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Research Paper

Chinese Postgraduates' Use of Metacognitive Strategies in Research Design

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Abstract. This study explored the application of metacognitive strategies by examining the experiences of two Chinese postgraduate students, Mike and Fendy, as they navigated the complexity of the research design stage of their thesis writing. Utilizing semi-structured interviews, observations, and think-aloud protocols, the study analyzed how these students employed planning, monitoring, and evaluation strategies to develop their research questions, select appropriate methods, and manage data collection processes. The findings revealed that both participants tailored their use of metacognitive strategies to their individual research needs, resulting in distinct paths in their respective research design processes. Mike predominantly utilized evaluation strategies, emphasizing the integrity and quality assessment of his work, whereas Fendy excelled in planning and monitoring, focusing on strategic foresight and process adjustments. This study highlighted the significant role of unconscious strategy use, showing that even without deliberate intent, students can be engaged in sophisticated metacognitive practices. These insights contributed to the understanding of metacognition in educational research design, suggesting implications for instructional strategies that can enhance research competencies in academic settings. This research underscored the importance of fostering metacognitive awareness among students to improve their academic and research outcomes.

Keywords: Educational research, metacognitive strategy, research design, thesis writing, postgraduate education.

INTRODUCTION

In the rigorous academic journey of postgraduates in China, where thesis writing not only demands mastery of content but also proficiency in navigating complex cognitive and metacognitive processes, research design emerges as a critical yet challenging component. The prevailing cultural and educational frameworks, deeply rooted in Confucian values and contemporary educational pressures, emphasize respect for authority and collective success. These cultural norms can uniquely shape postgraduates' strategic approaches to complex academic tasks, both supporting and constraining innovative thinking and critical inquiry. Moreover, the existing body of literature, while rich in exploring the constituents and theoretical models of effective research design (Gerring, 2011; King, *et al*., 2021), often overlooks the interplay of metacognitive strategies - planning, monitoring, and evaluating one's own cognitive processes that are crucial for navigating this complexity.

This study seeks to address this gap by not only mapping the metacognitive strategies employed by Chinese postgraduates in research design but also by analyzing the impact of these strategies on the efficacy of their research projects through semi-structured interviews, observations, and think-aloud protocols. In doing so, it offers insights into a domain where cultural and educational contexts pose unique challenges to thesis writing and a broader understanding of the role of metacognition in academic success, building up a foundation for pedagogical

innovations that can enhance research competencies across diverse educational contexts.

Thesis Writing in China: Navigating Cultural and Educational Dynamics

In the landscape of Chinese postgraduate education, the blend of Confucian tradition and contemporary educational pressures crafts a unique context for thesis writing. Confucian values emphasizing respect for authority and collective success shape an academic environment where questioning and innovation are subtly navigated (Li, 2012). This cultural setting, while nurturing respect and diligence, may limit critical inquiry essential for effective research design (Wang and Bai, 2016). For instance, the respect for hierarchical structures may limit the questioning of established norms, thus affecting the planning and evaluation phases of metacognitive strategies employed by students.

Furthermore, the intense focus on academic achievement as a route to social mobility (Zhang, 2014) often increases stress, potentially hindering engagement with complex metacognitive tasks necessary for effective planning, monitoring, and evaluating (Hayat, et. al., 2020). This scenario is exacerbated by educational practices that prioritize rote memorization over critical thinking, posing significant challenges in cultivating the metacognitive awareness necessary for sophisticated research tasks (Chen, 2013; Zhou and Xu, 2015). However, the same cultural emphasis on perseverance (Li and Xu, 2011) and collective effort (Zhao & McDougall, 2008) can also facilitate deeper collaboration and engagement with metacognitive strategies, potentially enhancing research outcomes.

These cultural norms in the Chinese academic environment could subtly shape the metacognitive approaches adopted by students, potentially affecting their ability to question and innovate within their research domains. As such, while the primary focus remains on the cognitive and strategic aspects of research design, a nuanced understanding of these cultural influences is crucial for comprehensively interpreting the findings.

