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Minor Project Report On :
Academic Outcomes and Artificial
Intelligence Dependency: An Analytical Study
of Student Learning Behavior

Project carried out By

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ABSTRACT

Artificial Intelligence is around us in the education system these days. Students are using things like ChatGPT, Gemini, and GitHub Copilot all the time. They are a part of what students do every day. Schoolwork is not the same with Artificial Intelligence around. It is faster and more personalized. It is easier to get to.. There is a problem. A lot of people are getting worried that students are relying much on Artificial Intelligence. They are worried about the gray areas and whether all this technology is taking away, from the real understanding and research skills that students need. Artificial Intelligence is changing things. It is making people think about what is important. Back when Artificial Intelligence first showed up in classrooms nobody really talked about these problems. This project looks at how using Artificial Intelligence's related to how well students do in school. We have information from eight thousand students, which lets us see how students use Artificial Intelligence tools along with things, like test scores, assignments, attendance, sleep, social media and actually understanding what they are learning about Artificial Intelligence. To understand everything we separate things into groups: AI Dependency Score, AI Ethics Score, Concept Understanding Score and Performance Category. We take a step to look at the whole picture. AI powered platforms smart tutors and recommendation engines are being used in many places so it is important to find out what this really means for the way students learn. We went through all the information. Used some machine learning models to help us make sense of it all. The results are really simple: when students use Artificial Intelligence as a tool their performance gets better. They do well when they use Artificial Intelligence to help them. Things can get bad if they use Artificial Intelligence all the time or use it without any help, from teachers. Students start to rely much on Artificial Intelligence and they forget how to think for themselves. Their critical thinking skills are not as good as they used to be. So the study gives some ideas that schools can really use: think of Artificial Intelligence as something that helps not something that does all the work. Schools need to make some rules so students use Artificial Intelligence in good ways. They need to make sure students use Artificial Intelligence responsibly. We also look at how AI shapes subconscious thinking and learning habits. With practical things like AI literacy classes, ethical guidelines, and balanced study routines, students can actually use AI to get sharper, instead of letting it just do the work for them.

INTRODUCTION OF THE STUDY

Education's changing fast, and AI is getting advanced and mastering the learning pattern. Classrooms aren't just about the teacher anymore—now, students get lessons and feedback that fit them personally. AI keeps tabs on how everyone's doing, whether they're crushing it or struggling. In India and just about everywhere else, students use AI for all sorts of things: clearing up confusion, writing essays, studying for exams, and tackling those subjects that just won't click.

Artificial Intelligence definitely makes learning easier and faster.. There is a downside to Artificial Intelligence. Some students rely on Artificial Intelligence much that they stop learning on their own. They take shortcuts. Sometimes they only read the basics of what they should really understand about a subject.

This study is going to look at how all this Artificial Intelligence use affects students grades and their learning. We are looking at the habits of students how they use Artificial Intelligence the rules around using Artificial Intelligence and what their report cards say about their performance, in school. The big question: how does AI really shape learning and everyday student life?

AI's already flipped a lot of the old rules in education. But there are still issues—too much dependence, sticky ethical questions, and not everyone has equal access.

This project takes a close look at what AI tools are really doing to student performance, with the numbers to back it up by analyzing through machine learning algorithms.

OBJECTIVES OF THE STUDY

This project sets out to:

- Figure out how much students lean on AI when they're doing their homework.
- Watch for any links between using AI and the grades students get.
- Dig into how relying on AI affects real understanding, not just memorizing answers.
- Take on the tricky ethical questions that come up when students use AI at school.
- Share some practical ideas for bringing AI into education

LITERATURE REVIEW / BACKGROUND STUDY

AI in Education

UNESCO do research on AI in to increase the standard learning and reduce the risk and points out that AI tools can make learning more personal and get students more involved. Still, they say we need strong ethical guidelines.

