# The Role of AI in Supporting Self-Regulated Learning among International University Students in China

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## ABSTRACT

The rapid adoption of artificial intelligence (AI) in higher education has changed the way students engage in self- regulated learning (SRL). Yet, little is known about the role of AI in promoting self-regulated learning experiences for international students in China who might face unique cultural and language challenges. To understand the impact of AI tool users' effectiveness and efficiency in the process of self- regulated learning (SRL) during the planning, monitoring, and reflection stages, a cross-sectional study was conducted with 199 international students on the use of AI tools in self-regulated learning (SRL) on international students' autonomous learning in Chinese universities. Descriptive statistics with correlations and linear regression analyzes were also used to understand the data. The Study's results showed that AI platforms such as ChatGPT and Grammarly are used extensively, with AI-powered planning, monitoring and reflection significantly predicting perceived academic benefits and explaining 55.8% of the variance in outcomes. The participants further reported improved autonomy and efficiency, nevertheless they also cited challenges such as language barriers, cultural mismatches and the risk of over-reliance on AI tools. These findings highlight the dual role of AI both as a facilitator and potential barrier to SRL. The results advocate that AI tools should be integrated deliberately into learning with support systems that facilitate profound reflection and critical examination, rather than superficial reliance on the AI tools. Most important, the study suggested educational institutions to foster responsive AI systems that can assist diverse international student populations, with the help of AI literacy professional development in order to equip students with the skill to appropriately use these tools in appropriate and ethical manner.

**Keywords:** Artificial Intelligence in education, Self-Regulated Learning, Perceived outcomes, international students, China

## INTRODUCTION

The rapid integration of artificial intelligence (AI) into education, has changed the way students engage with the content. In high education AI powered systems are increasingly being used to improve learning efficiency and autonomy, such as intelligent tutoring systems, AI generative (ChatGPT, Deep Seek), and adaptive learning platform (Banihashem et al., 2023; Fan et al., 2025). These tools not only hold significant potential for supporting self-regulated learning (SRL), but they give essential skills that enable learners to plan, monitor, and reflect on their academic progress (Zimmerman, 2002). Yet, some studies have recognized the potential of AI to support SRL processes (Jin et al., 2023). The most existing research is missing cultural specificity and is often limited to local student' populations. International students in China often face unique linguistic, cultural, and technological barriers that may influence how they use AI in academic settings (Shi et al., 2025). In China, where the population of international students has been increasing steadily over the past decade, universities

are adopting AI tools to support improved provision and student services (Ministry of Education of the People's Republic of China, 2020).

However, even-though the potential of AI in facilitating SRL is realized globally, little empirical research exists to analyze how Chinese university international student actually utilize such tools in learning management. This is posing an important gap for self-regulation learning specially for students who are novice to the new culture, language and education (Zimmerman, 2002; Hadvin et. Al., 2018). While previous researches have addressed AI in education more broadly, most of them examined national students' cohorts or aggregate pedagogical outcomes (Holmes et al., 2019; Roll & Winne, 2015). Though, few studies have examined how international students, who often have their own distinct self-regulatory challenges, use AI to support their academic autonomy in the environment of a Chinese university. This study aims to examine how AI-learning materials support self-regulated learning practices among international students in China. Understanding this dynamic is essential at informing AI integration strategies that address the needs of international students' populations. The findings of this study have implications for informing targeted support systems for international students, enhancing culturally responsive EdTech policy for Chinese higher education, and widening theoretical understanding of AI-SRL intersections across-cultural academic contexts.

**Research Objectives**

1. To explore how international students use AI tools to support self-regulated learning in Chinese universities.
2. To examine how these AI tools influence the key phases of self-regulated learning (planning, monitoring, and reflection).
3. To investigate the perceived benefits of AI-supported learning from the perspective of international students.
4. To identify the challenges international students, face when using AI to support their self-regulated learning students.

**Research Questions**

1. In what ways do international students use AI tools to support self-regulated learning in Chinese universities?
2. How do these AI tools support the self-regulated learning processes (planning, monitoring, and reflection) for international students?
3. How do international students perceive the effectiveness of AI tools in enhancing their learning autonomy and academic performance?
4. What challenges do international students in China encounter when using AI for self-regulated learning?

