

Learning from Cognitive Slips: Reflective Mentoring and Error-Driven Informal Learning in Internship Contexts

Sopingi Sopingi^{1*}, Riana Nurmalasari², Hanggara Budi Utomo³, Buyung Adi Dharma⁴,
Autchariya Krautharot⁵

^{1,2,3,4} Universitas Negeri Malang, Indonesia

⁵ Lampang Rajabhat University, Thailand

*Email: sopingi.fip@um.ac.id

Submitted: December 17, 2025. Revised: January 19, 2026. Accepted: Januari 20, 2026.

Abstract

Background - In the VUCA era, defined by uncertainty and rapid change in professional environments, internships act as critical learning spaces linking academic preparation with professional practice, where students encounter complex cognitive demands and learn through error-driven processes.

Research Urgency - While experiential and informal learning are widely discussed, limited attention has been paid to how interns learn from cognitive errors, particularly attention and memory slips, and how internship design can intentionally address these learning challenges.

Research Objective - This study examines how attention and memory slips operate as cognitive thresholds in informal interns' learning, explores the role of reflective practice in transforming these slips into adaptive learning opportunities, and proposes an integrated internship design model.

Research Method - A qualitative interpretivist constructivist approach was employed involving 30 undergraduate interns across corporate, creative, and educational sectors. Data was collected through interviews, reflective journals, and field observations and analyzed using thematic analysis with cross-case comparison.

Research Findings - Attention slips were linked to cognitive overload and task fragmentation, while memory slips were associated with procedural disruption, fatigue, and the absence of cognitive aids. Supported by psychological safety, reflective supervision, and tools such as digital checklists, these slips became catalysts for informal learning and metacognitive regulation.

Research Conclusion - Attention and memory slips function as developmental thresholds that, when reflectively scaffolded, strengthen cognitive resilience, procedural fluency, and professional judgment.

Research Novelty/Contribution - This study advances a cognitive scaffolding framework that positions attention and memory slips as interconnected triggers for reflective mentoring and error-driven informal learning in internship contexts. The framework contributes theoretically by integrating cognitive error mechanisms into experiential learning discourse and practically by informing the design of reflective and mentor-supported internship structures.

Keywords: cognitive errors, informal learning, internship, professional development, reflection-in-action

How to Cite:

Sopingi, S., Nurmalasari, R., Budi Utomo, H., Adi Dharma, B., & Krautharot, A. (2026). Learning from Cognitive Slips: Reflective Mentoring and Error-Driven Informal Learning in Internship Contexts. *Journal of Nonformal Education*, 12(1), 72-84. <https://doi.org/10.15294/jone.v12i1.39127>

INTRODUCTION

Internships have become increasingly strategic in the VUCA world, serving as essential bridges between academic preparation and professional practice (Leal et al., 2026). Universities now position internships as contextual learning spaces that strengthen students' work readiness, while employers often view internship experience as a more reliable indicator of employability than academic credentials alone (Bolli et al., 2021; Alawamleh & Mahadin, 2022). This shift underscores the growing demand for graduates who can adapt, collaborate, and innovate within rapidly changing organizational environments (Almeida & Morais, 2021). In response, collaboration between higher education institutions and industry has intensified to enhance student learning outcomes. These partnerships promote the development of both technical skills and transversal competencies, such as teamwork, communication, and problem-solving, which are increasingly vital in contemporary organizations (Ferreira et al., 2024). As a result, many internship programs now adopt structured pathways that integrate hard and soft skill development to cultivate well-rounded professional capability (Rego et al., 2022; Jackson et al., 2021).

Experiential learning models provide a strong pedagogical foundation for this shift by enabling students to apply theoretical knowledge in authentic work contexts. Approaches such as project-based and service-learning activities help students build practical competence (Perales-Esteve et al., 2025), while fostering self-awareness, agency, and professional resilience (Maulana, 2023; Kane et al., 2007). Within these environments, emerging scholarship highlights the important role of error and failure in deepening learning. Mistakes can be reframed not as signs of incompetence but as catalysts for reflection, contextual understanding, and skill development (Monk et al., 2025; Ibrahim et al., 2017). When supported by mentoring cultures that normalize failure and encourage constructive dialogue, errors stimulate deeper cognitive processing (Kikalishvili, 2024) and strengthen interns' emotional and metacognitive adaptability (Maulana, 2023).

Parallel to these developments, workplace learning research shows a broad shift from formal instruction to informal learning processes. Informal learning emphasizes knowledge construction through observation, collaboration, and trial-and-error rather than structured teaching (Bhattarai, 2024; Agbaxode et al., 2025). Such processes depend on personal agency, psychological safety, and supportive interactions among mentors and peers, which enable reflective dialogue and encourage situated learning within organizational communities (Anselmann, 2022; Cunningham & Hillier, 2013). Complementing this perspective, Error-Based Learning argues that mistakes trigger critical reflection and contextual awareness, particularly when organizations foster error management cultures that emphasize learning over blame (Zhao et al., 2024; Jonasson, 2014). Emotional and metacognitive preparation further enhances the developmental impact of errors, especially within supervised internship contexts (Lauzier & Clarke, 2023; Cui et al., 2025).

