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Revolution or Reliance? The Dual Impact of AI-Based Learning Tools on College Students' Academic Skills*

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This study investigates college students' perceptions of AI-based learning tools, particularly their use and acceptance of AI-based learning technologies, such as ChatGPT, to enhance their academic experience. The research aims to understand how motivational factors and learning strategies impact students' adoption or avoidance of these tools. Data were collected through a survey of 773 students from a range of academic disciplines at a public university in the western United States, offering insights into the diverse factors that influence their decision-making. This research sheds light on the potential of AI tools to support personalized learning, while also identifying the factors that shape students' engagement with these innovations. The findings reveal that Intrinsic Goal Orientation and Task Value were both significant predictors of opposition to AI, suggesting that students who are highly motivated by internal interests and value traditional academic engagement tend to view AI with skepticism. In contrast, these variables did not significantly predict support for AI, highlighting an asymmetry in how intrinsic motivation relates to AI acceptance. Critical Thinking, however, was positively associated with both opposing and supporting AI, indicating that students with stronger evaluative skills are more likely to take a definitive stance – either for or against – rather than remain neutral. Thematic analysis further showed that support for AI is primarily driven by its potential to enhance personalized learning, efficiency, conceptual understanding, and adaptability. Together, these results suggest that students' engagement with AI is complex and shaped by both cognitive dispositions and perceived educational values.

Keywords: AI-based learning tools; motivation; learning strategies

1. Introduction

As artificial intelligence (AI) technologies rapidly advance, they are increasingly integrated into educational environments, offering new avenues for enhancing learning experiences and outcomes. In this study, AI-based learning technologies refer to digital tools and platforms that utilize artificial intelligence algorithms to support, enhance, or personalize the learning experience by adapting content, providing feedback, or automating instructional tasks. Among these, disruptive tools like ChatGPT have gained traction, promising to transform how students access information, develop skills, and tackle complex academic tasks. However, the decision to adopt or avoid these technologies is not uniform among students and can be influenced by various motivational and strategic factors. Understanding these factors is essential to developing AI-driven tools that align with students' needs and support effective learning practices.

This study investigates the perceptions and decision considerations (or factors) of college students regarding the use of AI-based learning tools. Conducted at a public university in the western United States, the research gathered survey responses from 773 students across diverse academic disciplines, providing a comprehensive view of how students approach and integrate, or resist, AI technologies in their learning routines. Focusing on two key research questions, this study examines the role of motivational factors, such as intrinsic and extrinsic goal orientation and task (or learning) value, and the impact of students' individual learning strategies, including critical thinking and help seeking skills, on their engagement with AI-based learning tools like ChatGPT.

By exploring these influences, this research offers insights into the dynamic relationship between students' personal motivations, learning approaches, and their potential engagement with AI tools. The findings aim to inform people about the development of educational technologies that not only enhance learning outcomes but also respect and adapt to the diverse preferences and needs of students in higher education.

The findings of this study have important implications for the design and implementation of AI-based educational tools and instructional practices.

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In understanding the interplay between students' motivations, learning strategies, and technology preferences, educators and developers can create tools that are not only more effective but also better suited to diverse learner profiles. Furthermore, this research offers insights into how educational institutions can better support students in developing the digital literacy and critical thinking skills needed to navigate the evolving landscape of AI in higher education. As AI continues to influence how students learn and engage with content, studies like this provide valuable guidance on fostering technology adoption that enhances learning outcomes while remaining aligned with students' individual and collective needs.

2. Brief Literature Review

2.1 Motivation as a Catalyst for Learning

Motivation plays a pivotal role in driving cognitive engagement and fostering deep learning, particularly in complex learning environments. Research demonstrates that motivated learners are more likely to set meaningful goals, employ effective strategies, and persevere through challenges [1, 2]. Among the critical aspects of motivation, task value – the perceived importance, usefulness, and interest of a learning activity, stands out as a key determinant of sustained effort and persistence [3, 4]. Task value encompasses intrinsic value (enjoyment of the task), utility value (relevance to future goals), and attainment value (personal importance), creating a foundation for both cognitive and emotional engagement.

Intrinsic and extrinsic goal orientations further shape learners' motivational pathways. Intrinsic goal orientation emphasizes learning for its inherent enjoyment and personal growth, often fostering curiosity and a mastery-oriented approach to challenges [5]. In contrast, extrinsic goal orientation focuses on external outcomes, such as grades, rewards, or approval. While intrinsic motivation supports deeper, self-regulated learning, extrinsic motivation can provide an initial spark for engagement. Together, these motivational elements interact with perceptions of task value to influence how learners approach, engage with, and sustain effort in educational activities.

In STEM education, where abstract and demanding concepts are prevalent, aligning task value with students' intrinsic interests and future aspirations is essential for fostering motivation. By understanding the interplay of intrinsic and extrinsic goal orientations with task value, educators can design learning experiences that not only promote persistence but also cultivate meaningful and transformative engagement [6].

The integration of AI based learning tools in education presents a unique opportunity to leverage key motivational factors, including intrinsic and extrinsic goal orientations and task value, to enhance learning outcomes. Tools such as intelligent tutoring systems, adaptive learning platforms, and AI-driven feedback systems are well-suited to support these motivational dimensions, fostering a deeper connection to learning tasks [7].

AI tools can play a pivotal role in fostering intrinsic motivation by creating personalized and engaging learning experiences. Features such as gamified elements, adaptive challenges, and real-time feedback spark curiosity, encourage exploration, and support mastery of new concepts. These features align with self-determination theory, which emphasizes the importance of autonomy, competence, and relatedness in intrinsic motivation [2]. The potential for interactivity and responsiveness in AI platforms can further enhance learners' sense of ownership and engagement in their educational journey.

In addition to intrinsic motivation, AI tools address extrinsic motivations by offering tangible rewards, progress tracking, and goal-setting features. Digital badges, performance dashboards, and achievement visualizations can enable students to align their efforts with external objectives, such as grades or certifications. However, care must be taken to balance extrinsic rewards to prevent them from diminishing intrinsic interest over time [8].

Task value, another critical motivational factor, is also elevated through AI-based learning platforms. By offering content that is contextualized, relevant, and aligned with students' personal and career aspirations, these tools increase the perceived importance, usefulness, and interest of learning activities [3, 6]. For example, intelligent systems can recommend personalized learning pathways based on individual goals, thereby highlighting the utility and attainment value of specific tasks. Furthermore, AI-driven analytics can demonstrate how mastering certain skills contributes to broader objectives, reinforcing the significance of the learning activity. Importantly, there is a significant connection between students' perceptions of task value and their expectancy for success. Specifically, research suggests that intrinsic goal orientation and task value are strong predictors of students' confidence in their ability to succeed [9, 10], indicating that AI tools which enhance perceived value may simultaneously strengthen students' motivation and self-efficacy.

By addressing intrinsic and extrinsic motivations while enhancing task value, AI-based tools have the potential to transform learning experiences into deeply engaging and meaningful processes.

Thoughtful design and implementation are essential to ensure these tools not only support immediate engagement but also sustain long-term motivation and foster deeper learning outcomes [7].

2.2 *Critical Thinking and Help Seeking Skills*

Critical thinking and help-seeking skills are vital components of effective learning, empowering students to engage deeply with content, solving complex problems, and overcome academic challenges. These skills work in tandem to create a dynamic learning process that fosters intellectual growth and resilience. Critical thinking involves the ability to reflect, analyze, and evaluate information systematically, enabling learners to assess arguments, make reasoned decisions, and devise solutions to complex problems. As Ennis [11] defines it, critical thinking is "reasonable reflective thinking focused on deciding what to believe or do," encompassing skills such as interpretation, analysis, inference, evaluation, and explanation [12].

Research consistently highlights the importance of critical thinking for academic success and lifelong learning. Students who excel in critical thinking move beyond rote memorization, striving instead to understand underlying principles and connections, which leads to deeper engagement with learning materials [13]. They are better equipped to approach challenges systematically, generating creative and effective solutions [14]. In the digital age, these skills are particularly essential for evaluating the credibility of vast and often conflicting sources of information, a challenge that demands discernment and intellectual rigor [15].

Equally important, help-seeking is a self-regulated learning strategy that reflects a learner's ability to recognize when they need assistance and take appropriate steps to obtain it. This proactive approach to addressing gaps in understanding demonstrates resilience and a commitment to growth. Effective help-seeking behaviors include identifying specific areas of difficulty, determining the best source of support, and articulating clear questions [16]. Studies show that help-seeking enables learners to overcome barriers to understanding, reducing frustration and preventing disengagement [17]. It also builds resilience by fostering persistence and adaptability in the face of academic challenges [18], while encouraging collaboration through interactions with peers, instructors, and mentors [19].