**Significant of The Study**

This study is valuable in many ways as it provides valuable insights into the under-researched area of AI and self-regulated learning by focusing on its use by international students in China. The interplay between AI and learning is well documented among local students, while there is little research available on international students. Despite the fact that international students face some challenges in terms of culture, language and technology, there is little research on how they seek to improve their self-regulated academic autonomy through the use of technology. This study therefore aims to address this gap and extend the understanding of the AI-SRL phenomenon in a cross-cultural framework. Furthermore, the research findings are useful for practitioners and policy makers when considering the integration of AI into pedagogy and how it can simultaneously streamline and hinder SRL processes. The study also adds value to existing knowledge by validating Zimmerman and Winne and Hadwin's SRL models in a multicultural setting through the use of AI. Finally, these findings justify the need for systematic culturally sensitive EdTech regulations targeting international students in China, as well as responsive support that promotes self-regulated learning.

# LITERATURE REVIEW

## Theoretical Framework

This Study is guided with two most relevant theories such as the Zimmerman's Social Cognitive Model of SRL and Winne and Hadwin's Information-Processing Model of SRL.

### Zimmerman's Social Cognitive Model of SRl:

The Zimmerman's (2002) social cognitive model conceptualizes self-regulated learning (SRL) as an iterative cycle of forethought (planning), performance (monitoring), and self-reflection. AI-powered learning tools map directly into these phases: adaptive recommendation systems support planning by helping learners set goals, AI dashboards and intelligent tutoring systems facilitate monitoring through real-time feedback, and generative AI such as ChatGPT supports reflection via prompt-based critiques and summaries. A recent systematic review confirmed that AI tools, including chatbots and adaptive feedback systems, can scaffold all three SRL phases, while cautioning that students must remain active agents to maintain self-efficacy efficacy (Li et al., 2024). Similarly, a study on generative AI demonstrated that ChatGPT-supported learners showed distinct SRL processes and improved essay outcomes, although risks of "metacognitive laziness" emerged when reflection was overly automated (Weng et al., 2024).

### Winne and Hadwin's Information-Processing Model of SRL:

Winne and Hadwin's (1998) information-processing model views SRL as a recursive cycle involving task definition, goal setting/planning, strategy enactment, and adaptation, with metacognitive monitoring guiding each stage. AI technologies align closely with this model: NLP-based tools assist with task definition, adaptive learning platforms guide goal setting, intelligent tutoring systems scaffold strategy enactment, and analytics dashboards support adaptation. Evidence from China highlights SRL's critical role in blended learning. Chang et al. (2023) found that SRL was a strong predictor of academic performance among Chinese university students, underscoring the importance of supporting recursive SRL cycles. Furthermore, experimental systems such as SRL Agent a gamified, AI-assisted platform demonstrated significant improvements in SRL skills like goal-setting, monitoring, and reflection among college students (Zhao, 2024). These findings illustrate how AI can operationalize Winne and Hadwin's model by embedding metacognitive scaffolds directly into the learning process.

In a nut shell, Zimmerman's model provides a macro-level framework, emphasizing broad SRL phases (planning, monitoring, reflection), while Winne and Hadwin's model adds a micro-level cognitive lens, detailing how learners define tasks, enact strategies, and adapt iteratively. Collectively, these two theories offer a holistic understanding of how AI tools support SRL. Zimmerman explains the structured phases that AI systems scaffold, while Winne and Hadwin explain the adaptive, moment-to-moment adjustments that AI technologies facilitate. For international students in China, who face cultural, linguistic, and academic challenges, combining these theories clarifies how AI can scaffold both strategic self-regulation and adaptive metacognitive processes, thus promoting autonomy and academic resilience in unfamiliar contexts.

## AI Tool Usage

The application of artificial intelligence (AI) in tertiary education has grown rapidly, especially in assisting international students and those who have been confronted with issues such as language difficulties, cultural transition, and new learning requirements.AI tools such as Deep Seek, ChatGPT, and Grammarly have become prominent as learning tools, helping with writing, research, and critical thinking (Chan & Hu, 2023). Hence, AI nowadays has become a significant means of enhancing the learning experience of multicultural cohorts of students. According to Chang (2023), foreign students frequently face significant difficulties in higher education, such as struggling to comprehend lectures, cope with homework and adjust to new pedagogies. In addition, some recent studies reveal that AI can improve the quality of writing by improving grammar, vocabulary and fluency (Jaramillo et al.,2025).

