Integration of Artificial Intelligence in Higher Education Programming Courses:
Insights from Student Perspectives and Practices

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CONTRIBUTIONS

Based on the following surveys conducted at Tallinn University of Technology (TalTech), IT College, Estonia:

Jaanus Pöial (Java), 22 responses

Einar Kivisalu (Python), 49 responses

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Prof. Slavko Rakic (University of Novi Sad, Faculty of Technical Sciences, Serbia) - abstract, RQ3 and RQ4

Prof. Uglješa Marjanović (University of Novi Sad, Faculty of Technical Sciences, Serbia) - limitations and future implications

Prof. Janika Leoste (TalTech) - design of the research framework and discussion

MOTIVATION

- Artificial intelligence (AI) is intensively used in software industry
- Integration of AI into programming tools (e.g. IDEs) is natural and unavoidable in practice
- Use of AI in programming courses may lead to ethical conflicts (e.g. in case the student homework requirements forbid any usage of AI)
- Computer programming is a very specific activity, where ethical standards for solving tasks with AI may differ from those used for normal homework (for example, an essay).
- Mapping of current situation (spring term 2024) is relevant to university teaching staff for the use of AI to support software engineering courses

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RESEARCH QUESTIONS

RQ1: To what extent do students rely on AI tools in their academic tasks?

RQ2: What types of AI tools are commonly utilized by students in the context of programming courses?

RQ3: To what extent do students rate their proficiency in using AI tools for academic tasks?

RQ4: What are students' attitudes and perceptions towards the integration of AI tools in their university studies?

SUMMARY

- AI Usage in Homework: 74% of students at TalTech IT College use AI tools like ChatGPT-3, ChatGPT-4, and Microsoft Copilot for homework, highlighting both benefits and ethical concerns.

- Student Proficiency: Nearly half of the students consider themselves proficient in using AI tools for simple tasks, with a significant portion using them effectively.

- Ethical Considerations: Many students do not cite AI usage in their work, indicating a need for better understanding and transparency regarding ethical AI use.

- Curriculum Recommendations: The study suggests integrating AI courses at all levels to ensure responsible and effective use of AI tools, emphasizing digital literacy and ethical standards.

METHOD: SURVEY QUESTIONS I

- **I used the following sources for my homework:** Task description / Programming language documentation / Web search / YouTube videos / Forums / AI tools / Help of other students / Other (specify)

- **In case AI tools were used:** I used AI so little that I didn't think it was necessary to refer to it / I used AI and referenced it / I used AI but didn't reference it / Other

- **I used the following AI tools (be as specific as possible):** None / OpenAI ChatGPT 3 / OpenAI ChatGPT 4 / Google Gemini / GitHub Copilot / Microsoft Copilot / Microsoft Bing / Codeium / Meta CodeLlama / Perplexity / Amazon Code-whisperer / Askcodi / Other (specify)

- **The code created by AI:** Was perfectly adequate and suitable without alteration / Needed some minor changes / Needed a major change / Was not at all suitable for the given task / Other (comment)

METHOD: SURVEY QUESTIONS II

- **I value my skills in using AI tools:** No skills at all / Beginner / Able to use AI for simple tasks / Use AI a lot and effectively / I am an expert / Other (specify)

- **How do you feel about using AI tools in the context of university studies?** I consider it cheating even if the usage of AI is not prohibited and reference is provided / I consider it cheating if the usage is not explicitly referenced / It is allowed in a reasonable amount if all the regulations are followed / It is promoted and AI tools must be taught at the university as an elective course / It is compulsory to take a course on AI tools and their usage is highly recommended / Other (please specify)

- **What to teach on the university level AI course:** Such a course is not needed / Topics in order of importance / Other (please specify)

SURVEY EXAMPLE

Full details of all surveys are available in the article, the following part of the presentation is concentrated on advanced Java programming course:

- Algorithms and Data Structures (2-nd year)
- Lecturer: Jaanus Pöial
- Questionnaire in SurveyMonkey – anonymous and voluntary
- Ca 60 participants, 22 responses