Research Design

Research design, a vital component of a thesis, serves as a logical bridge using empirical data to connect research questions with conclusions. This process, as described by Yin *et al.* (2004), is akin to a journey from the formulation of the research question (“here”) to reaching the derived conclusion (“there”), involving various steps from data collection to analysis. Scholars like Nachmias and Nachmias (1992), Nachmias *et al.* (2015) view research design as a plan that guides the collection, analysis, and interpretation of data, while others, such as Philiber *et al.* (1980), consider it the ‘blueprint’ of research, addressing key questions about the study’s scope, data relevance, collection, and analysis. This conceptualization aligns with O’Sullivan *et al*.’s (2016) perspective, which sees research design as an operational plan encompassing necessary data collection methods, variable measurement, and sampling procedures.

Reflecting this diversity, researchers have operationalized research design into various components. King *et al*. (2021) identify four key components: research questions, theoretical basis, data collection, and data analysis. O’Sullivan *et al*. (2016) extend this to include a literature review, sample determination, and variable measurement. Yin *et al.* (2004) focus on case study design, highlighting elements like the problem, theoretical hypothesis, unit of analysis, and data-hypothesis connection. Creswell *et. al.* (2018) adopt a broader perspective, encompassing philosophical worldviews, research methods, and inquiry strategies.

Each of these viewpoints underscores three pivotal factors: the framing of research questions, the selection and execution of research methods, and the data collection process. These elements form the core of the current study on research design. Moreover, the completion of these elements in thesis writing unfolds with references to prior studies, for example, other researchers’ research perspectives and methodological choices. The research design process is then an inherently complex and non-linear approach that embraces the co-constructive and recursive nature of reading, writing, and researching as supported by Kwan (2008). The participants’ stories in Kwan’s study illustrate how unexpected findings and the development of new research questions can compel students to explore new literature, challenging previous assumptions and enriching their understanding of a research topic. The act of writing itself, as indicated by Lee (1998), serves as a pivotal moment for students to consolidate their understanding, identify gaps, and seek specific literature to address these gaps, which is emblematic of the cyclical and iterative nature of the thesis writing process. The involvement of reading, writing, and researching particularly makes the research design process a sophisticated task that extends beyond mere cognitive execution to include a researcher’s metacognitive awareness. This study centers on how Chinese postgraduates employ metacognitive strategies in navigating the complexities of their research design in terms of generating research questions and choosing research methods, especially the finalization of data collection methods.

Metacognitive Strategy

John Flavell’s (1978) seminal work on metacognition highlights the importance of metacognitive strategies, which he identifies as a crucial component of

metacognitive knowledge - a person's understanding of their cognitive processes and tasks. Oxford (2017) extends this definition, describing metacognitive strategies as tools that aid learners in managing their learning process. Flavell (1979) also links the application of metacognitive strategies to metacognitive experiences, defined as an individual's conscious awareness of their cognitive processes. The use of a metacognitive strategy is essential for achieving cognitive or metacognitive goals through the regulation of cognitive processing. With consistent practice, these strategies develop into advanced executive functions, including planning, monitoring, and evaluating learning activities. Building on this, Brown (1987) and Kluwe (1982) explain that strategy use involves actively monitoring and controlling cognition and behavior, underscoring the conscious nature of metacognitive strategy deployment across various cognitive tasks.

Researchers classify metacognitive strategies variably, particularly within the contexts of reading and writing. There is a consensus that fundamental metacognitive strategies encompass planning, monitoring, and evaluating learning processes. O'Malley and Chamot (2001) define these strategies as planning, selective attention, monitoring, and evaluation. In contrast, Oxford's (2017) categorization includes cognitive planning and resource acquisition, diverging from O'Malley and Chamot's framework by de-emphasizing metacognitive awareness of attention. However, due to its applicability to complex tasks in research design, the current study adopts O'Malley and Chamot's classification. This approach has been widely utilized in language learning and adapted to other cognitive activities, including reading and writing, as demonstrated by researchers like Carrell (1989), Sheorey and Mokhtari (2002), Devine (1993), and Pacello (2014). The current research uniquely investigates these strategies within the intricate framework of research design, which involves substantial reading and writing.

