

NEUROPSYCHOLOGY AND TRANSFORMATIONAL LEADERSHIP: INTEGRATIVE STRATEGIES FOR MANAGING STUDENTS' ATTENTION, MEMORY, AND EMOTIONS

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Abstrak: Pendidikan dasar menghadapi tantangan kompleks dalam mengelola proses belajar peserta didik yang melibatkan aspek kognitif (atensi dan memori) dan afektif (emosi). Kepemimpinan transformasional kepala sekolah memiliki peran strategis dalam menciptakan ekosistem pembelajaran yang mendukung optimalisasi fungsi neurokognitif peserta didik. Penelitian kepustakaan ini bertujuan untuk menganalisis integrasi antara prinsip-prinsip neuropsikologi (atensi, memori, dan emosi) dengan praktik kepemimpinan transformasional di pendidikan dasar, serta merumuskan strategi pengelolaan yang efektif. Metode yang digunakan adalah studi kepustakaan sistematis dengan menganalisis 18 sumber literatur yang mencakup teori pemrosesan informasi Atkinson-Shiffrin, neuropsikologi pendidikan, kepemimpinan transformasional, serta penelitian terkait emosi dan pembelajaran. Hasil analisis menunjukkan bahwa (1) atensi peserta didik dapat dikelola melalui strategi kepemimpinan yang menciptakan lingkungan bebas gangguan dan stimulasi optimal; (2) memori kerja dan jangka panjang dapat dioptimalkan melalui pendekatan pengulangan terstruktur, pembelajaran bermakna, dan elaborasi informasi; (3) emosi positif (kebahagiaan) meningkatkan efisiensi encoding memori, sementara emosi negatif (kecemasan, kesedihan) mengganggu proses retensi dan recall. Kepemimpinan transformasional berkontribusi melalui keteladanan, motivasi inspirasional, stimulasi intelektual, dan perhatian individual. Penelitian ini merekomendasikan model kepemimpinan integratif berbasis neuropsikologi untuk meningkatkan kualitas pembelajaran di pendidikan dasar.

Kata Kunci: neuropsikologi pendidikan, kepemimpinan transformasional, atensi, memori, emosi, pendidikan dasar.

Abstract: Elementary education faces complex challenges in managing students' learning processes involving cognitive (attention and memory) and affective (emotion) aspects. Transformational leadership of school principals plays a strategic role in creating a learning ecosystem that supports the optimization of students' neurocognitive functions. This research library aims to analyze the integration between neuropsychological principles (attention, memory, and

emotion) and transformational leadership practices in elementary education, as well as formulating effective management strategies. The method used is a systematic literature review analyzing 18 sources covering Atkinson-Shiffrin's information processing theory, educational neuropsychology, transformational leadership, and research on emotion and learning. The results show that (1) students' attention can be managed through leadership strategies that create distraction-free environments and optimal stimulation; (2) working and long-term memory can be optimized through structured repetition, meaningful learning, and information elaboration; (3) positive emotions (happiness) increase memory encoding efficiency, while negative emotions (anxiety, sadness) disrupt retention and recall processes. Transformational leadership contributes through exemplary behavior, inspirational motivation, intellectual stimulation, and individual consideration. This study recommends an integrative leadership model based on neuropsychology to improve learning quality in elementary education.

Keywords: educational neuropsychology, transformational leadership, attention, memory, emotion, elementary education.

Introduction

Elementary education is a strategic foundation in the formation of quality human resources, because at this stage students experience very rapid cognitive and emotional development (Nursalim et al., 2024). The success of elementary education is largely determined by the quality of the learning process that takes place in the classroom, which is inseparable from the role of the principal as an educational leader. In the context of changes and challenges in 21st-century education, transformational leadership has been identified as the most relevant leadership style (Rapelianto et al., 2026). This leadership emphasizes role models, inspirational motivation, intellectual stimulation, and individual attention to the needs of both teachers and students (Farida et al., 2025). However, the effectiveness of transformational leadership has so far been measured more by increasing teacher motivation and school organizational culture, without being explicitly linked to the internal mechanisms of the student learning process, such as attention, memory, and emotional regulation.