While error-based and informal learning theories recognize a broad spectrum of cognitive errors, not all errors carry the same developmental significance in internship settings. Interns, as novice practitioners, typically operate under conditions of high cognitive load, frequent task switching, and limited procedural automation (Zhu et al., 2025). Under such conditions, attention slips (e.g., lapses in focus, missed cues) and memory slips (e.g., forgetting procedural steps or task sequences) emerge as the most prevalent and disruptive forms of cognitive error (Mylopoulos, 2022). Unlike conceptual misunderstandings or strategic decision errors, these slips are closely tied to working memory limitations and attentional control, which are particularly vulnerable in fast-paced and multitasking workplace environments. From a cognitive-theoretical perspective, these slips reflect momentary breakdowns in attentional regulation and working memory updating rather than deficiencies in conceptual knowledge, making them especially salient indicators of learning under cognitive load.

Importantly, attention and memory slips are also highly amenable to instructional and organizational intervention (Audrit et al., 2021). Cognitive scaffolding tools, such as checklists, workflow cues, and reflective prompts, along with mentor-guided reflection, can directly target these slips by externalizing cognitive demands and supporting metacognitive regulation (Munshi et al., 2023; Richardson et al., 2022). This makes

attention and memory slips especially relevant for internship design, where learning support must be embedded within real-time work processes rather than delivered through formal instruction.

Despite these insights, significant gaps remain in understanding how learning from error unfolds specifically among interns. Much of the existing research focuses on experienced employees, leaving interns' unique developmental challenges understudied (Kieu, 2023). Yet the internship period is highly formative: errors shape emerging competence, professional identity, and resilience (Manasikana & Hartono, 2021). Moreover, while experiential and informal learning research acknowledges the importance of errors, few studies systematically examine how specific cognitive slips, particularly attention and memory errors, can be addressed through intentional internship design. Even fewer investigate how cognitive scaffolding can be embedded into internship systems to strengthen attentional control, procedural accuracy, and adaptive performance.

Addressing these gaps requires a more comprehensive model that connects cognitive processes with reflective learning mechanisms. This study therefore pursues three interconnected objectives. First, it examines the relationship between cognitive slips, particularly attention and memory errors, and the development of interns' informal learning trajectories, including mechanisms underlying attentional lapses, multitasking difficulties, task-switching challenges, and working memory limitations. Second, it analyzes how reflective practice enables interns to reinterpret these slips and transform them into adaptive learning opportunities, functioning as cognitive thresholds that activate metacognitive regulation and resilience. Third, it proposes an integrated internship design model that combines cognitive tools (e.g., attention strategies, digital checklists, workflow cues) with mentoring-based reflective supervision to strengthen interns' attentional control, procedural fluency, psychological safety, and long-term adaptive capacity within organizational settings.

METHOD

Research Design

This study employed a qualitative research design situated within interpretivist and constructivist paradigms, which aligns with the study's aim to understand how interns make sense of cognitive slips, particularly attention and memory errors, as informal learning opportunities during workplace immersion. This orientation enabled an in-depth exploration of interns' subjective meaning-making, reflective engagement, and the cognitive-emotional processes that shape adaptive learning.

The interpretivist stance foregrounded the interns' descriptions of their lived experiences, while the constructivist perspective recognized learning as co-constructed through interactions among interns, mentors, and researchers. Prior evidence underscores the role of mentoring and social support in shaping professional identity and reflective capacity during internships (Wright et al., 2019; Naidoo et al., 2013). Positioning errors within experiential learning further reflects the view that mistakes can serve as triggers for competence building and resilience (Lee & Ahn, 2021; Gonzales, 2022). This design was therefore well suited to illuminate how cognitive errors evolve into informal learning trajectories in dynamic workplace contexts.

Research Setting and Participants

The study was conducted across three professional domains corporate business, creative industries, and educational services to allow comparison across task structures and learning cultures. A total of 30 undergraduate interns participated. Of these, 10 were placed in corporate business settings, 10 in creative industries, and 10 in educational services. All participants had completed a minimum of eight weeks of internship engagement to ensure adequate exposure to real workplace demands. This distribution provided sufficient representation across sectors to explore potential variations in the prevalence and nature of cognitive

errors within different professional contexts. Although this qualitative design does not aim to quantify statistical dominance, the proportional distribution across sectors provides contextual grounding for interpreting whether certain types of cognitive slips appear more salient within specific task environments.

Purposive sampling was utilized to identify interns who had directly experienced task-related cognitive slips and engaged in reflective attempts to address them. This strategy ensured alignment with the research focus on error-driven informal learning. Diversity in academic backgrounds, internship roles, and organizational settings was intentionally sought to enhance the variability and analytical richness of the dataset. Such heterogeneity enabled not only within-case exploration but also cross-sector comparison of how attention and memory slips manifested under different task demands and organizational cultures. This strengthened the study's capacity to examine patterns and divergences across contexts, thereby improving the robustness and transferability of the findings.

Data Collection Procedures

Three complementary data sources were used to capture both reflective and behavioral dimensions of learning: semi-structured interviews, reflective journals, and field observation notes. Semi-structured interviews (60–90 minutes) invited participants to recount episodes of attention lapses, memory failures, emotional reactions, coping strategies, and mentoring support. The flexible format promoted depth while retaining alignment with core analytic categories.

Reflective journals, written during the internship period, provided longitudinal insights into evolving self-awareness, problem-solving approaches, and informal learning processes. Field observations documented naturalistic interactions, error management behaviors, and contextual features of workplace tasks. Triangulation across these sources allowed cross-verification of narrative and behavioral evidence, enhancing the credibility and comprehensiveness of the dataset.

