
RESEARCH ARTICLE

AI cognitive laziness in programming learning among university students

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ABSTRACT

Artificial intelligence become an essential part in education. In this research we study the impact of Generative Artificial Intelligence GenAi tools on student adoption in programming learning, the data was collected from 105 students how study a programming language in the university the survey include 20 question that is analysis to find the mean, standard deviation and AI dependency Index the result show that the AI Dependency is 3.6 which indicates that student over-reliance on these tools so this will reduce the cognitive effort made by students during learning, we recommend to use these tools to support learning process rather than reduce the critical thinking and cognitive effort.

KEYWORDS

Artificial intelligence tools, cognitive effort, AI dependency, learning

ARTICLE INFORMATION

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1. Introduction

In recent years the Artificial Intelligence plays a very important role in our life especially in education (vieriu, 2025), Health, Entertainment and financial ,there are many AI tools that contain virtual assistant, algorithms and decision maker system these plays a very important role because it is integral part of our daily work, it making available to access to the information unprecedented and provide us with personal experience (Hwang, 2020). Although the university environments have undergone a major transformation in teaching methods especially in programming learning these generative AI tools provide the student with ready-made solutions, explanation in programming concept and fixed programming error in a very quick way and in high accuracy this will leads to complete the academic task and reducing times that needs to solve programming problems. So, these tools can enhance leaning outcome by giving us instructional and feedback which support skills acquisition (Gerlich, 2025) (Zawacki-Richter O. M., 2019) .

Despite the clear benefits of these tools concerns are being raised about the effect of its used in the cognitive effort among student, excessive reliance on AI leads to cognitive laziness because the student will put less effort to analysis and solve the programming task dependently ,so the recent research says that the student show improvement in technical performance when they use AI tools but this not necessarily guarantee the deep understanding or development of critical skills like analysis and solve complex problems (Zhang, 2024), so that's why we should study the relationships between the use of these tools and the degree of dependence on it and study the impact of that on independent learning and the active mental engagement.

The aim of this study is to discover extent of dependence on Generative AI tools for Information technology student especially the student who learns programming and to evaluate the impact of this reliance on their cognitive efforts while they solve task for programming problem, unlike previous studies that focus on the advantage of using AI in educational process, The study presents a quantitative index to measure the AI dependency based on the survey data that is collected from student. Furthermore, this study seeks to provide feedback and recommendations on how effectively integrate the tools into education without damage the development of student fundamental programming skills, and finding deep understanding of how the

programming student using AI to solve the task, this will help university to integrate these tools to provide and support learning process without diminishing cognitive effort of the student.

2. Related work

In past few years the research focus on the computer science major, engineering and technology (Zawacki-Richter O. M., 2019), there is a lot research about how the Generative AI is used in education , research study the integration between GenAI tools and programming learning this leads a major transformation in learning and teaching ,there are many model provide student with quick assistant to generate ,write and find error in the code (Kurtz, et al., 2024). Manorat el al. (Manorat, 2025)study 119 research paper about AI applications in the higher education especially in programming learning the study shows that the AI is used in very wide range in education this indicate that AI providing a comprehensive support for lecturer.while other study by Boxuan et al (Boxuan Ma, 2025) examined 10000 record that collected using questionnaires answers from student and lecturer the result give guide line of how using AI tools enhance the learning of the student. Qian et al. (Qian, 2025) highlighted a key tension between using GenAI that enhance the efficiency and it is raise the concerns about overreliance so this will lead to use external resource for critical cognitive and essentially skills. In the other hand, Nathaniel et al (Nathaniel, 2025)reviewed the use of AI in programming this paper provides information about how to integrate AI tools in curriculum and highlight the benefits if its use such as personal feedback and save the time they also highlight the challenges including over reliance on AI tools and surface learning. Winara et al. (Lala Rahayu Winara, 2026) studies the impact of using AI tools in laziness of thinking and complete academic task the sample include 56 student the result shows that GenAI tools has a significant impact on cognitive laziness.