On the other hand, the development of neuropsychology has provided a deeper understanding of how the brain processes information. The information processing model (Atkinson & Shiffrin, 1968) explains that information is processed through three memory systems: sensory memory, short-term memory (*working memory*), and long-term memory. (Fajrina, 2019) adds that the process of remembering involves *encoding* , *storage* , and *retrieval* , which can be optimized through repetition, meaningful learning, organization, elaboration, and visual imagery. Furthermore, attention acts as a gateway for information to enter the memory system (Nursalim et al., 2024), while emotions have a substantial influence on the efficiency of *encoding* and retention (Tyng et al., 2017). (Zhang, 2024) shows that positive emotions such as happiness increase dopamine release which facilitates memory consolidation, conversely anxiety and chronic stress disrupt hippocampal function and synaptic plasticity (Johnson, 2024). These neuropsychological principles should be the foundation for designing learning policies, but the reality on the ground shows that most principals in elementary education have not integrated them into leadership practices.

The gap between neuropsychological understanding and leadership practice in elementary schools remains a problem that has not been systematically addressed. Research on transformational

leadership in Indonesia tends to focus on variables such as teacher performance, job satisfaction, and school climate (Farida et al., 2025), (Rapelianto et al., 2026) without connecting them to the cognitive-affective dimensions of students. Meanwhile, research in educational neuropsychology has been conducted more in laboratory settings or micro-classrooms and has not been translated into macro-policies at the school level (Nursalim et al., 2024). Consequently, there is no leadership model that explicitly integrates strategies for attention management, memory optimization, and emotion regulation into a transformational leadership framework. Yet these three domains are closely interrelated: attention determines which information enters *working memory*, memory determines the retention and transfer of knowledge, while emotions moderate the efficiency of both processes. The absence of such an integrative model means that the potential for optimizing learning in elementary education has not been fully achieved.

This study aims to formulate an integrative strategy between neuropsychological principles and transformational leadership in managing students' attention, memory, and emotions in elementary education, as well as to develop a three-domain strategic model that can be used as a guide for school principals in designing evidence-based policies. The novelty of this study lies in: (1) the integration of findings from *Cognitive Load Theory* (Sweller et al., 2019) and current emotion research (Zhang, 2024); (Johnson, 2024) into a transformational leadership framework; (2) translating neuropsychological strategies into concrete policies at the school level, such as creating a distraction-free environment, implementing *chunking* and spaced repetition, and a *trauma-informed approach*; (3) formulating indicators for the principal's readiness to implement a neuropsychological approach. Practically, this research is expected to serve as a reference for principals and supervisors in developing learning policies that are friendly to students' cognitive and emotional functions. Theoretically, this research contributes to the development of cross-fields between educational leadership and neuropsychology, which have so far rarely been integrated.

Method

This study uses a qualitative approach with a library research type. Primary (Zed, 2008) data sources include literature on information processing theory (Atkinson & Shiffrin, 1968), educational neuropsychology (Tyng et al., 2017); (Nursalim et al., 2024), and transformational leadership (Farida et al., 2025); (Rapelianto et al., 2026). Secondary data sources include educational psychology textbooks, related national and international journal articles, and empirical research results on attention, memory, emotion, and leadership in elementary schools. Data collection was carried out through a literature search using keywords such as *educational neuropsychology*, *information processing theory*, *transformational leadership*, *attention*, *memory*, *emotion*, and *elementary education* through the Google Scholar, Scopus, and ScienceDirect databases.

The data analysis technique used content analysis with the following steps: data reduction, categorization and thematic coding, conceptual synthesis, and drawing conclusions. Data validity was maintained through source triangulation (comparing various literatures) and systematic documentation of the entire research process (*audit trail*). The results of the analysis are presented descriptively and qualitatively in the form of an integrative strategic framework that connects neuropsychological principles with dimensions of transformational leadership to manage students' attention, memory, and emotions in elementary education.

