AI in Student Learning - Analyzing its effect on Critical Thinking and Academic Integrity

A Capstone Project

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Chapter 1

INTRODUCTION

Artificial Intelligence (AI) is rapidly transforming education, providing students with tools for learning, research, and academic work. While AI enhances accessibility and efficiency, it also raises concerns about dependency, critical thinking, and academic integrity. This study aims to explore the dual impact of AI in student learning—whether it fosters intellectual growth or encourages an overreliance that diminishes problem-solving skills.

1.1. Context of the Study

Artificial Intelligence (AI) has transformed many aspects of our lives, especially in education. These AI-powered tools such as OpenAI's ChatGPT, Grammarly, DeepSeek, and Anthropic's Claude became life-changing tools that are capable of generating real-time responses, problem-solving, and knowledge retrieval. These tools use Natural Language Processing (NLP) and machine learning to communicate with humans and give them personalized responses. In effect, it makes education more accessible. However, the increasing reliance on these tools is problematic in the academic community, impacting students' problem-solving and critical thinking skills.

Critical thinking, as well as problem-solving, is a timeless and fundamental skill that transcends disciplines and tasks. Regardless of the field or the goal, it remains essential for analyzing information, making informed decisions, and solving problems effectively. In education, this means students are required to analyze problems that are given to them and evaluate and synthesize the information independently. Traditional learning

encourages these by engaging students with complex problems, fostering deep comprehension. However, these tools often provide instant answers that may reduce the cognitive effort put into problem-solving or worse inhibit the development of those skills. Studies suggest that while AI enhances productivity and information access, it also leads to over-reliance, where students accept AI-generated responses without critically assessing their validity.

Another significant concern is academic integrity. Since these tools leverage machine learning, they utilize large amounts of data to identify patterns. Through this process, they generate high-quality and accurate solutions, raising ethical concerns about originality, plagiarism, and potentially academic dishonesty. Universities are now facing challenges in differentiating between AI-assisted learning and academic dishonesty. Some institutions implemented policies to regulate AI usage and others are struggling to detect AI-generated work, banning them completely.

Given these circumstances, this study aims to explore the dual effect of AI on student learning—whether it enhances or diminishes critical thinking and problem-solving skills—and how students perceive these tools in academic integrity. By investigating these concerns, this research aims to provide insights into a responsible integration of AI in educational establishments, ensuring its use encourages learning while upholding academic integrity and ethical standards.

1.2. The Problem, Gap or Opportunity

The integration of AI in education shows a promising opportunity: its potential to enhance learning and accessibility. However, there is limited evidence that focuses on its impact on students' critical thinking and problem-solving. While some argue that AI can be a good influence on students' learning, others are concerned that students might over-rely on its abilities.

A major gap that this study aims to explore is the unclear boundaries of AI usage in academics. There is an unclear definition of the ethical use of AI in academic institutions, potentially leading students to cross ethical lines—raising concerns about the academic integrity and authenticity of their work.

Another key issue is differentiating between AI-assisted learning and complete reliance on AI for academic outputs. While these tools provide concise explanations and detailed solutions, there is still a risk of bypassing students' cognitive engagement in learning by replacing original and authentic resources with artificial content. Despite the presence of AI detection tools, overreliance remains a persistent issue, as detection alone does not necessarily discourage the improper usage of AI.

1.3. Research Questions

This study aims to explore the impact of AI on students' learning and academic integrity by addressing these questions:

(1) How do AI tools influence students' critical thinking and problem-solving skills

(2) To what extent do students rely on AI-generated content for academic work, and how does this affect their cognitive engagement in learning.

(3) How effective are AI detection tools in addressing originality, and do they promote proper AI tool usage?

1.4. Research Objectives

The following objectives are to evaluate the impact of AI usage on students' learning behaviors and overall cognitive engagement. Specifically, it aims to:

(1) Assess the impact of AI tools on critical thinking and problem-solving abilities by examining how they could either support or hinder cognitive development.

(2) Analyze the extent of students' reliance on AI-generated outputs and its effect on cognitive engagement.

(3) Evaluate AI detection tools' effectiveness in upholding academic integrity and authenticity—and promoting proper AI usage.

1.5. Significance of the Study

The integration of Artificial Intelligence (AI) in education has revolutionized how students acquire knowledge, process information, and develop academic skills. This study is significant as it provides an in-depth analysis of how AI tools influence students' critical thinking and academic integrity, two essential aspects of effective learning.

