Integrating The Flower and Hayes' Cognitive Process Model with the SOAR Writing Framework in Mobile Supported Synthesis Instruction

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ABSTRACT

Synthesis writing remains one of the most challenging academic writing skills for tertiary learners, particularly in English-medium instruction (EMI) contexts, due to its high cognitive and metacognitive demands and the lack of explicit instructional scaffolding. While the Flower and Hayes (1981) Cognitive Process Model provides a robust theoretical account of the mental processes involved in writing, it offers limited guidance on how these processes can be operationalised into teachable strategies for synthesis instruction. At the same time, the SOAR strategy (Select, Organise, Associate, Regulate) has been shown to support learning from multiple texts, yet its theoretical alignment with cognitive writing models remains underexplored. This conceptual paper addresses this gap by systematically integrating the Flower and Hayes Cognitive Process Model with the SOAR writing framework as the pedagogical foundation of the SEESOAR mobile learning module. Specifically, the paper maps each SOAR component onto key cognitive writing processes, namely planning, translating, and reviewing, in demonstrating how complex cognitive behaviours in synthesis writing can be transformed into structured, teachable, and mobile-supported learning tasks. The integration is discussed within the context of instructional design for tertiary learners in EMI environments, highlighting implications for Technology-Enhanced Language Learning (TELL) and Mobile-Assisted Language Learning (MALL). The paper contributes a theory-driven instructional model that is expected to enhance learners' cognitive engagement, metacognitive awareness, and synthesis writing proficiency in higher education settings.

Keywords: Cognitive Process Theory, SOAR Strategy, Synthesis Writing, Mobile-Assisted Language Learning (MALL), Instructional Design

INTRODUCTION

In tertiary education, especially within English-medium instruction (EMI) contexts, synthesis writing is often viewed as one of the most challenging academic writing skills. This complexity stems from the multifaceted nature of synthesis, which requires learners not only to comprehend multiple source texts but also to integrate, reorganise, and rearticulate the information coherently and purposefully. The cognitive demands of synthesis writing are particularly pronounced in EMI settings where students must process and articulate complex academic content in a second or foreign language. Despite its critical importance, many learners are not explicitly taught how to engage in synthesis writing, resulting in fragmented understanding, surface-level integration, and mechanical reproduction of source texts. This gap points to an urgent need for pedagogical frameworks that not only clarify the mental processes involved in synthesis writing but also translate those processes into structured, teachable strategies.

In English for Academic Purposes (EAP) contexts, synthesis writing plays a crucial role in developing higher-order cognitive skills, including critical analysis, evaluation, and integrative reasoning. Unlike summarisation or descriptive writing, synthesis requires learners to actively select, reorganise, and connect ideas from multiple sources to construct new meaning (Nelson & King, 2023). Despite its importance for academic tasks such as literature reviews and professional communication, synthesis writing is often insufficiently scaffolded in tertiary curricula. As a result, learners frequently engage in surface-level reporting rather than meaningful integration,

underscoring the need for pedagogical frameworks that explicitly support the cognitive and metacognitive demands of synthesis writing.

This capability is especially vital for students preparing for professional roles that demand advanced problem-solving and leadership competencies, as it trains them to adeptly merge diverse information into persuasive and coherent documents (Simonovic et al., 2023). Moreover, the current emphasis on synthesis addresses a persistent gap in many educational systems, where instructional priorities tend to focus on foundational writing skills rather than cultivating advanced integrative abilities (Jalleh & Mahfoodh, 2021; Mateos et al., 2020). By prioritising synthesis writing, this study seeks to empower students with the analytical and compositional tools required to meet the increasingly complex expectations of academia and the workplace. The central focus on synthesis writing in this study is further justified by its integral role in academic tasks such as literature reviews, which are foundational to academic achievement and scholarly identity (Nikbakht & Miller, 2023).

As this chapter progresses, it will examine the cognitive frameworks that underpin synthesis writing, namely the knowledge-telling and knowledge-transforming model, and present a synthesis of strategies, culminating in the discussion of the SOAR strategy as a pedagogical framework to support structured and effective synthesis writing instruction. In addition to the model, the chapter will also explore the Information Processing Theory and the Selection-Organisation-Integration (SOI) model, both of which provide critical insights into how learners attend to, structure, and internalise information. Most significantly, this chapter will highlight the integration of the Flower and Hayes (1981) cognitive writing model into the SOAR strategy, illustrating how complex cognitive processes involved in writing are operationalised into teachable, scaffolded instructional phases through the SEESOAR mobile learning module.

Guided by the need to bridge cognitive writing theory and instructional practice, this conceptual paper aims to examine how the Flower and Hayes (1981) Cognitive Process Model can be systematically integrated with the SOAR strategy (Select, Organise, Associate, Regulate) to support synthesis writing instruction. Specifically, the paper seeks to:

(1) analyse the cognitive demands of synthesis writing through established writing and learning theories;
(2) map the components of the SOAR strategy onto the planning, translating, and reviewing processes in the Flower and Hayes model; and
(3) propose a theoretically grounded framework for operationalising synthesis writing instruction within a mobile-assisted learning environment through the SEESOAR module.