Data Analysis and Trustworthiness

Data analysis followed Braun and Clarke's (2019) six-phase thematic analysis, comprising familiarization, coding, theme generation, review, definition, and reporting. The analytic process began with inductive open coding to capture emergent categories surrounding cognitive slips, emotional responses, and informal learning trajectories. This was followed by a deductive phase connecting the emerging categories with theoretical constructs from Error-Based Learning and Informal Learning Theory to situate the findings within broader conceptual frameworks.

Thematic analysis not only identified recurrent patterns across participants' accounts but also served a configurative function. The emergent thematic structure was synthesized to generate preliminary design principles and formulate a conceptual model for internship learning design. This model integrates cognitive scaffolding mechanisms, such as attention-support tools and procedural aids, with reflective mentoring processes, ensuring that empirical insights directly inform the conceptual framework proposed in this study.

Subsequently, cross-case analysis was conducted to trace how interns progressed from error recognition to reflective reappraisal and adaptive adjustment. This comparative logic made it possible to identify shared mechanisms of cognitive threshold development and resilience building across sectors. NVivo supported systematic data management, coding rigor, and analytic transparency (Hybholt & Spotswood, 2025). To ensure trustworthiness, the study employed multiple strategies: (a) methodological triangulation across interviews, journals, and observations; (b) member checking to validate interpretive accuracy; (c) reflexive journaling to monitor researcher positionality; and (d) audit trail documentation to enhance transparency. Collectively, these procedures strengthened credibility, dependability, and confirmability. Through this rigorous analytic approach, the study elucidates how internships function as potent environments for error-driven informal learning and how cognitive scaffolding can be systematically embedded into internship design.

RESULTS AND DISCUSSION

Attention Slip among Student Interns

Attention slips were identified as a significant cognitive challenge for student interns working in fast-paced environments characterized by intensive multitasking and high levels of digital distraction. Interns often needed to simultaneously respond to instant messages, update enterprise resource planning (ERP) systems, and draft reports, leading to frequent shifts in focus. Neurocognitive research indicates that sustained attention relies heavily on the dorsolateral prefrontal cortex and the anterior cingulate cortex, which are critical for cognitive control (Friedman & Robbins, 2022; Unal et al., 2025). This neurological foundation helps explain why attention slips become more prevalent under multitasking conditions.

The findings of this study demonstrate that attention slips are not caused by a lack of conceptual understanding or technical incompetence, but rather by a misalignment between individuals' cognitive control capacity and the complexity and fragmentation of the work context. In other words, attention slips are more accurately understood as disruptions in attentional regulation under conditions of high cognitive load, rather than as deficits in ability. This interpretation is important because it shifts the analytical focus from individual shortcomings toward a structural understanding of the work demands faced by student interns.

Rapid task-switching was found to exacerbate cognitive load and reduce the stability of reasoning. The pressure to monitor multiple systems simultaneously generated a tangible experience of attentional fragmentation. One participant described the situation as follows: *"At that moment, I had two dashboards open, email notifications kept coming in, and my supervisor asked for a quick update. I noticed that a number had changed, but before I could double-check it, I had already switched to another task. Only afterward did I realize that I had missed an important detail, it felt as if my mind was always one step behind my work"* (Q1).

This experience is consistent with prior research showing that divided attention negatively affects complex reasoning and decision-making (Butt & Warraich, 2022). Within the dual-process theoretical framework, multitasking pressure encourages a shift from deliberate, analytical processing to automatic and intuitive processing (Shrivastava et al., 2025; Xu et al., 2025). This shift explains the emergence of a gap between intended actions and actual performance, allowing attention slips to be interpreted as indicators of the dominance of automatic processing under conditions of limited metacognitive regulation.

Attention slips most frequently emerged during the initial transition phase of internships, when students moved from relatively structured academic environments to dynamic and non-linear work systems. During this phase, fast-paced workflows, repeated interruptions, and demands for immediate responsiveness disrupted attentional continuity. Interns frequently overlooked simple procedural steps, such as saving files or performing final verifications, not due to a lack of knowledge, but because their focus was repeatedly interrupted. Previous studies have shown that fluctuating work pressure negatively affects subsequent attentional performance, making the early adaptation phase particularly vulnerable to attentional lapses (Fresé et al., 2023).

Cross-sectoral analysis revealed that patterns of attention slips varied according to task structure and workplace culture. In the corporate sector, attention slips were most prominent in activities involving simultaneous data monitoring, real-time communication, and the management of multiple digital systems. In creative industries, attention slips more often emerged in contexts of rapid revisions and tight deadlines that required abrupt shifts in focus. In contrast, within the education sector, attention slips were relatively less frequent and were typically triggered by unexpected external interruptions. These variations indicate that attention slips are highly contextual and strongly influenced by work rhythms, task structures, and technological demands across sectors.

Digital fragmentation and exposure to media multitasking further intensified vulnerability to attention slips. Research has shown that sustained exposure to continuous digital stimuli can diminish long-term attentional capacity and reduce task management efficiency (Kokoç et al., 2022; Vedeckina & Borgonovi, 2021). In internship contexts, the complexity of digital interfaces and the demand for rapid responses accelerate attentional fatigue and increase the probability of micro-errors that cumulatively affect performance quality and learning processes.

Despite their disruptive nature, attention slips also possess significant learning value. When accompanied by reflective supervision, attentional lapses become moments of self-awareness regarding the limits of cognitive capacity. In this study, attention slips are framed as situational cognitive thresholds, that is, points at which individuals recognize the limits of their attentional regulation within real-world work contexts. Unlike threshold concepts, which emphasize transformations in conceptual understanding, the thresholds identified here are regulatory and performative in nature, involving transformations in attentional management strategies and work practices.