It also helps save time and provides personalized feedback and automated assessment (Lund et al., 2023; Liu et al., 2024 Chen, 2021; Ge, et al., 2025; Zawacki-Richter et al., 2019). Foreign students, are further compounded by having to work within unfamiliar academic structures and language barriers.AI-powered tools like ChatGPT and Grammarly have an important role to play in both these respects by enhancing linguistic ability, facilitating the structuring of research and idea formation (Farrelly & Baker, 2023). In addition, such tools encourage academic independence rather than creating over-dependence. Contemporary studies highlight the capability of AI tools in providing immediate assistance, particularly to students who lack sufficient exposure to the language of instruction. AI-driven tools like automated translation tools, language learning software and text-to-speech tools provide highly useful assistance, enhancing students' ability to comprehend learning material (Du & Daniel, 2024). These programs not only facilitate translation but also assist in interacting with complex content more effectively, facilitating academic performance in foreign learning environments.

**AI Tools Support and Self-Regulated Learning Processes**

The integration of artificial intelligence (AI) in supporting self-regulated learning (SRL) for international students in higher education in China is a game-changer in the potential for improved learning experiences. AI applications can either enable or undermine the self-regulated learning (SRL) of international students, depending on implementation. While there is as much AI potential for positives like differentiated learning and more engagement, there is potential risk like over-reliance and diminished critical thinking.

**Planning:** Artificial intelligence systems enable the planning phase of SRL by enabling students to set goals, select resources, and map individualized learning paths. For international students who may not be able to cope with unfamiliar academic systems, AI supported recommendation systems and learning dashboards have the potential to offer personalized advice and reduce cognitive overload in the planning phase (Viberg et al., 2020). Such tools can scaffold learners' goal-setting by suggesting realistic learning objectives based on prior performance or learning preferences (Roll & Winne, 2015). Yet, other findings argue that AI technologies can oversimplify the planning process so that students end up being receivers rather than planners, which may stifle international students' ability to make independent goal-setting and decision-making. Furthermore, culturally or linguistically biased AI suggestions might mismatch individual students' learning environments or goals that lead to disengagement or inappropriate planning strategies (Zawacki-Richter et al., 2019).

**Monitoring:** Software based on artificial intelligence offers constant analysis and feedback. Thus, allowing international students to monitor performance at all times and then adjust accordingly. Learning analytics dashboards are capable of offering visualization of progress, diagnosing gaps, and recommending remediation steps, thus enabling metacognitive regulation (Viberg et al.,2020). International learners who might not have direct access to academic support or find themselves struggling to access traditional instructional feedback mechanisms may find this especially useful. Though these benefits are abundant, there are issues of transparency in AI systems that may interfere with the decision of learning. In case AI feedback is unclear or difficult to interpret, especially for non-native English speaker, students may misunderstand or lose trust in the system, which can interfere with effective self-monitoring (Tsai et al., 2020). Over-reliance on AI in making decisions also diminishes learners' intrinsic monitoring capacities and autonomy (Luckin et al., 2016).

**Reflection:** Some AI tools prompt reflection by providing post-task report-outs or requesting learning to reflect on their learning methods and outcomes. These tools may facilitate international students' reflective exercise, especially when used with guided prompts that force them to think critically about what did or did not work (Roll & Winne, 2015). AI tools currently are not refined enough, though, to facilitate deep, meaningful reflection. They are less likely to cope with performance indicators (e.g., quiz scores, rate of completion) rather than with such in-depth qualitative phenomena as emotional engagement or learning approach. This disadvantage can lead to superficial reflection or ''checklist thinking" where students simply respond to queries without inherent reflection (Zawacki-Richter et al., 2019). Further, international students may struggle to engage in reflective discussion with AI systems due to linguistic problems or cultural insensitivity in the construction of feedback.

**Perceived Outcomes for International Students in China**

The rapid expansion of AI in revolutionizing in between students' self -regulated learning and academic performance in higher education. International students mostly have positive experiences, particularly better academic autonomy and effective time management. Artificial intelligence-powered platforms such as intelligent tutoring systems and adaptive learning programs support them in finding their way through the Chinese education system, which leans more toward Chinese education system, which leans more toward being autonomous -based and strict academic standards (Zawacki-Richter et al, 2019). Learning platforms that offer customized scholarly learning pathways and real-time feedback facilitate learning to set goals, monitor progress, and look back on learning, in line with SRL processes (Viberg et al., 2020). This is particularly beneficial for students who are not accustomed to the pedagogy or local language because AI systems can surpass inherent communication barriers and help beyond the parameters of regular classroom settings.