Findings and Discussion

Findings

1. Strategies for Managing Student Attention through Transformational Leadership

Attention is the gateway through which information enters the memory system. Without adequate attention, the learning process will be ineffective. Transformational leadership plays a strategic role in creating conditions that support the optimization of student attention.

a. Creating a Learning Environment that Supports Attention

Pratt (2023) proposed six strategies for cultivating student attention: *building connections*, *creating*, *varying*, *charisma*, *collaborating*, and *checking understanding* (Nursalim et al., 2024)(pp. 83-87). Transformational principals can translate these strategies into school policies through:

- 1) Connection: Encourage teachers to recognize students' individual characteristics and create a safe, welcoming, and inclusive classroom environment. Principals can facilitate orientation programs and develop interpersonal relationships.
- 2) Changes in learning structure: The principal encourages teachers to use a variety of teaching methods to accommodate different learning styles, with a “modular” approach that engages students at the beginning of class with important questions, short presentations, processing activities (Think-Pair-Share), and applications in real scenarios.
- 3) Reducing Visual/Auditory Extraneous Load: Leaders and teachers must ensure that the design of teaching materials does not distract attention. The principle of *split-attention* and the *redundancy effect* (Sweller et al., 2019) should be avoided. For example, combining text and images on one page, rather than separate ones.

b. Management of Attention Disorders

Attention deficit hyperactivity disorder (ADHD) affects students' ability to maintain focus. Nursalim et al. (2024) explain that attention deficit disorders can be managed through strategies integrated into school policies, such as organizing classrooms, reducing irrelevant stimuli, and providing clear and structured instructions (Nursalim et al., 2024)pp. 87-88).

Transformational principals can implement training programs for teachers on classroom management that is responsive to the needs of students with attention disorders, as well as provide individual counseling and mentoring services.

c. Attention Stimulation through a Multisensory Approach

Information processing theory emphasizes that information received through multiple sensory channels has a greater chance of being processed and retained. Principals can encourage teachers to use a multisensory approach that simultaneously involves visual, auditory, and kinesthetic learning. This aligns with the findings of Nursalim et al. (2024) regarding the importance of utilizing various tools and media in learning (Nursalim et al., 2024)(p. 22).

2. Strategies to Optimize Student Memory

Memory is the foundation of learning. (Atkinson & Shiffrin, 1968) have identified three interrelated memory systems. Transformational leadership can optimize memory function through various strategies.

a. Optimizing Working Memory

Working memory has a limited capacity (7 ± 2 items) and a short duration (15-30 seconds). To optimize it, principals can encourage teachers to implement:

- 1) Rehearsal: (Fajrina, 2019) emphasizes that repetition is a way to retain information in short-term memory. Teachers can use periodic review techniques, spaced repetition, and distributed practice.
- 2) Chunking: Grouping information into smaller, more meaningful units. For example, changing the phone number 1234567890 to 123-456-7890 (Nursalim et al., 2024), p. 67).
- 3) Meaningful Learning: Linking new information to existing knowledge. (Fajrina, 2019) states that meaningful learning will be most effective if the associations made with students' prior knowledge are appropriate (Fajrina, 2019), p. 46).

b. Transfer to Long Term Memory

In order for information to be stored permanently, a process of elaboration and organization is required. (Fajrina, 2019) recommends:

- 1) Organization: Making connections between different pieces of new information. Teachers can present material in an organized manner and demonstrate the organizational structure of the subject matter.
- 2) Elaboration: Incorporating additional ideas into new information based on what is already known. Teachers can encourage students to go beyond the information itself by drawing conclusions or predicting implications.
- 3) Visual Imagery : Forming mental pictures of information by illustrating verbal instruction using pictures, maps, diagrams, etc. (Fajrina, 2019), p. 47).

c. The Principal's Role in Supporting Memory Strategies

Transformational principals can:

- 1) Facilitate teacher training on metacognitive strategies and effective memory techniques.
- 2) Providing supporting facilities and infrastructure such as libraries with adequate collections, teaching aids, and interactive learning media.
- 3) Integrating project-based and problem-based approaches that encourage students to recall information from long-term memory.
- 4) Creating a collaborative culture where teachers share good practices on effective teaching strategies.

3. Strategies for Managing Student Emotions

Emotions have a dual influence on learning: positive emotions facilitate learning, while negative emotions can hinder it. Transformational leadership plays a crucial role in creating a positive emotional climate in schools.

a. Increase Positive Emotions (Happiness)

(Zhang, 2024) shows that happiness increases the efficiency of memory encoding through the release of dopamine. Strategies that can be applied:

- 1) Creating a pleasant classroom atmosphere
Enthusiastic and energetic teachers help students stay alert and pay better attention in learning (Pratt, 2023 in (Nursalim et al., 2024), pp. 85-86). By creating a pleasant classroom atmosphere and social support (transformational leadership), it has been proven to help students manage their physiological stress responses, so that working memory capacity can be focused on learning (*germane load*). (Nursalim et al., 2025)
- 2) Use of humor and ice breaking: Principals can encourage teachers to use humor in learning to create a relaxed and positive atmosphere.
- 3) Appreciation and recognition: Giving praise for students' efforts, not just the end result, helps boost self-confidence and motivation.
- 4) Fun activities: Activities such as educational games, simulations, and collaborative projects can evoke positive emotions.
- 5) Scheduled Repetition and Elaboration: This strategy, found in information processing theory (Suryana, 2022), is crucial for transferring information from working memory to long-term memory. Transformational leaders encourage teachers to design meaningful review and elaborative projects.

b. Reducing the Impact of Negative Emotions

(Johnson, 2024) explains that anxiety and sadness can interfere with the process of encoding and retrieval of memory. Mitigation strategies that can be implemented:

- 1) Reducing excessive stress: Principals can review policies that cause excessive stress on students, such as excessively frequent testing or unrealistic goals. Research (Nursalim et al., 2025) and articles on stress (Happy et al., 2013) indicate that negative emotions such as anxiety and chronic stress activate the HPA (*hypothalamic-pituitary-adrenal*) axis, which releases cortisol, thereby disrupting the function of the *prefrontal cortex* (the center of attention and working memory) and inhibiting long-term memory formation.
- 2) Emotional regulation training: Teaching students breathing, mindfulness, and grounding techniques to manage anxiety. Reis's research shows that the time spent in a state of confusion before becoming frustrated can be predicted based on the student's personality and prior knowledge, allowing for tailored interventions ((Reis et al., 2018) pp. 8-9).
- 3) Psychologically safe environment: Creating a culture where mistakes are seen as part of the learning process, not as embarrassing failures.
- 4) Trauma-informed approach: Recognizing that some students may carry traumatic experiences that influence their emotional responses.

c. The Role of Transformational Leadership in Emotional Regulation

(Farida et al., 2025) found that the transformational principal at SDIT Permata Hati Jayapura implemented:

- 1) Inspirational motivation: Providing encouragement both verbally and nonverbally, interpreting the profession as worship, and creating a culture of sharing good practices (Farida et al., 2025), pp. 8-9).
- 2) Individual consideration: Paying attention to the individual needs of both teachers and students, using a coaching approach, and delegating tasks based on potential (Farida et al., 2025), pp. 10-11).
- 3) Emotional role model: The principal demonstrates good emotional regulation, remains calm in difficult situations, and responds with empathy to problems faced by the school community.

4. Integration of Neuropsychology and Transformational Leadership: A Strategic Model

Based on a literature analysis, this study proposes an integrative model that links neuropsychological principles with transformational leadership practices. This model consists of three main domains:

Domain 1: Attention Management

Principles of Neuropsychology	Transformational Leadership Strategy
Selective attention requires the elimination of distractors.	Policy for managing a distraction-free learning environment, limiting uncontrolled use of gadgets
Sustained attention requires a variety of stimuli.	Encourage the use of diverse teaching methods (modular approach, changing activities every 15-20 minutes)
Attention is influenced by intrinsic motivation	Creating a shared vision about the importance of learning, understanding learning as worship

Domain 2: Memory Optimization

Principles of Neuropsychology	Transformational Leadership Strategy
Limited working memory (7 ± 2 items)	Policy of material simplification, use of chunking, and structured repetition
Transfer to LTM requires elaboration	Facilitate teacher training on elaboration, organization, and visual imagery strategies
Retrieval is influenced by context	Creation of contextual assessments, use of project and problem-based learning

Domain 3: Emotion Regulation

Principles of Neuropsychology	Transformational Leadership Strategy
Positive emotions increase dopamine encoding	Creating a school climate of fun, appreciation, and recognition
Anxiety interferes with hippocampal function	Excessive stress reduction policy, emotional regulation training
Chronic stress impairs synaptic plasticity	Trauma-informed approach, psychologically safe environment

Discussion

1. Contribution of Gagne's Information Processing Model

This study reinforces the finding that the systematic application of Robert M. Gagne's information processing theory effectively improves students' retention and understanding of concepts at the elementary level. The findings (Zulfah & Mukhoiyaroh, 2022) at SDI Al-Mubarak Surabaya show that Gagne's eight learning phases of motivation, understanding, acquisition, retention, recall, generalization, treatment, and feedback successfully create structured learning that reduces extraneous cognitive load. Meanwhile, (Dalimunthe et al., 2023) it confirms that the information processing model depends not only on the sequence of stages, but also on the selection of strategies that suit students' cognitive characteristics, such as inductive reasoning models, concept acquisition, and *advance organizers*. Principals with transformational leadership play a key role in facilitating teacher training to be able to design learning that follows this information processing flow, thereby creating a learning environment that is neuropsychologically friendly to the development of students' long-term memory.