The interplay between critical thinking and help-seeking is profound, as these skills are mutually reinforcing. Critical thinkers are more likely to recognize their limitations, acknowledging when additional support is necessary to navigate challenging material. In turn, effective help-seekers can apply critical thinking to evaluate and make use of the assistance they receive, ensuring that it contributes meaningfully to their learning process. Together, these skills enable learners to approach challenges with a balance of independence and interdependence, fostering both academic success and personal growth.

AI-based learning tools further amplify the impact of critical thinking and help-seeking practices in today's educational settings. These tools offer personalized, adaptive experiences that challenge students to think critically by presenting real-world problems, varying levels of complexity, and scaffolding that adjusts to their abilities. Features such as intelligent tutoring systems and gamified challenges stimulate deeper engagement and cognitive flexibility, helping students practice the evaluation and application of knowledge in dynamic scenarios [7].

In addition to fostering critical thinking, AI-based tools can encourage and normalize help-seeking behaviors by providing just-in-time assistance and tailored feedback. For instance, chatbots and virtual tutors can respond to student queries instantly, offering explanations and resources that align with their specific learning needs [20]. These tools also provide a low-stakes environment for learners who may hesitate to seek help from peers or instructors, thus lowering barriers to help-seeking and building confidence in their ability to self-regulate learning.

By integrating critical thinking and help-seeking into their design, AI-based learning tools have the potential to transform education, equipping students with skills essential for academic and professional success. When thoughtfully developed and implemented, these technologies not only enhance engagement and motivation but also cultivate resilience and adaptability, preparing learners to thrive in an ever-evolving knowledge landscape.

3. The Study

This study is to examine college students' perceptions of AI-based learning tools, with a focus on identifying the motivational and strategic factors that influence their decisions to support or oppose AI-based learning technologies like ChatGPT. Conducted at a public university in the western United States, this research seeks to understand how elements such as perceived the value of the learning tools, critical thinking skills impact students' engagement with AI in their learning processes. By investigating these factors, this study aims to provide insights that inform the development of educational AI tools that align with students' diverse needs, support personalized learning strategies, and promote effective integration of technology into higher education environments.

3.1 Purpose and Research Questions

The purpose of this study is to explore the factors that shape students' decisions to adopt or avoid AI-based learning technologies, such as ChatGPT, in their learning processes. Specifically, the study examines the role of motivational factors, including intrinsic and extrinsic motivation, and task value, in influencing these decisions. Additionally, it investigates how students' learning strategies, such as help-seeking behaviors, and critical thinking practices, affect their willingness to engage with or refrain from using such technologies. By addressing these questions, the study aims to provide a deeper understanding of the interplay between motivation, learning strategies, and the adoptability of AI-based learning technologies, ultimately contributing to the design of more effective and student-centered educational tools.

Two research questions were constructed to guide the study: (1) *How do motivational factors and learning strategies influence students' choices to use or avoid AI-based learning technologies like ChatGPT during their learning activities?* and (2) *What drives college students to either embrace or avoid AI-based learning technologies, such as ChatGPT, in their academic pursuits?*

3.2 Study Participants

Seven hundred seventy-three (773) undergraduate and graduate students from one public university in the western of the United States participated in the study. This institution was selected for its wide range of academic programs across STEM and non-STEM fields, its leadership in instructional innovation, and its commitment to technology-enhanced education, which provides a relevant context for examining students' perceptions of AI in learning environments. Participants were recruited, and the study was conducted using procedures approved by our university's institutional review board (IRB). Participants were provided informed consent prior to their participation in the study.

The participant group was predominantly undergraduate students (75.3%), with a smaller representation of master's (14.5%) and doctoral (9.4%) students. In terms of gender, females comprised the majority (55.2%), followed by males (40.7%), while a small portion chose not to disclose. Most participants identified as White (87.3%), with other racial and ethnic groups represented in much smaller proportions. Academically, the majority of students reported high academic performance, with 74.9% having a cumulative GPA between 3.51 and 4.00. Students came from a wide range of colleges, with notable representations from the College of Engineering, College of Science, College of Education & Human Services, and the College of Agriculture and Applied Sciences. (see Table 1).

3.3 Data Generation

The data collected for this study was part of a larger research project designed to explore various aspects

Table 1. Demographics information of the study participants (N = 773)

Demographics information	**Response options (number of responses)**		
Gender	Male (315)	Female (427)	Not to declare (31)
Race	America Indian/Alaska Native (1)	Asian (37)	
	African American/Black (7)	Hispanics or Latino (35)	
	White (675)	Other (18)	
Cumulative GPA	3.51–4.00 (579)	3.00–3.50 (141)	2.51–2.99 (38)
	2.00–2.50 (10)	1.51–1.99 (3)	Below 1.50 (2)
School/College	Caine College of the Arts (23)		
	College of Agriculture and Applied Sciences (111)		
	College of Engineering (140)		
	College of Humanities and Social Sciences (102)		
	College of Science (116)		
	College of Veterinary Medicine (4)		
	College of Education & Human Services (113)		
	School of Business (106)		
	College of Natural Resources (39)		
	Not to declare/Yet to be determined (19)		
Level of education	Undergraduate (582)		
	Graduate-Master (112)		
	Graduate-Doctoral (73)		
	Master and Doctoral Concurrent program (6)		

of student engagement with AI-based learning tools. For the purposes of this study, we utilized only a subset of the data from the broader dataset, specifically focusing on survey responses relevant to the research questions being addressed. This selective use of data ensured that the analysis was targeted and aligned with the specific objectives of this study while remaining part of the larger research effort.

Data for this study were collected through a multi-semester (fall 2024 and spring 2025) survey administered via Qualtrics, featuring both closed- and open-ended questions. The analysis focuses on 24 specific survey items, including one open-ended question asking students to articulate their reasons for avoiding AI-based learning technologies, such as ChatGPT. Additionally, 22 seven-point Likert-scale items assessed motivational and learning strategy factors adapted from the validated Motivated Strategies for Learning Questionnaire (MSLQ; [21]). The motivational factors included intrinsic goal orientation (4 items), extrinsic goal orientation (4 items), and task value (5 items), while the learning strategies measured critical thinking (5 items) and help-seeking strategies (4 items).

The Likert-scale items measured respondents' perceptions and attitudes, with response options ranging from 1 ("Not at all true of me") to 7 ("Very true of me"). Participants were also asked to reflect on a specific course they found important, memorable, or particularly interesting, grounding their responses to the MSLQ items in meaningful and relevant experiences. This targeted approach using well-established MSLQ constructs provides a nuanced understanding of how motivation and learning strategies relate to students' decisions to adopt or avoid AI-based learning technologies. Sample items are provided in Table 2. Note that the five constructs analyzed here represent only a subset of the full MSLQ.

An additional survey item captured students' overall decision regarding AI adoption, derived from the question: "On a scale of 1 to 11, how much do you support or oppose AI development in your field of study?" The use of an 11-point scale was intended to increase the sensitivity of responses [22], capturing nuanced views students may hold toward emerging technologies. Participants' responses were not forced, as this does not enhance survey quality or completion rates.

3.4 Data Analysis

The data analysis process began with a thorough data-cleaning phase to ensure the accuracy, consistency, and reliability of the dataset. Given that survey participation was entirely voluntary and the instrument was lengthy, a high level of irregularities was anticipated. Students were allowed to start, pause, and resume the survey at their own pace, which contributed to incomplete or inconsistent responses.

The cleaning process addressed several types of irregularities, including incomplete submissions, patterned responses (e.g., selecting the same value across all scale items), and extreme outliers that were contextually implausible. For example, responses containing nonsensical open-ended answers or consistently selecting "0" across all Likert-scale items were excluded from further analysis. Additional steps included eliminating duplicate entries and verifying those responses that met the survey's predefined parameters. In some cases, missing or ambiguous data were imputed using appropriate methods; in others, the responses were excluded based on established guidelines.

Initially, over one thousand students participated in the survey, but after the data-cleaning process, only 773 responses were deemed valid and included in the final analysis. This careful and systematic preparation was essential for preserving the integrity and robustness of the subsequent analyses.

To address Research Question 1 – "*How do motivational factors and learning strategies influence students' choices to use or avoid AI-based learning technologies like ChatGPT during their learning activities?*" – a multinomial logistic regression (MLR) analysis [23] was conducted. The outcome (dependent) variable, students' AI adoption decision making (DM), was derived from a survey item assessing students' stance toward adopting AI for

Table 2. Motivational and Learning Strategies MSLQ Survey Items

Constructs		Sample survey items
Motivational	Intrinsic Goal Orientation (IGO)	The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.
	Extrinsic Goal Orientation (EGO)	If I can, I want to get better grades in this class than most of the other students.
	Task Value (TV)	It is important for me to learn the course material in this class.
Learning Strategies	Critical Thinking (CT)	I treat the course material as a starting point and try to develop my own ideas about it.
	Help Seeking (HS)	When I can't understand the material in this course, I ask another student in this class for help.

academic purposes and was recoded into three ordered categories: Oppose (1–3), Neutral (4–8), and Support (9–11), with Neutral serving as the reference category. These categories represent qualitatively distinct decision-making states: resistance to adoption, ambivalence or conditional openness, and affirmative adoption intent. The broader Neutral category was intentionally defined to capture unresolved, context-dependent, or provisional decisions, which are especially prevalent when individuals evaluate emerging technologies with uncertain pedagogical, ethical, or performance implications. This operationalization aligns with decision-making frameworks that emphasize adoption as a process involving evaluation, risk–benefit appraisal, and commitment rather than a binary choice, thereby supporting more meaningful inference about students' AI-related adoption decisions [24–26].

