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The Influence of Academic Emotions on Academic Performance in the Context of Artificial Intelligence

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Abstract: The role of academic emotions in influencing students' learning experiences and outcomes is increasingly recognized, particularly as artificial intelligence (AI) becomes more integrated into educational settings. Understanding how these emotions interact with AI is essential for enhancing student performance. While existing research has established the general effects of academic emotions on performance, the specific impacts of AI on these emotions and their subsequent influence on academic outcomes remain under-explored. This study employs a mixed-methods approach, involving 120 translation students from three universities that utilize AI-driven learning systems. Participants completed a modified Academic Emotions Questionnaire and provided qualitative reports detailing their experiences with AI tools. Their academic performance was collected. Regression analysis reveals that positive emotions—anticipation, joy, and curiosity—significantly predict academic performance in AI-enhanced environments. Additionally, topic modeling of students' reports identifies key themes such as reduced cognitive load, access for academic resources, immediate feedback and personalized learning, indicating that AI tools positively influence academic emotions and performance. The findings underscore the importance of designing AI systems that foster positive academic emotions, thereby improving educational outcomes. This research highlights the need for further exploration into the emotional dynamics of AI in education to support both cognitive and emotional development in students.

Keywords: academic emotions; academic performance; artificial intelligence; cognitive load; academic access; personalized learning

1. Introduction

In educational psychology, the role of academic emotions in shaping students' learning experiences and outcomes has been increasingly recognized. Academic emotions, defined as emotions that are directly linked to achievement activities or achievement outcomes [1], influence students' motivation, learning strategies, cognitive resources, and, ultimately, their academic performance. The ways in which students feel about their academic tasks—whether they experience emotions like anxiety, enjoyment, or frustration—can significantly impact their academic success. Understanding the complex relationship between these emotions and academic performance is crucial for educators and policymakers striving to improve learning environments and enhance student outcomes.

Previous research has extensively explored how academic emotions influence various aspects of learning and academic performance. Pekrun's control-value theory suggests that students' emotions in academic settings are shaped by their perception of control over learning activities and the value they attach to those activities [1]. Positive emotions, such as enjoyment and pride, often enhance learning by fostering engagement, creativity, and intrinsic motivation [1]. Conversely, negative emotions like anxiety and depression can hinder learning and achievement [2].

Several studies have supported the relationship between academic emotions and performance. Pekrun et al. developed the Academic Emotions Questionnaire, which empirically demonstrated that positive emotions are associated with higher academic performance, while negative emotions tend to correlate with lower performance [3]. For example, positive emotions like enjoyment can lead to deeper cognitive processing, better problem-solving skills, and more persistence in challenging tasks [1]. In contrast, anxiety often impairs working memory and cognitive capacity, leading

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to poorer outcomes [4].

Studies on test anxiety have shown that it is a significant predictor of academic underachievement [4]. Furthermore, boredom has been identified as a demotivating factor that exerts a negative correlation with academic achievement [5]. On the other hand, enjoyment of learning has been consistently linked to higher academic achievement, as it increases engagement and motivation to persist in challenging tasks [3].

However, while much has been learned about the general relationship between academic emotions and performance, there has been less focus on how emerging technological contexts, such as artificial intelligence (AI), may alter this dynamic. As AI becomes more integrated into educational settings, it offers new opportunities for learning but also introduces new challenges that may elicit different emotional responses from students. This raises important questions about how academic emotions interact with AI-driven learning environments and how these emotions influence performance in this new context.

Although the influence of academic emotions on performance has been well-documented, the specific context of artificial intelligence in education remains under-explored. AI has been heralded as a transformative tool in education, capable of personalizing learning experiences, automating assessments, and providing real-time feedback to students [6]. These innovations have the potential to reshape the academic experience, but they may also introduce new emotional dynamics. For example, students might feel empowered by AI's ability to offer personalized learning pathways, thereby increasing feelings of control and competence. Alternatively, AI systems may also provoke negative emotions, such as anxiety or confusion, particularly if students struggle to understand or interact with the technology.

Existing research on AI in education has primarily focused on its technical and pedagogical benefits, such as increased efficiency and improved learning outcomes [6]–[8]. The results of the study demonstrated that the students who interacted with the chatbot performed better academically compared to those who interacted with the course instructor [8]. However, there is limited understanding of how students' emotional responses to AI systems influence their academic performance, which is a critical gap.