Due to the increasing research that addressed the GenAI use in education especially in programming. However most studies focus that the use of these tools will support learning and improving academic productivity. In other hand, there is still a research gap that relates to understand the impact of increasing reliance on these tools on cognitive effort for student. Especially in the task that require problem solving and analysis. This study seeks to fill this gap by analysis the student dependance on these tools in programming learning. And measure the effective of this on there cognitive laziness. Through analysis of survey data that collected from university student who study in the major of information technology especially student how study programming. The study provides a quantitative indicator to measure the degree of reliance on AI, so this will get a deeper understanding of how these technologies affect learning process in university.

3. Methodology

This study relies on Quantitative Research approach to analysis the dependences level of student while they use AI tools and the impact of this on cognitive effort while they learn programming, we use survey to collect data from university student, the survey designs a question to measure the degree of using AI tools and the level of analysis while they solve programming problems.

We analyze the data using descriptive statistical method to understand student using pattern of these tools and the possible impact on learning process.

3.1 Participants

The dataset was collected from student who study programming courses in universities, the participant answered the question voluntarily. As shown in Figure.1 the participant how answered the question represent a multi-level of experience in programming some of them are beginner, intermediate and advanced in programming. This diversity of experience provides a diversity in the collected data helps to understand the use of AI. All data was collected anonymously to ensure that the student answer the question and encourage them to answer the question honestly.

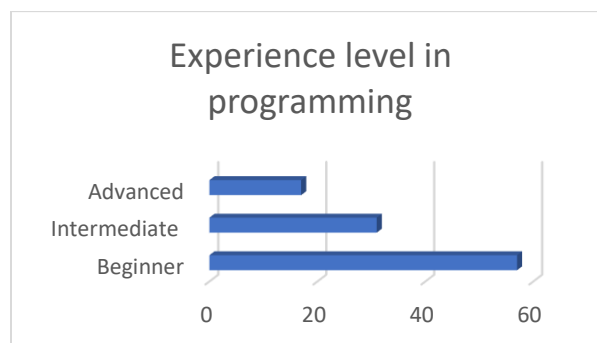


Figure 1 Distribution of student Experience level in programming

3.2 Data Collection

We collected the data using online Form, the survey was answered from 105 student how study programming in different level, the survey contains 20 questions the questions designed to measure 5 parts as shown in Table 1, the first part contains 4 questions about (Gender, Programming experience level, Year of study, and if they use AI tools to solve programming problems task), if the student answers the last question “yes” the next page will be appear so they can complete the other parts. The second part have 5 questions about the Using of Artificial Intelligence to know the extent of student use the tools for solving task. The third part have 5 questions about cognitive laziness to know the extent of student on AI rather than personal analysis and critical thinking. The fourth part also contain 5 question to study the impact of use AI on the understanding of programming fundamentals. The final part contains 1 question about the critical thinking level of student while they use these tools. The answer for these questions depends on the Likert scale the answer is strongly disagree, disagree, neutral, agree and strongly disagree where the answer range between 1 for strongly disagree and 5 for strongly agree.

Dimension	Number of Question	Question range
General question	4	Q1-Q4
Using of Artificial Intelligence	5	Q5-Q9
Cognitive Laziness	5	Q10-Q14
Impact of use AI in learning	5	Q15-Q19
Critical thinking	1	Q20

Table 1.Number of questions for each Dimension

3.3 Data Analysis

We analyze the data to perform descriptive statistical analysis, the analysis included calculating the average for each student in each dimension in this study, calculating the (mean) and standard deviation for each dimension study and analyze the result to identify student dependency level while using AI tools.

We use the mean to measure the general trend in student response while we use standard deviation to measure the degree of data dispersion around mean.

In addition, we calculated the AI dependency Index for each participant by calculate the overall average for question belong in the dependency on AI. This index reflects the student level on reliance on AI tools while solving Programming task. After that the student classification into three parts (low, Moderate, and high dependency), this classification supports the analysis of the AI use pattern between student and to discover the effect of these tools on cognitive effort while the student learns programming.

4. Result

4.1. Sample description

We collected the data from 105 university students the dataset showed that student distribution by gender ,75 of them was male and 30 was female, the distribution based on experience level in programming as it showed in Figure 1. (57) student sample consisted of responses from beginner level that equivalent to 54.3% of the sample, (31) response is in Intermediate level that equivalent to 29.5% of sample while (17) response in advanced level that equivalent to 16.2% of the sample, all these student use AI tools in programming task.

