

Insights from the Frontline: GenAI Utilization Among Software Engineering Students

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Generative AI is reshaping SE

Survey: The Al wave continues to grow on software development teams



Al is getting very popular among students and teachers, very quickly

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Quizlet's State of AI in Education Survey Reveals Higher Education is Leading AI Adoption TECH

Google CEO says more than a quarter of the company's new code is created by AI

lugh Langley Oct 29, 2024, 9:36 PM UTC

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Dichotomy of opinions in education

- Appropriateness of using genAl in learning?
 - O Threat to education?
 - Not all negative, it depends on how these tools are being used.
- A knee-jerk reaction can't we just **BAN** it?
- But, should we?
 - O Native in workplace
 - Being Al-savvy is becoming a necessary job skill for the future workforce

ChatGPT: A Threat To Higher Education? FORBES > LEADERSHIP > LEADERSHIP STRATEGY ChatGPT is going to change echnology education, not destroy it The narrative around cheating students doesn't tell the whole story. Meet the teachers who think generative AI could actually

Prioritize guiding students on the appropriate use of genAl tools

What can we do?

ChatGPT is going to change education, not destroy it

- Educators seek a clear understanding of
 - where these tools can help or hinder?
 - what its impacts would be for students?
- Prior studies have explored genAl's benefits and challenges, but:
 - O focused on introductory CS
 - O focused on programming

How can genAl tools be effectively leveraged in supporting students in SE education?

Revie

Research Questions (RQs)

RQ1: What is the state of genAl usage among SE students?

- <u>When</u> and <u>how</u> do they use genAl in SE education?
- <u>Where</u> do they perceive benefits and challenges?

RQ2: What are the causes and impacts of the challenges faced by SE students?

- <u>Why</u> did the challenges arise?
- <u>How</u> did the challenges impact students?

Causes and impacts of challenges ("why's")

Circumstances ("when")

Methods ("how")

Benefits/Challenges ("where")

Method Overview



Conducted <u>semi-structured reflective</u> interviews with SE students (N=16) at our university



Core interview questions:

- Reasons for using genAl?
- How and in what contexts they used these tools?
- Where did they perceive benefits and challenges?
 - Specific contexts & reasons for these perceptions?

Participants were asked to **examine their conversations** with genAl to **ground reflections in concrete examples**.



Search for

themes

=

Generate

initial codes

≣

Reflexive thematic analysis

Familiarize

yourself

with your

data

_

CODE

Inductive open-coding

TRANSCRIP



Saturation after 10 interviews

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative research in psychology, 3(2), 77-101.

Method Overview





RQ1: State of genAI usage among SE students

<u>Where</u> do they perceive benefits and challenges?

("when") = Phases/scenarios "when" students used these tools

("how") = Methods of "how" they used these tools

("where") = Contexts "where" they perceived benefits/challenges when they used it

RQ1-When

Phases "when" students used genAI

Initial Learning (L1)	Incremental Learning (L2)	
Learning SE concepts from scratch, without any prior knowledge of it	Learning after having some background knowledge; refine understanding	
	Advanced Implementation (I2)	
Initial Implementation (I1)	Advanced Implementation (I2)	

RQ1-Where

		Incremental I	
		Clarifying concepts and code	
 Ethical dilemma Setting realistic expectations C3. Difficulty in aligning AI to process or 	Framing the right questions or prompts Communicating context * Need for domain knowledge to query AI * Multiple back and forth exchanges	Getting structured outlines and roadmaps	
• Hard to align with learning style *		Learning syntax ★	
	 Hard to verify AI responses Misleading or confusing responses Hard to adapt AI to needs 	Personalized support	
Initial Imple	nentation (I1)	Advanced Impl	ementation (I2)
		C1.Unclear understanding of genAI & its use	
		 Ethical dilemma Setting realistic expectations Gauging genAl's limitations * 	Framing the right questions or prompts Multiple back and forth exchanges
		C3. Difficulty in aligning AI to process or preferences • Hard to align AI to preferences * • Interrupts thought processes *	C5. Difficulty in appropriately using genAI responses • Hard to verify AI responses • Misleading or confusing responses
Obtaining initial guidance ★		C4. Issues in obtaining proper rationales behind genAI's responses	 Hard to adapt AI to needs Hard to modify or generalize AI responses *

Perceived benefits and challenges. Benefits were perceived in L2 and I1, with challenges in L1 and I2. Stars indicate perceptions unique to the quadrant.