Moreover, the growing use of AI in education raises important ethical and psychological questions regarding student autonomy and emotional well-being. Some scholars argue that AI could diminish students' sense of control, as learning becomes more automated and less reliant on human interaction [9]. This potential loss of control could heighten feelings of helplessness or frustration, thereby negatively impacting performance. On the other hand, AI's ability to adapt to individual learning needs might foster positive emotions like confidence and motivation, enhancing academic achievement.

Given the increasing prevalence of AI in education and the paucity of research on its emotional implications, there is a pressing need to investigate how academic emotions interact with AI systems and how these emotions influence academic performance. Understanding this relationship is crucial for ensuring that AI technologies are designed and implemented in ways that support not only cognitive learning but also emotional well-being.

The present study tries to explore the relationship by answering the following questions: (1) Do academic emotions aroused by AI influence academic performance? (2) If yes, then how?

2. Literature Review

2.1 Academic Emotions and Academic Performance

Academic emotions are an integral part of the learning experience and significantly impact students' academic performance. According to Pekrun's control-value theory of academic emotions, emotions such as enjoyment, hope, and pride are positively related to academic engagement and performance, while negative emotions like anxiety, anger, and boredom can impair academic outcomes [1]. This theory posits that emotions are triggered by students' perceptions of control over their learning and the value they assign to the learning activity.

Empirical research has demonstrated that positive academic emotions are associated with better cognitive processing and higher achievement. Pekrun et al. found that emotions like enjoyment and pride promote deeper cognitive engagement, increase persistence in academic tasks, and result in higher academic performance [3].

Conversely, negative emotions such as anxiety and boredom have been shown to have detrimental effects on academic performance. Test anxiety, in particular, has been identified as a significant predictor of poor performance, as it can impair students' working memory, reduce their ability to concentrate, and increase cognitive load [4]. Similarly, boredom in academic settings is associated with decreased motivation, disengagement, and lower achievement [10].

Research further suggests that academic emotions influence students' use of self-regulated learning strategies, which in turn affects performance. Positive emotions encourage the use of metacognitive strategies, such as goal setting, self-monitoring, and strategic planning, which enhance academic performance. In contrast, negative emotions often lead to maladaptive strategies, such as avoidance and procrastination, which negatively impact performance [3].

2.2 AI and Positive Academic Emotions

The integration of artificial intelligence (AI) into educational environments has the potential to influence students' academic emotions, particularly positive emotions like enjoyment, confidence, and motivation. AI tools, such as adaptive learning systems and intelligent tutoring programs, have been shown to provide personalized learning experiences that cater to individual student needs. These tools can create more engaging and supportive learning

environments, which can enhance students' emotional experiences.

Studies have demonstrated that AI can foster positive emotions by providing real-time feedback and tailored learning pathways. For example, Luckin et al. highlight that AI systems can adapt the difficulty of tasks to match students' skill levels, thereby reducing frustration and enhancing feelings of competence [6]. When students feel that the learning process is aligned with their abilities, they are more likely to experience positive emotions like enjoyment and satisfaction, which contribute to better learning outcomes [7].

Additionally, AI-driven systems can reduce anxiety by offering students individualized support and guidance. For instance, AI-powered tutoring systems provide immediate feedback, helping students correct mistakes and clarify misunderstandings before they become overwhelming sources of confusion or frustration [7]. This type of just-in-time feedback reduces the cognitive load associated with uncertainty and promotes positive emotions such as confidence and security in learning.

However, while the potential for AI to elicit positive academic emotions is clear, it is essential to consider the design and implementation of these systems. AI tools that are overly complex or lack intuitive interfaces may inadvertently lead to negative emotions like confusion or frustration [9]. Therefore, educators and developers must ensure that AI systems are designed with user experience in mind to maximize their positive emotional impact.

2.3 AI and Positive Academic Performance

AI technologies in education are increasingly being used to enhance academic performance through personalized learning experiences, automated feedback, and data-driven insights into student learning. Several studies have shown that the use of AI can lead to improved academic performance by offering tailored instruction that meets the unique needs of each student.

One of the key advantages of AI in education is its ability to adapt to students' individual learning styles and paces. Adaptive learning platforms, for instance, use algorithms to continuously assess students' performance and adjust the difficulty of tasks accordingly [6]. This ensures that students remain challenged but not overwhelmed, which promotes sustained engagement and higher performance. Research has shown that students who use AI-driven adaptive learning systems perform better on assessments compared to those who follow traditional, one-size-fits-all instructional models [7].