4.2 Key indicators

We analyze the student answer to evaluate the use of AI tools in programming task and its impact on cognitive effort and critical thinking, The mean was calculated for each student this represent the level of reliance on artificial intelligence tools and the overall mean was 3.6 with standard deviation 0.59 this average indicates the concentration of the majority of student demonstrated an average high level of reliance on tools. Based on the mean and standard deviation the student were categorized into three part (High, Moderate and low) , most of students were concentrated in the high category which indicates that they use AI tools and they depend on it, we also analyze the sub-indictors such as AI tools use, mental effort, learning and critical thinking they found shows that student in the highest average in these indicator’s, while the result of moderate category were lower, this reflect the different level of dependency between these categories.

4.3 Data analysis

The study shows that the student use AI tools widely while they are learning the mean of index reached 3 on Likert scale this indicate medium to high level of use AI tool among students, also the standard deviation show that there is a moderate variation among student in the degree of reliance on these tools. In other hand the result shows that these tools help students to reduce cognitive effort while they solve programming problems this dimension recorded an average that fall within the average level in Likert scale this mean that the student depends on AI tools to find the answer rather than solve it by them self. This will indicate that these tools provide educational support to students, helping them to understand programming fundamental and discussing the code in simple way this dimension recorded an average that fall within the average level in Likert scale this indicates that student use these tools as a source to support learning process. In contrast, the result shows that some students reduce the critical thinking while using AI tools.

To analyze the reliance of AI tools while learning programming we calculate the mean and the standard deviation for each dimension in the survey as shown in Table 2.

Dimension	Mean	Standard Deviation
Using of Artificial Intelligence	3.72	0.69
Cognitive Laziness	3.423754	0.77
Impact of use AI in learning	3.422933	0.72
Critical thinking	4.029785	0.81

Table 2.Descriptive Statistics of AI Usage and Dependency

4.4 AI dependency

The AI dependency index was calculated from the arithmetic mean of question that is related to the reliance on AI from the survey, the result was (3.65) which indicates that the reliance of using AI tools is very high. As shows in Figure 2. most students 70 of them show high level AI dependency, while 35 student showed moderate AI dependency. No students were classified as Low AI dependency. This indicated that student depend on AI tools from a moderate to high degree in their task, this might reflect the role of these tools in education and the importance of promoting critical thinking skills and reducing reliance on these tools and technologies.

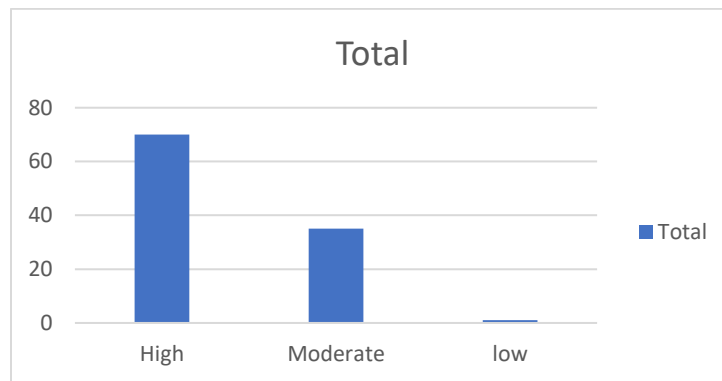


Figure 2.Distribution of AI Dependency level

Conclusion

The aim of this study is to analyze the degree of dependency in AI tools while students learning programming, In addition to study the impact of these tools on cognitive efforts.

The result shows that students use AI tools while learning programming, these tools provide them with support while they learning which help them to understand programming concepts and problem solving. In contrast the result shows that the student over-reliance on these tools this will reduce the cognitive effort made by students during learning.

Based on the above the study recommend using AI tools as a tool for supporting learning rather than an alternative to thinking and analysis. In addition to designing educational strategies to help students better understand of how to use these tools while maintaining the development of skills like critical thinking.

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