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Profiling the Working Brain: Using the MLA EEG Framework to Understand Learning Ability, Burnout Risk, and Mental Health in Employees

Shin Yeen Shiw [1,2*], Kevin Kah Weng Gee[1,2], Huey Ling Wong[3,4], Nur Fatini Binti Kamaruzzaman[2], Yasmin Binti Hussain[3], and Chai Yin Ooi [3,5]
[1] *Faculty of Human Development, Sultan Idris Education University (UPSI), Tanjung Malim, Malaysia.*
[2] *BrainScience Academy Sdn. Bhd., Malaysia.*
[3] *Faculty of Education and Liberal Studies, City University Malaysia, Petaling Jaya, Malaysia.*
[4] *Merrychild Development Centre, Selangor, Malaysia.*
[5] *Keepers Medi Care Centre Sdn. Bhd., Malaysia.*
[*] *Corresponding author: brainsciencemy@gmail.com*

Abstract
Modern work requires employees to continuously learn, adapt, and manage themselves despite ongoing stress. However, most organisational assessments still depend on self-reports and performance data, which offer limited insight into underlying brain function. This conceptual paper introduces the EEG-based Learning Ability and Mental Health (MLA) Framework, a systematic method for evaluating the "working brain" in employees. The framework features twelve neurophysiological indicators that measure relaxation, attention, concentration, tendencies toward anxiety and depression, stress resilience, hemispheric balance, brain arousal, sleep quality, brain voltage, inflammation susceptibility, and overall rhythm organisation. The paper illustrates how these indicators relate to three key areas: learning ability, burnout risk, and mental health, to enhance understanding of these concepts. It also highlights how integrated MLA profiles can help identify high-potential learners, detect employees at risk of burnout, and recognise individuals with heightened emotional sensitivity. The paper also discusses practical ways to apply these strategies in human resource and occupational health settings, while addressing key ethical issues such as data protection, fairness, and responsible communication. The paper emphasises the importance of establishing clear research and policy priorities to validate the MLA framework for working adults and to facilitate the responsible adoption of brain-based profiling within broader workplace mental health strategies.

Keywords
EEG; working brain; learning ability; burnout risk; mental health; MLA framework; self-regulation.

1. Introduction

1.1 The changing landscape of work and mental health

Modern workplaces increasingly demand that employees quickly acquire new skills, adapt to continual technological advancements, and perform under ongoing pressure. Conversely, evidence from healthcare and other high-demand environments indicates higher levels of stress, anxiety, and depressive symptoms among working-age adults (Maharaj, 2020; Wong et al., 2023). Wider research in occupational health indicates that common mental health issues impose a significant financial cost on employers, mainly due to more absences, lower productivity, and increased staff turnover (Goetzel et al., 2004; Sainsbury Centre for Mental Health, 2007). These indicators imply that many workers are operating close to their coping limits, even if they remain officially "present" at work. Current organisational assessments rarely measure employees' underlying capacity to regulate their brain states and maintain healthy learning over time.

1.2 Why the "working brain" matters for organisations

From an organisational perspective, performance relies not only on skills and motivation but also on the brain's capacity to allocate attention, regulate arousal, and integrate emotion with cognition. Network neuroscience stresses that perception, cognition, and emotion originate from interacting large-scale brain systems rather than isolated modules (Bassett & Sporns, 2017; Pessoa, 2022). This perspective aligns with social–cognitive models of self-regulation, where individuals continuously monitor their internal states, compare them to goals, and adjust behaviour based on feedback (Bandura, 1991). In workplace contexts, these regulatory processes facilitate sustained focus, flexible problem-solving, and recovery after setbacks. When self-regulation is disrupted by ongoing stress, lack of sleep, or emotional difficulties, people may struggle to learn efficiently and reach their full potential, even if their fundamental abilities are unaffected (Immordino-Yang et al., 2019).