Consistent with the concept of reflection-in-action (Schön, 1983), attention slips trigger reflection on disruptions in workflow. However, the findings indicate that reflection does not occur automatically. The effectiveness of reflection depends heavily on the presence of psychological safety within mentoring relationships. One participant reflected on this experience as follows: *“At first, I felt embarrassed when I entered the data incorrectly. I was afraid of being seen as careless. But when my supervisor said that mistakes are part of the learning process, I became more willing to talk about them. That’s when I realized that my attention slips happened when I rushed too much. I then started making small notes and pausing briefly before submitting reports”* (Q2).

When supervisors create a safe space for acknowledging errors and discussing their underlying causes, attention slips can be transformed into sources of adaptive learning. Without such conditions, lapses tend to be concealed and fail to develop into meaningful reflection. In this way, the findings extend Schön’s reflective framework and Edmondson’s theory of psychological safety by identifying the cognitive mechanisms through which reflection and psychological safety become effective in internship contexts (Edmondson & Lei, 2024). These findings are particularly relevant for early-stage interns working in environments with high multitasking intensity and significant digital complexity. In contrast, in low-risk routine tasks or among more experienced interns with more developed self-regulation, the frequency of attention slips tends to decrease and their impact becomes more manageable.

Overall, this study demonstrates that attention slips are not merely attentional failures but diagnostic signals of the limits of cognitive control within fragmented work systems. By integrating neurocognitive perspectives, dual-process theory, reflection-in-action, and psychological safety, this study expands understanding of how attention lapses can be transformed into triggers for informal learning. The central contribution lies in demonstrating that attention slips function as regulatory thresholds that, when facilitated through cognitive scaffolding and reflective mentoring, strengthen metacognitive regulation, attentional stability, and the professional maturity of student interns.

Memory Slip as a Cognitive Threshold and Reflective Trigger

Memory slips emerged as a distinct yet interrelated form of cognitive disruption alongside attention slips in the experiences of student interns. While attention slips are associated with failures to sustain focus during task execution, memory slips refer to failures to maintain, update, or retrieve relevant procedural information within an ongoing workflow. In internship contexts, these lapses do not merely reflect weak individual memory capacity; rather, they indicate the operational limits of working memory when individuals are confronted with dynamic, layered, and frequently interrupted task demands.

The findings indicate that memory slips most frequently occurred in situations involving stepwise procedural sequences, such as multi-stage data entry, administrative verification processes, or cross-departmental coordination. Student interns often reported forgetting to complete final steps, overlooking minor

updates, or failing to recall verbal instructions delivered in fast-paced work contexts. One participant described the experience as follows: *“I followed all the steps from the beginning, but at the end of the day I realized that there was one stage I hadn’t clicked yet. It felt like a small piece of the sequence was missing, even though I was sure I had completed everything”* (Q3). Another participant explained: *“The instructions were actually clear when they were given, but after a phone call came in and I was asked to help with another task, the details seemed to evaporate. I had to ask again because I wasn’t confident about the sequence”* (Q4).

These experiences indicate disruptions in working memory updating, defined as the ability to maintain relevant information while replacing outdated information with new inputs within a cognitively limited system (Vedechkina & Borgonovi, 2021). Theoretically, working memory is highly sensitive to cognitive load and distraction. Under conditions of intensive multitasking and frequent interruptions, procedural information that has not yet been automatized is easily degraded, leading to breakdowns in action continuity (Kanaan & Moacdieh, 2022; Grundgeiger & Sanderson, 2022). This explains why student interns who conceptually understand procedures still experience memory slips during practical work execution. Accordingly, memory slips are more accurately understood as disruptions in the continuity of mental representations rather than as deficits in knowledge or ability.

Unlike conceptual errors, which are epistemic in nature, memory slips are performative, as they emerge during real-time task execution when the working memory system fails to maintain the informational traces required to complete procedural sequences in full. One participant stated: *“I knew the workflow exactly because it had been explained and I had even written it down. But while working, I suddenly doubted whether I had already completed the previous step or not. It felt like the sequence became scrambled”* (Q5). Another participant reported: *“As soon as a notification came in and I paused for a moment, when I returned to the screen I needed time to remember where I had left off. Sometimes I just continued, and only later realized that something had been missed”* (Q6).

These findings are consistent with research demonstrating that interruptions and cognitive fatigue significantly reduce procedural retention and cognitive flexibility (Schmitt et al., 2021; Yeo et al., 2023). Cross-sectoral analysis revealed that the occurrence of memory slips varied according to contextual work characteristics. In corporate sectors characterized by complex digital systems, memory slips frequently occurred in document management and administrative processes involving multiple validation stages. One participant from the corporate sector noted: *“In a single document there were several approval stages. I thought I had sent it to the next department, but it turned out I hadn’t pressed the final confirmation button”* (Q7). In creative industries, memory slips more often involved overlooked minor details during rapid revision cycles and tight deadlines: *“During design revisions, I focused on the major changes. But later the client reminded me of a small detail that hadn’t been fixed, even though I had already noted it earlier”* (Q8).