Moreover, AI can enhance academic performance by providing more efficient and targeted feedback. Traditional forms of feedback in educational settings are often delayed, which can hinder learning progress. AI systems, however, offer immediate, actionable feedback, allowing students to correct their mistakes in real-time. This timely feedback has been shown to improve learning outcomes by promoting continuous improvement and preventing the accumulation of misunderstandings [9].

AI tools also provide teachers with data-driven insights that enable more informed decision-making about instructional strategies. For example, AI systems can analyze students' progress and identify areas where they are struggling, allowing educators to intervene more effectively. Studies have demonstrated that such targeted interventions, guided by AI data, lead to significant improvements in student performance [7].

While the evidence for the positive effects of AI on academic performance is strong, it is essential to recognize that these benefits are contingent on the proper use and integration of AI tools within educational settings. Poorly designed AI systems, or those that are not aligned with educational goals, may fail to deliver the expected improvements in performance. Therefore, ongoing research and development are necessary to ensure that AI technologies are both pedagogically sound and accessible to students and educators.

3. Research Design

3.1 Participants

The study involves students majoring in translation from three universities in Hebei province that have integrated AI-driven learning systems into their curricula. A diverse sample of approximately 120 participants from four-year programs was recruited. Recruitment was done through offline classes. Informed consent was obtained from all participants before their

involvement in the study, ensuring that they understood the purpose of the research and the confidentiality of their responses.

3.2 Questionnaire on Academic Emotions

Participants completed a validated structured questionnaire designed to measure academic emotions, such as anxiety, frustration, enjoyment, and curiosity. The Academic Emotions Questionnaire [3] was adapted to include questions specific to AI-driven learning contexts. For example, students were asked to rate their emotional responses when interacting with AI-based systems, such as automated tutoring programs, adaptive learning platforms, or AI-assisted assessments.

3.3 Academic Performance

Academic performance data were collected from students' grades, test scores, and participation metrics in AI-driven learning systems. This data provided an objective measure of students' academic achievement, which was analyzed in relation to their emotional responses.

3.4 Reports on AI Usage

Participants provided detailed reports on how, when, and why they use AI tools in their academic work. These reports included information on types of AI tools, frequency and timing of AI use, perceived outcomes, and their feelings about AI use. Most importantly, their perceived AI experiences were reported, including ease of use, effectiveness, and overall satisfaction. The data gauged how the design and implementation of AI tools influence academic emotions. The reflective reports were submitted electronically, providing qualitative data for topic modeling analysis.

4. Results

4.1 Regression Analysis of Academic Emotions and Performance

Questionnaire data were analyzed in RStudio. Students' reports on AI usage were analyzed in ROST software, and the valence of emotion was calculated. Different topics were extracted from the reports by LDA modeling.

A multiple regression analysis was conducted to examine the relationships between academic emotions, perceptions of AI tools, and academic performance. The independent variables included academic emotions (e.g., anxiety, enjoyment, frustration) and students' perceptions of the AI tools' usability and effectiveness. The dependent variable was academic performance, as measured by grades, test scores, and performance within AI-based learning systems.

The regression analysis aims to identify which academic emotions (positive or negative) significantly predict academic performance in AI-assisted learning environments. It quantifies the impact of different emotions on students' academic success, revealing whether AI systems evoke emotions that either enhance or inhibit learning outcomes. The analysis also explored the way in which students' academic emotions influence their performance.

The regression analysis of the questionnaire data revealed that academic emotions significantly predict academic performance in the context of artificial intelligence. Three key academic emotions—anticipation, joy, and curiosity—were found to positively influence students' academic performance, accounting for varying levels of variance.

Anticipation, which refers to the excitement and expectation students feel about their learning journey, was a significant but moderate predictor of academic performance, $\beta = 0.11$ ($p < 0.01$). Students who reported higher levels of anticipation tended to perform better in AI-driven learning environments, as anticipation likely motivates engagement and preparation.

Joy, characterized by the positive emotional experience during learning activities, emerged as a stronger predictor of academic performance, $\beta = 0.20$ ($p < 0.001$). Students who found joy in their interactions with AI tools, such as intelligent tutoring systems or adaptive learning platforms, exhibited higher academic outcomes. Joy likely fosters greater persistence and deeper engagement with the learning material.

Curiosity was the most substantial predictor of academic performance, accounting for 23% of the variance, $\beta = 0.23$ ($p < 0.001$). Students who displayed curiosity were more likely to explore AI-driven learning tools thoroughly, leading to enhanced comprehension and academic success. Curiosity encourages students to delve into complex topics, seek additional resources, and engage more actively with AI technologies.

Overall, the regression analysis confirms that positive academic emotions—anticipation, joy, and curiosity—are critical contributors to academic success in AI-enhanced learning environments.