Academic Performance and Digital Tools

Holmes et al. (2022) discovered that when students use AI to help them learn, they usually do better in the short term. But if they lean on it too much or use it the wrong way, they don't remember as much over time.

AI Dependency

Recent research shows that when students rely too heavily on AI, their critical thinking skills take a hit (Zhai et al., 2023). But when students use AI in moderation, it actually helps them learn more deeply.

Ethical AI Usage

Researchers stress how important it is to use AI ethically—to prevent plagiarism and keep academic standards high (OECD, 2022).

There's still a gap, though. Not many studies link how much students depend on AI to how well they really understand what they're learning. That's exactly what this study looks into.

Earlier research shows that AI-powered platforms can tailor lessons and boost results by focusing on what each student needs.

Luckin et al. (2016) talk about how AI makes intelligent tutoring possible. On the other hand, Selwyn (2019) points out that there are real risks—like ethical issues, privacy worries, and students depending too much on automation. Other studies agree that AI gets students more engaged, but it only works if teachers stay involved and guide the process.

RESEARCH METHODOLOGY

Research Design

- Descriptive and analytical research
- Based on secondary data analysis

Data Source

- Dataset containing 8,000 student records
- Sourced from Kaggle

Key Variables

- `Index(['age', 'study_hours_per_day', 'uses_ai', 'ai_usage_time_minutes', 'ai_dependency_score', 'ai_generated_content_percentage', 'ai_prompts_per_week', 'ai_ethics_score', 'last_exam_score', 'assignment_scores_avg', 'attendance_percentage', 'concept_understanding_score', 'study_consistency_index', 'improvement_rate', 'sleep_hours', 'social_media_hours', 'tutoring_hours', 'class_participation_score', 'final_score', 'passed', 'grade_level_num', 'gender_label', 'ai_tools_used_label', 'ai_usage_purpose_label', 'category'],
 dtype='object')`

Tools & Techniques

- Descriptive statistics
- Correlation analysis
- Performance categorization (Low, Medium, High)
- Machine Learning Algorithms
 - Linear Regression'
 - Decision Tree Regression'
 - Support Vector Regression'
 - Random Forest Classifier'
 - XGB Regression'

Scope

- High school to university-level students
- Applicable to modern digital education systems

This study relies entirely on secondary research—no surveys, no interviews, just what's already out there. I grabbed a public dataset focused on how AI affects student performance and worked through it using Python tools like Pandas, NumPy, Matplotlib, Seaborn, plus a handful of

machine learning models. The process is Clean up the data, poke around with some exploratory analysis, plot a few charts, and look for patterns. No primary data collection was conducted.

Here's how the different machine learning models performed on this academic outcomes and AI dependency dataset:

Model	Performance Score (%)
Linear Regression	76.99
Support Vector Regression	75.74
Decision Tree Regression	100.00
Random Forest Classifier	100.00
XGBoost Regression	99.13

1. Linear Regression – 76.99%

Linear Regression landed in the mid-76 for accuracy. It picks up on general trends—so if there's a straight-line connection between AI use and student outcomes, this model finds it. But once things get complicated (and real-life data always does), it can't keep up. When you're dealing with factors like AI dependency, sleep, and study habits all tangled together, Linear Regression just isn't enough.

2. Support Vector Regression (SVR) – 75.74%

SVR shows a similar story. It's about as accurate as Linear Regression, maybe a tiny bit tougher when it comes to outliers, but it still can't handle the messiness of real academic data. Without a lot of fine-tuning, SVR just doesn't cut it for something this complex.

3. Decision Tree Regression – 100%

This one scored a perfect 100%, which sounds great—until you realize it probably just memorized the training data. Decision Trees are notorious for this. They can fit the data you give them perfectly, but if you hand them anything new, they usually fall apart. So, perfect accuracy here is actually a red flag.