Rather than presenting empirical findings, this paper offers a theory-driven instructional model intended to inform the design of synthesis writing pedagogy in English-medium instruction (EMI) contexts.

Knowledge-Telling and Knowledge-Transforming Model

To better understand the variation in learners' approaches to synthesis writing, Scardamalia and Bereiter's (1987) dual-model framework provides a useful lens for examining the cognitive behaviours of novice and expert writers. They introduced two foundational models of writing: the *knowledge-telling model*, which characterises the writing approach of novice writers, and the *knowledge-transforming model*, which captures the more complex and reflective writing processes of skilled or expert writers. These models differ significantly in how writers retrieve, plan, and generate written content. They serve as a theoretical basis for understanding the cognitive development required for high-quality academic writing.

The knowledge-telling model explains how novice writers tend to approach writing as a linear and direct reporting task. Upon receiving a writing prompt, these writers retrieve information from long-term memory and transcribe it with minimal planning or restructuring. The organisation of their text often mirrors the associative flow of their thoughts, lacking deeper integration or critical engagement. In contrast, the knowledgetransforming model reflects how expert writers approach writing as a problem-solving activity. These writers spend more time analysing the writing task, developing elaborate and adaptive writing plans, and continuously evaluating their output against their initial goals. Throughout the writing process, knowledge transformers consistently demonstrate high levels of self-regulation, often revising their drafts to improve clarity, coherence, and content

quality. This recursive process encourages deeper reflection and leads to the construction of new knowledge, effectively transforming what the writer knows through the act of writing.

Table 1. Knowledge-Telling and Knowledge-Transforming

Model	**Knowledge-telling**	**Knowledge-transforming**
Writer	Novice writers	Expert writers
Writing process	Text production is guided by the direct retrieval of content from long-term memory and is organised solely by the associative relationships between content as it is stored in long-term memory	They develop more elaborate plans before writing, modify and elaborate these more radically during writing, and revise their initial drafts of texts more extensively
Written product	Reporting what is stored in writers' knowledge	Show much more evidence of reflective thought during writing
Writing approach	A direct task execution model which did not employ any complexity or problemsolving activity on the writer's part	In a constant problem-solving process, which required continuous content generation and planning

Scardamalia and Bereiter's models have since influenced numerous writing studies, especially in the field of synthesis writing. Their distinction between novice and expert writing processes has encouraged researchers to analyse how students at different proficiency levels engage in synthesis. Notably, synthesis writing researchers such as Luo and Kiewra (2019) have observed that novice writers often adopt a knowledge-telling approach, where they simply report on what they have read without meaningful integration. Skilled writers, however, embody the knowledge-transforming model by engaging in strategic analysis, reorganisation, and synthesis of information drawn from multiple texts (Mateos & Solé, 2009; Nelson & Hayes, 1988; Neuwirth & Kaufer, 1989).

Figure 1. Synthesis Writing Process

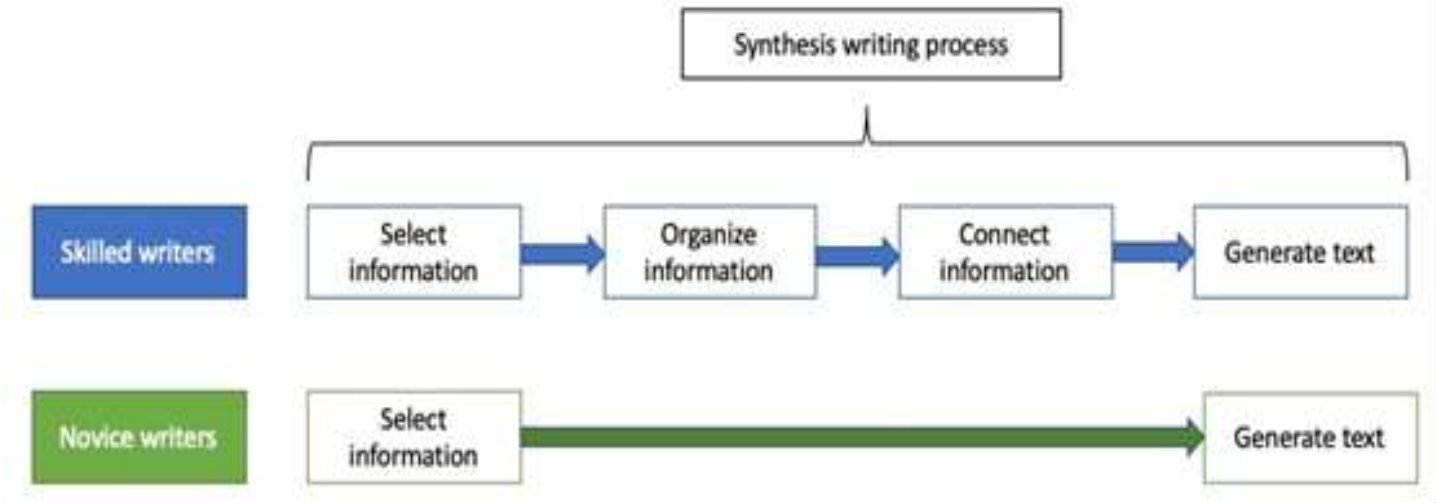


Figure 1 illustrates the process for synthesis writing (Scardamalia & Bereiter, 1987). Empirical studies indicate that novice writers typically perform synthesis writing in just two steps: (1) selecting important information from source texts, and (2) producing an essay that reports the selected content.