With new generative AI tools such as ChatGPT and Deep Seek development, their use is beginning to be researched within university studies. Some international students, for instance, come from more teacher-directed systems and may have difficulty adapting to AI-based platforms' focus on learner autonomy and self-direction (Zawacki-Richter et al., 2019). The experience of international students in China with AI-based learning tools for self-regulated learning (SRL) is determined by a mix of hope and skepticism for cultural, language, and contextual reasons. Nevertheless, research indicates that all may not be well. Some foreign students are overwhelmed by inadequately localized or culture-misaligned AI tools. For instance, computer feedback may be sufficiently contextual sensitive such that learners are unable to readily interpret or act on it, especially when it is required to use technical or intricate language (Tsai et al., 2020). Moreover, performance measure can stress or lower intrinsic motivation since learners are inclined to feel pressured to perform to algorithmic standards rather than being engaged in meaningful learning (Luckin et al., 2016).

**Challenges That International Student in China Face When Using AI for SRL**

Foreign learners in China face several challenges when using AI systems to support self-regulated learning (SRL), the majority of which are linguistic, cultural, and technical challenges. The primary challenge is language, as the majority of AI systems rely primarily on Chinese or English, making it difficult for students with little fluency to understand instructions, feedback, or interface features (Tsai et al., 2020). They face distinctive academic challenges includes the need to conduct independent research, engage in critical thinking and meet advanced academic standard (Creswell, 2015). Poor understanding of AI-generated prompts or scorecards can hinder learners' ability to plan, monitor and reflect on their learning effectively. International students may encounter difficulties related to cultural differences and language skills, which can affect their interaction with AI tools (Giannakos,2024).

In addition, cultural clashes between students' pedagogical backgrounds and embedded assumptions in AI tools may get in the way of engagement. For instance, some global students come from more teacher-centric systems and may find difficulty with adapting to AI-driven platforms focusing on learner self-direction and autonomy (Zawacki-Richter et al., 2019).

However, while some studies highlight the positive impact of ChatGPT or AI generator, some prior research has pointed to potential challenges in using AI tools for learning, such as over-reliance or a lack of human connection (Li et al., 2025). Others have warned that the application of AI would inadvertently weaken the development of intrinsic motivation and self-regulation among students since they would be too dependent on technology in getting instructions and help. The rationale supports the balancing of the measures for using AI in learning methodologies.

Besides, transparency of AI decision-making constraints restricts students from understanding how feedback or recommendations are being generated, lowering confidence in the system and limiting metacognitive development (Luckin et al., 2016). On occasion, excessive reliance on data-driven performance metrics can amplify apprehension and divert students' focus away from meeting algorithmic needs instead of learning (Viberg et al., 2020). These issues highlight the requirement for culturally responsive design, language

accessibility, and institutional support in using AI resources to promote SRL for Chinese international students. While AI have certain enormous benefits, there is also the issue of privacy, cultural responsiveness, and ethics which have to be handled wisely so that all of the students get an equal opportunity and support (Chang et al., 2023).

# METHODOLOGY

## Research Design

This study employed a quantitative research design using an online questionnaire to examine the role of AI tools in supporting self-regulated learning (SRL) among international students pursuing their studies all across Chinese universities. This approach is chosen based on the study's aim to gather measurable data on students' use of AI tools, their self-regulated learning, and perceived academic outcomes from a larger and dispersed students' population that cannot be achieved in short period and with affordable costs. Additionally, quantitative methods allow for broader generalization, statistical analysis, and the identification of patterns or relationships between variables (Creswell & Creswell, 2018).

## Participant

The target population consists of this study includes international students who are currently pursuing their studies in Chinese universities. Moreover, purposive sampling technique was used to ensure the inclusion of participants who have direct experience with AI in learning contexts. The total sample size was 199 participants**,** which is considered sufficient to support basic inferential statistical analysis (Hair et al. (2019).

## Data Collection Tools

Data was be collected using a self-administered online questionnaire developed from the existing literature. The questionnaire consists of the participants demographic characteristics, AI tools usage, items measuring SRL behaviors (planning, monitoring, and self-reflection), perceived academic outcomes, and challenges associated with AI use. A 5-point Likert scale items ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) were used to apprehend students' perceptions.

## Data Analysis

The collected data was analyzed using SPSS version 30, where descriptive statistics to summarize the frequencies and percentages for each item, correlational analysis to explore relationships between the use of AI tools and students' self-regulated learning behaviors and **l**inear regression analysis was performed to identify the extent to which AI tool usage predicts SRL outcomes and perceived academic performance.