Zimmerman's (2002) Self-Regulated Learning (SRL) model and the Metacognitive Awareness Inventory (MAI) developed by Schraw and Dennison (1994) provide comprehensive insights into metacognitive strategies in academic settings. Zimmerman's model outlines self-regulation through forethought, performance, and self-reflection phrases, enabling students to set goals, monitor progress, and reflect on outcomes. This structured approach to self-regulation complements the metacognitive strategies used in research design. The MAI, meanwhile, assesses individuals' metacognitive awareness, distinguishing between knowledge about cognition and regulation of cognition. Although not used for data collection in this study, the MAI informed our initial stage of open data coding to identify specific metacognitive strategies employed by postgraduates in their research design processes.

Together, Zimmerman's (2002) SRL model and Schraw and Dennison's (1994) MAI enrich the understanding of how the metacognitive strategies observed in the participants interact with their self-regulation and metacognitive awareness in the context of thesis research design. This approach extends the framework established by Flavell (1979) and O'Malley and Chamot (2001), offering a broader spectrum for analyzing successful research design. Though the investigation did not delve deeply into the affective components of metacognition, such as emotional states and self-efficacy, these aspects are nonetheless pivotal in the monitoring strategies employed by postgraduates. This inclusion highlights the complex interplay between cognitive and affective domains in metacognitive processes, underscoring the need for comprehensive approaches in future research.

Metacognitive Strategy Use in Reading and Writing for Research Design

The complexity of thesis writing, particularly in research design, necessitates effective reading and writing strategies. Research by Mokhtari and Sheorey (2002) and Zhang (2010) underscores the significance of these strategies in reading, while targeted training has been shown to improve metacognitive awareness in diverse contexts (Carrell, 1989; Nunan, 1997). These studies highlight the effectiveness of planning, monitoring, and evaluating strategies in improving understanding and retention of information, which are essential for synthesizing and critiquing scholarly texts in research design.

In the realm of writing, Hacker's (2018) model of 'applied metacognition,' illustrates how strategies such as pre-planning and integrating feedback can significantly enhance the quality of writing. This is particularly important given the iterative nature of drafting research design components. Although detailed statistical outcomes are outside the scope of this paper, studies by Azizi *et al*. (2017) and Zhang and Zhang (2022) report significant correlations indicating that metacognitive strategy use is strongly related to improved writing performance.

Recent studies further highlight the importance of metacognitive strategies in research design. Santelmann *et al.* (2018) observed enhanced metacognitive awareness in postgraduate students through structured instructional activities, while Filipović and Jovanović (2016) emphasized how supportive academic environments aid research-related reading and writing. Thesis writing requires a sophisticated integration of reading and writing, prompting postgraduates to employ strategies such as planning, peer assistance, and iterative reviewing. These practices typically involve explicit goals and continuously evaluating task progress (Ji, 2002; Yang and Wang, 2012). The current analysis of individual case studies like those of Mike and Fendy reveals a tailored application of these metacognitive processes, demonstrating the dynamic interaction between reading and writing in research

design. Despite individual differences in strategy preferences, the essential role of metacognitive strategies in navigating the complexities of research design remains clear.

METHODS

A Case Study Methodology

This eight-month study, spanning from April to December 2020, adopted a case study methodology to examine two individual postgraduate students' use of metacognitive strategies in completing their research design. This method has been effectively used in similar educational research, like Santelmann *et al.* (2018), and this study extends it to explore metacognitive strategy use in research design, a relatively unexplored area.

Though the methodology has limitations in generalizability due to the small sample size, the use of the case study method, following Yin *et al.* (2004), was strategic and enabled a detailed chronological examination of events to uncover connections and answer explanatory 'how' questions. By meticulously analyzing two carefully chosen cases, the study reached a deep understanding of the critical metacognitive strategies that impact research design. This careful examination led to the point of saturation, where additional data collection would unlikely yield novel insights. This approach is perfectly aligned with the study's objective to delve into the influence of metacognitive strategies on research design, offering nuanced insights that broad quantitative methods might overlook. Hence, despite the small sample size, the depth and quality of the analysis ensure the provision of substantial insights and robust evidence supporting the significance of metacognitive strategy application in academic research design. This upholds the findings' validity and reliability and underscores this study's contribution to the field despite the inherent limitations of sample size.