1.3 From psychological measures to neurophysiological profiling

Most organisations rely on self-report questionnaires, observational ratings, and performance indicators to assess well-being and capability. These tools are useful but have limitations: self-report is prone to stigma and response bias, and performance metrics often identify issues only after they have already affected outcomes. Applied neuroscience has demonstrated the potential of electroencephalography (EEG) as a non-invasive, relatively affordable method for gathering additional information about attention, arousal, and sleep-related regulation (Sterman, 2000; Sherlin et al., 2011). Furthermore, EEG provides sensitive indicators of fatigue that are highly relevant in workplace settings. Reviews of sustained-performance tasks show that increases in low-frequency brain activity, particularly in the delta and theta bands, reliably emerge as workers become fatigued, underscoring the potential of EEG-based measures for monitoring fatigue-related declines in attention, safety, and performance at work (Lal & Craig, 2001). Neurofeedback and EEG/QEEG-guided treatments for anxiety and mood disorders normally focus on specific frequency bands (e.g., alpha, theta, and combined alpha–theta protocols), and clinical reviews suggest that training these rhythms can reduce anxiety and depressive symptoms (Moore, 1999; Hammond, 2004). Furthermore, QEEG measures such as frontal alpha asymmetry have been suggested as indicators of a biological tendency towards depression, implying that abnormal EEG patterns might reflect affective vulnerability rather than just current symptom severity (Hammond, 2004).Despite this promise, no broadly accepted framework exists for analysing EEG data related to employees' learning ability, burnout risk, and mental health. Current tools are generally designed for clinical diagnosis, experimental research, or work with children and adolescents. This highlights a gap between sophisticated EEG-based neuroscience methods for improving executive functions in healthy adults and their application as dependable, real-world support tools, such as in environments that promote brain health and optimal performance (Viviani & Vallesi, 2021).

1.4 Aim and scope of the paper

This paper presents the EEG-based Learning Ability and Mental Health Assessment Report (MLA) Framework as a conceptual model for analysing the "working brain" in employees. MLA arranges twelve EEG-derived indicators into three functional domains: learning ability, burnout risk, and mental health. The aim is not to develop a diagnostic system but to demonstrate how a structured set of neurophysiological indicators can offer a more detailed understanding of employees' cognitive and emotional readiness for work. This paper first outlines the theoretical and empirical background linking brain networks, self-regulation, and workplace functioning, then describes the MLA indicators and domains, illustrates integrated employee profiles, and finally discusses implementation, ethics, limitations, and research directions.

2. Theoretical and Empirical Background

2.1 Network neuroscience and the working brain

Modern descriptions of brain function highlight dynamic networks over localised modules. Large-scale connectivity patterns facilitate the integration of perception, cognition, and emotion, featuring extensive network configurations that can adapt across various tasks and mental states (Bassett & Sporns, 2017; Pessoa, 2022). Educational and affective neuroscience also emphasise that meaningful learning depends on integrating social, emotional, and cognitive processes, along with learners' ability to regulate their emotions, motivation, and engagement in context (Immordino-Yang et al., 2019; Holmes, 2019). A framework for the "working brain" should therefore cover overall regulation patterns rather than concentrating on single task scores.

2.2 Self-regulation, learning, and performance

Psychological models of self-regulation describe individuals as agents who monitor their internal states, assess their progress toward goals, and modify their behaviour based on feedback (Bandura, 1991). Research on self-regulated learning indicates that adults who accurately assess their understanding, allocate effort wisely, and modify strategies show improved long-term performance (de Bruin et al., 2020; Nuckles et al., 2020). These skills are supported by neural systems that regulate attention, working memory, and emotion regulation, which can be enhanced through training such as mindfulness meditation (Hölzel et al., 2011). Mindfulness-based programmes, including those tailored for learners and individuals with intellectual disabilities, indicate that regular practice can enhance stress management, self-regulation, and readiness to learn behaviourally (Bakosh et al., 2016; Goral, 2023). An EEG-based framework such as MLA supports this research by seeking to identify the neural foundations of self-regulated learning and performance in everyday tasks.