## Reliability Assessment and Validity Assessment

The reliability of the study instrument was confirmed by calculating the internal consistency (Cronbach's alpha) for the total scale of the questionnaire items. Furthermore, to assure the validity of the data collection tools, the questionnaire was presented to two research experts who have comprehensive research experience in higher education contexts to voluntarily review the questionnaire items by cross-checking it with the research questions. The reliability of the study instrument showed excellent internal consistency, with a Cronbach's alpha of .894 across 27 items.

## Ethical Considerations

This study adhered to the ethical considerations such as confidentiality, anonymity, and trustworthiness. All participants received a written statement about the purpose of the research in the Google form link. They were also informed about the purpose of the research, their voluntary participation and that they can withdraw from the research at any time without giving any reason.

# RESULTS

Table I: Participants Demographic Information

| Variables | Categories | Frequency | Percent | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Gender | Female | 66 | 33.2 | 33.2 | 33.2 |
| | Male | 133 | 66.8 | 66.8 | 100 |
| Age group (in years) | 20-25 | 37 | 18.6 | 18.6 | 18.6 |
| | 26-30 | 98 | 49.2 | 49.2 | 67.8 |
| | 31-34 | 36 | 18.1 | 18.1 | 85.9 |
| | 35-40 | 16 | 08 | 08 | 94 |
| | 40 or above | 12 | 06 | 06 | 100 |
| Field of Study | Engineering | 22 | 11.1 | 11.1 | 11.1 |
| | Humanities | 70 | 35.2 | 35.2 | 46.2 |
| | Natural-Sciences | 12 | 06 | 06 | 52.3 |
| | Social Sciences | 95 | 47.7 | 47.7 | 100 |
| Year of Study | 1st | 35 | 17.6 | 17.6 | 17.6 |
| | 2nd | 29 | 14.6 | 14.6 | 32.2 |
| | 3rd | 58 | 29.1 | 29.1 | 61.3 |
| | 4th | 77 | 38.7 | 38.7 | 100 |
| Qualifications | Masters' | 79 | 39.7 | 39.7 | 39.7 |
| | PhD | 86 | 43.2 | 43.2 | 82.9 |
| | Undergraduate | 34 | 17.1 | 17.1 | 100 |
| Total | | 199 | 100 | 100 | |

Table 1 displays the demographic characteristics of participants. The sample comprised mostly male participants (66.8%) and a substantial percentage of young adults (49.2%) aged 26-30. Whereas, nearly half of the participants were from Social Sciences (47.7%)**,** showing that majority of the participants were from social sciences and humanities (35.2) disciplines. With respect to their years of study**,** 38.7% were in their 4th year**,** accompanied by 29.1% in their 3rd year**,** signifying that most respondents had accumulated substantial academic experience in China. Finally, in terms of academic qualifications, 43.2% were PhD, followed by 39.7% Masters'. This shows that the sample was principally composed of postgraduate students.

Participants' Country of Origin with Their Respective Percentages The respondents of this study came from a wide range of 40 different countries**,** underscoring the diversity of the sample. There exist great differences in representation, with Indonesia having the highest percentage at 5.0%, followed by Afghanistan, Ethiopia, Nigeria and Yemen, each lagging behind at 4.5%. Pakistan, Syria and the Republic of Congo are also relatively well represented at 4.0%. While Sudan, DRC and Myanmar have an average level of representation at 3.0%. Whereas, countries such as Eritrea, India, Kenya, Tanzania, and Thailand, which all have an indicator value of 2.5%, are slightly above average. The same applies to Algeria, Malaysia, Egypt, Chad, Gambia, Azerbaijan, the Democratic Republic of Congo, Türkiye, Ghana, Morocco, Nepal, Niger, Rusia, Turkmenistan, Tajikistan, and Vietnam, which all present a lower value of 2.0% and are in the middle range. The lower values of 1.5% are represented by Armenia, Equatorial Guinea, Azerbaijan, Djibouti and Saudi Arabia with the lowest value followed by Sierra Leone at 1.0%. It is imperative to note that in this distribution, there is a greater concentration of countries that lie between 1.5% and 2.5% with only a few countries exceeding the 4.0% mark, including Indonesia, Afghanistan, Ethiopia, Nigeria and Yemen, as well as Pakistan, Syria and the Republic of Congo, which indicates greater representation. In contrast, Sierra Leone appears to be most underrepresented in this study.