Meanwhile, in the education sector, memory slips typically emerged due to verbal instructions that were not systematically documented: *“The instructions were given while walking to the workspace. I nodded because I thought I understood, but once I arrived, I was no longer sure about the sequence”* (Q9). These variations underscore the contextual nature of memory slips and highlight the influence of procedural automation, documentation structure, and the availability of cognitive supports within the work environment (Panagiotopoulos et al., 2024). These findings extend understandings of error-based learning. Rather than being interpreted as individual failures, memory slips are positioned as situational cognitive thresholds moments when individuals become aware of the limits of their working memory capacity and the need for external regulatory strategies. Such awareness typically emerges after interns experience minor consequences, such as supervisor corrections or the need to repeat procedures. One participant reflected: *“When I was asked to redo the task because a step was missing, I felt disappointed. But that’s when I realized I couldn’t rely on memory alone. I started making small checklists for myself”* (Q10).

Within Schön’s reflective framework, memory slips function as triggers for reflection-on-action, namely retrospective reflection on disruptions in procedural continuity (Korthagen, 2020). However, such

reflection does not occur automatically. This study shows that reflective processes are highly dependent on the presence of psychological safety within workplace relationships. One participant stated: *“I dared to admit that I had forgotten because my supervisor didn’t immediately blame me. We discussed it together, and that made me more aware of how I actually work”* (Q11).

This finding aligns with Edmondson and Lei’s (2024) emphasis on the role of psychological safety in fostering learning from errors. Consistent with the cognitive scaffolding approach developed in this study, memory slips can be mediated through the use of external aids such as digital checklists, systematic reminders, procedural templates, and visual workflows. Several participants described these strategic shifts: *“After forgetting things several times, I started creating workflow templates. That way, I didn’t have to keep everything in my head”* (Q12). *“Digital checklists helped me track my progress. I felt calmer because I knew no step had been skipped”* (Q13).

Previous research demonstrates that such tools effectively reduce execution errors and enhance reflective learning, particularly among novice learners or workers (Crétot-Richert et al., 2023; Leva et al., 2022). In this context, external supports function not only as technical compensations but also as extensions of metacognitive regulation that help stabilize mental representations under conditions of high cognitive load. The boundary conditions of this study indicate that memory slips are more prevalent among early-stage interns who have not yet automated work procedures and in environments characterized by high interruption frequency and digital complexity. Conversely, in work contexts with strong procedural documentation, relatively stable work rhythms, and structured cognitive supports, the frequency of memory slips tends to decline.

Overall, memory slips in this study are reconstructed as diagnostic signals of the limits of working memory capacity within complex and fragmented work systems. By positioning them as regulatory cognitive thresholds, this study demonstrates that memory lapses can become transformative points leading to heightened procedural awareness, the adoption of more effective external strategies, and strengthened metacognitive regulation. The integration of reflection, psychological safety, and cognitive scaffolding enables memory slips to function not as terminal failures, but as triggers for informal learning and professional maturation within internship contexts.

Integrating Attention–Memory Interventions for Reflective Internship Design

Theoretical Implications

Attention slips and memory slips need to be reconceptualized as indicators of ongoing learning processes rather than merely as performance failures. Attention slips generally signal limitations in cognitive control under conditions of intensive multitasking and frequent interruptions, whereas memory slips reveal gaps in procedural fluency and working memory stability. In internship contexts, these two types of slips often co-occur and reinforce one another, forming recurring patterns of cognitive disruption that affect performance consistency.

Theoretically, these findings extend understandings of learning from error by integrating professional reflection, psychological safety, and cognitive regulation. Reflective approaches explain how individuals interpret workflow disruptions as learning opportunities, while psychological safety explains the relational conditions that enable individuals to disclose mistakes without fear (Edmondson & Lei, 2024). However, these frameworks do not fully explicate the cognitive mechanisms underlying the transformation of errors into learning. This study demonstrates that informal learning occurs through the interaction between cognitive capacity limits and structural–relational supports that allow slips to be processed reflectively and systematically.

Practical Implications

Through guided reflection, student interns begin to recognize these recurring slip patterns and develop more adaptive self-regulation strategies. This process is reflected in participants’ narratives describing shifts in their emotional responses to errors. Reflection not only helps correct mistakes but also strengthens

metacognitive awareness of the limits of attentional and memory capacity. From a practical perspective, integrating attention–memory interventions into internship design can be formulated into three core principles. First, the provision of structured cognitive tools, such as digital checklists, procedural templates, and visual cues, embedded within daily workflows to stabilize working memory and reduce cognitive load. Second, the implementation of structured reflective dialogue between mentors and interns, including identification of slips, analysis of cognitive triggers such as multitasking or interruptions, and formulation of preventive strategies. Third, the establishment of psychological safety norms that explicitly encourage error disclosure as part of the learning process. These three principles are complementary: cognitive tools stabilize performance, reflective dialogue processes the meaning of errors, and psychological safety creates the relational conditions necessary for optimal learning.

Adopting a systemic approach that integrates attention-control training, memory-support tools, and reflective engagement has been shown to foster long-term adaptive capacity. Several studies demonstrate that such hybrid models enhance cognitive resilience, metacognitive awareness, and professional adaptability (Heydarikhayat et al., 2024; López & Rivera, 2023). Within this framework, internships are no longer understood merely as transitional phases into professional life, but as dynamic informal learning ecosystems in which errors are constructively managed.