Predictor variables included five motivational and learning strategy constructs: Intrinsic Goal Orientation (IGO), Extrinsic Goal Orientation (EGO), Task Value (TV), Critical Thinking (CT), and Help Seeking (HS). For each construct, composite scores were computed by aggregating individual item responses, providing a more stable and reliable measure than single-item indicators [27].

Multinomial logistic regression (MLR) is the appropriate analytical method for this study because the dependent variable, students' stance on the use of AI-based learning technologies (i.e., oppose, neutral, and support), is nominal with more than two categories. The five motivational and learning strategies constructs serve as predictor variables. It does not require normally distributed predictors or residuals and models the log odds of each outcome category relative to a reference group [28].

The model estimates a separate set of coefficients for each non-reference outcome, and the odds ratio for a given predictor is calculated as:

$$\text{Odds Ratio} = e^{\beta} \qquad \text{Eq. (1)}$$

where β is the estimated coefficient for the predictor variable. This represents the multiplicative change in the odds of the outcome category (versus the reference) associated with a one-unit increase in the predictor.

Moreover, MLR is equivalent to estimating a series of binary logit models for each pair of outcome categories, allowing for detailed comparisons across decision-making options. This method produces regression coefficients, p-values, and odds ratios that reveal the direction, strength, and statistical significance of the relationships between motivational factors and students' decisions. It also yields predicted probabilities that illustrate how students' likelihood of supporting or opposing AI-based learning tools varies as a function of their motivational and cognitive characteristics. This analytic strategy aligns with prior research on technology adoption in education [24] and offers insight into how internal factors may shape students' openness to using AI in learning environments.

To answer Research Question 2 – "What drives college students to either embrace or avoid AI-based learning technologies, such as ChatGPT, in their academic pursuits?" – the open-ended survey responses were systematically analyzed using MAXQDA, a qualitative data analysis software, through an inductive thematic coding approach. The analysis began with a close reading of all responses, including those reflecting both support for and resistance to AI learning tools, to gain an in-depth understanding of the data. Initially, responses were coded into highly specific and detailed themes, which were later referred to as subthemes, that captured the nuances of students' perspectives, particularly their reasons for avoiding tools such as ChatGPT. These subthemes were then carefully reviewed and consolidated into broader, overarching themes that reflected higher-level patterns in students' reasoning. MAXQDA's code occurrence tools were used to quantify the occurrence of each subtheme and theme, allowing for the identification of the most prevalent concerns and attitudes expressed across the dataset.

To enhance reliability, the process included two iterations of theme development. In the first iteration, themes were identified and grouped using MAXQDA. In the second iteration, two coders independently reviewed and refined the themes, regrouping them as necessary to ensure coherence and consistency. The Inter-coder Agreement of >90% attained through the peer-debriefing Process to verify the codebook [29]. This iterative approach, combining qualitative depth and quantitative insights, provided a more comprehensive understanding of students' perspectives on avoiding or supporting AI-based learning technologies.

4. Results

4.1 Research Question 1: How do motivational factors and learning strategies influence students' choices to use or avoid AI-based learning technologies like ChatGPT during their learning activities?

Descriptive analyses revealed only minor differences between engineering and non-engineering students across all study variables (IGO, EGO, TV, CT, HS, and DM), as shown in Table 3. Mean scores and standard deviations were highly comparable between groups, suggesting broadly similar motivational orientations, learning strategies, and decision-making tendencies. A post hoc

Table 3. Descriptive Statistics of Engineering and Non-Engineering Students

Motivational Factors, Learning Strategies, and Decision Making	**Engineering Students (N = 140) Mean (*SD*)**	**Non-Engineering Students (N = 633) Mean (*SD*)**
IGO	5.29 (0.87)	5.29 (0.83)
EGO	5.18 (1.02)	5.20 (1.16)
TV	5.91 (0.87)	5.98 (0.83)
CT	4.78 (0.87)	4.96 (1.06)
HS	4.89 (0.91)	4.86 (1.01)
DM	7.16 (2.21)	6.53 (2.59)

power analysis indicated low statistical power (Power [1–β] = 0.19), suggesting that the study was unlikely to detect small between-group differences. As such, the absence of statistically significant differences should be interpreted with caution. Nevertheless, the small magnitude of the observed differences suggests that any true differences between engineering and non-engineering students are likely modest in practical significance. Given the similarity of the two groups across all key variables, subsequent analyses in this study were conducted using the combined sample of engineering and non-engineering students. Within this institutional context, the relationships examined in this study appear to function similarly across both groups.

Given the similarity of engineering and non-engineering students across key motivational and cognitive variables, the results of the multinomial logistic regression analysis examined the associations between students' motivational and cognitive strategy scores and their decisions to adopt or avoid AI-based learning technologies such as ChatGPT. Using neutral (category 0) as the reference group, the model tested how composite scores for task value (TV), intrinsic goal orientation (IGO), and critical thinking (CT) predicted membership in the oppose (category 1) and support (category 2) categories. These findings provide insight into how students' beliefs about the importance of learning tasks, their internal motivation to learn, and their engagement in higher-order thinking processes shape their stance toward AI-based technologies in learning contexts. By contrast, no statistically significant associations were found between extrinsic goal orientation (EGO) or help seeking (HS) and students' decisions to oppose or support the use of AI.

Focusing specifically on intrinsic motivation, Intrinsic Goal Orientation (IGO) emerged as a significant predictor of students' opposition to AI in their field. The coefficient for the oppose category (relative to neutral) was positive and statistically significant ($\beta = 0.491$, $p = 0.0082$), indicating that students with higher intrinsic motivation are more likely to oppose AI development than remain neutral. This pattern suggests that students driven by an inherent interest in learning may express reservations about the adoption of AI, potentially due to concerns about authenticity, effort, fairness, or the displacement of meaningful engagement. In contrast, the coefficient for the support category was not significant ($\beta = 0.13$, $p = 0.134$), indicating no strong relationship between intrinsic motivation and support for AI development when compared to neutrality. This asymmetric effect implies that while intrinsically motivated students may feel compelled to reject AI, they do not necessarily endorse it with equal conviction.

Next, we create a graphical representation of the multinomial logistic regression findings using a predicted probability plot. The three plots in Fig. 1 display the predicted probabilities from a multinomial logistic regression examining students' stance toward AI-based technologies for the three learning contexts (oppose, neutral, support) and across levels of intrinsic goal orientation (IGO). As IGO increases, the probability of maintaining a neutral stance declines, while the probabilities of both support and opposition increase. However,

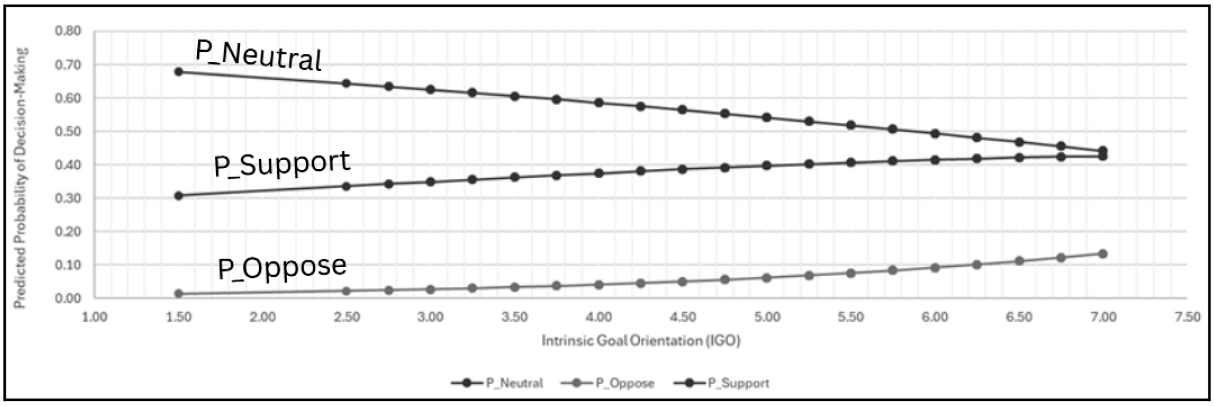

Fig. 1. Predicted probabilities of AI stance by levels of Intrinsic Goal Orientation (IGO).