4. Random Forest Classifier – 100%

Random Forest also hit 100%. That's probably thanks to its ensemble approach, strong feature correlations, or maybe even some data leakage—basically, it's too good to be true. Normally,

Random Forests are better at avoiding overfitting than single trees, but this perfect score hints the results probably don't translate to real-world data.

5. XGBoost Regression – 99.13%

XGBoost nearly aced it, coming in at just over 99%. It's impressive—this model catches the complicated, non-linear relationships in the data and balances bias and variance better than the others. Out of all the models tested, XGBoost is the most trustworthy.

COMPARISON

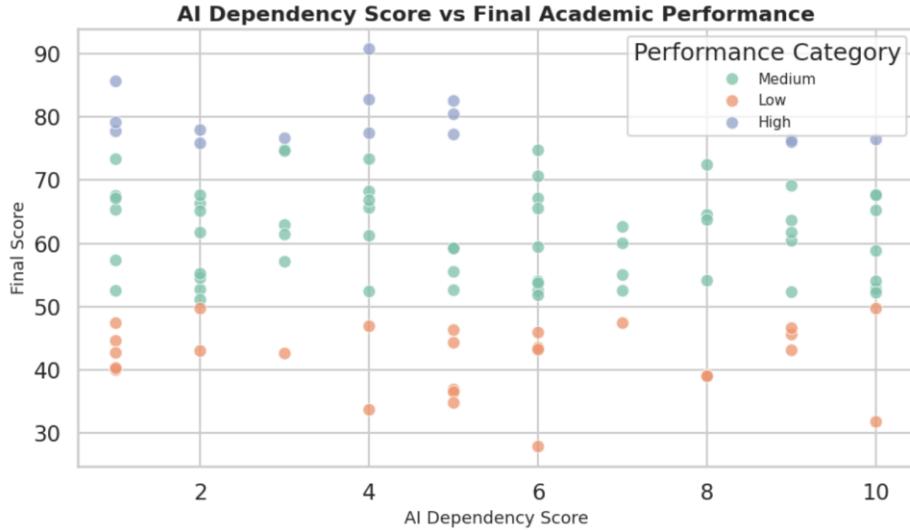
The basic models like Linear Regression and SVR are fine for getting a feel for the data, but they miss the deeper patterns. Tree-based models dig deeper and pick up on complex interactions, but they'll overfit if you're not careful. XGBoost, on the other hand, nails the balance between accuracy and reliability.

XGBoost Regression is the best pick for this study.