Theoretical implications: These findings are in line with *Cognitive Load Theory*. (Sweller et al., 2019); (Skulmowski & Xu, 2022) that a clear learning structure helps students allocate limited working memory capacity only to processing essential information (*German load*), not to dealing with confusion resulting from unsystematic presentation of material (*extraneous load*).

Practical implications: Transformational principals need to facilitate teacher training to be able to design learning that follows this information processing flow, thereby creating a learning environment that is neuropsychologically friendly to the development of students' long-term memory.

2. Integration of Modern Neuropsychological Technology

Research (Wijaya et al., 2025) using the *Bibliometric-enhanced Systematic Literature Review* (BenSLR) approach reveals that the use of EEG in educational research has become a major methodological trend. These findings provide a new scientific foundation for transformational leaders and elementary school teachers to not only rely on behavioral observations but also consider neurophysiological data in evaluating learning effectiveness. Haqi also added that the implications of information processing theory in learning require leaders and teachers to use visualization, *chunking techniques*, and providing social context to optimize students' limited working memory capacity. (Haqi et al., 2023)

Critiques and limitations: While promising, the adoption of EEG technology at the elementary school level still faces challenges such as cost, the need for expertise, and the ethical use of students' biological data. Therefore, for the current context, a strategy based on neuropsychological principles (without hardware) is more applicable.

3. Integration of Three Domains: Research Novelty

The main novelty of this research lies in the integration of three domains – attention, memory, and emotion – into a transformational leadership framework. Previous research has tended to address these three domains separately. The proposed integrative model suggests that:

1. Attention, memory, and emotion are not separate entities, but rather interconnected systems.
2. Transformational principals act as "cognitive architects" who consciously design policies, build teacher capacity, and create a school culture that manages cognitive load while reducing emotional load. Bibliometric and thematic analysis of articles (Karakose et al., 2024) shows (Syahputra, 2024) that transformational leadership models in elementary schools have a strong correlation with improving the quality of the learning environment that is conducive to students' neurocognitive processes.
3. Learning success is not measured solely by test scores, but by the school ecosystem's ability to support optimal student brain function. The Atkinson & Gagne information processing model, found in several articles (Suryana, 2022), (Budi, 2022) emphasizes that new information is processed through three stages: sensory memory (stimulus capture), working memory, which has a very limited capacity (only capable of holding 4 ± 1 new information elements in a short time), and long-term memory, which has unlimited capacity.

Conclusion

This literature research resulted in the following conclusions:

1. Attention is the primary gateway for information to enter the memory system. Transformational leadership can manage students' attention by creating a distraction-free learning environment, using a multisensory approach, and policies that support student focus and concentration.
2. Memory consists of three interrelated systems: sensory memory, short-term memory (*working memory*), and long-term memory. Memory optimization can be achieved through strategies such as rehearsal, chunking, meaningful learning, organization, elaboration, and visual imagery. Transformational principals play a role in facilitating teacher training and providing supporting infrastructure.
3. Emotions have a significant influence on learning. Positive emotions (happiness) increase the efficiency of memory encoding through dopamine release, while negative emotions (anxiety, sadness) interfere with the encoding and retrieval processes. Transformational leadership contributes through creating a positive school climate, reducing excessive stress, adopting a trauma-informed approach, and modeling emotional regulation.
4. The integration of neuropsychology and transformational leadership yields a strategic model encompassing three domains: attention management, memory optimization, and emotion

regulation. This model can serve as a guide for school principals in designing evidence-based leadership policies and practices.

5. This research confirms that the effectiveness of learning in primary education is determined not only by the quality of teaching but also by leadership skills in creating an ecosystem that supports optimal brain function in students. Transformational leadership integrated with neuropsychological principles is essential for creating a generation of superior, character-driven, and competitive learners.

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