Limitations and Future Research

Despite its contributions, this study has several limitations. First, the participant group consisted exclusively of undergraduate interns, which may limit the transferability of the findings to graduate-level trainees or experienced professionals. Second, the qualitative and cross-sectional design captures reflective experiences at a single point in time and does not allow for examination of developmental change across internship phases. Third, the data rely on self-reported reflective accounts, which may be subject to recall bias and social desirability effects. Finally, as with all interpretive qualitative research, researcher interpretation bias cannot be entirely eliminated despite systematic analytic procedures. Future research should employ quantitative and longitudinal designs to test the effectiveness and generalizability of the proposed cognitive scaffolding framework across sectors, learner levels, and organizational contexts. To operationalize the proposed framework, Table 1 summarizes the core cognitive scaffolding templates that translate the three practical principles into implementable tools.

Tabel 1. Cognitive Scaffolding Templates for Error-Driven Informal Learning in Internship Settings

Component	Template Elements	Purpose
Cognitive Tools Checklist	<ul style="list-style-type: none"> • Task-sequence checklist • Final-step verification box • Progress-tracking indicator • Digital reminders at transition points 	Stabilize working memory, reduce omission errors, and lower cognitive load during multitasking
Reflective Dialogue Steps	<ol style="list-style-type: none"> 1. Identify the slip (what was missed?) 2. Trace the trigger (interruption, multitasking, fatigue) 3. Examine cognitive process (attention or memory breakdown) 4. Formulate prevention strategy 5. Agree on follow-up action 	Transform errors into structured reflective learning and metacognitive regulation
Psychological Safety Norms	<ul style="list-style-type: none"> • Errors framed as learning signals • Non-blaming supervisory language • Explicit permission to disclose mistakes • Regular reflection check-ins 	Enable open error disclosure, reflective dialogue, and adaptive learning

CONCLUSION

This study demonstrates that attention and memory slips among interns are not merely cognitive failures but developmental thresholds that reveal the limits of attentional control and working memory in fast-paced, multitasking-intensive workplaces. Attention slips emerge from cognitive overload and task fragmentation, whereas memory slips arise from disrupted procedural continuity and working memory strain. When supported by reflective mentoring, psychological safety, and structured cognitive scaffolding, these lapses function as diagnostic learning signals that strengthen metacognitive regulation, informal learning, and professional growth. The findings extend error-based and informal learning theories by specifying the cognitive mechanisms that trigger reflection, thereby complementing Schön's reflection-in-action and Edmondson's psychological safety framework with a cognitively grounded account. Practically, the study offers an integrated internship design framework that combines cognitive scaffolding tools, structured reflective dialogue, and psychologically safe supervision. However, this study is limited by its focus on undergraduate interns and its qualitative, cross-sectional design. Future quantitative and longitudinal research is needed to test the effectiveness and generalizability of the proposed model across diverse sectors and learner populations. Overall, reframing cognitive slips as productive thresholds advances a novel understanding of internships as adaptive learning ecosystems that foster cognitive resilience, procedural fluency, and adaptive professional judgment.

REFERENCES

- Agbaxode, P. D., Coffie, G. H., Ahiabu, M. K., Adzivor, E. K., Teku, A., Korsah, J. K., & Ocloo, N. A. (2025). Enhancing informal artisan training in Ghana's construction industry: assessment of learning patterns and project impact. *International Journal of Construction Management*, 1–15. <https://doi.org/10.1080/15623599.2025.2597967>
- Alawamleh, M., & Mahadin, B. K. (2022). Will university internship secure you a job?: interplaying factors from an emerging market perspective. *Education + Training*, 64(4), 491–515. <https://doi.org/10.1108/et-03-2021-0093>
- Almeida, F., & Morais, J. (2021). Strategies for developing soft skills among higher engineering courses. *Journal of Education*, 203(1), 103–112. <https://doi.org/10.1177/00220574211016417>
- Anselmann, S. (2022). Learning barriers at the workplace: development and validation of a measurement instrument. *Frontiers in Education*, 7. <https://doi.org/10.3389/feduc.2022.880778>
- Audrit, H., Beauchamp, M. H., Tinawi, S., Laguë-Beauvais, M., Saluja, R., & De Guise, E. (2021). Multidimensional psychoeducative and counseling intervention (SAAM) for symptomatic patients with mild traumatic brain injury: a pilot randomized controlled trial. *The Journal of Head Trauma Rehabilitation*, 36(4), E249–E261. <https://doi.org/10.1097/htr.0000000000000653>
- Bhattarai, P. C. (2024). Professors' informal learning in their workplace: The case of Nepali university. *The Qualitative Report*. <https://doi.org/10.46743/2160-3715/2024.6492>
- Bolli, T., Caves, K. M., & Oswald-Egg, M. E. (2021). Valuable Experience: How University Internships Affect Graduates' Income. *Res High Educ*, 62(8), 1198–1247. <https://doi.org/10.1007/s11162-021-09637-9>
- Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, 11(4), 589–597. <https://doi.org/10.1080/2159676X.2019.1628806>
- Butt, I., & Warraich, N. F. (2022). Cognitive overload in multitasking environments: Evidence from young professionals. *Applied Cognitive Psychology*, 36(5), 978–992.
- Crétot-Richert, A., Leva, M. C., & Debouzy, J. C. (2023). Assessing cognitive workload in task management environments: Implications for human performance. *Applied Ergonomics*, 107, 103969. <https://doi.org/10.3390/s22186894>
- Cui, F., Jin, Y., Wang, R., Zhang, J., Jin, C., Xu, F., & He, H. (2025). Exploring nursing students' reality shock