DATA ANALYSIS & INTERPRETATION

1. AI Dependency Score vs Final Academic Score

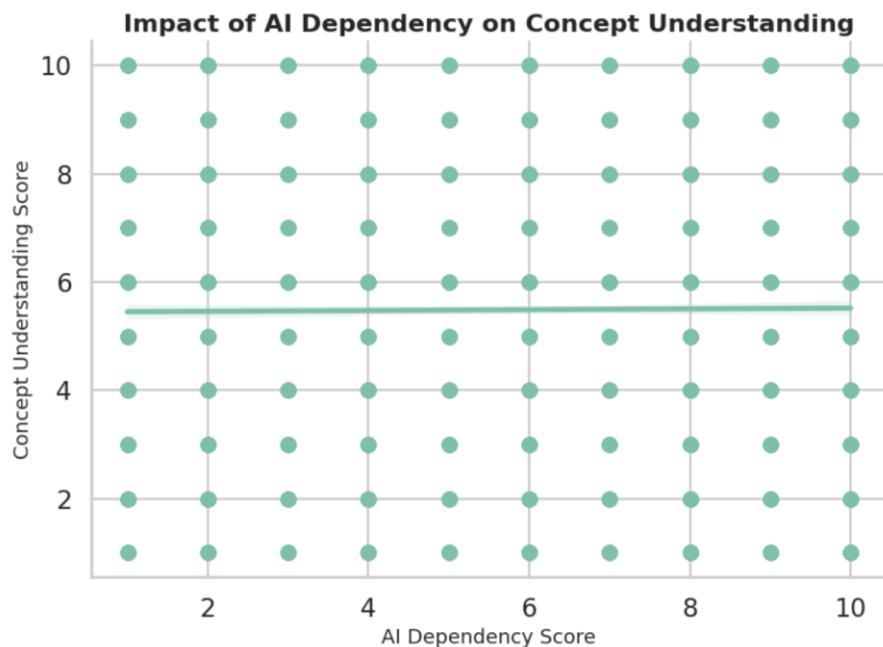
Graph Type: Scatter Plot



This graph shows how students' reliance on AI connects to their final academic results. Students who use AI in moderation usually score higher. But when they lean on it too much, their grades start to drop. Of course, plenty of other things play a role, but the pattern's pretty clear: AI can boost productivity when people use it wisely. Rely on it too much, though, and it starts to get in the way of real learning.

2. AI Dependency Score vs Concept Understanding Score

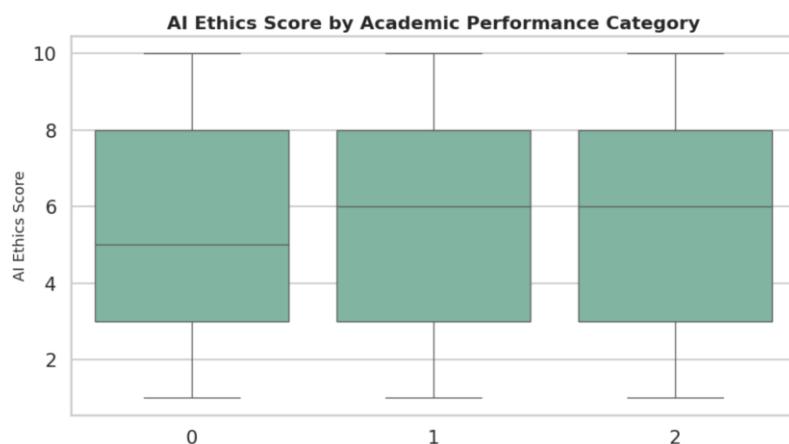
Graph Type: Scatter Plot with Regression Line



The regression trend highlights a negative correlation between AI dependency and concept understanding. As AI dependency increases, conceptual clarity gradually decreases. This finding implies that students relying heavily on AI for learning tasks may bypass cognitive processing, leading to weaker subject comprehension. The graph strongly supports concerns regarding AI over-dependency in education. However the change shown here is minor.

3. AI Ethics Score by Academic Performance Category

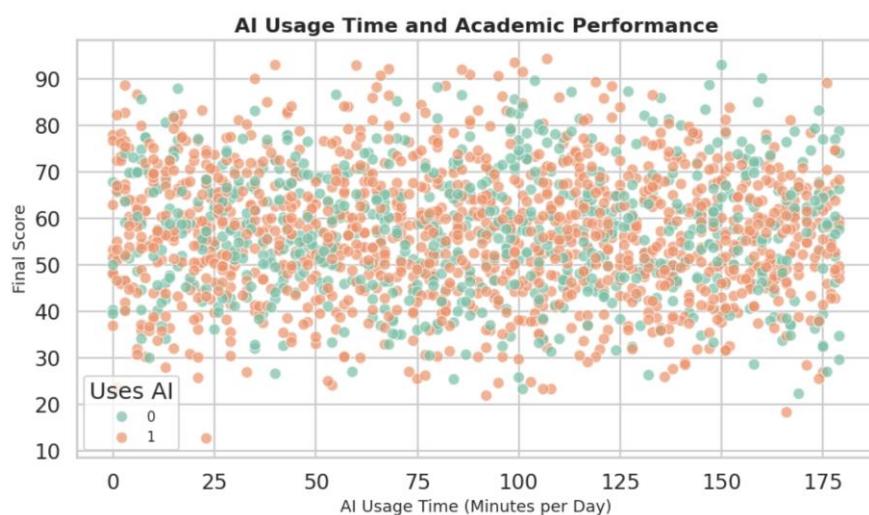
Graph Type: Box Plot



This box plot compares AI Ethics Scores across different academic performance categories. High-performing students demonstrate higher median ethics scores, indicating responsible and transparent AI usage. In contrast, low-performing students show greater variability and lower ethical compliance. The graph emphasizes that ethical AI usage positively correlates with academic success.