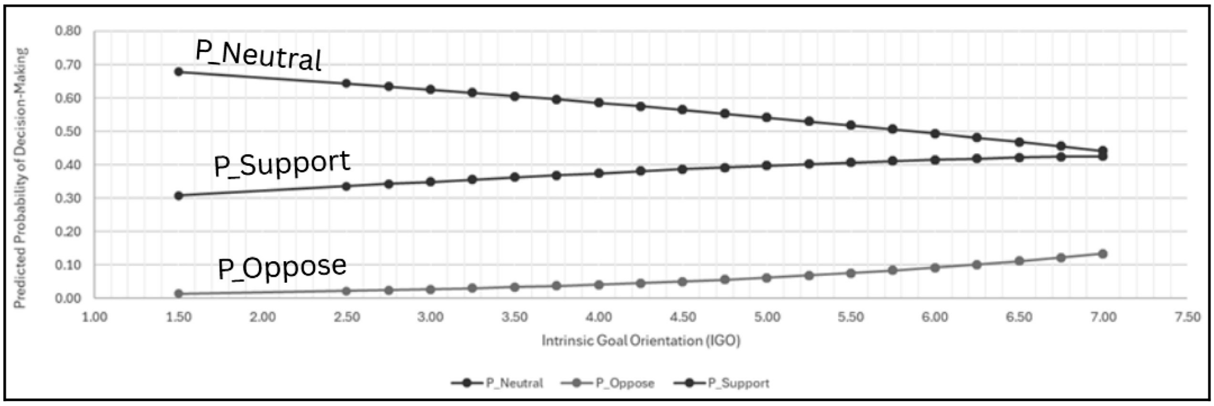

Fig. 2. IGO log add ratio.

the regression coefficients indicate that only the increase in opposition is statistically significant (β = 0.491, p = 0.0082), while the increase in support is not (β = 0.13, p = 0.134). This suggests that intrinsically motivated students are more likely to reject AI-based technologies rather than remain neutral, possibly due to concerns about effort, authenticity, or the value of human learning. Although support appears to rise visually, the statistical model does not confirm it as a reliable trend. Overall, neutrality remains the most probable stance across all levels of IGO, but the probability of opposition grows meaningfully with higher intrinsic motivation.

Observing the two plots, (Fig. 2) reveals that as Intrinsic Goal Orientation (IGO) increases, the likelihood of both supporting and opposing AI rises. However, only the relationship with opposition is statistically significant. Students with higher IGO are slightly more likely to oppose than remain neutral, with odds ranging from 0.02 to 0.30. Although the odds of support increase more noticeably (0.45 to 0.96), this trend is not statistically significant (p = 0.134).

Task Value (TV) also emerged as a significant predictor of opposition to AI but not support. Students who rated their coursework as more interesting, useful, or important were significantly more likely to fall into the *oppose* category than remain neutral (β = 0.408, p = 0.044). This association may reflect a protective stance toward traditional academic practices; students who highly value their academic tasks might perceive AI as a threat to educational rigor or integrity. On the other hand, no statistically significant relationship was observed between TV and the *support* category (β = 0.003, p = 0.972), suggesting that perceiving learning tasks as valuable does not necessarily translate into active support for AI. Rather, the findings imply that students with high task value may be more cautious or critical of AI's place in academic contexts.

The three plots (Fig. 3) display the predicted probabilities of students' stance toward AI-based

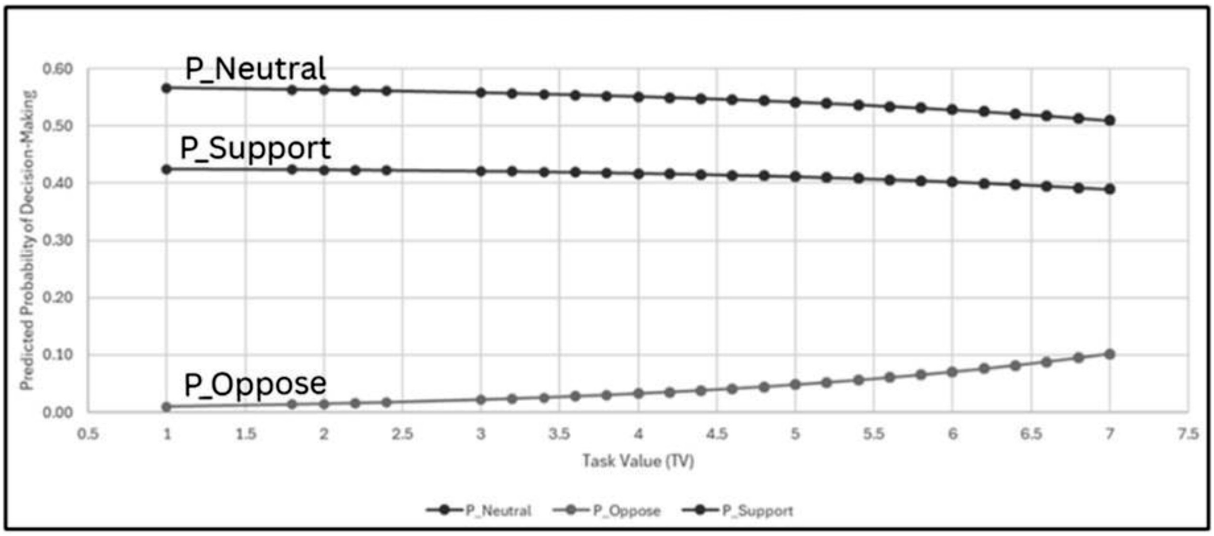

Fig. 3. Predicted probabilities of AI stance by levels of Task Value (TV).

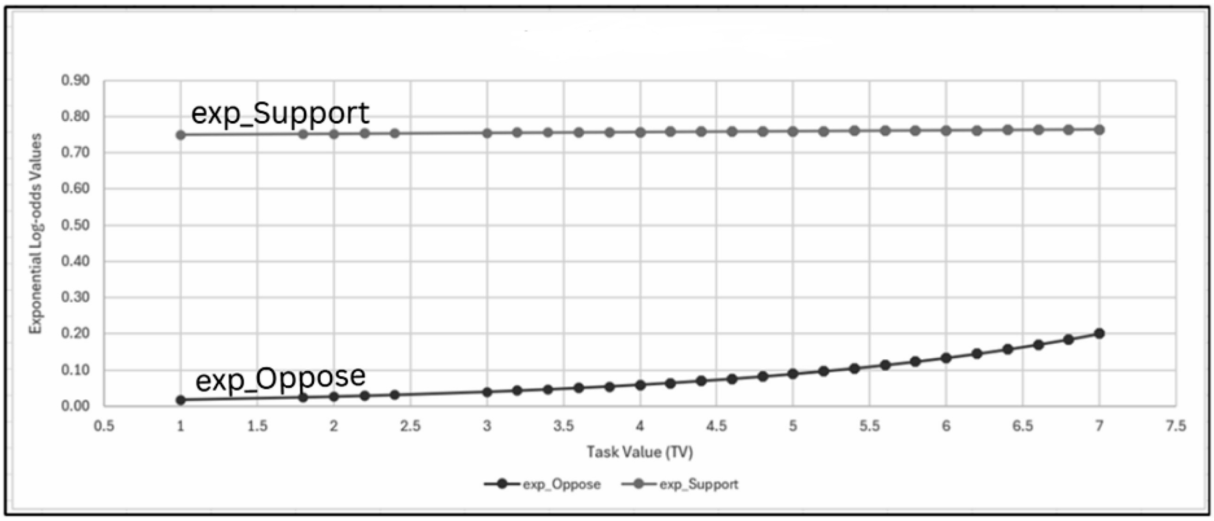

Fig. 4. TV log odd ratio.

technologies in learning contexts (oppose, neutral, support) across levels of task value (TV). The probability of opposing AI-based technologies is consistently the highest across all levels of TV, while the probability of supporting is moderate, and the probability of being neutral remains the lowest. While there is a slight upward trend in support and a slight downward trend in opposition as task value increases, these changes are relatively small, indicating that task value has a modest effect on students' stances.

In the log-odds ratio plots (Fig. 4), as Task Value (TV) increases, the likelihood of opposing a decision rises slightly, with odds ratio ranging from 0.02 to 0.20. This effect is statistically significant, suggesting that students who place greater value on the task are less likely to remain neutral than opposed. In contrast, the likelihood of support remains relatively stable, with odds ratio for Support ranging narrowly from 0.75 to 0.76, indicating no meaningful change as TV increases.