4.2 Topic Modeling of Reports

The emotional value of the reflective reports was calculated. A paired T test indicated that positive valence (mean=143.1, SD=25) was significantly higher than negative valence (mean=-36.8, SD=18), $t(119) = 2.67$, $p < .05$. The results suggested that students thought positively of AI and recognized its contribution to academic work.

The qualitative data collected from students' reflective reports were analyzed using Latent Dirichlet Allocation (LDA) topic modeling techniques. Topic modeling helps identify recurring themes related to emotions and performance in students' experiences with AI tools. This method allows for the identification of key topics. Topic modeling revealed the following four key themes related to how AI contributes to academic performance:

1.Reduction of Cognitive Load:** Many participants reported that AI tools helped reduce their cognitive load by automating routine tasks such as organizing notes, searching for information, or managing citations. By offloading these tasks to AI systems, participants were able to focus on more complex cognitive tasks like critical thinking and analysis, leading to improved academic performance.

2.AI-Assisted Research Tools:** AI-powered research tools played a significant role in aiding students' academic performance. Participants highlighted that AI tools helped them locate relevant academic sources, analyze data, and synthesize research findings more efficiently, enabling them to produce higher-quality work and manage their time effectively.

3.Intelligent Tutoring Systems:** AI-driven intelligent tutoring systems were praised for providing personalized learning experiences that aligned with individual student needs. These systems offered immediate, step-by-step guidance on difficult topics, allowing students to overcome learning obstacles faster and achieve better results in their coursework.

4.Immediate Feedback:** Immediate feedback was another recurrent theme in students' reflections. AI tools provided real-time evaluations of assignments and tests, allowing students to quickly identify mistakes and make necessary corrections. This feedback loop encouraged continuous improvement and helped students perform better in subsequent



assessments.

These topic modeling results underscore the significant role that AI technologies play in enhancing students' academic performance, particularly through reducing cognitive load, improving research efficiency, offering personalized tutoring, and delivering immediate feedback. The results of the topic modeling complement the quantitative findings from the regression analysis by providing richer, context-specific insights into how AI tools influence students' emotions and learning experiences.

5. Discussion

The present study aimed to explore the influence of academic emotions on students' academic performance in the context of artificial intelligence (AI) tools. The results from the regression analysis and topic modeling provided valuable insights into the critical role of positive academic emotions and the functional contributions of AI tools in enhancing academic performance. This section discusses these findings in relation to the existing literature, the theoretical framework, and the broader implications for AI-enhanced education.

5.1 The Impact of Academic Emotions on Academic Performance

The regression analysis revealed that academic emotions—specifically anticipation, joy, and curiosity—significantly predict academic performance. This finding aligns with Pekrun's control-value theory, which posits that positive academic emotions enhance cognitive engagement, motivation, and ultimately academic success [1]. Curiosity emerged as the most substantial predictor of performance, highlighting its pivotal role in AI-driven learning environments. Students who exhibited higher levels of curiosity were more inclined to engage deeply with AI tools, explore complex subjects, and seek additional learning opportunities, which led to better academic outcomes.

Joy was another strong predictor of performance, underscoring the importance of emotional engagement with AI systems. Students who experienced joy during their interactions with AI-based learning tools demonstrated higher levels of persistence and task engagement, consistent with prior research that links enjoyment to improved learning and academic outcomes [3]. AI tools, such as intelligent tutoring systems and adaptive learning platforms, likely foster this emotional engagement by making learning more interactive and personalized [6].

Anticipation also contributed positively to academic performance, albeit to a lesser extent. Anticipation likely reflects students' excitement and motivation to engage with AI-driven learning experiences, as they expect the tools to facilitate their learning. This emotion may stimulate students to prepare for learning activities and engage more proactively with AI tools, supporting their academic achievement.

Overall, the regression results confirm that positive academic emotions are integral to academic success in AI-enhanced environments. These findings contribute to the growing body of literature on the role of emotions in learning, expanding it by demonstrating how AI technologies interact with academic emotions to shape student outcomes.

5.2 The Role of AI Tools in Enhancing Academic Performance

In the reflective reports, participants provided insights into how AI-assisted learning impacted their academic performance, and most of them believed the AI tools improved their understanding of the subject matter instead of presenting challenges affecting their performance.

The topic modeling analysis of participants' reflective reports identified several key themes regarding the role of AI tools in academic performance: reduction of cognitive load, AI-assisted research tools, intelligent tutoring systems, and immediate feedback. Each of these themes corresponds to functional areas where AI significantly contributes to students' learning and performance.