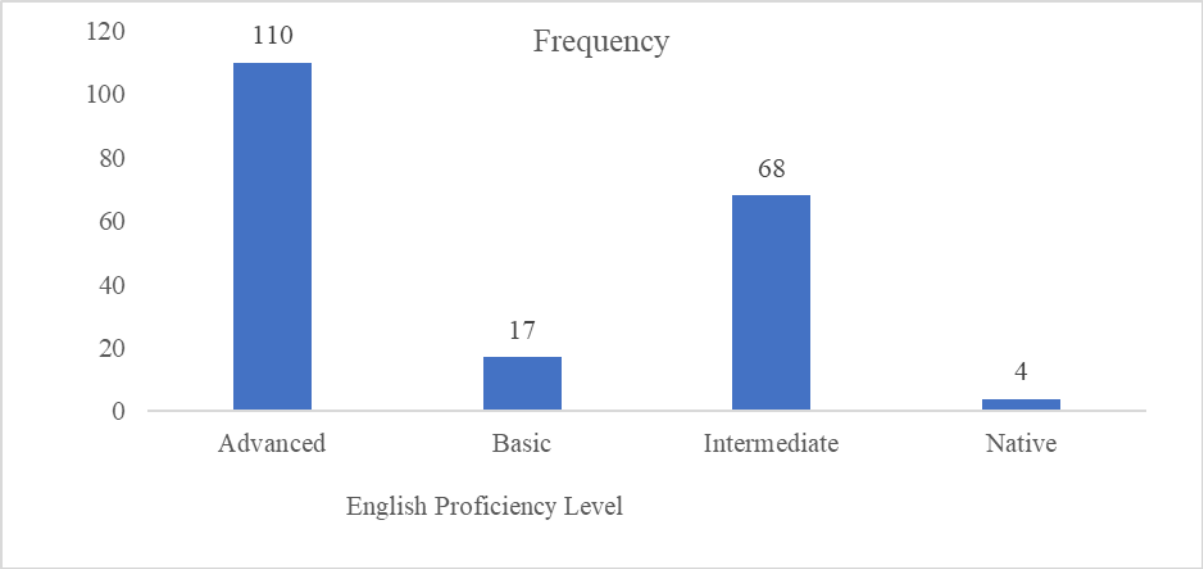


Figure 1: English Proficiency Level

Figure 1 demonstrates the respondents' self-reported English proficiency levels. Where the largest proportion of participants reported an advanced level of English proficiency (n = 110), accompanied by those at the intermediate level (n = 68). Whereas the smallest number of respondents shown basic proficiency (n = 17), while only a very small group conveyed being native speakers (n = 4). Thus, these results indicate that majority of the sample possessed strong English language skills, indicating that they are capable of effectively engaging with academic materials and AI-based tools that require English comprehension.

| Table II: Use of AI Tools | | | | |
|---|---|---|---|---|
| Items | Percent | Valid % | Cumulative% | |
| I regularly use AI- tools (e.g., ChatGPT, Grammarly, AI tutors) for my academic tasks. | 63.3 | 63.3 | 100 | |
| I use AI tools to help me understand difficult academic content. | 45.7 | 45.7 | 100 | |
| I rely on AI tools to generate ideas or outlines for assignments. | 45.2 | 45.2 | 100 | |
| I feel confident in using AI tools effectively for my studies. | 48.7 | 48.7 | 100 | |
| I have received some form of training or guidance on using AI tools. | 66.8 | 66.8 | 100 | |

Table 2 reveals the extent of AI tools use among students. Majority of respondents (63.3%) reported regular use of AI tools (e.g., ChatGPT, Grammarly, or AI tutors) for academic tasks. In addition, 45.7% indicated that they use AI tools to understand difficult academic content, while 45.2% count on these tools for generating ideas or assignment outlines. Furthermore, 48.7% of students expressed confidence in their ability to use AI tools effectively, and a notable 66.8% stated receiving training or guidance on their use. These results highlight that AI tools have been widely integrated into students' academic practices, with training emerging as an important factor in fostering confidence and effective use.