Unlike IGO and TV, Critical Thinking (CT) was significantly associated with both opposing and supporting AI development, indicating a more complex relationship. Higher CT scores predicted greater odds ratio of opposing AI relative to remaining neutral ($\beta = 0.281$, $p = 0.044$), as well as greater odds ratio of supporting AI ($\beta = 0.214$, $p = 0.03$). These findings suggest that students who engage more deeply in evaluative and analytical thinking are less likely to remain indifferent. Instead, they tend to form stronger positions, either in favor of or against the use of AI in their field. This polarization effect may stem from their heightened ability to consider multiple dimensions of the issue, such as ethical implications, cognitive trade-offs, and the practical benefits of AI in learning environments. Therefore, CT appears to drive students toward critical engagement, rather than passive neutrality, in the debate over AI technologies.

The three plots in Fig. 5 illustrate the predicted probabilities of students' stance toward AI-based technologies in learning contexts (oppose, neutral, support) across levels of critical thinking (CT). As CT increases, the probability of opposing AI steadily declines, while the probability of supporting AI rises, eventually surpassing opposition at higher levels of CT. The probability of a neutral stance remains relatively low and stable across the CT range. These findings indicate that students with stronger evaluative and analytical thinking skills are less likely to stay neutral and more likely to develop a clear stance, either supporting or opposing the use of AI in their field.

As students' Critical Thinking (CT) levels increase, the log odds of both opposing and supporting AI based learning technologies, relative to remaining neutral, rise steadily, as shown in the plots in Fig. 6. The odds ratio for support range from 0.36 to 1.19, reflecting a stronger increase than those for opposition, which range from 0.05 to 0.24. This suggests that higher CT skills significantly shift students away from neutrality, with a greater tendency toward support.

4.2 Research Question 2: What drives college students to either embrace or avoid AI-based learning technologies, such as ChatGPT, in their academic pursuits?

The results highlight both the drivers and barriers influencing students' engagement with these technologies, drawing on data from qualitative responses to capture a holistic perspective. Key

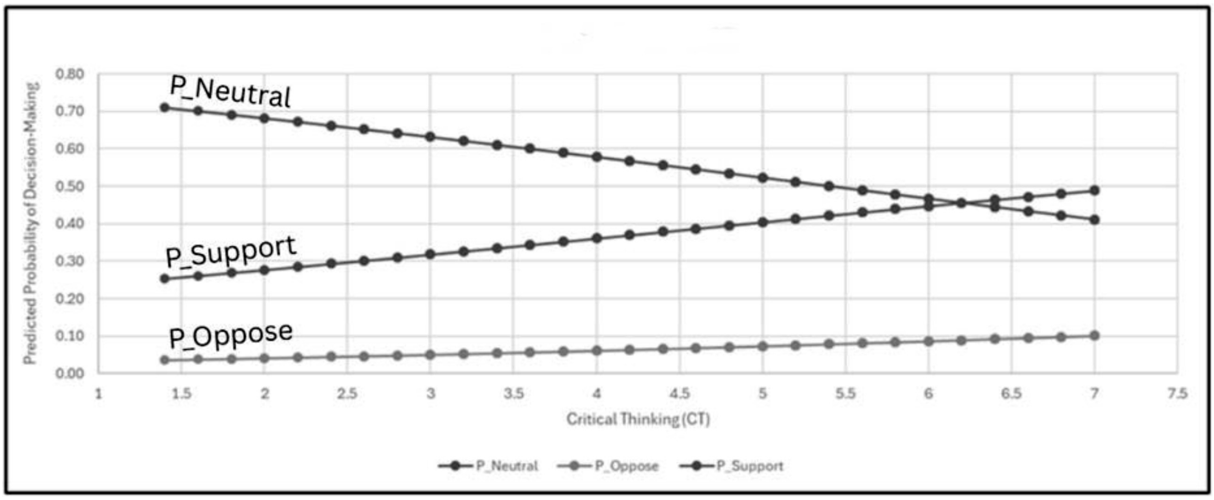

Fig. 5. Predicted Probability for AI stance by levels of Critical Thinking (CT).

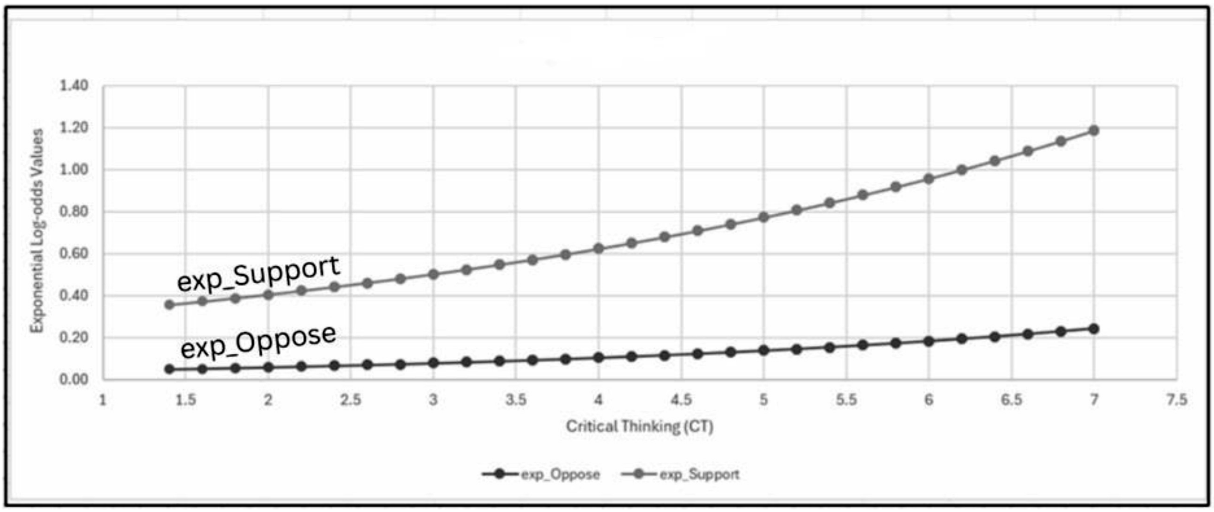

Fig. 6. CT log odd ratio.

themes emerged from the analysis, offering insights into the motivations behind students' adoption of ChatGPT, such as its perceived ability to enhance efficiency, provide instant feedback, and serve as a supplementary learning resource. At the same time, the findings shed light on the reasons for avoidance, including concerns about academic integrity, a lack of trust in the tool's accuracy, and fears of dependency or reduced critical thinking skills.

To provide a comprehensive understanding, the results are organized into categories reflecting these themes and subthemes. Importantly, the findings are presented in the order of themes with the highest percentage of coded occurrences, highlighting the most prominent patterns and including illustrative verbatim quotes from student responses. This dual approach aims to capture both the breadth of the patterns observed across the sample and the depth of individual experiences. Together, these findings reveal the complex interplay of factors shaping students' choices regarding AI-based learning technologies in their academic environments.

4.2.1 Driving Factors for Supporting AI-based Learning Technologies

AI-based learning technologies like ChatGPT have become increasingly valuable to students, serving not just as tools for efficiency but as personalized learning partners that support academic growth and confidence. Students use these technologies to tailor their learning experiences, develop essential skills, and receive timely support, especially when traditional resources such as instructors or peers are unavailable. Three dominant themes emerged from the data: AI as a personalized learning partner, a tool for efficiency and task support, and a means to deepen conceptual understanding. Together, these accounted for over 70% of student responses and illustrate how AI fosters autonomy, problem-solving, and cognitive engagement (Themes A, B, and C). Students described using AI for customized feedback, clarification of complex ideas, brainstorming, writing assistance, and iterative learning, all of which enhance their confidence and academic independence.

Students acknowledged that while AI outputs are not always accurate, they treat them as starting points rather than final answers, using AI to augment rather than replace traditional learning methods. Additional themes revealed how students are adapting their learning strategies in response to AI, view AI as preparation for future careers, and value the emotional support AI offers in building confidence and reducing anxiety. Collectively, these findings highlight the thoughtful and multifaceted ways students integrate AI into their learning, provided it is used responsibly and not as a shortcut. The six major themes and their associated subthemes are outlined below.

Theme A: AI as a Personalized Learning Partner (25.55%)

AI as a Personalized Learning Partner reflects students' strong appreciation for AI's ability to tailor educational experiences to their individual needs. This theme weaves together three complementary subthemes, personalized learning, skill development, and supplementary learning tools, which collectively underscore the role of AI in fostering autonomy, intellectual curiosity, and confidence. Students describe how AI tools support iterative learning by offering customized feedback, adapting explanations to their pace and prior knowledge, and providing additional practice or clarification when needed. These tools act as on-demand learning companions, enabling students to explore topics more deeply and develop essential academic and problem-solving skills.

(i) *Personalized learning (8.76%)*

This subtheme reflects how AI fosters tailored educational experiences based on individual learning needs, curiosity, and autonomy. Students appreciate AI's adaptability, accessibility, and ethical implications. Personalized learning also includes confidence-building and intellectual independence.