Participants

The current study focused on two master's students, Mike and Fendy, both at the initial stages of thesis writing and facing challenges in research design. Mike struggled with grasping the concept of research design, while Fendy was uncertain about formulating research questions. Preliminary interviews revealed their limited understanding of metacognitive strategies, particularly in procedural and conditional knowledge (e.g., how to operate and apply specific skills, and knowing when and why to use strategies).

Despite their limited knowledge in this area, these challenges presented an opportunity to observe and investigate their use of metacognitive strategies. Both participants agreed to engage in the study under the assurance of confidentiality and maintained continuous communication with the researchers.

Data Collection

Data collection was conducted through a combination of interviews, think-aloud methods, and observations. Each participant underwent two 15-minute informal and retrospective interviews and 30-minute think-aloud sessions where they verbalized their thoughts during specific tasks, as outlined by Veenman (2011). Observations were systematically organized, with two 15-minute sessions per participant to assess their application of metacognitive strategies during the research design process.

Each participant also partook in five 40-minute informal interviews, focusing on their research design progression, specifically the development of research questions, methodology, and data collection strategies. These interviews offered insights into their metacognitive processes, revealing their approaches to constructing and evaluating research questions and methodologies. For the think-aloud sessions, participants had 30 minutes to articulate their thought processes during tasks such as literature review and questionnaire development. Follow-up interviews helped clarify critical aspects of these sessions. Supplementary observation data, including electronic and paper materials, provided additional context to the research methods and questions, enriching the primary data collected.

Data Analysis

The analysis employed a grounded theory approach as outlined by Chen (1999), utilizing open coding, axial coding, and selective coding techniques. The analysis began with meticulous open coding to dissect participant responses from interviews, think-aloud transcripts, and observational data, enhancing the robustness and reliability of the findings through a rigorous data triangulation process.

Initially, the first author and a trained graduate student collaboratively coded two interviews to establish preliminary categories, achieving an 85% inter-coder reliability rate. This high consistency validated the coding scheme's accuracy in capturing the nuanced use of metacognitive strategies. Any discrepancies were resolved through detailed discussions, resulting in a refined coding protocol applied uniformly to the dataset, thus ensuring the validity of the findings.

During the open coding phase specific instances were identified where metacognitive strategies like planning and monitoring influenced participants' research design approaches. Axial coding was then used to link these

Table 1. Axial Coding of Fendy's Metacognitive Strategies Use at the Data Collection Stage.

Concept	Subcategory	Category
Assuming lack of data-review	Possible plan	Planning strategies
Pre-set possible results	Default result	
Unreal Data -Reflection Consciously recognise the shortcomings of data	Self-monitoring	Monitoring strategies
Ask afterwards Research subjects understand the question asked	Monitoring of tasks	
Examples-Explanation Refer to other researchers' interview outlines Change strategy	Monitoring of strategies	
Data authenticity Data validity Data fitness Supervisor opinions	Data collection effect	Evaluation strategies
Whether answer the research question Language organisation	Focus	Selective attention strategies
Comparison of other research and self-research	Pay attention to the differences with others	

instances to broader metacognitive engagement, revealing consistent patterns across different stages of the research design process.

For example, Table 1 shows the axial coding for Fendy's data collection stage. Open coding pinpointed key concepts such as 'Assuming a lack of data' and 'Pre-set possible results,' classified under 'Possible plan' and 'Default result' subcategories, respectively. Axial coding connected these two subcategories to form the 'Planning strategies' category. Other insights included coding for 'Self-monitoring' and 'Monitoring of tasks,' with entries such as 'Ask afterward' and 'Research subjects understand the questions asked.' These were integrated into broader categories like 'Monitoring strategies.' Further analysis led to the 'Selective attention strategies' category, encapsulating subcategories like 'Focus,' which examined alignment with the research question, and 'Pay attention to the differences with others,' highlighting comparative analysis.

We opted not to proceed with core coding, which typically aims to identify a central category that integrates all other categories. This decision, while limiting the depth of our analysis, was driven by our focus on exploring metacognitive strategy use rather than developing a new theoretical framework. Consequently, no single category emerged as a comprehensive theoretical framework, but this approach allowed for a detailed descriptive analysis of the metacognitive strategies employed.