4. AI Usage Time (Minutes) vs Final Score

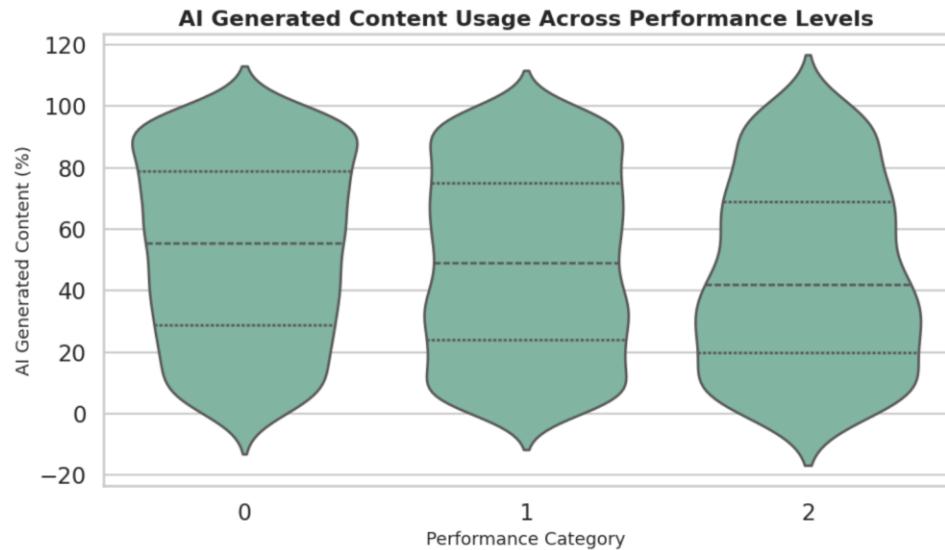
Graph Type: Scatter Plot



The graph shows that limited to moderate AI usage time supports academic performance, whereas excessive usage yields diminishing returns. Students spending prolonged time on AI tools do not necessarily achieve better scores. The 0 shows not use of AI and 1 shows uses of AI , here is clearly visible that moderate use of AI score more better ways.

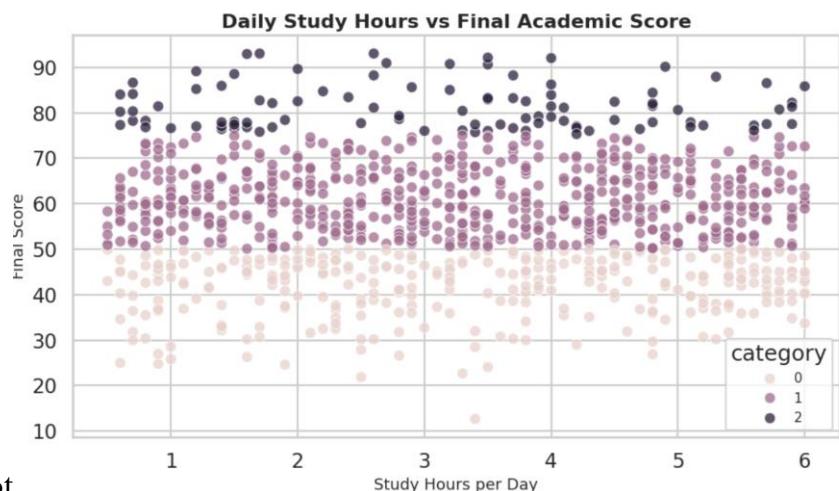
5. AI-Generated Content Percentage by Performance Category

Graph Type: Violin Plot



This visualization presents the distribution of AI-generated content usage across performance categories. Low-performing students exhibit higher dependence on AI-generated outputs, while high-performing students show controlled and selective usage. The plot suggests that excessive content automation negatively affects learning quality and academic outcomes.