2.3 EEG signatures of attention, stress, and affect

EEG research consistently shows that brainwave patterns are closely linked to how we focus attention, hold information in working memory, and sustain mental effort. In particular, alpha and theta rhythms play an important role in regulating information flow and supporting memory processes (Klimesch, 1996; Klimesch, 1999). Classroom hyperscanning research indicates that brain-to-brain synchrony varies with student engagement and correlates with learning outcomes across different teaching styles in real-world settings (Bevilacqua et al., 2019). Clinical EEG research connects changes in frontal alpha asymmetry, beta activity, and reactivity markers with anxiety, depression, and stress-related disorders (Keller et al., 2022; Meena et al., 2022; Thibodeau et al., 2006). New evidence also shows links between EEG changes, immune markers, and metabolic factors, suggesting an interconnected relationship among brain activity, stress physiology, and health habits (Kang et al., 2023; Tsalamandris et al., 2023). Neurofeedback research demonstrating that individuals can learn to control specific frequency bands supports the concept of a two-way relationship between brain rhythms and self-regulation (Sterman, 2000; Sherlin et al., 2011).

2.4 Workplace stress, burnout risk, and mental health

Epidemiological and occupational research shows elevated psychological distress among groups with continuous demands, such as healthcare workers and other adults of working age (Maharaj, 2020; Wong et al., 2023). The burden of mental health challenges, particularly those linked to work and caregiving, falls more heavily on disadvantaged groups and individuals facing unstable housing or employment, further deepening existing social and health inequalities (Sentell et al., 2020; Lokot & Bhatia, 2020; Yu et al., 2023). Burnout risk arises from the combined influence of personal vulnerability factors, such as sleep issues or emotional sensitivity, and organisational conditions, including heavy workloads, unclear roles, and leadership styles. Recent systematic reviews of EEG-neurofeedback and technology-assisted interventions highlight the importance of integrating neurobiological measures, such as EEG or brain-computer interface signals, with behavioural and cognitive outcomes to better understand changes in cognitive functioning and mental health (Viviani & Vallesi, 2021; Doulou et al., 2025). In this context, multi-indicator EEG frameworks like MLA can offer further insights into stress regulation and the risk of burnout.

3. MLA EEG Framework for Working Adults

3.1 Origin and conceptual foundations

The EEG-based Learning Ability and Mental Health (MLA) Framework was developed to transform complex EEG data into a clear profile of adults' learning processes, stress management, and emotional well-being at work. It combines insights from network neuroscience, educational neuroscience, and EEG-based self-regulation. Network-based theories propose that intricate mental functions arise from interacting systems. Research highlights that perception, cognition, and emotion stem from interconnected, distributed brain networks (Pessoa, 2022; Bassett & Sporns, 2017). Building upon educational neuroscience, recent studies show that academic learning is significantly shaped by the combined activity of cognitive regulation, emotional experience, and engagement in meaningful, socially relevant contexts (Immordino-Yang et al., 2019; Holmes, 2019).A second foundation comes from EEG and neurofeedback studies, linking certain frequency bands like alpha and sensorimotor rhythms to attention, arousal control, and mood. These studies show that these patterns can be modified through training (Sterman, 2000; Sherlin et al., 2011; Jeunet et al., 2019). Viviani and Vallesi's review underscore that EEG-neurofeedback's effectiveness should be assessed by its ability to alter both brain wave activity and behavioural or psychological indicators of executive function. It also highlights that EEG markers should not be interpreted on their own (Viviani & Vallesi, 2021). MLA translates these insights into a familiar set of indicators that genuinely capture learning ability, burnout risk, and mental health in working adults.