SOURCES USED BY STUDENTS TO SOLVE THE JAVA PROGRAMMING TASK

ANSWER CHOICES	RESPONSES	
Ülesande kirjeldust / Task description	100.00%	22
Java dokumentatsiooni / Java documentation	63.64%	14
Veebiotsingut / Web search	95.45%	21
Youtube videosid / YouTube videos	59.09%	13
Foorumeid / Forums	36.36%	8
Tehisintellekti / AI tools	90.91%	20
Kaasüliõpilase abi / Help of other students	9.09%	2
Muu (täpsusta) / Other (specify)	Responses	4.55%	1
Total Respondents: 22		

REFERENCING THE USE OF AI

ANSWER CHOICES ▼		RESPONSES ▼	
▼ Kasutasin AI abi nii vähesel määral, et ei pidanud vajalikuks sellele viidata / I used AI so little that I didn't think it was necessary to refer to it		30.00%	6
▼ Kasutasin AI abi ja viitasin sellele / I used AI and referenced it		40.00%	8
▼ Kasutasin AI abi, aga ei viidanud sellele / I used AI but didn't reference it		20.00%	4
▼ Muu (täpsusta) / Other (specify)	Responses	10.00%	2
TOTAL			20

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AI TOOLS USED BY STUDENTS

ANSWER CHOICES		RESPONSES
Mitte ühtegi / None of the above		9.09%
OpenAI ChatGPT 3...		63.64%
OpenAI ChatGPT 4		27.27%
Google Gemini		13.64%
GitHub Copilot		22.73%
Microsoft Copilot		13.64%
Microsoft Bing		4.55%
Codeium		9.09%
Meta CodeLlama		0.00%
Perplexity		0.00%
Amazon Codewhisperer		0.00%
Askcodi		0.00%
Muu (nimeta) / Other (specify)	Responses	9.09%
Total Respondents: 22		

CODE QUALITY ESTIMATION

| ANSWER CHOICES ▼		RESPONSES ▼	
▼ Täiesti adekvaatne ja sobiv muutusteta / Was perfectly adequate and suitable without alteration		5.00%	1
▼ Vajas väikesi muudatusi / Needed some minor changes		40.00%	8
▼ Vajas muutmist olulisel määral / Needed a major change		35.00%	7
▼ Ei sobinud üldse antud ülesande jaoks / Was not at all suitable for the given task		10.00%	2
▼ Muu (kommenteeri) / Other (comment)	Responses	10.00%	2
TOTAL			20

PROFICIENCY RATING

ANSWER CHOICES		RESPONSES	
Igasugune kogemus puudub / No skills at all		4.55%	1
Algaja / Beginner		27.27%	6
Saan lihtsamad asjad tehtud / Able to use AI for simple tasks		22.73%	5
Kasutan palju ja tulemuslikult / Use AI a lot and effectively		36.36%	8
Olen ekspert / I am an expert		0.00%	0
Muu (täpsusta) / Other (specify)	Responses	9.09%	2
TOTAL			22

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ATTITUDES AND PERCEPTIONS

ANSWER CHOICES ▼	RESPONSES ▼	
▼ Loen seda petmiseks isegi siis, kui AI kasutamine pole keelatud ja sellele on on viidatud / I consider it cheating even if the usage of AI is not prohibited and reference is provided	0.00%	0
▼ Loen seda petmiseks juhul, kui selge viide AI kasutamisele puudub / I consider it cheating if the usage is not explicitly referenced	4.76%	1
▼ See on lubatav mõistlikus mahus, kui järgitakse kõiki kehtestatud norme / It is allowed in a reasonable amount if all the regulations are followed	47.62%	10
▼ See on soositud ja ülikool peaks valikkursusena õpetama AI vahendite kasutamist / It is promoted and AI tools must be taught at the university as an elective course	28.57%	6
▼ AI vahendite kasutamine on tungivalt soovitatav ning seda õpetatakse ülikoolis kohustusliku kursusena / It is compulsory to take a course on AI tools and their usage is highly recommended	19.05%	4
TOTAL		21

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THE POPULARITY OF AI TOOLS AMONG PARTICIPANTS (SUMMARISED)