Understanding the impact of AI on student learning is crucial for educators, policymakers, and institutions seeking to implement AI responsibly. While AI-powered tools such as OpenAI's ChatGPT and Grammarly enhance accessibility and streamline learning processes (Dwivedi et al., 2023), they also pose potential risks, such as over-reliance on AI-generated content and reduced cognitive effort in problem-solving

(Holmes et al., 2022). This study will help institutions differentiate between AI-assisted learning and AI-dependent learning, ensuring that students use AI as a tool for enhancement rather than as a replacement for critical thinking.

Moreover, the research will contribute to ongoing discussions on academic integrity in an AI-driven academic environment. Universities worldwide struggle to balance AI usage with maintaining originality in student work (Cotton et al., 2023). By analyzing students' perceptions and usage patterns, this study can offer insights into whether current AI detection and regulatory measures are effective. The findings will assist universities in formulating ethical guidelines for AI usage in academic settings, ensuring that AI remains a tool for academic growth rather than a shortcut to bypass learning.

Additionally, this study benefits educators by providing data-driven recommendations on how to integrate AI into the learning environment without compromising essential cognitive skills. AI developers and educational policymakers may also use these insights to refine AI tools, making them more aligned with the goals of fostering independent thinking and academic honesty.

1.6. Scope and Limitations (or Delimitations)

This study focuses on analyzing the impact of Artificial Intelligence (AI) tools on students' critical thinking, problem-solving abilities, and academic integrity. It specifically examines how university students interact with AI-powered tools such as

ChatGPT, Grammarly, and other learning aids that provide automated assistance. By collecting data from students in various academic disciplines, the study aims to determine whether AI usage patterns differ across fields of study and how students perceive and rely on AI-generated content for academic work. Additionally, it evaluates the effectiveness of AI detection tools in maintaining originality and academic honesty.

Despite its contributions, the study has certain limitations. First, it focuses on selected universities, which may limit the generalizability of the findings to a broader student population. The research also relies on self-reported data, which may be subject to bias or inaccuracies in students' perceptions and experiences. Furthermore, since AI technology is rapidly evolving, the findings may become outdated as new advancements emerge. Lastly, the study is confined to higher education institutions, excluding perspectives from primary and secondary education. Despite these constraints, the research aims to provide valuable insights into AI's role in student learning and academic integrity, benefiting educators, policymakers, and academic institutions in developing ethical AI integration strategies.

Chapter 2

REVIEW OF RELATED LITERATURE & STUDIES

Artificial Intelligence (AI) is increasingly integrated into educational settings, offering tools that enhance learning, accessibility, and personalized education experiences. The distinction between human and AI-generated text is likely to become irrelevant soon. We are transitioning to an era of AI collaboration, where AI's role as a co-creator in various tasks, including writing (Hockenbary, 2024), AI-powered platforms, such as intelligent tutoring systems, adaptive learning technologies, virtual assistants, and automated grading systems, have revolutionized how students interact with educational content. Furthermore, AI enhances accessibility by providing support for students with disabilities, offering language translation services, and enabling flexible learning opportunities through virtual classrooms and online resources.

Despite these advantages, the growing presence of AI in education raises critical questions about its impact on essential cognitive skills like critical thinking and problem-solving. Educational institutions traditionally emphasize the development of these skills through complex problem-solving tasks, analytical reasoning exercises, and independent research. However, the convenience of AI-driven tools that provide instant answers and ready-made solutions may inadvertently discourage students from engaging deeply with academic challenges. This overreliance on AI risks creating a passive learning environment, where students accept information at face value without questioning its validity or exploring alternative perspectives.

2.1 Impact of AI on Critical Thinking and Problem-Solving Skills

AI's influence is growing fast, A quick search of AI-related science stories reveals how fundamental a tool it has become. Thousands of AI-assisted, AI-supported and AI-driven analyses and decision-making tools help scientists improve their research. (Justin Jackson, 2025). In Figure 2.1, the graph illustrates a significant insight into how AI tools influence the research process, highlighting that the utilization of AI tools has a greater impact on research effectiveness compared to the researchers' education level. This observation underscores the transformative role of AI in modern research, where the accessibility and functionality of AI-driven tools can bridge gaps in expertise. Artificial Intelligence (AI) is increasingly seen as a powerful tool to augment critical thinking skills, especially in educational settings. One of the primary areas of focus is its application in academic research, where AI technologies like Natural Language Processing (NLP) play a crucial role. (Darwin et al., 2023)