Table III: Relationships Between AI Tools Use and Self-Regulated Learning Behaviors

| Variables | Correlation | AI Usage | SRLPla-nning | SRLMonit-oring | SRLRefle-ction |
|---|---|---|---|---|---|
| AI Usage | Pearson Correlation | 1 | 0.054 | 0.029 | 0.053 |
| | Sig. (2-tailed) | | 0.447 | 0.683 | 0.453 |
| | N | 199 | 199 | 199 | 199 |
| SRLP | Pearson Correlation | 0.054 | 1 | .787** | .764** |
| | Sig. (2-tailed) | 0.447 | | 0 | 0 |
| | N | 199 | 199 | 199 | 199 |
| | Pearson Correlation | 0.029 | .787** | 1 | .786** |

| | | | | | |
|---|---|---|---|---|---|
| SRLM | Sig. (2-tailed) | 0.683 | 0 | | 0 |
| | N | 199 | 199 | 199 | 199 |
| SRLR | Pearson Correlation | 0.053 | .764** | .786** | 1 |
| | Sig. (2-tailed) | 0.453 | 0 | 0 | |
| | N | 199 | 199 | 199 | 199 |

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3 presents the relationships between the use of AI tools and students' self-regulated learning (SRL) dimensions. The results indicate strong, positive, and statistically significant associations among planning, monitoring, and reflection (r = .764–.787, p < .001)**.** Specifically, students who engaged in planning were also highly likely to engage in monitoring and reflection, suggesting that AI tools usage influence the different phases of SRL in a mutually reinforcing manner**.**

Table IV: Effectiveness of AI Tools in Predicting SRL Outcomes and Academic Performance

| Model | **B** | **t** | **Sig.** |
|---|---|---|---|
| (Constant) | | 7.384 | .000 |
| SRLP | .230 | 2.754 | .006 |
| SRLM | .312 | 3.580 | .000 |
| SRLR | .266 | 3.186 | .002 |

Note: SRL= Self-Regulated Learning Planning, SRLM= Self-Regulated Learning Monitoring, SRLR= Self-Regulated Learning Reflection.

Table 4 presents the regression coefficients of the perceived effectiveness of AI tools in predicting SRL outcomes and perceived academic performance. The results indicate that all three self-regulated learning (SRL) dimensions were significant predictors. SRL-Planning (β = .230, p = .006)**,** SRL-Monitoring (β = .312, p < .001)**,** and SRL-Reflection (β = .266, p = .002) each contributed positively to predicting perceived effectiveness. These findings suggest that students who engage more actively in planning, monitoring, and reflection are more likely to perceive AI tools as beneficial for their academic tasks.

TABLE V: ANOVA[A]

| Sum of Squares | | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Regression | 1200.287 | 3 | 400.096 | 81.893 | .000[b] |
| Residual | 952.688 | 195 | 4.886 | | |
| Total | 2152.975 | 198 | | | |

a. Dependent variables: Perceived outcomes of AI tools
b. Predictors: (Constant), Self-Regulated Learning Reflection, Self-Regulated Learning Planning, Self-Regulated Learning Monitoring

The ANOVA results are reported in Table 5. The model was found to be statistically significant, F (3, 195) = 81.893, p < .001**,** indicating that the combination of SRL dimensions (planning, monitoring, and reflection) reliably predicted the perceived outcomes of AI tools. This confirms that the regression model as a whole provides a meaningful explanation of the variation in students' perceptions.

Table VI: Model Fit

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .747[a] | 0.558 | 0.551 | 2.21033 |

Table 6 provides the model summary for the regression analysis. The results show that the predictors accounted for a substantial portion of variance in perceived effectiveness, with R = .747 and $R^2$ = .558**.** The adjusted $R^2$ was .551, indicating that approximately 55.8% of the variance in perceived outcomes was explained by the SRL dimensions. The standard error of the estimate was 2.21, suggesting an acceptable level of model fit. These results reflect a strong explanatory power of the model, reinforcing the importance of SRL skills in shaping students' positive perceptions of AI tools.

# DISCUSSION

The study sought to investigate the application of artificial intelligence (AI) for supporting self-regulated learning (SRL) among international university students in China, guided by four research questions that are interconnected. The empirical findings make a significant contribution to the literature through the presentation of empirical data on the manners in which AI tools are applied by international students to support SRL planning, monitoring, and reflection processes, in addition to addressing the unique challenges of a cross-cultural learning environment.

### Use of AI Tools to Support SRL

The study results revealed that the majority of the students used AI-driven tools such as ChatGPT, Grammarly, and intelligent tutoring systems on a regular basis to complete academic tasks. This aligns with earlier studies arguing that AI is increasingly at the core of learning activities in higher education (Banihashem et al., 2023; Chan & Hu, 2023). Nonetheless, as students added from the immediacy and personalization of AI, the use of these tools also resonates with arguments regarding over-reliance and reduction of self-directed agency (Fan et al., 2024; Luckin et al., 2016). The findings therefore build on previous research by showing how AI both supports and potentially undermines learners' independent SRL processes in multicultural school settings.