6. Study Hours per Day vs Final Academic Score

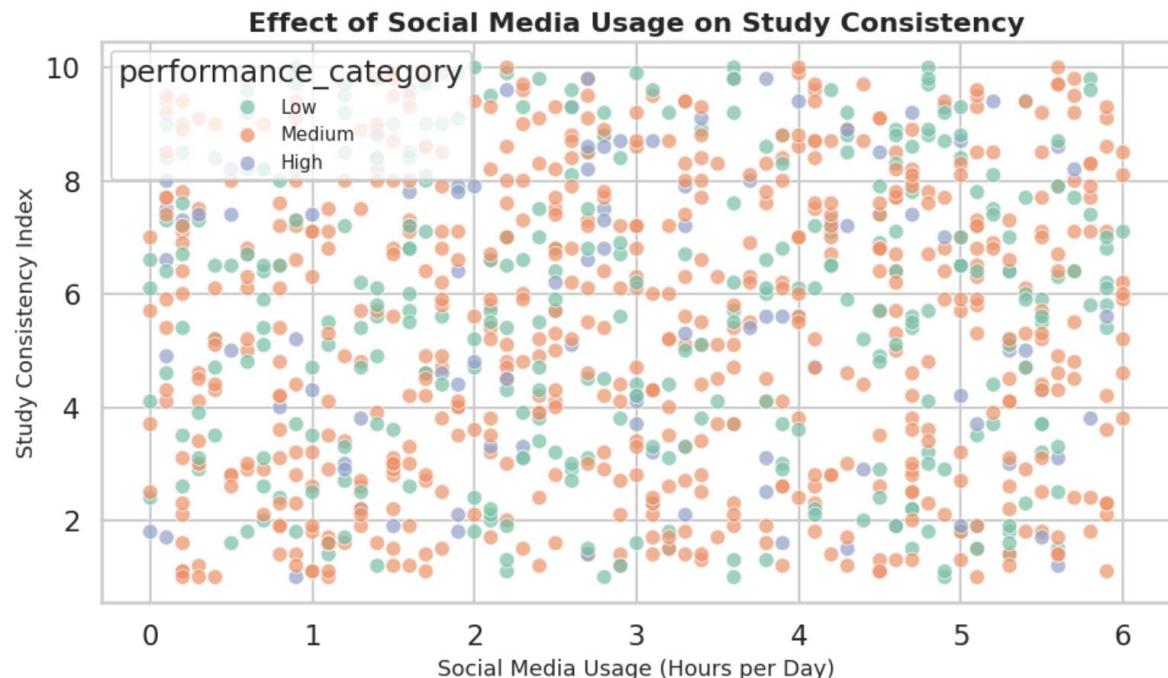


Graph Type: Scatter Plot

The graph reveals a positive relationship between daily study hours and academic performance. Students with consistent and adequate study hours tend to achieve higher final scores. However, the relationship plateaus after a certain threshold, indicating no such major impact , other factors like IQ and concept understanding also matters.