Skilled writers, on the other hand, demonstrate a more elaborate four-step process: (1) selecting the important information, (2) accumulating information externally using tools such as compare-contrast tables, (3) analysing intertextual relationships and constructing a coherent writing plan, and (4) producing the final synthesis essay

following that plan. These additional steps, particularly organising and associating information across texts, are what elevate synthesis writing to a knowledgetransforming task. The process not only enables learners to write better but also reshapes their understanding of the topic as they refine and reconstruct their knowledge.

In essence, the distinction between these two models underscores the developmental trajectory that learners must undergo to move from surface-level reporting to deep synthesis. Synthesis writing, therefore, must be supported with strategies and instruction that cultivate planning, organisation, connection-making, and selfregulation. Without structured guidance, learners may remain stuck in the knowledge-telling phase, producing writing that lacks coherence, critical insight, and academic depth. As such, pedagogical interventions should aim to facilitate this transformation by fostering the skills and habits of mind associated with expert writing.

Taken together, the distinction between knowledge-telling and knowledge-transforming writing underscores the need for instructional strategies that explicitly support planning, organisation, and integration across multiple sources. Understanding this developmental trajectory provides a foundation for examining the specific strategies learners employ, or fail to employ, when engaged in synthesis writing tasks.

Synthesis Writing Strategies

Although synthesis writing is widely acknowledged as a knowledge-transforming task that demands higherorder thinking and integrative reasoning (Wiley & Voss, 1999), many tertiary learners continue to rely on surface-level strategies that align more closely with knowledge-telling practices. These learners often default to simply reporting or paraphrasing what they have read, rather than engaging in the deeper cognitive processes required to produce genuinely synthesised text (Addison & McGee, 2010; Dovey, 2010; Mateos & Solé, 2009; Neuwirth & Kaufer, 1989; Solé et al., 2013). This discrepancy between theoretical expectations and actual student performance highlights a pressing pedagogical challenge in English for Academic Purposes (EAP): the need to scaffold synthesis writing with more effective, transformational strategies.

Empirical evidence further reinforces this concern. In a study conducted by Spivey (1989), a comparative analysis of student essays and their source texts revealed that over half of the sentences in students' synthesis essays were paraphrased or directly quoted from the source materials. An additional quarter of the content consisted of summarised ideas from individual texts, while less than ten per cent reflected proper synthesis, where information from two or more sources was combined and restructured. Similarly, Luo and Kiewra (2019) found that when learners were left to apply their own strategies without structured guidance, the resulting synthesis writing was largely ineffective. These findings further highlight the persistence of surface-level synthesis practices in tertiary writing contexts.

Among the most commonly used strategies in synthesis writing are note-taking and summarisation. However, while these methods are frequently employed by learners, they are not sufficient to produce highquality synthesis essays. Note-taking, for example, is often used as a pre-writing strategy in which learners extract key information from source texts (Dovey, 2010; Mateos & Solé, 2009; O'Hara et al., 2002; SegevMiller, 2007). However, the linearity of this method often results in limited integration across sources. (Neuwirth & Kaufer, 1989). This practice tends to result in shallow, fragmented essays that lack integration and coherence.

A particular concern with note-taking as a sole strategy is the phenomenon of *plagiphrasing*, a term coined by Krishnan and Kathpalia (2002, p.193) to describe the act of copying information verbatim or with minor alterations into one's essay, often without synthesis or original contribution. While note-taking can assist in identifying relevant content, it does little to promote the reorganisation or conceptual linking of ideas across multiple sources (Katayama & Robinson, 2000; Robinson & Kiewra, 1995). This leads to low-level synthesis products such as *patchwriting* and *tag-all writing*. Patchwriting refers to a practice in which phrases and sentences are lifted from various sources and pieced together without meaningful transitions or conceptual integration (Barks & Watts, 2001; Campbell et al., 1998; Garner, 1987; Jaidka et al., 2013). Tag-all writing, by contrast, occurs when students list multiple points from different texts in a linear, unconnected fashion, offering little synthesis and cohesion (Britt et al., 1999; Britt & Rouet, 2012).

Summarisation is another frequently used strategy in synthesis writing, but this strategy too presents limitations when applied without a synthesis-oriented framework. Although summarisation may support the understanding

of individual texts (Dunlosky et al., 2013; Thiede & Anderson, 2003), it does not facilitate comprehension across multiple texts (Bednall & Kehoe, 2011). Students who summarise one source at a time tend to organise their essays according to the structure of each source, resulting in *separate representation writing*, a format that mirrors knowledge-telling and fails to generate new, integrated insights (Hidi & Anderson, 1986; Hill, 1991; Taylor & Beach, 1984).