- and professional behavioral development in clinical practice: a hermeneutic phenomenological study. *Frontiers in Medicine*, 12. <https://doi.org/10.3389/fmed.2025.1490975>
- Cunningham, J., & Hillier, E. (2013). Informal learning in the workplace: key activities and processes. *Education + Training*, 55(1), 37–51. <https://doi.org/10.1108/00400911311294960>
- Edmondson, A. C., & Lei, Z. (2024). Psychological safety and error learning revisited: The role of adaptive feedback in team learning. *Academy of Management Annals*, 18(1), 175–199. <https://doi.org/10.5465/annals.2023.0021>
- Ferreira, C., Gabriel, B., Valente, R., Andrade-Campos, A., Dias-de-Oliveira, J., Neto, V., & Figueiredo, C. (2024). In search of a more balanced engineering curriculum: the perspective of students, teachers, alumni and employers. *Trends in Higher Education*, 3(1), 142–154. <https://doi.org/10.3390/higheredu3010008>
- Fresé, M., Keith, N., Anand, R., Chapman, S., Rackley, A., Keebler, M., Zientz, J., Hart, J., Baumgartner, S., Schuur, W., Lemmens, J., Poel, F., Chowdhury, F., Elwes, R., Koutroumanidis, M., Morris, R., Nashef, L., Richardson, M., Corriveau, A., ... Song, J. (2023). Cognitive neuroscience of attention and memory dynamics. *Annual Review of Psychology*, 62(1), 749–778. <https://doi.org/10.1348/096317905x37442>
- Friedman, N.P., Robbins, T.W. The role of prefrontal cortex in cognitive control and executive function. *Neuropsychopharmacol.* 47, 72–89 (2022). <https://doi.org/10.1038/s41386-021-01132-0>
- Gonzales, J. (2022). Transformative online mentoring: the student interns’ lenses. *The Normal Lights*, 16(1). <https://doi.org/10.56278/tnl.v16i1.1712>
- Grundgeiger, T., Sanderson, P., MacDougall, H. G., & Venkatesh, B. (2010). Interruption management in the intensive care unit: Predicting resumption times and assessing distributed support. *Journal of experimental psychology. Applied*, 16(4), 317–334. <https://doi.org/10.1037/a0021912>
- Heydarikhayat, N., Leung, K., & Mori, H. (2024). Cognitive slips and adaptive regulation in work-integrated learning: Evidence from engineering internships. *Frontiers in Psychology*, 15. <https://doi.org/10.3389/fpsyg.2024.1498724>
- Hybholt, M. G., & Spotswood, F. (2025). Emotional reflexivity and lifelong leisure time physical activity: managing ‘successful womanhood’ for busy middle-class women. *Sociology of Health & Illness*, 47(2). <https://doi.org/10.1111/1467-9566.70004>
- Ibrahim, R., Boerhannoeddin, A., & Bakare, K. (2017). The effect of soft skills and training methodology on employee performance. *European Journal of Training and Development*, 41(4), 388–406. <https://doi.org/10.1108/ejtd-08-2016-0066>
- Jackson, D., Shan, H., & Meek, S. (2021). Enhancing graduates’ enterprise capabilities through work-integrated learning in co-working spaces. *Higher Education*, 84(1), 101–120. <https://doi.org/10.1007/s10734-021-00756-x>
- Jonasson, C. (2014). Interactional processes of handling errors in vocational school: students attending to changes in vocational practices. *Vocations and Learning*, 8(1), 75–93. <https://doi.org/10.1007/s12186-014-9124-x>
- Kanaan, D., & Moacdieh, N. M. (2022). Eye Tracking to Evaluate the Effects of Interruptions and Workload in a Complex Task. *Human factors*, 64(7), 1168–1180. <https://doi.org/10.1177/0018720821990487>
- Kane, M., Brown, L., McVay, J., Silvia, P., Myin-Germeys, I., & Kwapil, T. (2007). For whom the mind wanders, and when. *Psychological Science*, 18(7), 614–621. <https://doi.org/10.1111/j.1467-9280.2007.01948.x>
- Kieu, Q. (2023). Designing internships for the development of digital skills of agricultural students in vietnam. *Problems of Education in the 21st Century*, 81(5), 627–646. <https://doi.org/10.33225/pec/23.81.627>
- Kikalishvili, S. (2024). Unlocking the potential of GPT-3 in education: Opportunities, limitations, and recommendations for effective integration. *Interactive Learning Environments*, 32(9), 5587–5599. <https://doi.org/10.1080/10494820.2023.2220401>