3.2 The twelve MLA indicators in the work context

MLA comprises twelve indicators that function as profiling dimensions instead of diagnoses. The 3D Brainwave Graph shows the balance between slower rhythms (delta, theta) and faster rhythms (alpha, SMR, beta), providing a detailed view of neural organisation. Consistent with earlier EEG research, extensive slow brain activity generally reflects fatigue or reduced alertness. Conversely, elevated fast activity may suggest heightened alertness or, at times, anxiety (Klimesch, 1999; Keller, 2021). The Relaxation indicator shows EEG states, typically highlighting alpha rhythms that users can consciously control using neurofeedback. These self-regulation skills are designed for daily use to aid recovery and relaxation outside clinical settings (Sherlin et al., 2011). Attention and Concentration involve the capacity to selectively focus on pertinent information and maintain engagement with difficult tasks. EEG research links these abilities to oscillations in theta and alpha/beta ranges, which are associated with selective attention, working memory, and executive functions (Klimesch, 1996; Bevilacqua et al., 2019; Galindo-Aldana et al., 2025).Anxiety Tendency indicates brain activity patterns linked to heightened vigilance or persistent worry, such as increased beta waves and typical frontal alpha asymmetry (Keller, 2021; Meena et al., 2022; Thibodeau et al., 2006; Leaf et al., 2023; Byeon et al., 2023). Depression Tendency exhibits patterns associated with low mood and reduced motivation. Past studies also connect these features to specific EEG changes, particularly in the alpha band (Keller, 2021). Stress resistance reflects our brain's and cognition's ability to cope with life's ongoing challenges. Evidence suggests that stress in demanding roles correlates with distinct EEG frequency patterns and declining attention and memory (Maharaj, 2020). High perceived stress is also common among students managing heavy academic workloads (Wong et al., 2023). Lower stress resistance is understood as a pattern of experiencing high stress and cognitive overload, which can lead to faster fatigue and eventually burnout.

Left-Right Balance describes how brain activity is shared between the two hemispheres, with a focus on the frontal regions. Research on frontal alpha asymmetry suggests that differences in activity between the left and right frontal areas relate to individual tendencies for approach and avoidance behaviours, along with distinct emotional regulation styles (Davidson, 1992; Coan & Allen, 2004; Kaur et al., 2020; Keller, 2021). Brain arousal reflects the overall activation level across cortical networks. Sterman's research demonstrates that operant conditioning of sensorimotor rhythms via EEG can modify cortical excitability (Sterman, 2000). In our framework, low arousal reflects drowsiness and disengagement, whereas high arousal denotes hyper-excitability and challenges in settling down.

Within the MLA framework, sleep quality is mainly based on evidence indicating that EEG abnormalities often align with psychiatric symptoms, such as sleep disturbances, in clinical groups like patients with alcohol use disorder (Kang et al., 2023). Wider research also indicates that systemic factors like nutrition can impact neurological function and behavioural or cognitive outcomes (Tsalamandris et al., 2023). Brain voltage shows how active the brain is overall and provides a general sense of cortical activation. This aligns with research showing that improvements in cognition and mood in depression are connected to changes in large-scale brain networks, such as increased activity in cognitive control networks and decreased activity in default-mode networks (Bursky et al., 2022).

Finally, Inflammation Tendency serves as a comprehensive indicator linking EEG-based measures of brain activity with overall physiological stress. This idea is supported by research on alcohol use disorder, indicating that alterations in EEG-based brain function indices occur alongside changes in immune and stress-related proteins such as NK cells, JNK, p-JNK, and Elk-1 (Kang et al., 2023). Additionally, there is broader evidence indicating that nutritional, inflammatory, and metabolic disturbances notably impact neurological function and clinical symptoms (Tsalamandris et al., 2023).