RESULTS

Metacognitive Strategies Used in Research Design

The analysis reveals that Mike and Fendy employed metacognitive strategies selectively at different stages of their research design. Both participants utilized strategies of selective attention, planning, monitoring, and evaluation strategies to focus on the logic of research questions, the appropriateness of research methods, and the reliability of data collection as shown in Figure 1. Their planning was detailed, involving the resolution of data collection issues, setting research goals, and managing time efficiently. Monitoring, which extended to assessing their emotional state and the logical structure of their research, occasionally indicates a need for tighter progress oversight due to procrastination. Regular evaluation of their work, including continual dialogue with supervisors, was a cornerstone of their strategy use, aligning with Oxford (2017).

These strategies were interconnected; for example, areas targeted for selective attention were subsequently emphasized in the planning, monitoring, and evaluation phases, albeit sometimes unconsciously. Mike preferred evaluation, assessing data quality and authenticity, while Fendy excelled at planning and monitoring, shaping their distinct research trajectories. This interplay and unconscious strategy use provided further insights into the application of metacognitive strategies in research design, resonating with Wu (2011).

Metacognitive Strategies' Impact on Research Design

Metacognitive strategies distinctly influenced the research paths of each participant. For Mike, selective attention was focused on the logical scope of research questions and method reliability, comprehensive planning addressed data collection challenges, and evaluation included rigorous supervisor interactions. These stages are

Figure 1. Mike and Fendy's Metacognitive Strategy Use in Research Design.

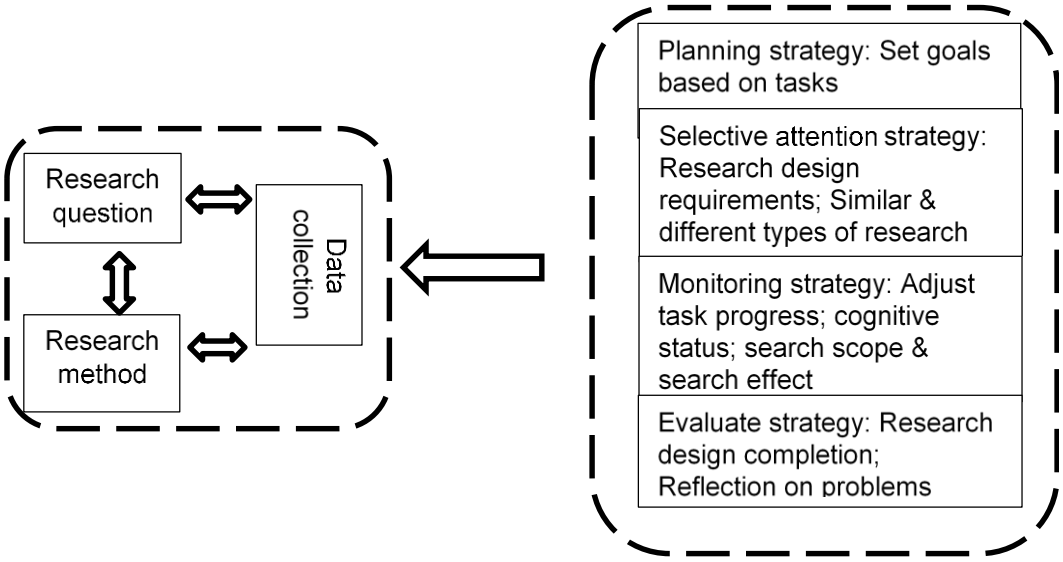
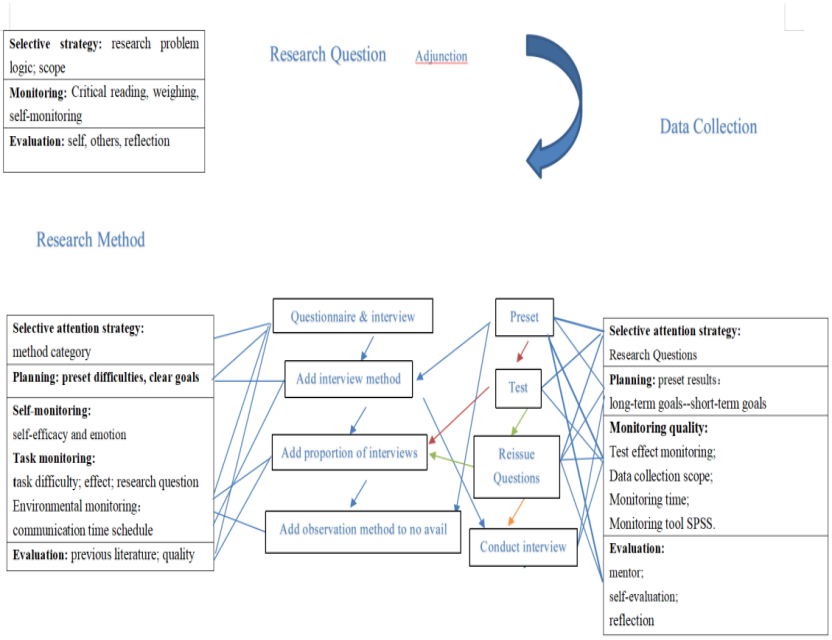