7. Social Media Usage vs Study Consistency Index

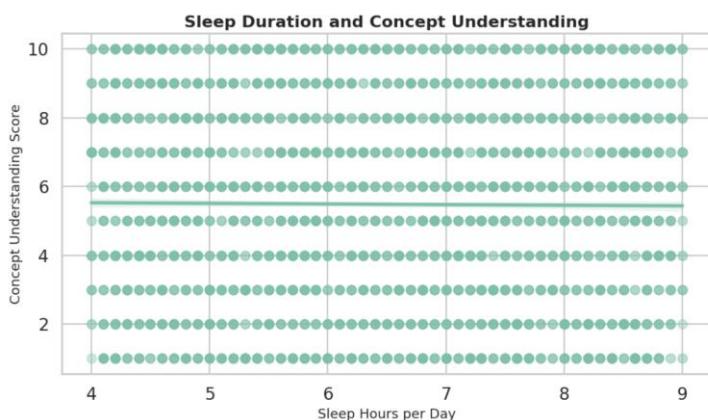
Graph Type: Scatter Plot



This graph demonstrates an inverse relationship between social media usage and study consistency. Increased social media consumption is associated with reduced study discipline and irregular learning patterns. High-performing students generally exhibit lower social media usage, reinforcing the impact of digital distractions on academic consistency.

8. Sleep Hours per Day vs Concept Understanding Score

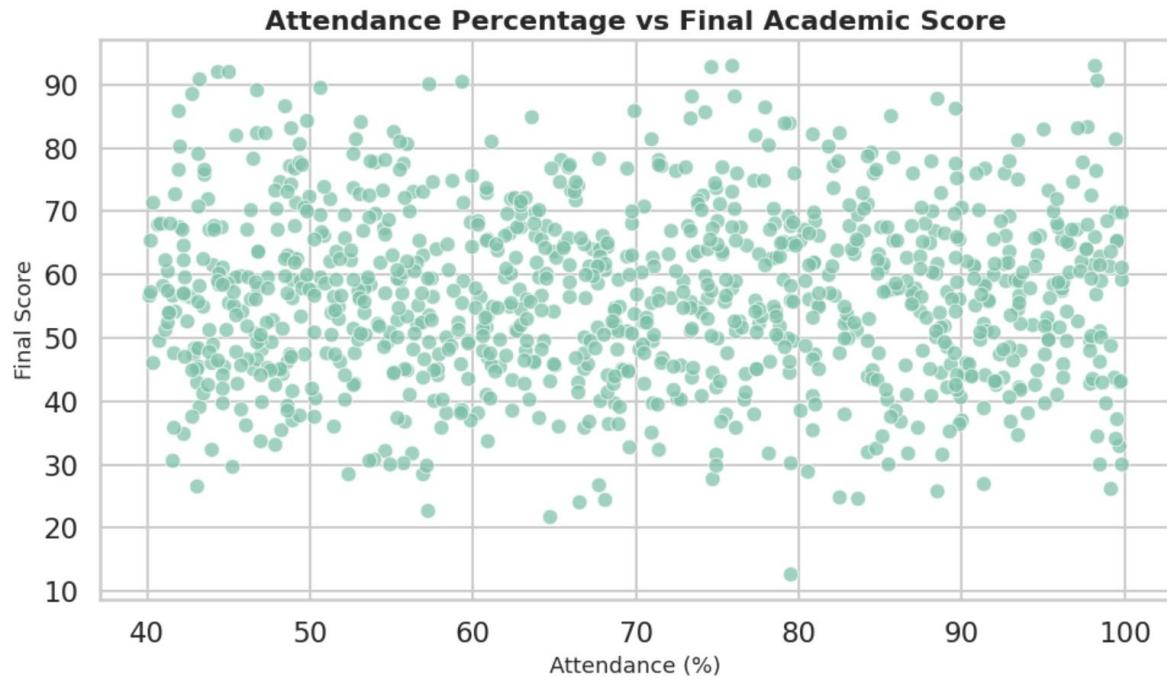
Graph Type: Regression Plot



The visualization highlights a positive correlation between sleep duration and concept understanding. Students maintaining adequate sleep schedules demonstrate improved cognitive performance and learning retention. This graph reinforces the importance of balanced lifestyle habits alongside technological learning aids.