Table 1. Overview of the 12 MLA EEG indicators for working adults, including neural basis and functional meaning

Indicator	Neural / EEG basis in adults	Functional meaning in working adults (learning ability, burnout risk, mental health)
1. 3D Brainwave Graph	Topographical distribution of delta, theta, alpha, and beta power across scalp regions; highlights regional over- or under-activation and hemispheric differences.	Provides a global “map” of the organisation of the working brain. Irregular patterns may signal inefficient neural networks, leading to slower learning, inconsistent performance, and increased susceptibility to stress and burnout.
2. Relaxation	Alpha (≈8–12 Hz) power, stability, and coherence at rest and during low-demand states.	This ability to reduce arousal, relax tension, and achieve a calm yet alert state is vital. Effective relaxation helps emotional recovery after work, promotes clearer thinking, and safeguards against chronic stress and insomnia.
3. Attention	Balance of theta/alpha activity and SMR/low-beta engagement over fronto-central regions during tasks.	Shows the ability to focus on relevant information and ignore distractions. Strong attention helps in maintaining focus, reading detailed reports, and following instructions. Weak attention leads to distractibility, mistakes while multitasking, and inconsistent task completion.
4. Concentration	Stable SMR and low-beta (≈13–20 Hz) activity during sustained cognitive effort; task-related modulation of upper-alpha/low-beta.	Indicates ongoing focus and persistence on challenging tasks. High concentration enables deep work, precise analysis, and prompt completion of complex projects; meanwhile, low concentration is associated with mental drifting, frequent task-switching, and cognitive exhaustion.
5. Anxiety Tendency	Elevated fast beta and related high-frequency activity, particularly over right frontal and central areas; altered frontal asymmetry.	Indicates a tendency toward cognitive worry, hypervigilance, and anticipatory stress. Such high anxiety levels can impair decision-making, elevate errors, disrupt sleep, and increase the risk of burnout and somatic complaints.
6. Depression Tendency	Frontal alpha asymmetry patterns and globally reduced or non-reactive alpha activity.	Indicates a tendency for low motivation, withdrawal, and diminished reward sensitivity. In employees, this may manifest as emotional “flattening,” disengagement from work, decreased initiative, and a perceived loss of purpose despite having adequate skills.
7. Stress Resistance	Ability to prevent excessive high-beta surges and to maintain coherent alpha-beta-theta organisation under cognitive or emotional load.	Shows how effectively the brain stays steady under deadlines, conflicts, or workload increases. High stress resistance helps keep performance stable and allows quick recovery; low resistance leads to overload, irritability, emotional outbursts, or shutdown under pressure.
8. Left-Right Balance	Relative alpha and beta power, phase, and activation patterns across homologous left and right cortical regions.	This reflects hemispheric balance in both cognitive and emotional processing. Significant imbalances may be linked to uneven verbal and visual skills, rumination, or emotional dysregulation, which can affect teamwork, communication, and problem-solving approaches.
9. Brain Arousal	Global configuration of alpha, beta, and theta power; fast/slow frequency ratios indicating hypo-, optimal, or hyper-arousal.	Represents the baseline activation level of the central nervous system. Low arousal is associated with sluggishness, “brain fog,” and slow learning, while hyper-arousal leads to restlessness, impatience, and anxiety. Optimal arousal enables alertness, flexibility, and efficient performance.
10. Sleep Quality	Organisation of slow-wave and spindle activity; presence of nocturnal high-beta or alpha intrusions in resting EEG patterns.	Indicates how well the brain attains restorative sleep. Poor sleep quality is associated with daytime tiredness, decreased focus, impaired emotional regulation, and increased burnout risk, while good sleep promotes resilience, memory consolidation, and mood stability.
11. Brain Voltage	Overall EEG amplitude across key bands; peak frequency and power characteristics indicating cortical “output strength.”	Serves as an indicator of mental energy and neural efficiency. Consistently low voltage may signify exhaustion or long-term overload, while well-organised moderate to high voltage supports sustained thinking, learning new skills, and maintaining cognitive stamina throughout the workday.
12. Inflammation Tendency	Relative slowing (increased low-frequency activity) and instability patterns consistent with systemic physiological burden or metabolic stress.	Indicates potential brain-body strain associated with chronic stress, inflammation, or metabolic issues. An increased tendency is conceptually connected to chronic fatigue, slower cognitive processing, mood sensitivity, and an elevated risk of long-term health problems and burnout.