15
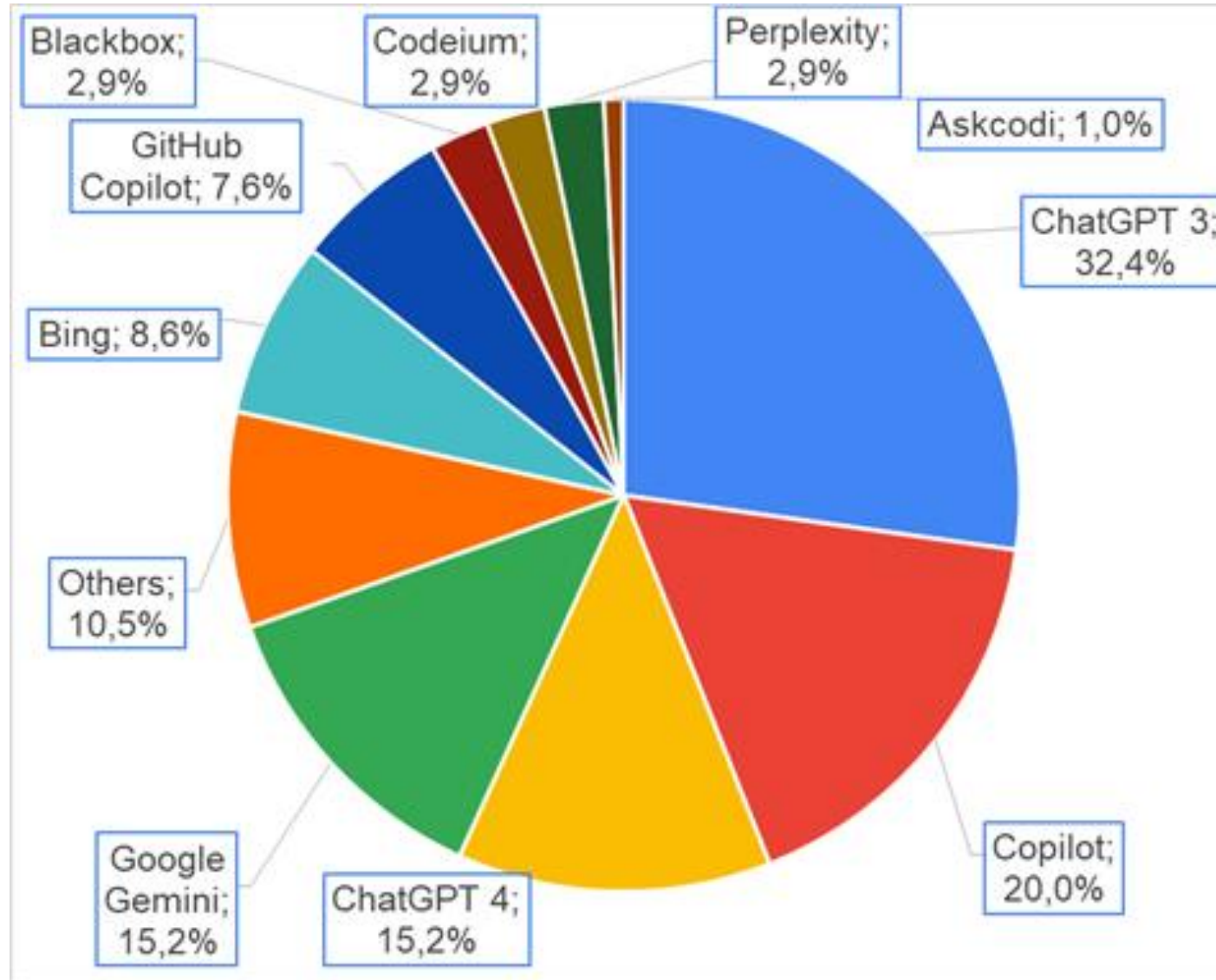
STUDENT FEEDBACK ON AI TOOLS

Positive Feedback:

Enhanced Learning: Students appreciate the support AI tools provide in understanding and completing tasks.

Efficiency: AI tools help in speeding up routine tasks, allowing more focus on complex problems.

Negative Feedback:

Quality Issues: Some students find that AI-generated code often requires significant modifications.

Ethical Concerns: There is a need for better guidelines on citing AI usage to maintain academic integrity.

Suggestions:

AI Courses: Students recommend integrating AI-related courses to improve proficiency and ethical use.

Practical Training: Emphasis on real-world applications and ethical considerations in AI tool usage.

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DISCUSSION AND FUTURE WORK

- Research opportunities
- Policy development towards AI
- Collaboration between stakeholders
- Curriculum development
- Methods of teaching
- Geographic scope

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Creativity Matters research group

https://cm.taltech.ee/