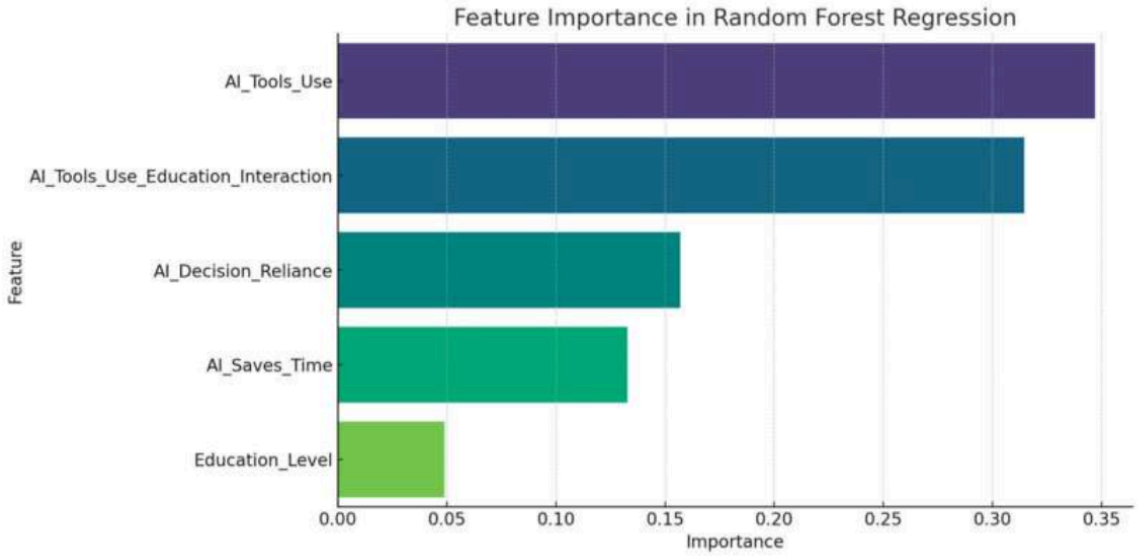

Figure 2.1 AI use linked to eroding critical thinking skills (Justin Jackson,2025)

2.2 Limitations of AI

Artificial Intelligence (AI) is often perceived as a double-edged sword—while it offers significant benefits that can greatly enhance daily life, it also presents critical limitations that warrant attention. Generative AI tools like ChatGPT have rapidly infiltrated educational settings, transforming how students approach learning. However, this surge in usage has raised concerns among educational institutions, as many students now rely on these tools to bypass traditional learning methods, opting for shortcuts like copying and pasting rather than engaging in critical thinking (Hockenbary, 2024b). This over-reliance on AI poses the risk of diminishing the human brain's natural capacity for deep thinking, problem-solving, and independent reasoning, leading to cognitive stagnation over time (Ahmad et al., 2023).

Moreover, AI's ability to process vast amounts of data and provide rapid solutions often sidelines human decision-making, gradually phasing out essential mental capabilities like intuitive analysis, critical thinking, and creative problem-solving (Ghosh et al., 2019). This growing dependence on AI in decision-making processes can lead to a passive mindset, where individuals trust algorithms over their judgment, potentially weakening their intellectual skills. Compounding this issue is the rapid advancement of generative AI models. These systems are evolving at an unprecedented pace, gaining more capabilities within a short span of time and expanding their influence by integrating with specialized expert systems, which further broadens their functional scope (Bailey,

2024b). While these advancements promise improved efficiency and innovation, they also amplify the ethical concerns and cognitive risks associated with unchecked AI usage.

2.3 AI and Academic Integrity

The advancement of technology, especially in the field of artificial intelligence (AI), has revolutionized numerous sectors, including education (Uunona and Goosen, 2023). The integration of Artificial Intelligence (AI) into educational settings has significantly impacted academic integrity, raising concerns about plagiarism, authenticity, and ethical practices. A mere week after ChatGPT appeared in November 2022, The Atlantic declared that "The College Essay Is Dead". The majority of both students and instructors also believe cheating will increase in the next few years, largely because of increased use of AI. And instructors worry that AI could negatively impact student's critical thinking and writing skills. (*AI & Academic Integrity | Center for Teaching Innovation*, n.d.) AI tools, such as generative language models and automated writing assistants, provide students with quick solutions and content generation capabilities, potentially blurring the lines between original work and AI-assisted outputs(Bogost, 2024).

Figure 2.3 illustrates the progressive rise of AI usage in academia from 2015 to 2024, starting with minimal adoption primarily in research and administrative tasks. Between 2018 and 2020, AI integration grew steadily as educational institutions explored AI-driven tools for learning management and student assessments, further accelerated by the COVID-19 pandemic. From 2021 to 2023, AI adoption surged, with

tools like virtual assistants, adaptive learning platforms, and generative AI becoming mainstream in academic settings. By 2024, AI usage in academia reached its peak, significantly shaping teaching, research, and administrative processes (Coffey, 2023).