Separate representation writing, which is characterised by a hierarchical but disconnected layout, promotes piecemeal content processing. Rather than synthesising insights across texts, learners present each source in isolation, thereby diminishing the analytical and evaluative depth of their work. Such approaches are consistently associated with low-quality synthesis outcomes (Garner, 1987; Dovey, 2010; Mateos & Solé, 2009).

In summary, the prevalence of note-taking and summarisation as default strategies underscores a persistent gap between student practices and the cognitive demands of synthesis writing. These methods, though foundational, do not inherently promote integration, evaluation, or transformation of knowledge. To bridge this gap, instructional approaches must extend beyond basic strategy training and focus on developing learners' abilities to select, organise, connect, and critically evaluate information from multiple sources. The following section will examine how one such model, the SOAR strategy, provides a structured, evidence-based approach for addressing this challenge.

While existing strategies such as note-taking and summarisation offer partial support for managing source texts, they fall short in guiding learners toward higher-level integration and self-regulation. This limitation highlights the need for a more comprehensive, process-oriented framework, which the SOAR strategy seeks to address.

The SOAR Strategy

The SOAR strategy system was initially conceptualised to support tertiary learners in navigating the complex task of learning from multiple texts (Daher & Kiewra, 2016; Jairam & Kiewra, 2009, 2010; Kiewra, 2005). Designed to enhance both student learning and instructional delivery, SOAR stands for Select, Organise, Associate, and Regulate. These four interrelated cognitive and metacognitive components form a comprehensive strategy for managing academic content. Although initially developed as a general learning system, SOAR has since gained recognition as a robust instructional scaffold for tasks that demand higher-order thinking, particularly synthesis writing.

Each component of the SOAR framework targets specific stages of the learning and writing process. The *Select* component emphasises the extraction and recording of complete and relevant information from lectures or texts, a practice aligned with the foundational cognitive operation of attention and encoding. The *Organise* component requires learners to structure their selected notes using graphic organisers such as hierarchies, sequences, matrices, and concept maps, thereby facilitating better retention and understanding through structured representation. The *Associate* component focuses on making meaningful connections among ideas across texts rather than analysing facts in isolation. Finally, the *Regulate* component incorporates self-assessment and retrieval-based strategies, such as self-testing, which are more effective than passive methods like rereading or recopying notes. This final step is crucial in fostering metacognitive awareness and long-term learning (Kiewra, 2009).

In the context of synthesis writing, SOAR has demonstrated promising potential. Luo and Kiewra (2019) conducted two experimental studies to evaluate the effectiveness of SOAR as an instructional tool for synthesis essay construction. In the first experiment, participants were provided with four source texts on creativity and asked to write a synthesis essay. One group received SOAR supplements, materials designed to scaffold the Select, Organise, Associate, and Regulate processes, while the control group did not. As hypothesised, the group that utilised the SOAR supplements produced significantly better synthesis essays. Their writing demonstrated improvements in information selection, organisation, and intertextual connection, confirming the utility of SOAR for synthesis writing.

The second experiment extended this inquiry by introducing SOAR as a trainable strategy. Participants first completed a baseline synthesis essay and were then divided into two groups: one received SOAR training while the other relied on their usual writing strategies. When asked to write a second synthesis essay, the SOARtrained

group showed marked improvements in both information selection and essay organisation. However, intertextual connection remained a challenge, indicating that limited training time may not be sufficient to fully internalise this component. Luo and Kiewra (2019) concluded that a more sustained and structured intervention, spanning multiple sessions, would be necessary to fully embed the strategy and maximise its benefits. This is supported by other studies in synthesis writing, which argue that longer-term interventions provide learners with more opportunities to internalise and apply complex writing strategies (Kirkpatrick & Klein, 2009; Martínez et al., 2015; Reynolds & Perin, 2009).

The efficacy of SOAR also aligns well with theoretical frameworks in writing research. Specifically, it supports the planning stage in the Flower and Hayes (1981) cognitive model of writing, which emphasises the recursive nature of planning, translating, and reviewing. Synthesis writing demands additional cognitive load at the planning stage due to the requirement of comprehending and integrating information from multiple texts. SOAR addresses this by providing learners with explicit strategies to manage selection, organisation, and association processes before moving to actual text production. As such, it facilitates the transformation of knowledge, rather than mere reporting, thereby aligning with the knowledge-transforming model proposed by Scardamalia and Bereiter (1987).

Further reinforcing SOAR's utility, Goswami (2020) conducted a study that examined the impact of SOAR on learners' abilities to synthesise and apply knowledge across academic contexts. The findings revealed that students who employed SOAR demonstrated superior performance in tasks requiring the integration of complex information. These students not only retained information better but were also more adept at applying concepts to novel situations. Goswami argued that SOAR enhances learning outcomes by fostering deeper engagement with content and strengthening cognitive processes like inference-making, pattern recognition, and reflective thinking.