> "It has explanations and step-by-steps that are much simpler than textbook material or other course materials. I can ask it to give me an in-depth explanation or teach me a concept I am struggling to understand to complete my work. Often, office hours/tutors are outside of my ability to attend, and emails are often not helpful enough in the manner I need them to be."

(ii) *Skill development (11.53%)*

This subtheme stands out for its strong focus on iterative learning and self-improvement. AI is portrayed as a platform for developing academic, technological, and cognitive skills. From conceptual mastery to creativity and tutoring, students use AI to build competencies.

> "I've used ChatGPT to practice counseling skills. Using ChatGPT gives me time to think over my responses (taking this time would be disruptive in a real life setting), takes some pressure off of me because ChatGPT is not judging my performance, and means I can avoid eating up others' time."

(iii) *Supplementary learning tools (5.26%)*

This subtheme is about how AI is positioned as a complementary aid rather than a replacement for traditional learning. Students utilize AI alongside existing resources for feedback, clarity, and writing assistance. The codes reflect value in augmentation, not substitution.

> "I use ChatGPT to bounce ideas off of and to explain concepts I am confused about, as well as organize essay structures."

Theme B: AI for Learning Efficiency and Task Support (23.78%)

AI for Learning Efficiency and Task Support captures how students use AI tools to enhance academic performance by streamlining their workflow and supporting their learning processes. This theme reflects a strong appreciation for AI's ability to improve efficiency, reduce time spent on routine tasks, and offer timely academic assistance. Students describe AI as a dependable tool that complements traditional instruction, helping them stay organized, clarify difficult concepts, and manage complex assignments.

(i) *Efficiency and productivity (7.26%)*

This subtheme highlights how learners use AI to streamline academic tasks, save time, and enhance productivity. Codes emphasize accessibility, convenience, and AI's role in reducing cognitive load. It reflects a growing reliance on AI to complete work efficiently and with less effort.

> "They help take the busy/unnecessary steps in classes so that I can focus on actually learning and mastering material. It also streamlines tasks so that I can focus on material."

(ii) *Task support and assignment help (8.01%)*

Students often turn to AI for help with summarizing, verifying, and completing academic tasks. This subtheme focuses on the practicality of AI in managing workloads and meeting deadlines. It emphasizes AI's value in routine academic support.

> "I use it to support my learning in my courses. Chat GPT is really good at teaching how to perform repetitive tasks or calculations or understand concepts."

(iii) *AI as tutor and assistant (8.51%)*

This subtheme centers on AI's tutoring capabilities, productivity tools, and accessibility features. Students benefit from responsive and always-available academic assistance. AI acts as a digital tutor, helping with writing, organizing, and concept clarification.

> "It's an efficient way to get help with any subject. It's like having a tutor available at any time."

Theme C: AI for Conceptual Understanding and Cognitive Growth (22.15%)

This theme centers on students' use of AI to foster deeper intellectual engagement and support higher-order thinking. This theme encompasses three interconnected subthemes: Conceptual understanding and clarification, Problem solving and creativity, and Learning enhancement**.** Together, these elements reflect how AI tools help students unpack complex ideas, explore alternative approaches to problems, and engage in more creative and reflective thinking. Students view AI not just as a source of answers, but as a cognitive partner that stimulates curiosity, encourages exploration, and promotes the development of critical and metacognitive skills. This theme underscores AI's role in facilitating meaningful learning experiences that go beyond surface-level understanding.

(i) *Conceptual understanding and clarification (8.51%)*

This subtheme captures AI's role in helping students understand complex concepts through explanation, research support, and ideation. Codes reflect curiosity, academic exploration, and the convenience of AI as an on-demand learning companion.

> "I use ChatGPT to help me come to conclusions on confusing topics or ideas. It helps me kind of talk through concepts that I might not have understood fully when they were presented in a lecture. It's a really helpful tool that I use to make my learning more effective."

(ii) *Problem solving and creativity (7.13%)*

This subtheme captures AI's role in helping students understand complex concepts through explanation, research support, and ideation. Codes reflect curiosity, academic exploration, and the convenience of AI as an on-demand learning companion.

> "My main use of this kind of technology is for coding help. I use it when my code doesn't work or when I'm not sure what step is next to reach my goal. These technologies help me find answers more quickly than I would by using other sources like forums or documentation, because those sources are hard to search through unless you know very specific terms/language."

(iii) *Learning enhancement (6.51%)*

AI is increasingly seen as a tool to enhance learning through targeted academic support and learning aids. Students leverage AI for brainstorming, clarifications, and overcoming traditional limitations. This subtheme also includes concerns about balance, over-reliance, and ethical usage.

> "Chat GPT is super useful as a support tool especially in online classes. It's a great resource to condense and explain large amounts of material, walk through solutions to difficult problems, etc. I have very little respect for professors that assign 'busy work' at no regard for students' personal lives or work schedules. It makes no sense for me to spend several hours reading a textbook every week when Chat GPT can teach me the same concepts just as well in 30 minutes to an hour."

Theme D: Adaptation, Flexibility, and Evolving Learning Practices (12.01%)

This theme highlights how students are actively adjusting their learning behaviors and strategies in response to the integration of AI tools. This theme emphasizes their growing ability to flexibly incorporate AI into academic routines, reflecting a shift in how they manage time, engage with content, and solve problems. It also points to a forward-looking mindset, where students recognize the value of becoming proficient with AI not just for immediate academic success, but as preparation for future careers in an AI-driven world. The theme includes subthemes related to adaptation and flexibility, as well as career preparation and future outlook, suggesting that students view AI literacy as an evolving and essential skill set for lifelong learning and professional relevance.

(i) *Adaptation and flexibility (5.51%)*

This subtheme captures the evolving use of AI for editing, understanding, and content generation, as students adjust to AI's role in education. Codes reflect the adaptive strategies learners employ to keep pace with technological change. Flexibility is both a necessity and a skill.

> "It explains well, if I give it a sentence that I don't understand because English is not my first language. Sometimes searching in Google for definitions and explanation becomes tough. A preliminary idea can be found easily from ChatGPT. Although I make sure to reread the same knowledge afterward from a proper source, to ensure I did not learn anything wrong."

(ii) *Career preparation and future outlook (6.51%)*

AI's role in career development is reflected in this subtheme through codes like resume support, conceptual clarification, and task automation. Students view AI as a future-oriented partner that supports lifelong learning and readiness for tech-driven professions.

> "I think it is a fascinating technology and I enjoy pushing it to its limits to see what it is capable of. I like learning what I can and cannot do. The other major reason is that it is a very powerful tool that I believe will be critical to relevancy in the future of engineering industry. Additionally, it can make some parts of work easier and quicker to complete, allowing me to spend more time on other parts of projects."

Theme E: AI's Role in Holistic Academic Support and Ethical Considerations (9.51%)

This theme encapsulates the tension between AI's usefulness and concerns over trust, accuracy, and institutional integrity. While recognizing the potential of AI to enhance learning and provide academic support, students also express ambivalence and skepticism regarding its reliability, ethical implications, and impact on academic integrity. Trust in AI is not automatic, it is shaped by individual experiences, institutional guidance, and perceptions of responsible use. This theme emphasizes the need to balance AI's benefits with critical reflection, fostering both confidence in and accountability for its use in educational contexts.

> "I was initially against ChatGPT/AI and I still am for most if not all creative tasks but it can be very helpful with problem-solving, explaining material and I use it mostly as an additional perspective for assignments/HW/etc."

Theme F: Confidence and Comfort (7%)

This theme centers on the affective outcomes of using AI tools, emphasizing how they help build students' confidence, reduce anxiety, and enhance emotional engagement in learning. By offering consistent support and reducing uncertainty, AI tools can foster a sense of comfort and emotional safety, which in turn motivates students to engage more actively with challenging tasks. The presence of trust and emotional support through AI use contributes to a more positive and empowering learning experience, making confidence and comfort a distinct and essential theme in understanding student-AI interactions.

> "When teaching styles of professors don't line up with my needs, I use Chat GPT/other AI to help me understand the material and explain it. I also upload lecture power points or readings and have it summarize them for me in a study guide."

In summary, six interconnected themes capture the key factors shaping students' support for AI-based learning tools. The most prominent themes highlight AI's role as a personalized learning partner (25.55%), a tool for enhancing efficiency and task support (23.78%), and a resource for deepening conceptual understanding and cognitive growth (22.15%). Additional themes reflect how students adapt their learning practices in response to AI (12.01%), navigate trust and ethical considerations (9.51%), and experience increased confidence and comfort through AI use (7.00%). Together, these themes illustrate a broad and nuanced endorsement of AI integration in education, grounded in both cognitive and emotional dimensions of student learning (see Fig. 7).