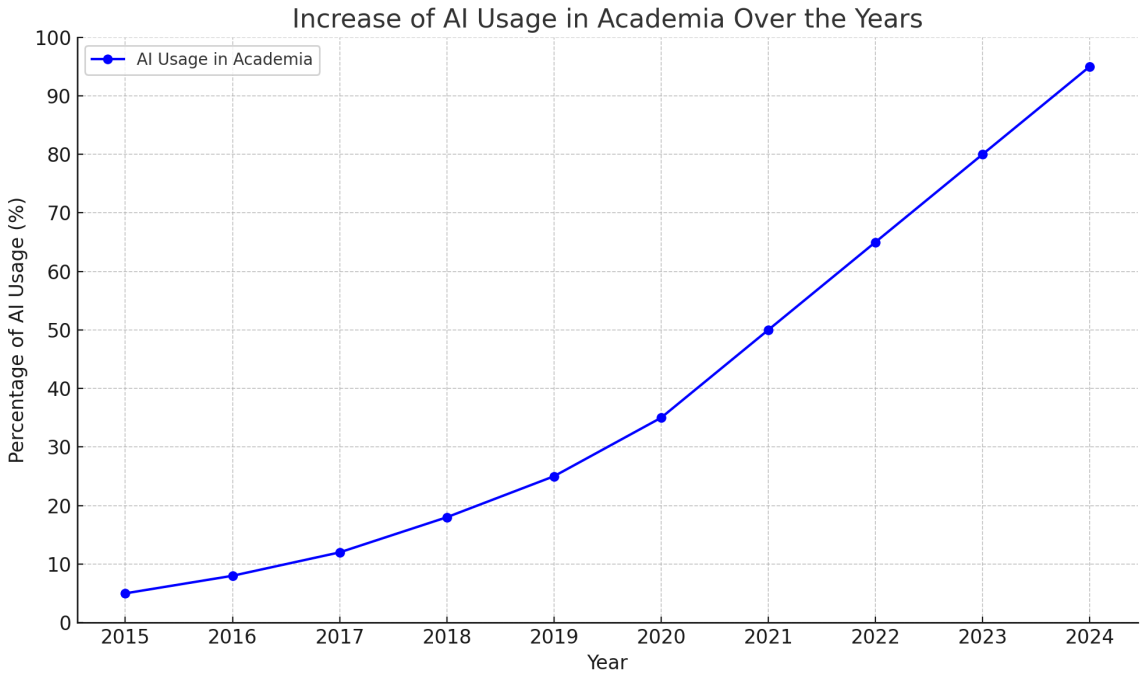

Figure 2.2 Graph of hypothetical increase of AI usage in Academically (Coffey, 2023)

2.4 AI's Role in Bridging Educational Gaps

AI has the potential to reduce educational inequalities by providing access to quality learning resources for underprivileged communities. Through free online courses, AI-powered tutoring systems, and language translation services, students from diverse backgrounds can access the same resources as those in well-funded schools (Johnson et al., 2022). AI also supports students with disabilities by offering tools such as

text-to-speech, speech-to-text, and visual aids. However, the digital divide remains a concern, as students without access to stable internet or devices risk further marginalization. We investigate the possibilities of big language models like ChatGPT and suggest a hybrid paradigm that combines teacher-facilitated, collaborative personalized learning with artificial intelligence (Laak & Aru, 2024), integrating Artificial Intelligence (AI) in education holds transformative potential for bridging educational gaps, particularly in under-resourced and marginalized communities. AI-driven technologies can democratize access to quality education by offering personalized learning experiences that cater to the unique needs of individual students, regardless of their geographical or socio-economic backgrounds.