By encouraging learners to systematically select key ideas, organise them coherently, associate them meaningfully, and regulate their understanding through reflective practices, SOAR empowers students to engage in more effective synthesis writing. Moreover, the strategy is adaptable across different educational contexts, including both traditional and technology-enhanced settings. This flexibility makes SOAR a robust framework for instructional design, especially in mobile-assisted environments such as SEESOAR, where learners benefit from guided, self-paced learning modules.

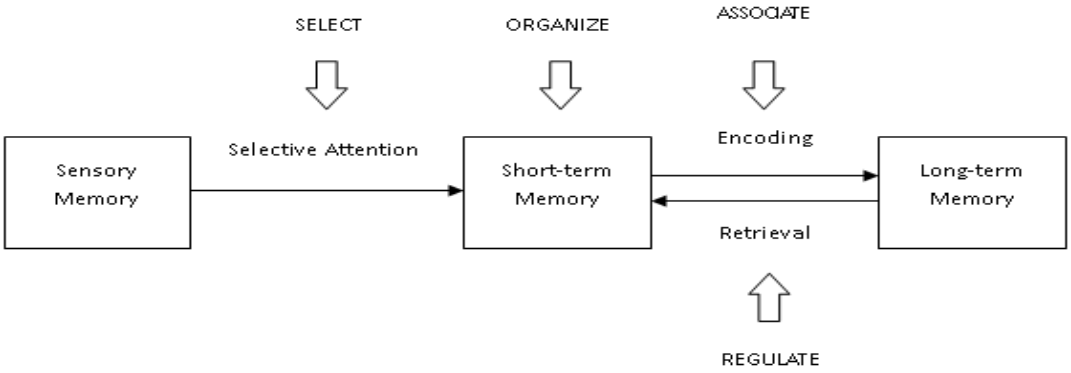
In summary, the SOAR strategy provides a research-grounded, pedagogically sound scaffold for synthesis writing. It addresses core issues identified in previous chapters, including the limitations of note-taking and summarisation and the challenges faced by novice writers. By operationalising the cognitive and metacognitive demands of synthesis into a teachable framework, SOAR holds significant promise for improving academic writing outcomes in higher education. The next chapter will explore how this strategy has been translated into SEESOAR, a mobile learning module designed to support synthesis writing in English for Academic Purposes (EAP) contexts.

To further substantiate the cognitive validity of the SOAR strategy, it is necessary to situate it within broader theories of human information processing that explain how learners attend to, encode, store, and retrieve information during complex learning tasks such as synthesis writing.

Information-Processing Theory

The Information-Processing Theory (Atkinson & Shiffrin, 1971) offers a foundational framework for understanding how learners acquire, retain, and retrieve information. According to this model, human memory is organised into three interrelated systems: sensory memory, short-term memory (also referred to as working memory), and long-term memory. Sensory memory briefly holds incoming stimuli from the environment. When learners consciously direct their attention to selected stimuli, the information transitions to short-term memory. Through encoding, which means a process of organising and associating information with prior knowledge, this information may be stored in long-term memory. Retrieval allows the stored information to be accessed and utilised for cognitive tasks such as writing, problem-solving, and decision-making. This cyclical process of attention, encoding, storage, and retrieval is central to effective learning, as illustrated in Figure 2.

Figure 2. Information-Processing Theory



The SOAR strategy aligns closely with this theoretical model by actively engaging learners in each stage of cognitive processing. The *Select* phase enhances selective attention, a key function of sensory memory, by guiding learners to identify and record essential information from multiple texts. The *Organise* phase supports short-term memory through the structuring of content using visual organisers, allowing learners to manage cognitive load and create meaningful representations. In the *Associate* phase, learners are prompted to make connections across texts and with prior knowledge, thereby facilitating encoding and improving long-term retention (Mayer, 1996; Moreno, 2010). Finally, the Regulate phase promotes retrieval through metacognitive activities such as self-testing and reflective assessment, which reinforce the transfer of learning to new contexts (Gettinger & Seibert, 2002; Karpicke, 2012).