Figure 2. The path of Mike's metacognitive strategy use in research design.



depicted in Figure 2, illustrating Mike's systematic and reflective research design process.

Conversely, Figure 3 portrays Fendy's metacognitive strategy use, showing her adept navigation through research design phases by employing selective attention to ensure question significance, planning for methodological challenges, and evaluating through literature and mentor feedback. Her adaptability is evident in her transition from using questionnaires to preferring interviews based on ongoing evaluations.

Figures 4 and 5 further depict their unique approaches during data collection. Fendy engaged in rigorous monitoring of data authenticity, adapting her methods based on pre-test results and incorporating observational techniques upon evaluating data relevance. Mike, meanwhile, integrated feedback dynamically into his

Figure 3. The path of Fendy's metacognitive strategy use in research design.

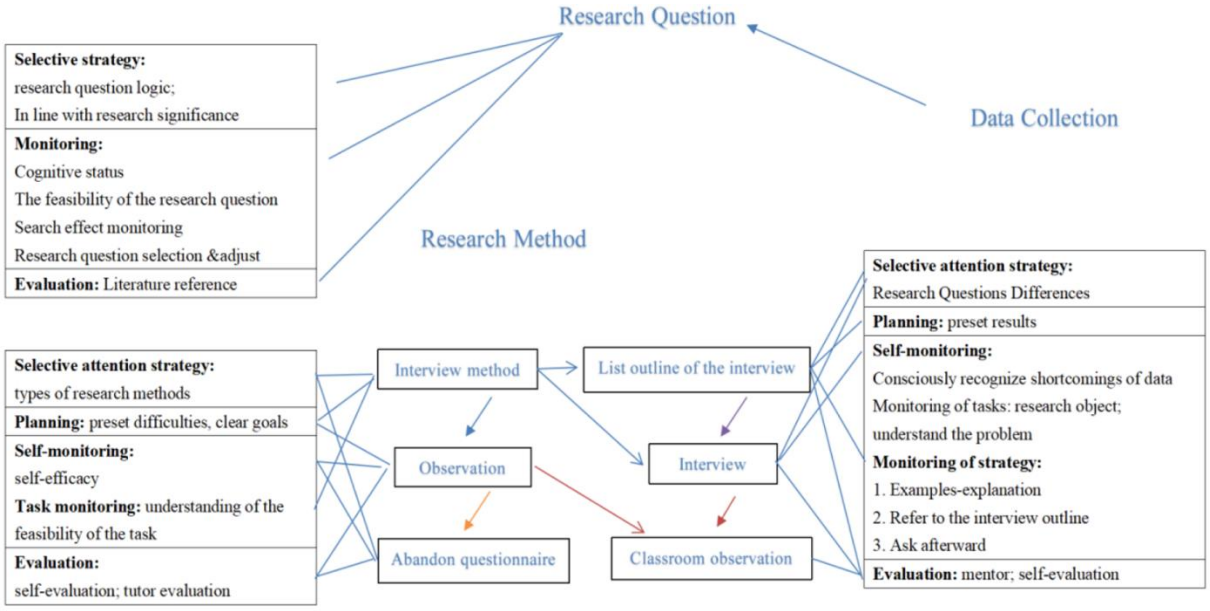
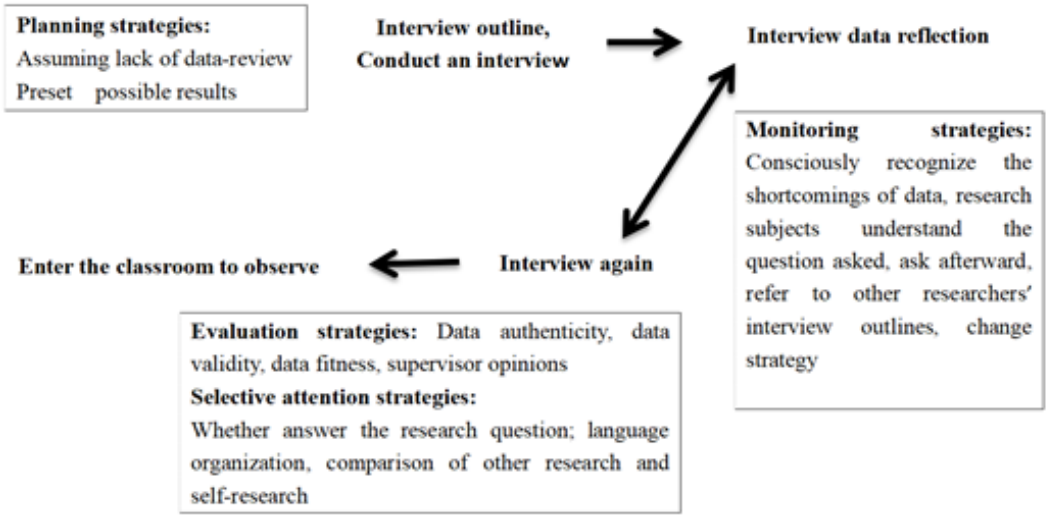