Many participants noted that AI tools helped reduce their cognitive load by automating routine tasks, such as information retrieval, note organization, and citation management. AI can offload repetitive tasks, allowing students to focus on higher-order thinking and complex problem-solving. By reducing cognitive load, AI enables students to allocate more mental resources to critical academic tasks, leading to improved performance.

AI tools help students organize their study schedules, remind them of deadlines, and break large projects into manageable tasks. Tools such as AI-powered scheduling systems assist students in managing their time more efficiently, leading to increased productivity and better academic results.

AI-driven research tools were frequently highlighted as beneficial for finding relevant academic resources quickly and efficiently. AI helps students find relevant academic resources, articles, and journals more quickly by using AI-powered search algorithms. This speeds up the research process, enabling students to gather and synthesize information more efficiently, ultimately improving the quality of their assignments and research projects. AI has enhanced research methodologies, empowered educators and students, and fostered innovation in academia [11]. AI can help students overcome information overload by filtering through large volumes of academic content and presenting the most relevant sources. By streamlining the research process, AI tools enable students to produce higher-quality assignments and research projects, contributing to better academic outcomes.

AI enhances personalized learning and improves student engagement [12]. Students praised AI-based intelligent tutoring systems for providing personalized learning experiences. These systems offer step-by-step guidance and tailored feedback, helping students overcome learning obstacles more effectively. AI tutoring systems simulate the

benefits of human tutors by providing personalized support. Such systems foster deeper understanding of the material, leading to enhanced academic performance.

Moreover, the personalized approach of AI allows students to focus on their specific needs and improve their understanding of difficult topics. AI-powered adaptive learning platforms adjust content delivery based on individual students' learning pace, preferences and weakness. AI systems can assess students' learning behavior in real-time and adapt the difficulty of exercises accordingly, fostering a tailored learning environment.

AI has the potential to tailor educational experiences to each student's needs by adapting content based on their performance [6]. These systems help students remain engaged and perform better academically because the material is presented in a manner that best suits their learning style.

Immediate feedback was another key benefit reported by participants. AI systems provide real-time evaluations of assignments and assessments, allowing students to quickly identify mistakes and make corrections. This quick feedback loop ensures that students can make adjustments in real-time rather than waiting for human-graded assessments. Holmes et al. emphasized that immediate feedback is critical for continuous improvement and learning [7]. By offering this feedback loop, AI tools encourage students to refine their understanding and perform better in subsequent tasks.

These findings suggest that AI tools play a significant role in enhancing academic performance, not only by automating mundane tasks but also by providing personalized support and feedback. The functional benefits of AI align with the emotional predictors identified in the regression analysis, reinforcing the idea that both the cognitive and emotional dimensions of learning are important in AI-driven educational environments.

6. Conclusion

This study highlights the critical role of positive academic emotions, particularly curiosity and joy, in enhancing students' academic performance in the context of AI tools. The findings suggest that AI-driven learning environments have the potential to not only improve academic outcomes but also foster positive emotional experiences that drive deeper engagement and learning. By reducing cognitive load, offering personalized support, and providing immediate feedback, AI tools create an optimal environment for academic success. Future research should continue to explore the complex interplay between emotions, technology, and performance to ensure that AI in education supports both cognitive and emotional well-being.

This research has practical implications for educators, instructional designers, and policymakers who are integrating AI into educational curricula. By understanding how academic emotions influence performance in AI-driven contexts, educators can develop strategies to mitigate negative emotions, such as anxiety or frustration, while fostering positive emotions like curiosity and enjoyment. This will help create more effective and emotionally supportive learning environments that maximize the benefits of AI technologies.

Furthermore, this research contributes to the broader field of academic emotion theory by extending it to the context of AI in education. By examining how emotions like anxiety, frustration, and enjoyment interact with AI-based learning tools, this study will provide new insights into the role of emotions in technology-enhanced learning environments.

While this study provides valuable insights, it is not without limitations. The sample size, while sufficient, was limited to students already engaged in AI-enhanced learning environments, which may not be representative of all educational contexts. Future research should explore a wider range of institutions and disciplines to determine whether the observed relationships between academic emotions, AI tools, and academic performance hold across different educational settings.

Additionally, while this study focused on positive academic emotions, future research could examine the role of negative emotions, such as frustration or confusion, in AI-driven learning environments. Understanding how negative emotions impact academic performance could help educators and developers design AI systems that mitigate emotional challenges and promote emotional resilience.

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