### AI Support for SRL Processes

While the correlational analysis showed strong, positive, and bidirectional relations between planning, monitoring, and reflection ($r = .764–.787$, $p < .001$), which substantiated Zimmerman's (2002) cyclical model of SRL. Regression results also showed that planning ($\beta = .23$), monitoring ($\beta = .312$), and reflection ($\beta = .266$) were significant predictors of students' perceived outcomes, which accounted for 55.8% of the variance. This indicates that AI tools facilitate SRL not in isolation but as paired processes, consistent with Winne and Hadwin's (1998) recursive model. Importantly, the findings indicate that AI facilitates not only just each SRL phase but also creates synergies between them, a contribution bridging macro-level (Zimmerman) and micro-level (Winne & Hadwin) theoretical traditions.

### Perceptions of AI Tools Effectiveness

Students largely perceived AI tools as assisting to enhance academic autonomy, knowledge, and time management. The results are consistent with current research demonstrating AI-powered systems to improve efficiency and learning performance (Shi et al., 2025; Möller et al., 2024). At the same time, the results also demonstrate complex perceptions: students valued AI for crossing linguistic and cultural divides and criticized shallow engagement and lack of further reflection. This inconsistency highlights the two-sidedness of AI in education while it facilitates surface efficiency, it could detract from deeper metacognitive processing unless mediated by critical self-reflection approaches.

### Perceived Challenges When Using AI-Supported SRL

In line with the literature (Zawacki-Richter et al., 2019; Tsai et al., 2020), students cited challenges related to language, cultural mismatch, absence of transparency in AI feedback, and the potential for over-dependence. For students accustomed to teacher-centered teaching, the learner autonomy assumed by AI systems represented additional obstacles to use. These findings offer a valuable cross-cultural insight to existing research by showing that the use of AI among international students is not merely a matter of technological literacy but also of cultural and pedagogical appropriateness.

Cumulatively, the findings confirm the explanatory value of Zimmerman's (2002) and Winne and Hadwin's (1998) SRL models in understanding how AI scaffolds students' planning, monitoring, and reflection. But they also suggest that without careful framework by teachers, AI may risk causing "metacognitive laziness" (Fan et al., 2024). Thereby undermining the very autonomy that it attempts to promote.

# CONCLUSION

According to the results of this study, AI tools play a substantial role in supporting international students in China to acquire independent learning by enhancing planning, monitoring, and reflection. International students favor AI tools as helpful in improving their academic achievement and autonomy however language, culture, and dependence-related barriers still remain significant issues. Hence, by critically applying Zimmerman's, Winne and Hadwin's SRL models, this study therefore reveals that AI does not simply replace human learning strategies but complements them in complex and culture-mediated ways.

### Practical Implications

The findings of this study have several practical implications for stakeholders in higher education institutions. Teachers should incorporate AI tools as scaffolds, not replacements, stressing critical reflection activities that complement AI-generated feedback, rather than superficial reliance on these tools. Furthermore, Universities should also advance responsive AI literacy programs for both students and faculty, by integrating AI literacy based professional development courses in the curriculum to prepare students with the skills to critically assess and employ these contemporary AI resources focusing on ethical use and critical evaluation of AI outputs, particularly for international students who may face unique challenges. At the policy level, these implications draw attention to the need to develop ethical, transparent, and inclusive AI systems that are responsive to equity concerns and enable international students' capacity for independent learning.

### Limitations of the Study

First, the study's focus on self-report survey data might have been subject to biases such as social desirability or selective recall. Second, the cross-sectional design nature of the study might have constrained its ability to make causal inferences between AI tool utilization and self-regulated learning attainment. Third, the study's focus on international students in Chinese universities might limit the generalizability of the findings to other educational and cultural settings. Finally, the exclusive use of quantitative approaches might not fully capture the depth of lived experiences of international students, which qualitative or mixed-methods approaches could have examined in greater depth.

### Directions for Further Research

Future research can extend this work by employing mixed-method designs for ensuring both quantitative breadth and qualitative depth, thereby ensuring both quantifiable results and students lived experiences. In addition, longitudinal studies are also required to investigate how the application of AI tools and self-regulated practices change over time. Besides, cross-cultural comparative studies are anticipated to provide more insights into differences in AI-SRL dynamics in different educational systems and learner backgrounds. Additionally, the mediating variables like digital literacy skills, self-efficacy, and prior learning experience with AI tools, and psychological factors like motivation, trust, and academic integrity that might affect the acceptance of AI-assisted learning among foreign students need to be studied in the future.

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