RQ1-Where: Challenges



* Stars indicate perceptions (codes) that are unique to the quadrant. 14

C3: Difficulty in aligning AI to process or preferences



"[Copilot] gives huge blocks of things you don't want, it breaks your flow and the thought process" (P7)

RQ1-Where: Challenges

Learning style: Here referring to an individual's preferred ways of perceiving, absorbing, & understanding new knowledge or information (e.g. conceptual understanding, hands-on activities, etc)

"generative AI was not aligned to my style of learning...the way it talks to me is not the way I want to learn" (P12)



* Stars indicate perceptions (codes) that are unique to the quadrant. $_{15}$

RQ2: Antecedents and Impacts of Challenges *Why* did the challenges arise? *How* did the challenges impact students?





Associations between genAl's intrinsic issues (faults and gaps), challenges (C1-C5), and resulting impacts

Faults: Flaws in genAl's behavior and output

RQ2-Antecedents





"It doesn't want to give me output because it thinks it is a terms of use issue without evaluating my context" (P5)

"After I explained repeatedly that I needed to optimize my script without changing external dependencies, the solutions suggested by Gemini & ChatGPT still involved alternate libraries" (P9)

Neglects context & preferences: Misinterpretation, Misguided guardrails



Associations between genAl's intrinsic issues (faults and gaps), challenges (C1-C5), and resulting impacts

RQ2-Impacts



"Sometimes genAl gives wrong information due to mistakes in how I've inquired. I didn't know enough...to ask the question properly. I had to unlearn what Al said and relearn using Youtube" (P1)

"It didn't really help me understand the critical components of why something might work and not in a way I like to learn; a lot of things went over my head" (P6)

"I ended up learning wrong things in the past...so when it gives me responses that are not there on other platforms, I'm skeptical about whether I learnt the right thing" (P8)

Sweller, John. "Cognitive load during problem solving: Effects on learning." Cognitive science 12.2 (1988): 257-285.

Key Takeaways

Initial Learning (L1)		Incremental Learning (L2)	
C1.Unclear understanding of genAl & its use	C2. Difficulty in effectively communicating needs or context	Clarifying concepts and code	Getting practice problems 🖈
Ethical dilemma Setting realistic expectations C3. Difficulty in aligning AI to process or	Fizaming the right questions or prompts Communicating context Need for domain knowledge to query A1 Multiple back and forth exchanges	Getting structured outlines and roadmaps	Getting surface level understanding
Preferences Hard to align with learning style	C5. Difficulty in appropriately using genAl mpomes	Learning syntax 🛪	Obtaining descriptive examples 🖈
C4. Insues in obtaining proper rationales behind genATs responses	Hard to verify Al responses Madeading or confusing responses Hard to adapt Al to modu	Personalized support	Revising concepts 🕇
Initial Impler	nentation (I1)	Advanced Impl	ementation (12)
Brainstorming ideas 🖈	Clarifying concepts and code	CLUnclear understanding of genAl & its use	C2. Difficulty in effectively communicating needs or context
Comprehending code snippets *	Finding useful resources *	Ethical dilemma Setting realistic expectations Gauging grnATs limitations	Framing the right questions or prompts Multiple back and forth exchanges
Getting structured outlines and	Getting surface level understanding	C3. Difficulty in aligning AI to process or preferences + Hard to align AI to preferences. •	C5. Difficulty in appropriately using genAl responses
Obtaining initial guidance 🖈	Personalized support	Inverspts thought processes C4. Issues in obtaining proper rationales behind genATs responses	Hard to verify AI regioner Moleading or confining responses Hard to adapt AI to needs Hard to modify or generalize AI responses.

Educate students on *appropriate* and *ethical* use of AI, rather than forcing "minimal use"

- Students still need to *take responsibility for the work* they produce
 - Ethos particularly important to instill in senior students
- Emphasize *the need* **AND** *teach the methods* to verify (gen)AI outputs
 - Helps novices set clear expectations & scope appropriate trust in AI

Emphasize understanding <u>where</u> and <u>why</u> to integrate (gen)AI in curricula, not just <u>how</u>

- Should be aware of the issues genAI raises for L1 & I2
- Ban it? → Where and why is it worth it (or not)?





paper!

Thank You! Questions?

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