Figure 4. The Path of Fendy's Metacognition Strategy Use at the Stage of Data Collection



methodology, transitioning to emphasize interviews over observations.

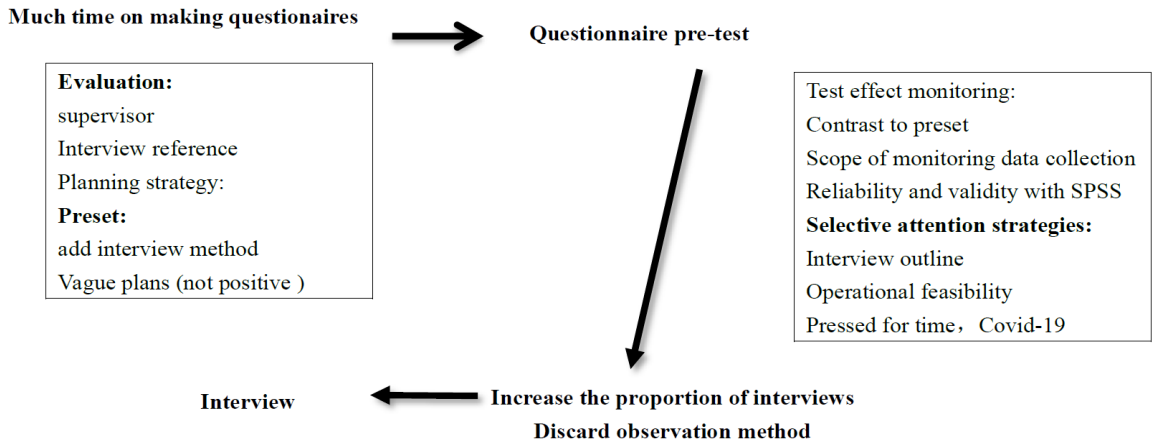
Both participants navigated through cycles of confusion, adjustment, and refinement, effectively shaping their research design to address their hypothesis. This dynamic, illustrated through their strategic use of metacognitive processes, underscores the essential roles of planning and evaluation in enhancing academic research outcomes and informs potential instructional strategies to increase metacognitive awareness during research tasks.