- Kokoç, M., Ilgaz, H., & Akçay, A. (2022). How deeply does media and technology usage affect the sustained attention? *International Journal of Human-Computer Interaction*, 38(15), 1410–1421. <https://doi.org/10.1080/10447318.2021.2002049>
- Lauzier, M., & Clarke, A. (2023). Linking learning goal orientation to learning from error: the mediating role of motivation to learn and metacognition. *European Journal of Training and Development*, 48(5/6), 485–500. <https://doi.org/10.1108/ejtd-11-2022-0127>
- Leal, M. T., Boixadós-Porquet, A., Castro-Diez, J., García Bernardos, Á., Magaña González, C. R., & Arranz Montull, M. (2026). Integrating VUCA and agile frameworks in work-integrated learning: a higher education case study. *Higher Education, Skills and Work-Based Learning*, 16(1), 69–81. <https://doi.org/10.1108/HESWBL-07-2025-0307>
- Lee, H., & Ahn, M. (2021). Consensual qualitative research on the internship experience and development of career identity of Korean doctors. *BMC Medical Education*, 21(1). <https://doi.org/10.1186/s12909-020-02451-4>
- Leva, M. C., Crétot-Richert, A., & Barcellini, F. (2022). Human factors and cognitive aids: Enhancing safety through design. *Safety Science*, 147, 105582. <https://doi.org/10.3303/CET1977048>
- López, P., & Rivera, A. (2023). Metacognitive adaptation and reflective capacity in experiential learning environments. *Learning and Individual Differences*, 106, 102173. <https://doi.org/10.1016/j.lindif.2023.102173>
- Manasikana, I., & Hartono, H. (2021). Teaching internship program for the development of student teachers' pedagogical competence: students' voices. *Journal of Advanced Multidisciplinary Research*, 2(2), 53–61. <https://doi.org/10.30659/jamr.2.2.53-61>
- Maulana, N. (2023). Toward sustainable higher education: integrating soft skill development into business school curriculum in Indonesia. *Journal of Law and Sustainable Development*, 11(4), e325. <https://doi.org/10.55908/sdgs.v11i4.325>
- Monk, D., Molebatsi, P., McGrath, S., Metelerkamp, L., Adrupio, S., Openjuru, G., & Tshabalala, T. (2025). Revisiting VET research paradigms: Critical perspectives from the South. *Journal of Vocational Education & Training*, 77(3), 683–705. <https://doi.org/10.1080/13636820.2023.2280972>
- Munshi, A., Biswas, G., Baker, R., Ocumpaugh, J., Hutt, S., & Paquette, L. (2023). Analysing adaptive scaffolds that help students develop self-regulated learning behaviours. *Journal of Computer Assisted Learning*, 39(2), 351–368. <https://doi.org/10.1111/jcal.12761>
- Mylopoulos, M. (2022). Oops! I did it again: The psychology of everyday action slips. *Topics in Cognitive Science*, 14(2), 282–294. <https://doi.org/10.1111/tops.12552>
- Naidoo, L., Jackling, B., & Natoli, R. (2013). Enhancing learning through reflection: An analysis of student internship experiences. *Accounting Education: An International Journal*, 22(1), 45–68. <https://doi.org/10.1080/09639284.2012.682010>
- Panagiotopoulos, P., Kim, J., & Chen, Z. (2024). Digital complexity and cognitive load in organizational learning. *Computers in Human Behavior*, 156, 107154.
- Perales-Esteve, M. A., Luis, S. Y., & Vega-Leal, A. P. (2025). From Project-Based Learning to Service Learning: A Practical Approach. *IEEE Revista Iberoamericana de Tecnologías Del Aprendizaje*, 21, 1–8. <https://doi.org/10.1109/RITA.2025.3644011>
- Rego, M., Sáez-Gambín, D., González-Geraldo, J., & García-Romero, D. (2022). Transversal competences and employability of university students: converging towards service-learning. *Education Sciences*, 12(4), 265. <https://doi.org/10.3390/educsci12040265>
- Richardson, J.C., Caskurlu, S., Castellanos-Reyes, D. et al. Instructors' conceptualization and implementation of scaffolding in online higher education courses. *J Comput High Educ* 34, 242–279 (2022). <https://doi.org/10.1007/s12528-021-09300-3>
- Schmitt, A., Sonnetag, S., & Wiese, B. S. (2021). Fatigue and performance dynamics in professional development contexts. *Journal of Vocational Behavior*, 130, 103636.

<https://doi.org/10.1177/10690727221120367>

- Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. Basic Books.
- Shrivastava, S., Bhanja, M., & Khati, K. (2025). Multi Tasking Proficiency Measurement in High Pressure Business Environments. *TPM–Testing, Psychometrics, Methodology in Applied Psychology*, 32(S1), 854–859.
- Unal, Z. E., Park, Y., Simsek, E., Menon, V., & Geary, D. C. (2025). Neurodevelopmental commonalities in cognitive control networks for mathematics and reading in meta-analysis of 3308 participants. *Nature Communications*, 16(1), 8398. <https://doi.org/10.1038/s41467-025-63259-8>
- Vedechkina, M., & Borgonovi, F. (2021). A review of evidence on the role of digital technology in shaping attention and cognitive control in children. *Frontiers in Psychology*, 12, 611155. <https://doi.org/10.3389/fpsyg.2021.611155>
- Wright, T., White, D., & Hiley, A. (2019). Mentoring, reflection, and identity: Shaping professional learning through internship programs. *Teaching and Teacher Education*, 84, 210–221. <https://doi.org/10.1016/j.tate.2019.05.007>
- Xu, F., Liu, A., & Li, X. (2025). Victimization mechanisms and countermeasures in telecom network fraud: a dual-system theoretical perspective. *Frontiers in Psychology*, 16, 1637935. <https://doi.org/10.3389/fpsyg.2025.1637935>
- Yeo, R. K., Lee, J. Y., & Carter, S. (2023). Cognitive adaptability and error resilience in experiential learning environments. *Learning and Instruction*, 86, 101768.
- Zhao, X., Lee, S., & Park, Y. (2024). Hybrid work-integrated learning models for employability in the digital age: Evidence from higher education. *Journal of Education and Work*, 37(2), 141–162.
- Zhu, L., Wei, S., An, Y., Hu, W., & Xie, X. (2025). Mechanism, contributing factors, and coping strategies of alarm fatigue in intensive care nursing: A qualitative study. *Frontiers in Public Health*, 13, 1654389.