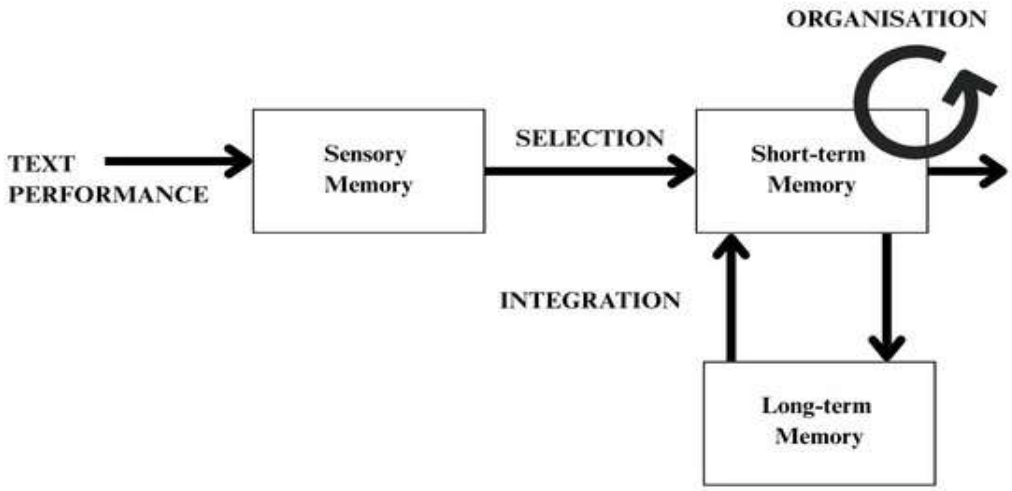
Integrating SOAR into SEESOAR leverages the principles of Information-Processing Theory to support deep, structured learning. The strategy's alignment with each phase of memory processing ensures that learners are not only exposed to information but are also empowered to organise, internalise, and apply it effectively. In this way, SEESOAR does more than teach synthesis writing; it optimises the cognitive conditions under which such learning takes place.

Building on general models of information processing, the Selection–Organisation–Integration (SOI) model offers a more fine-grained explanation of how learners actively construct meaning from instructional input, making it particularly relevant to synthesis writing and strategy-based instruction.

SOI Model

The Selection–Organisation–Integration (SOI) model, developed by Mayer (1996, 2002), presents a cognitive framework for understanding how meaningful learning occurs. According to the model, effective learning is not passive but rather an active process in which learners engage in three core cognitive operations: Selection, Organisation, and Integration. These processes operate within and across three memory systems, namely sensory memory, short-term memory, and long-term memory, as depicted in Figure 3.

Figure 3. Information-Processing Theory



The first process, *Selection*, involves the learner identifying and focusing on relevant information from the sensory input and transferring it to short-term memory (Mayer, 1996). This is essential for filtering and prioritising information amidst cognitive overload. The second process, *Organisation*, requires learners to construct coherent mental structures by connecting pieces of information within short-term memory. This phase promotes deeper comprehension and sets the stage for knowledge construction. The third process, *Integration*, is a bidirectional activity. Learners draw on prior knowledge from long-term memory and relate it to the newly organised information in short-term memory. Concurrently, they encode and commit this information to longterm memory by creating meaningful associations.

Recognising the increasing emphasis on learners' self-directed learning capacities, Mayer (2011) later introduced metacognition as a critical component of the SOI model. Metacognition involves learners' ability to plan, monitor, and evaluate their own learning processes (Bråten & Strømsø, 2011), thereby reinforcing the cyclical and self-regulated nature of learning.

The SOAR strategy is closely aligned with the SOI model's cognitive architecture. As shown in Table 2.4, each component of SOAR corresponds with one or more processes in the SOI model. The *Select* and *Organise* phases of SOAR directly mirror SOI's selection and organisation stages, supporting the learner's ability to filter and arrange information effectively. The *Associate* component of SOAR maps onto both SOI's organisation and integration processes. Internal associations foster connections within the material being studied, while external associations facilitate linkage with prior knowledge, a hallmark of deep learning. Lastly, the *Regulate* phase of SOAR parallels the metacognitive layer of the SOI model by encouraging learners to self-assess and refine their strategies through practices such as self-testing and reflective reviews.

This alignment enhances SEESOAR's instructional design. By embedding SOAR within SEESOAR, the mobile module not only supports the mechanics of synthesis writing but also reinforces the cognitive architecture necessary for meaningful and transferable learning. Learners progress systematically through the SOI stages, selecting key information, organising it meaningfully, integrating it with prior knowledge, and selfregulating their learning. As a result, the SEESOAR experience becomes a cognitively aligned and pedagogically sound pathway to synthesis writing proficiency.

While information-processing and learning models explain how knowledge is acquired and organised, a writing-specific cognitive framework is required to account for how this knowledge is transformed into written text. The Flower and Hayes cognitive writing model provides this perspective.

Integrating Flower and Hayes' Cognitive Writing Model with the SOAR Strategy

The study of writing as a cognitive activity emerged from early psychological research on problem solving, which served as the foundational inspiration for understanding how individuals process and produce written texts. This paradigm shift encouraged researchers to investigate not only the outcomes of writing but also the mental processes that underlie it (Galbraith, 2009). One of the seminal outcomes of this movement was the development of a comprehensive and empirically grounded model of writing by Hayes and Flower (1981). Their cognitive process theory of writing framed writing as a goal-directed, recursive, and problem-solving activity composed of interrelated cognitive operations.

The Hayes and Flower model outlines three principal cognitive processes involved in writing: planning, translating, and reviewing. Each of these is further subdivided: planning involves generating ideas, setting writing goals, and organising content; translating refers to transforming mental representations into written language; and reviewing includes evaluating the draft through reading and editing. These processes interact with two primary information sources: (1) the task environment, which includes the writing assignment and the evolving text, and (2) long-term memory, which stores content knowledge, discourse conventions, audience awareness, and writing strategies.