DISCUSSION

Evolving Metacognitive Awareness in Research Design

This study examines the employment of metacognitive strategies by postgraduates, Mike and Fendy, in formulating their research questions, methods, and data collection processes. The researchers of this study observed their use of selective attention, planning, monitoring, and evaluation strategies, which suggest an

Figure 5. The Path of Mike's Metacognition Strategy Use at the Stage of Data Collection



evolving metacognitive awareness in problem-solving contexts. The unconscious application of these strategies may be influenced by the Confucian cultural heritage, which emphasizes memorization and examination. This cultural backdrop could limit exposure to critical thinking and independent problem-solving, potentially affecting the impact of the strategic approaches Mike and Fendy employ in handling complex research tasks. However, this phenomenon also aligns with Santiago Arango-Muñoz's (2011) concept of low-level metacognition, where strategies are applied automatically, without conscious thought. In contrast, high-level metacognition involves a more conceptual and theoretical understanding. The current findings indicate that actively engaging students in their leafrning processes can enhance their research literacy and extend their capabilities beyond mere academic writing (Hacker, 2018; Santelmann *et al*., 2018) to encompass broader, more integrated approaches to research design.

The Role of Academic Support and Community in Enhancing Research Skills

The study emphasizes the pivotal role of supervisor feedback and peer interactions in enhancing research capabilities, supporting Vygotsky's (1978) Zone of Proximal Development theory. These interactions were instrumental in advancing the metacognitive and cognitive abilities of the participants, resonating with findings by Santelmann *et al*. (2018) and Filipović and Jovanović (2016). The benefits of peer feedback (Cho *et al*., 2010; Hull, 1987) and supportive academic environments, which balance external regulation with self-regulation, are evident in improved writing quality and overall academic growth. In their research journey, both Mike and Fendy experienced significant enhancements in their strategic planning and monitoring skills through regular, culturally nuanced interactions with their peers and supervisors. These interactions not only reflect but actively reinforce cultural values such as respect for authority and the prioritization of collective success prevalent in Chinese society. For instance, Mike's adaptation of feedback on his methodology was greatly influenced by his reverence for his supervisor's expertise, demonstrating the practical implications of these cultural values in academic settings.

Application and Impact of Metacognitive Strategies in Research Design

The application of metacognitive strategies, both explicit and implicit, significantly influenced the research designs of Mike and Fendy. Challenges during their research process underscored the value of their strategic planning, attention to detail, monitoring, and evaluation strategies in shaping their final thesis output. The analysis of this study shows that both participants effectively used selective attention to prioritize critical aspects of their research, enhancing the clarity and pertinence of their research questions. This focus facilitated the strategic narrowing of their research scope, aligning with their academic goals.
Meticulous planning was crucial in setting clear research objectives and implementing effective time management strategies, which structured their approach to data collection and helped in proactively addressing potential obstacles. Evaluation strategies played a key role in the iterative refinement of their methodologies, exemplified by Mike's detailed assessment of data integrity, highlighting the iterative reflection process essential to research rigor.
The combined use of selective attention, planning, and evaluation enriched the research design processes, enabling the researchers to overcome initial challenges and achieve well-defined research questions and methodologies. These findings highlight the vital role of metacognitive awareness and its application in academic

research, offering valuable insights for educators. Integrating metacognitive strategies into educational practices can significantly enhance research design competencies, suggesting that such integration can create learning environments that foster metacognitive awareness, thereby enhancing students' research skills.

This study has enhanced the researchers' understanding of metacognitive strategies within postgraduate research design, underscoring their transformative potential and setting the stage for further academic exploration. While the focus on only two Chinese postgraduates using a case study approach limits the generalizability of the findings, these insights are invaluable in highlighting the unique impact of metacognitive strategies on research design. The study contributes to the existing literature by delineating how academic environments influence research practices, as also noted by Filipović and Jovanović (2016).

The study advocates for the integration of metacognitive strategy training in postgraduate education to potentially improve research quality and academic performance. Additionally, future investigations should consider factors such as educational traditions, peer and mentor influences, teacher-student dynamics, and the specific impact of cultural values on learning strategies. Exploring how to measure and optimize metacognitive strategies in research design, and evaluating the effectiveness of various strategy types, are essential for advancing the understanding and appreciation of these strategies in diverse educational settings.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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