4.2.2 Opposition to AI Technology Adoption

Many students choose not to use AI-based learning technologies like ChatGPT due to a combination of distrust, ethical reservations, and a strong commit-

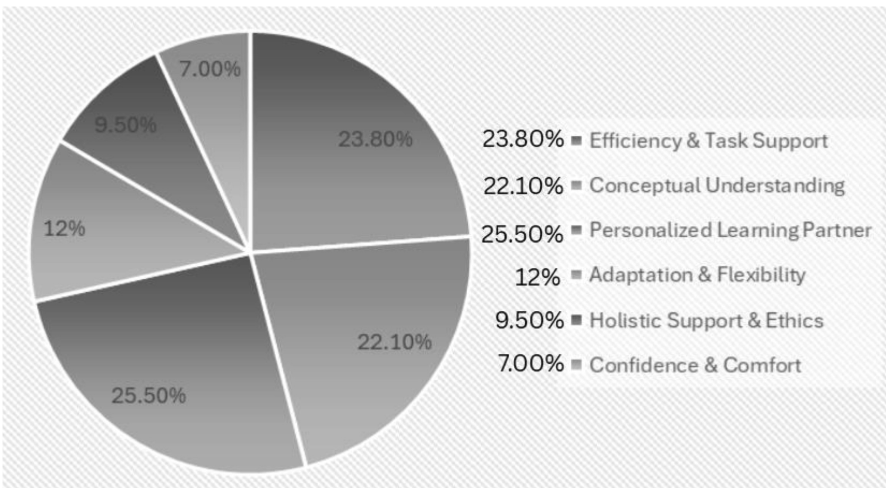

Fig. 7. Driving Factors for Supporting AI-based Learning Tools.

ment to authentic, self-directed learning. The most frequently cited concern is a preference for independent and traditional learning methods, valuing intellectual autonomy and genuine engagement over convenience. Others emphasize a lack of trust in the accuracy and reliability of AI generated content, with students expressing skepticism about the credibility of information and the risk of misinformation or learning disruption. Ethical concerns also play a major role, as students worry about the potential for AI tools to facilitate plagiarism or undermine academic integrity. Some fear that frequent AI use could hinder their development of critical thinking, creativity, and other essential academic skills. In addition, broader concerns about equity, environmental impact, and overreliance on technology contribute to their hesitation. Underpinning many of these responses is a desire to take ownership of the learning process and remain accountable for their growth. These concerns are organized into six major themes and multiple subthemes, presented below in descending order based on their frequency of occurrence.

Theme A: Preference for Independent and Authentic Learning (28.93%)

This theme reflects students' strong inclination toward maintaining autonomy, authenticity, and integrity in their educational experiences. This theme underscores a desire for learning that is personally meaningful and rooted in traditional, verifiable methods, such as direct engagement with instructors, textbooks, or hands on practice, rather than relying heavily on AI tools. Students express a commitment to developing their own understanding and skills, often viewing excessive AI use as a shortcut that could undermine the learning process. This theme consists of three sub-themes that reflect students' desire for self-directed, meaningful learning, with minimal reliance on AI: Preference for independent learning, Authenticity and integrity, and Preference for traditional learning methods.

(i) *Preference for independent learning (10.94%)*

This subtheme represents a strong inclination toward self-reliant, introspective, and AI-free learning experiences. Learners emphasized the value of independently driven education and intrinsic learning motivation.

> "I want to try to figure things out on my own rather than have something else do the work for me. How much will I actually learn if I don't put in the work myself to learn and figure it out?"

(ii) *Authenticity and integrity (10.09%)*

This subtheme reflects the emphasis students place on authentic, meaningful, and original learning. Participants resisted AI use when it appeared to compromise personal integrity or genuine learning efforts.

> "I feel very negatively towards most Generative AI as I like to create and I have seen it be used to replace or undermine artists. I have also always been very proud of my academic abilities and found it frustrating that suddenly I was no longer working with/ competing with my peers but rather a Generative AI instead. Overall it is just frustrating to see someone get the same rewards/ results as you when they did a fraction of the work."

(iii) *Preference for traditional learning methods (7.90%)*

This subtheme emphasizes a preference for conventional, human-centric educational practices. It includes valuing teacher interaction, verifiable information, and tangible learning experiences.

> "I don't see the benefit to my learning. It's great if ChatGPT can answer questions, but I want to be able to address them myself, and I don't see how ChatGPT can help me learn."

Theme B: Distrust and Skepticism Toward AI (26.02%)

This theme captures a significant portion of students' reservations about integrating AI into learning environments. This includes concerns about AI-based learning tools, epistemological uncertainty, technological limitations, and fear of learning disruption. This theme consists of three interconnected sub-themes that highlight students' concerns about the use of AI in learning environments: Distrust of AI, Skepticism toward AI capabilities, and General AI concerns.

(i) *Distrust of AI (17.63%)*

Many respondents expressed skepticism about the reliability, accuracy, and credibility of AI-generated information. Concerns were raised about ChatGPT's potential to produce incorrect or misleading content, which undermines trust in its capabilities.

> "I don't trust that the information provided to me will be true or accurate, especially when I can't see the sources the technology is using. I also believe that using these technologies is a hindrance to learning. I feel I will learn more by doing the work myself to gather information."

(ii) *Skepticism toward AI capabilities (8.39%)*

This subtheme captures doubts regarding the functional limitations and overreach of AI tools. It reflects fears that AI might not match human capabilities and could negatively affect learning and skill acquisition.

> "Don't want to rely on these technologies for anything. I don't believe they help students very much."

Theme C: Ethical and Academic Integrity Concerns (19.86%)

This theme captures students' apprehensions about the potential misuse of AI tools and the broader implications for honesty and fairness in academic settings. This theme reflects a strong awareness of how easily AI can be used to bypass genuine learning efforts, raising concerns about cheating, plagiarism, and the erosion of academic values. Students worry that widespread reliance on AI may blur the lines between acceptable support and dishonest behavior, potentially creating an uneven playing field. This theme consists of two closely related sub-themes that encompasses moral concerns, cheating, plagiarism, and fairness: Ethical concerns and Cheating and academic dishonesty.

(i) *Ethical concerns (17.67%)*

This subtheme encompasses apprehensions related to moral dilemmas, academic dishonesty, and ethical boundaries of AI use. Participants highlighted concerns about cheating, plagiarism, and maintaining academic integrity in AI-integrated environments.

> "It feels like cheating. I have never ever cheated on anything academic, and I have no plans of starting so now."

(ii) *Cheating and academic dishonesty (2.19%)*

This subtheme includes concerns that AI tools may promote dishonest academic behavior. Participants linked AI use with shortcuts, undermining effort and authentic student learning.

> "I feel like it isn't a real way to learn, for example, how to write a paper. If I were to write a paper, then prompt ChatGPT to write it for me, then where am I learning how to write? I think that AI has its other uses, like maybe coming up with certain topic ideas or answering a certain question in a more specific way than a Google search can ever do. My opinion is that it has its uses and it's areas it really shines at, but is often being way overused, sometimes to the point of cheating."

Theme D: Skill Development and Learning Process Concerns (14.09%)

This theme reflects students' apprehension that frequent use of AI may compromise the depth and quality of their learning. This theme emphasizes the value students place on cognitive independence, intellectual curiosity, and hands-on engagement as essential components of meaningful education. Many students worry that relying too heavily on AI tools could hinder the development of critical skills such as creativity, analytical thinking, and problem-solving. They express concerns that AI may encourage shortcut learning, where outcomes are prioritized over process, thereby limiting opportunities for active exploration and mastery. This theme highlights fears about AI hindering creativity, critical thinking, and skill acquisition, which includes Skill development concerns and Autonomy in learning.

(i) *Skill development concerns (7.53%)*

This subtheme highlights anxieties that AI reliance may inhibit creativity, hands-on experience, and critical skill development. Students feared that overdependence on AI could hinder long-term growth and innovation.

> "They cripple the ability to gain and improve important skills, including but not limited to, good writing, critical thinking, research, editing, brainstorming, and learning in general."

(ii) *Autonomy in learning (6.56%)*

This subtheme underscores the desire for self-guided learning and cognitive independence. Learners valued intellectual autonomy and personal engagement in the learning process.

> "I want to make sure that I understand the material and force my brain to work through problems so I can work through similar problems on my own."

Theme E: Broader Social, Environmental, and Equity Concerns (7.44%)

This theme captures concerns related to sustainability, equitable access to technology, and the fairness of AI systems in educational settings. Students express unease about the environmental impact of AI infrastructure, such as the potential for AI to widen existing educational inequalities, particularly for those with limited access to devices, internet, or AI tools.

(i) *Environmental and social concerns (2.68%)*

This subtheme captures considerations about the broader environmental and social impacts of AI technologies. Participants expressed concerns about sustainability, access disparities, and the ecological footprint of AI.

> "Generative AI is largely incorrect, extremely wasteful of water and energy, and profits off of the theft of the creations of individual artists, writers, and creatives. It is the antithesis to everything I support."