One of the most important characteristics of the Hayes and Flower model is its recursive nature, where the cognitive processes do not follow a linear sequence but may recur at any stage of writing. For instance, a writer may revisit planning while drafting or engage in reviewing even before completing the translation of ideas into text. This focus on cognitive operations, rather than on mechanical writing stages, underscores the complexity and dynamic nature of writing.

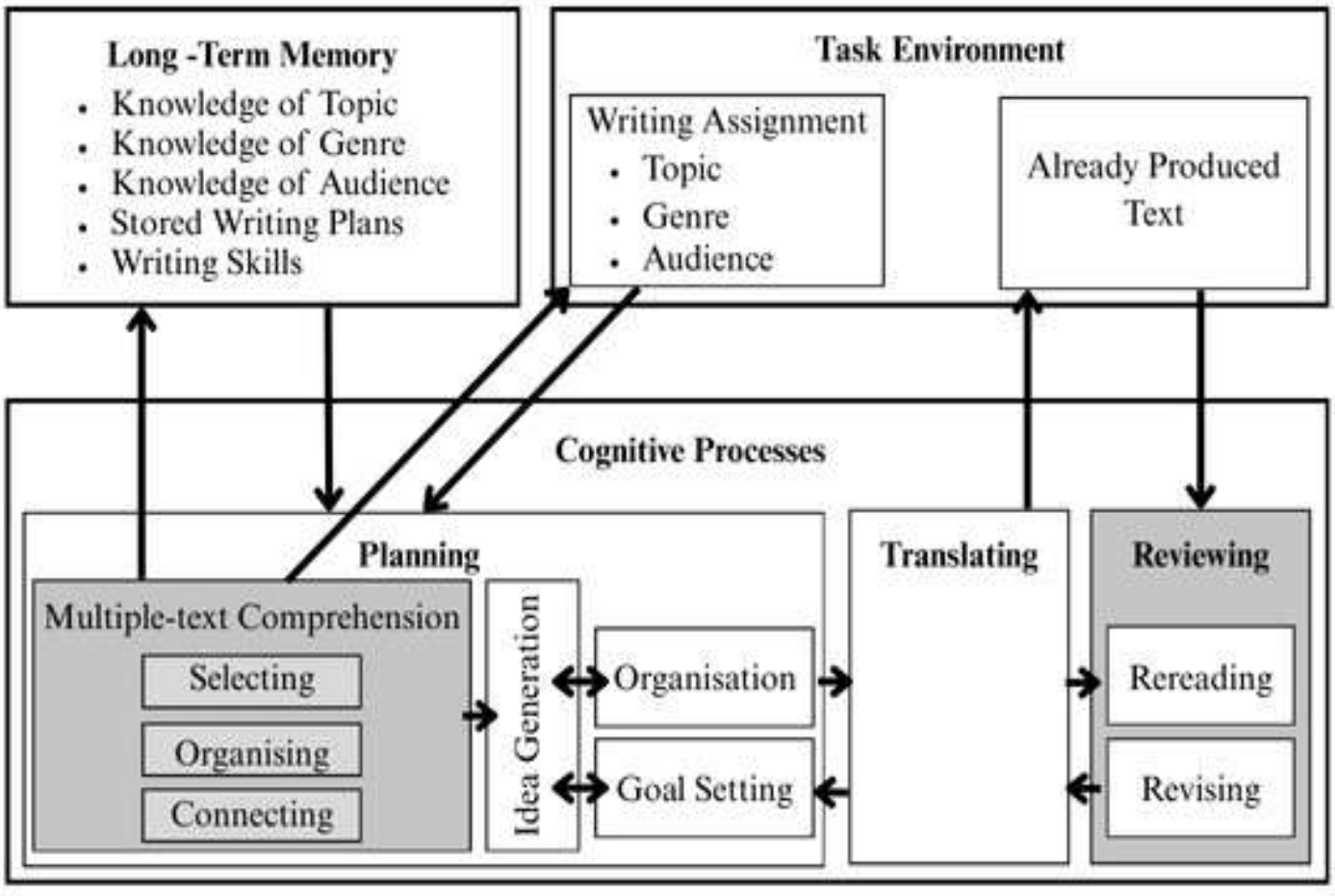
Synthesis writing, as a cognitively demanding task, fits well within this theoretical model. According to Luo and Kiewra (2019), the planning phase in synthesis writing is particularly intensive because it involves multiple-text

comprehension, a requirement that goes beyond the typical demands of single-source writing. Writers must select, organise, and connect information drawn from multiple texts, integrate them meaningfully, and generate a coherent written product that reflects understanding, critique, and synthesis of diverse perspectives.

In this context, the SOAR strategy, *Select*, *Organise*, *Associate*, and *Regulate*, serves as a pedagogical bridge that operationalises the core cognitive components of the Hayes and Flower model. Each phase of SOAR aligns directly with specific aspects of the writing model:

1. Select supports the initial phase of planning by guiding learners to identify relevant information across multiple texts. This aligns with idea generation and content selection in Hayes and Flower's planning sub-process.
2. Organise corresponds to the structural planning of content, helping learners map ideas logically before translating them into text, thereby supporting coherent text construction.
3. Associate or connect bridges the transition from planning to translating by fostering meaningful connections between ideas, an essential component for synthesis writing.
4. Regulate overlaps with the reviewing process by encouraging self-monitoring, peer feedback, and revision practices to improve the clarity and quality of the final output.