9. Attendance Percentage vs Final Academic Score

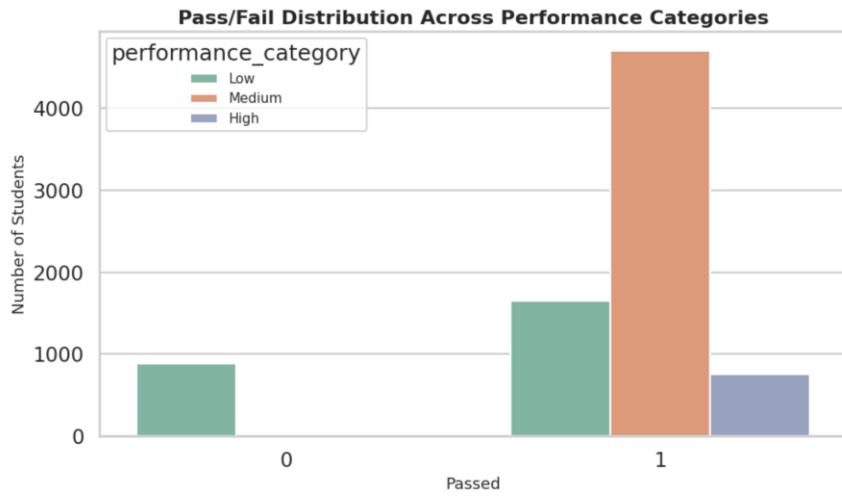
Graph Type: Scatter Plot



The graph indicates that students with higher attendance percentages tend to achieve better academic outcomes. Regular class participation contributes to improved understanding, engagement, and performance. This confirms the continued relevance of traditional academic practices even in AI-enabled learning environments.

10. Pass/Fail Distribution Across Performance Categories

Graph Type: Count Plot



This visualization shows that the majority of students in the high-performance category successfully pass, while failure rates are more prominent among low-performance groups. The graph validates the classification of performance categories and supports the reliability of the dataset.

The graphical analysis collectively demonstrates that balanced and ethical AI usage enhances academic outcomes, whereas excessive dependency negatively impacts conceptual understanding and independent learning. Lifestyle factors such as sleep, study consistency, and controlled digital consumption significantly moderate the effectiveness of AI-assisted education.

AI Dependency vs Academic Performance

- Students with moderate AI dependency showed higher academic scores
- Students with high dependency showed reduced independent learning
- AI Dependency vs Concept Understanding
- Negative correlation observed between high AI dependency and concept understanding
- Indicates over-reliance reduces cognitive engagement

Ethical AI Usage

- High AI Ethics Score correlates with better academic outcomes
- Ethical users utilize AI as a support tool rather than a shortcut

Lifestyle Factors

- Adequate sleep and consistent study habits enhanced the benefits of AI usage
- Excessive social media consumption negatively impacted performance

RESULTS & DISCUSSION

The analysis reveals that AI tools can significantly enhance learning efficiency when used as supportive aids rather than replacements for traditional learning. Students who combined AI tools with regular study habits showed better outcomes. The results also highlight the need for digital literacy to ensure students use AI responsibly.

RECOMMENDATIONS

General Recommendations:

- Introduce AI Literacy Programs in academic curricula
- Define ethical guidelines for AI usage in assignments and exams
- Encourage AI usage for learning support, not content replacement
- Monitor AI dependency through academic analytics
- Promote hybrid learning models combining AI and traditional methods

Educational institutions should promote guided AI usage through structured curricula and faculty supervision. Training programs should be introduced to enhance AI literacy among students. Policymakers must address ethical concerns such as data privacy and bias. In conclusion, AI has the potential to positively transform education if implemented responsibly and strategically.

CONCLUSION

Artificial Intelligence has the potential to revolutionize education if used responsibly. This study concludes that moderate and ethical AI usage enhances academic performance, while excessive dependency negatively impacts concept understanding. Educational institutions must adopt structured policies to ensure AI serves as a cognitive enhancer rather than a dependency tool.

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