutch are two modes of the same student**, selected case by case — not two types of student.
- "Replace thinking" only partly holds: students described replacing *effort*, by choice, more than ability — consistent with cognitive offloading.
- If ability stays intact, the pressing concern is the **motivational erosion**, which breaks down precisely under deadline pressure, tedium, and fatigue.
- Mapped onto Pólya: the **early interpretive stages are kept** while the **executional middle is delegated**, with persistence governing the return after a failed attempt.

2. Methodology

- **Design:** qualitative study of individual semi-structured interviews (in person & online, ~45 min; audio-recorded, transcribed verbatim).
- **Participants:** seven CS students at TU Delft; purposive sampling of experienced GenAI users; predominantly male; mostly 2nd/3rd year, one master's.
- **Analysis:** Reflexive Thematic Analysis (Braun & Clarke, 2022); inductive coding in ATLAS.ti through six phases, from codes to categories to themes.
- **Pólya's four-stage model** applied *post hoc* as an analytic lens for interpreting the themes — not as the interview structure.
- **Guide:** four thematic areas — general use; interaction strategies and their evolution; perceived cognitive impact; institutional & ethical considerations.

Figure 1

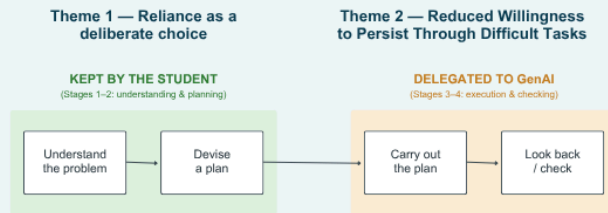


Fig. 1: Where engagement is retained or surrendered across Pólya's four problem-solving stages. Theme 1 splits the cycle into kept (Stages 1–2) and delegated (Stages 3–4). Theme 2 acts on entry (lowered threshold) and on the iterative return loop (motivation decline).

Figure 2

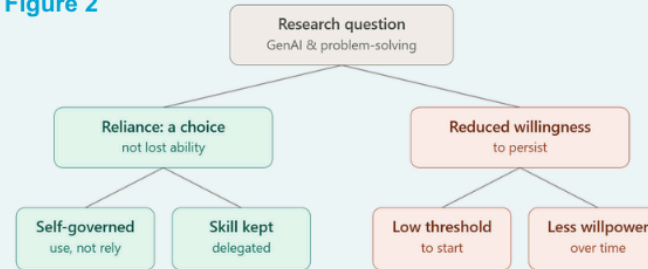


Fig. 2: Thematic map: two themes — reliance as a deliberate choice (Theme 1) and reduced willingness to persist (Theme 2) — each with two categories.

4. Conclusions & Future Work

- GenAI **reshapes** independent problem-solving rather than removing it: it lowers the effort required to *avoid* independent reasoning.
- The central tension is not that students cannot reason independently, but that **independent reasoning becomes the costlier option, one they increasingly decline**.
- Whether an ability that is rarely exercised stays intact is a question this study raises but cannot answer.

Future work

- Pair self-report with **observed behaviour** (task-based studies, with/without AI access) to test perceived vs. actual ability.
- A **larger, multi-institution** sample across stages of study.
- **Longitudinal** tracking of how reliance and motivation change with experience.

References

1. Prather, J. et al. (2023). The Robots Are Here: Navigating the Generative AI Revolution in Computing Education. ITICSE-WGR.

2. Braun, V. & Clarke, V. (2022). Thematic Analysis: A Practical Guide. SAGE Publications.

3. Pólya, G. (1945). How to Solve It. Princeton University Press.

4. Risko, E. F. & Gilbert, S. J. (2016). Cognitive offloading. Trends in Cognitive Sciences, 20(9).

5. Aruleba, K. et al. (2025). Beyond the Prompt: Student Strategies, Ethical Reflections and Learning with ChatGPT in Computer Science.

6. Wood, D., Bruner, J. S. & Ross, G. (1976). The role of tutoring in problem solving. J. Child Psychology and Psychiatry, 17(2).