Figure 4. Cognitive Writing Model



SEESOAR module not only scaffolds the writing process but also transforms theory into practice. It makes the invisible cognitive processes visible to learners, enabling them to internalise and apply complex writing behaviours through structured, mobile-supported learning activities. The integration supports learners in tackling synthesis tasks more effectively by equipping them with strategic entry points at each phase of the writing process.

Consequently, this combined approach reinforces the cognitive validity of SEESOAR as an instructional model. It empowers tertiary learners, particularly in EMI environments, to transition from novice knowledgetellers to

expert knowledge-transformers, a critical shift necessary for success in academic and professional contexts that demand high-level written communication.

Pedagogical and Technological Implications

The integration of Flower and Hayes' cognitive writing model with the SOAR strategy in the SEESOAR module carries significant pedagogical and technological implications for teaching synthesis writing in tertiary and English-medium instruction (EMI) environments. At the pedagogical level, this integration offers a theoretically grounded, structured approach to scaffolding higher-order writing skills that are often inadequately addressed in traditional curricula. By mapping abstract cognitive writing processes onto concrete, teachable steps, which are Select, Organise, Associate, and Regulate, educators can provide students with a systematic pathway to mastery in synthesis writing. This approach not only facilitates the development of metacognitive awareness but also promotes deeper cognitive engagement with texts, moving learners from passive recipients of information to active knowledge constructors.

The SOAR strategy, when embedded into instructional design, serves as a bridge between theory and practice, allowing instructors to explicitly teach the components of synthesis writing that were previously assumed to develop implicitly. It enables educators to assess students' writing processes more effectively, target specific areas for improvement, and deliver more personalised feedback. Moreover, its alignment with the knowledge-transforming model helps to cultivate expert-like writing behaviours by emphasising planning, reflective revision, and intertextual integration.

Technologically, SEESOAR exemplifies how mobile-assisted language learning (MALL) tools can operationalise cognitive writing theories in a digital environment. The module's mobile format enhances accessibility and flexibility, enabling learners to engage with content asynchronously and at their own pace, an essential feature for military learners and adult professionals. SEESOAR's structured learning units, each aligned with a SOAR component, promote sequential mastery of synthesis skills through multimodal content, interactive assessments, and reflective tasks. The mobile platform also supports self-regulated learning by incorporating features such as automated feedback, scaffolded guidance, and progress tracking.

Furthermore, the design of SEESOAR adheres to the principles of Technology-Enhanced Language Learning (TELL) by integrating authentic tasks, learner-centred design, and data-driven personalisation. It opens opportunities for adaptive learning, peer collaboration, and real-time analytics that inform teaching practices and curriculum refinement. The pedagogical synergy between cognitive theory and mobile technology thus offers a scalable model for writing instruction that can be adapted across disciplines, educational levels, and learning contexts.

In conclusion, SEESOAR demonstrates how a theoretically grounded, mobile-supported writing intervention can meaningfully enhance synthesis writing instruction. Its design principles provide a template for future instructional technologies aiming to bridge cognitive writing theories with effective, scalable digital pedagogy.

CONCLUSION

This conceptual paper set out to examine how synthesis writing instruction can be strengthened by integrating cognitive writing theory with a structured instructional strategy. By aligning the Flower and Hayes (1981) Cognitive Process Model with the SOAR strategy (Select, Organise, Associate, Regulate), the paper demonstrates how complex and often implicit writing processes can be translated into explicit, teachable instructional stages within a mobile-assisted learning environment.

The primary contribution of this paper lies in its theory-driven integration of writing cognition and instructional design. While the Flower and Hayes model provides a robust account of the cognitive processes underlying writing, it offers limited guidance on instructional implementation. The SOAR strategy addresses this gap by operationalising planning, translating, and reviewing processes into structured learning actions, which are further realised through the design of the SEESOAR mobile learning module. This integration contributes a coherent conceptual framework for understanding how synthesis writing can be taught more systematically in English-medium instruction (EMI) contexts.

In addition to its theoretical contribution, the paper offers pedagogical and technological insights for the design of synthesis writing instruction. The SEESOAR model illustrates how mobile-assisted language learning (MALL) tools can support cognitive engagement, metacognitive regulation, and intertextual integration through scaffolded, learner-centred activities. These implications are particularly relevant for tertiary learners who must manage complex writing demands across multiple sources.

As a conceptual study, this paper does not present empirical validation. Future research may therefore investigate the effectiveness of SEESOAR through experimental or design-based studies, examine learners' cognitive and metacognitive development during synthesis writing, and explore the adaptability of the integrated model across disciplines and learning contexts. Such work would further substantiate the pedagogical value of theory-driven, mobile-supported synthesis writing instruction in higher education.

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