(ii) *General AI concerns (4.76%)*

This subtheme encompasses broad concerns regarding the integration of AI in education. It includes concerns about unintended consequences, learning disruptions, and the risks of overreliance.

> "I think that it negatively impacts my ability to understand a subject. Additionally the computer power needed to power AI is causing utility costs to rise."

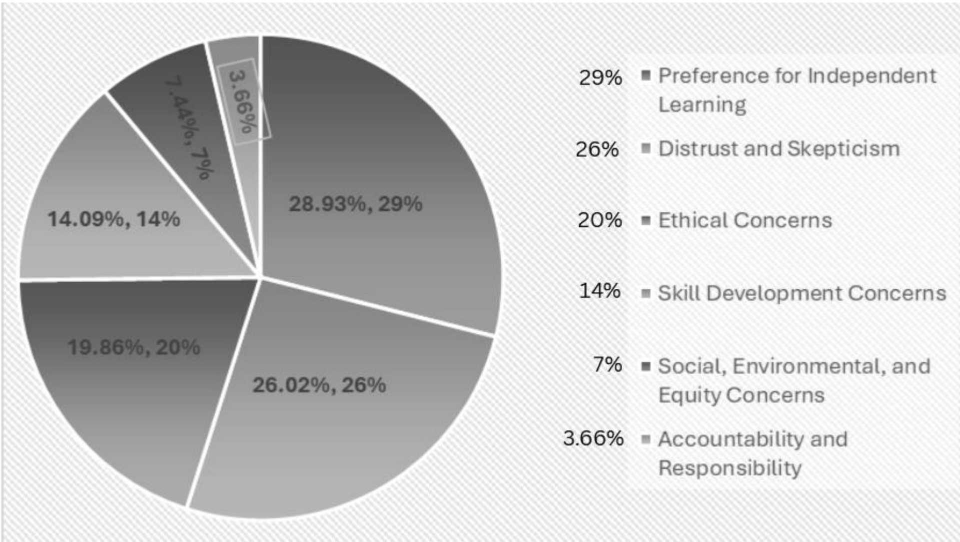

Fig. 8. Opposition to AI Technology Adoption.

Theme F: Accountability and Responsibility in Learning (3.66%)

This theme highlights students' emphasis on personal ownership of their educational journey. This theme reflects a belief that meaningful learning comes from effort, discipline, and self-direction, rather than dependence on AI tools. Students stress the importance of maintaining responsibility for their work, outcomes, and growth, viewing excessive reliance on AI as a potential threat to the development of essential habits of learner agency. For these students, true learning involves making decisions, grappling with challenges, and being accountable for both successes and mistakes. This theme underscores a commitment to integrity and self-motivation as foundational elements of education in an AI-enhanced world.

> "I've never felt the need to use it, and I feel more satisfied with my own abilities when I avoid AI."

In summary, the findings reveal that students' decisions to avoid using AI-based learning technologies, such as ChatGPT, are influenced by a range of concerns related to trust, ethical considerations, and the perceived impact on their learning processes. The overarching reasons for avoiding AI-based learning technologies center on students' desire to maintain trust in their learning tools, uphold academic integrity, and ensure that their education remains authentic and self-directed. Skepticism about AI capabilities and ethical concerns further reinforce their hesitations. These findings underscore the need for educators and developers to address trust, reliability, and ethical issues when integrating AI tools like ChatGPT into educational environments (see Fig. 8).

5. Discussion

This study provides a multifaceted understanding of students' perceptions of AI-based tools in higher education by integrating quantitative and qualitative findings. It highlights how students' motivational and cognitive orientations, including Intrinsic Goal Orientation (IGO), Task Value (TV), and Critical Thinking (CT), shape their support for or opposition to AI, revealing a strong connection between internal dispositions and receptiveness to educational technologies.

Quantitative findings indicate that students with higher intrinsic motivation and stronger perceptions of task value are significantly more likely to oppose AI integration. This suggests that highly engaged learners who find personal meaning in their academic work may view AI as a threat to authenticity, self-reliance, and the integrity of the learning process. Indeed, concerns also center on the integrity of comparing the apparent knowledge or skills of those who use AI tools and those who do not, reflecting a desire for fair and meaningful comparisons. These results are reinforced by thematic analysis, where students expressing opposition frequently emphasized independent learning, academic authenticity, and skepticism toward AI-generated content. Themes such as epistemic skepticism, ethical concerns, and anxiety over skill development support the idea that highly motivated students tend to adopt a critical stance toward AI.

In contrast, Critical Thinking (CT) emerged as a significant predictor of both support and opposition, indicating a more polarized stance among analytically inclined students. These individuals were less likely to remain neutral and more likely to form strong opinions. Thematic findings elaborate on this polarization: students who supported AI highlighted its role in personalized learning, efficiency, task support, and conceptual clarity, which aligns with literature on AI's potential to scaffold learning and promote cognitive growth [7, 30]. On the other hand, students high in CT who opposed AI raised concerns related to autonomy, educational responsibility, and broader societal implications, hallmarks of evaluative thinking associated with strong critical reasoning [31, 32].

Notably, ethical concerns, such as plagiarism, academic dishonesty, and environmental sustainability, were strongly represented among AI skeptics. This finding reinforces the quantitative result that Task Value (TV) negatively predicted support for AI. Students who highly value their coursework appear especially sensitive to perceived shortcuts and threats to academic integrity posed by AI.

Subthemes related to emotional reassurance, stress mitigation, and academic comfort (Support – Theme F) appeared infrequently in the qualitative data (approximately 7%). This pattern corresponds with the non-significant associations found for Extrinsic Goal Orientation (EGO) and Help Seeking (HS) in the quantitative analysis. These findings suggest that externally driven motivations, such as focusing on performance outcomes or seeking help, may not be central factors in students' decisions to support or oppose AI technologies. Instead, students' attitudes seem more closely tied to deeper educational values, ethical principles, and identity-related beliefs about learning, autonomy, and integrity.

Taken together, the convergence of statistical and thematic findings suggests that students' reactions to AI in education reflect more than mere preferences for technology. Rather, they emerge from a complex interplay of motivation, cognition, and values. While some students view AI as a valuable tool for personalized learning and academic support, others express principled resistance rooted in educational philosophy, ethics, and identity. These insights highlight the need to foster AI literacy, promote ethical awareness, and engage students in reflective discussions about the role of emerging technologies. In doing so, institutions can better support informed, critical, and value-aligned engagement with AI in higher education.

6. Conclusion

To address students' diverse beliefs and concerns about AI, instructional practices should harness the benefits of AI tools while respecting students' motivational and ethical values, as revealed by both the quantitative results and qualitative themes. Students expressing opposition often align with Theme A (Preference for Independent and Authentic Learning), emphasizing the importance of preserving academic integrity and discouraging overreliance on AI. These concerns are echoed in Theme C (Ethical and Academic Integrity Concerns), which includes issues such as plagiarism, dishonesty, and environmental impact, and is supported by the quantitative finding that higher Task Value (TV) is associated with reduced support for AI. This aligns with prior research showing that students who highly value a course or learning material are more likely to engage meaningfully and achieve learning success. To foster ethical engagement, integrating AI literacy modules that cover topics like fairness in use and availability, fairness in knowledge assessment, responsible use, plagiarism risks, and environmental impact is essential.

Conversely, students who support AI tools align with Theme B (AI for Learning Efficiency and Task Support), reflecting an appreciation for AI's role in scaffolding learning and offering personalized assistance. Providing customizable AI guidance, where students choose their level of support, can encourage autonomy and self-regulated learning. This approach resonates with students higher in IGO and CT, who tend to evaluate AI thoughtfully and critically.

Although Theme F (Confidence and Comfort) appeared less frequently, it suggests that AI tools can also contribute to emotional reassurance and academic well-being without undermining core learning values. Project-based learning activities that require students to collaborate with AI and to critically evaluate and justify AI generated content can balance efficiency with accountability. This also addresses the polarized views among analytically inclined students, as reflected in CT's dual role as a predictor of both support and opposition. Finally, clearly communicating how to verify AI results, along with its capabilities and limitations, can help build trust and support students in aligning AI use with their learning goals and identities.

This study has a few limitations. First, the data were collected from a single public university in the western United States, which may limit the generalizability of the findings. Second, the analysis was conducted at the aggregate level without examining differences across specific subgroups such as gender, college affiliation, or cumulative GPA due to small sample sizes in some of these categories.

Future research should explore how these subgroup characteristics influence students' attitudes toward AI-based tools, as differences may emerge across academic disciplines, identity groups, achievement levels, or levels of education (undergraduate, master's, doctoral). Longitudinal studies could also investigate how students' perceptions evolve as AI technologies become more embedded in higher education. Additionally, experimental and intervention-based studies are needed to evaluate the impact of AI literacy programs and to identify instructional approaches that foster both critical engagement and ethical, effective use of AI tools in diverse learning contexts.

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