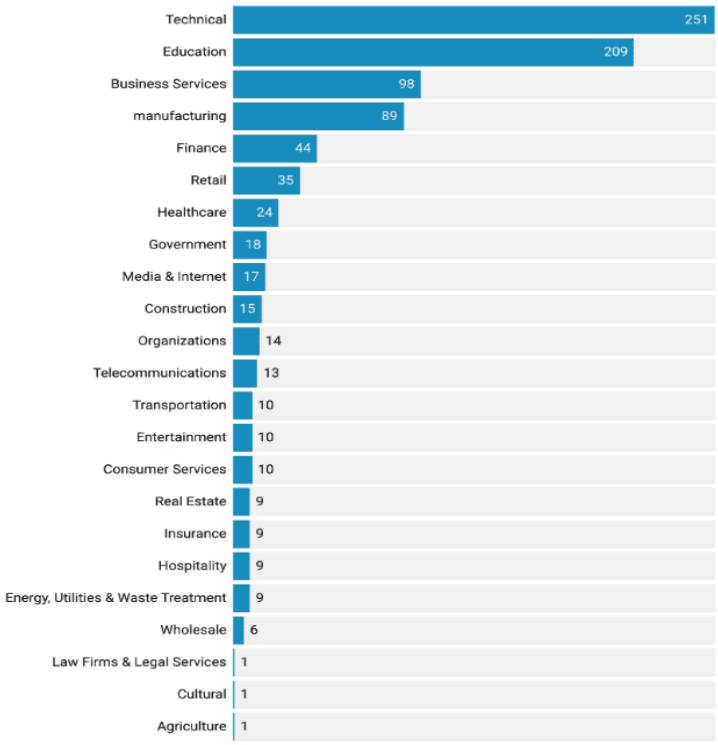

Figure 2.3 Applications of AI in Education (Miszczak, 2023)

Chapter 3

METHODOLOGY

3.1 Research Design

This study will employ a mixed-methods research design, incorporating both quantitative and qualitative approaches to evaluate the effects of Artificial Intelligence (AI) on students' critical thinking, problem-solving skills, and academic integrity. A survey-based cross-sectional study will be conducted to gather student perceptions, while experimental tasks will be used to measure cognitive engagement and academic integrity concerns.

3.2 Participants and Sampling

The study will target university students enrolled in various academic disciplines where AI tools are commonly used. A stratified random sampling technique will be applied to ensure diverse representation across fields of study. The sample size will be determined using power analysis to ensure statistical significance. Participants will be required to provide informed consent before participating.

4.1 Data Gathering

4.1.1 Ethical Considerations

Before data collection, the following approvals will be secured:

- **Informed Consent:** Waivers (Appendix A) will be provided to students.
- **Institutional Permission:** School administrators will be requested for approval to conduct the study and use educational facilities (Appendix C).

4.1.2 Participants and Sampling

- **Participants:** University students using AI-powered tools for learning.
- **Sampling Method:** Stratified random sampling will be used to ensure representation across different academic levels and disciplines.
- **Sample Size:** A minimum of 100 students will participate, divided into two groups: **AI-assisted learners** and **non-AI-assisted learners** for comparison.

4.1.3 Data Collection Tools

1. **Pre-Test and Post-Test Assessments**
    - Designed to measure changes in critical thinking skills before and after using AI tools.
    - Questions will be adapted from established critical thinking rubrics.
2. **AI Usage Logs**
    - AI-generated outputs (e.g., essays, code, problem solutions) will be collected.

    - Metadata such as timestamps and AI model versions will be recorded for trend analysis.

3. **Surveys and Questionnaires**
    - Students will answer Likert-scale surveys assessing their perceptions of AI's role in learning and integrity.
4. **Interviews and Focus Group Discussions (FGDs)**
    - Conducted with students and educators to gain qualitative insights into AI's influence.
5. **Plagiarism and Originality Detection**
    - AI-generated content will be analyzed for AI-assisted group using Turnitin and GPTZero to detect originality and potential academic dishonesty.

4.2 Data Processing and Analysis

4.2.1 Quantitative Data Analysis

- **Descriptive Statistics:** Mean, median, and standard deviation of test scores before and after AI use.
- **Comparative Analysis:**
    - **T-tests** will be used to compare performance between AI-assisted and non-AI-assisted students.
    - **ANOVA** may be applied to assess variations across different student groups.
- **Plagiarism Scores:** Analyzed to identify trends in academic integrity issues.

4.2.2 Qualitative Data Analysis

- **Thematic Analysis:** Interview transcripts will be coded for recurring themes related to AI's influence on critical thinking and academic honesty.
- **Sentiment Analysis:** AI tools will be used to analyze students' written responses on AI usage.

4.2.3 AI-Specific Analysis

- **Natural Language Processing (NLP) Techniques:** AI-generated responses will be analyzed using sentiment analysis and text coherence models to assess reasoning quality.
- **Machine Learning Classifiers:** Used to predict academic integrity risks based on AI-assisted work.

4.3 Research Replicability and Feasibility

- The study's methodology is designed to be replicable, with clear data collection protocols.
- Time-bound constraints are considered, with a three-month data collection period.
- Ethical considerations ensure realistic implementation while maintaining student privacy

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