Source: Conceptual framework developed for the present study (MLA framework)

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3.3 Three functional domains: learning ability, burnout risk, and mental health

For occupational purposes, the twelve indicators are grouped into three main areas: learning ability, burnout risk, and mental health. This structure provides clear, detailed indicators and creates a framework that enables human resources and occupational health teams to understand and use effectively.

The Learning Ability Domain captures the neurophysiological factors that affect how well individuals absorb, process, and use new information. Key influences include Attention, Concentration, Brain Arousal, Brain Voltage, Sleep Quality, and the patterns seen in the 3D Brainwave Graph. Research in educational neuroscience, classroom EEG studies, and mindfulness practices on executive function indicate that sustained attention, consistent focus, and strong executive control are vital for lifelong learning and solving complex problems (Holmes, 2019; Bevilacqua et al., 2019; Galindo-Aldana et al., 2025). Adequate restorative sleep is widely acknowledged in cognitive neuroscience as essential for supporting attention, working memory, and problem-solving abilities, even though these are secondary focuses in some studies.

The Burnout Risk Domain examines how ongoing work stress, the need for rest and recovery, and physiological strain are closely interconnected and how their combined effects shape individuals' well-being over time. It includes elements such as Stress Resistance, Brain Arousal, Sleep Quality, Relaxation, and Inflammatory Tendency. Studies in high-demand settings show that ongoing exposure to stressors, including heavy workloads, long working hours, poor sleep, and academic pressure, is associated with higher levels of stress, anxiety, and other health problems among healthcare workers and students (Maharaj, 2020; Wong et al., 2023). Extensive research in occupational and educational settings shows that continuous stress is a major predictor of burnout and decreased engagement in work or studies (Dall'Ora et al., 2020; Schaufeli et al., 2002). In MLA, a combination of high arousal, low relaxation, poor sleep, and elevated inflammation markers signify cumulative strain. Conversely, greater stress resilience and effective recovery suggest improved overall resilience.

The Mental Health Domain explores the neurophysiological connections related to emotional vulnerability and resilience. It includes aspects such as Anxiety Tendency, Depression Tendency, Left-Right Balance, Relaxation, and components of Brain Arousal. Emerging EEG research suggests that patterns of frontal alpha asymmetry and beta activity, along with self-regulation capacity developed through neurofeedback, are linked to internalising symptoms and individual differences in approach-avoidance and emotional style (Keller, 2021; Meena et al., 2022; Davidson, 1992; Coan & Allen, 2004; Kaur et al., 2020; Byeon et al., 2023; Leaf et al., 2023). In the MLA framework, higher anxiety or depression tendencies, together with left-right imbalance and lower relaxation, suggest greater emotional vulnerability. In contrast, more balanced patterns usually indicate greater emotional stability and resilience. The domain is explicitly shown as a risk profile instead of a diagnostic tool.

3.4 Technical and interpretive considerations

Implementing MLA requires standardised EEG data collection and analysis methods to ensure consistent and comparable indicator values. Data collection involves scalp recordings using the international 10-20 system, usually including resting-state periods and brief task-related segments. Pre-processing follows established QEEG and neurofeedback standards, addressing artefact management and calculating spectral indices such as band-limited power and their ratios, which serve as feedback targets (Sherlin et al., 2011; Jeunet et al., 2019; Viviani & Vallesi, 2021). Indicator scores are calculated using predefined rules and standardised ranges.

Interpretation follows principles designed to ensure validity and ethical use. Indicators are seen as probabilistic signs of underlying brain regulation tendencies rather than absolute classifications. MLA is presented as a non-diagnostic decision-support framework intended to complement, not substitute, psychological or clinical assessments. Successful implementation involves incorporating contextual factors like role, workload, self-reported experiences, and organisational elements, recognising that similar EEG patterns can have varying interpretations based on the environment. Repeated assessments are valuable for tracking changes over time, such as in EEG-neurofeedback, technology-based cognitive training, and serious-game interventions (Viviani & Vallesi, 2021; Doulou et al., 2025). They are also commonly used in workplace stress management programmes and organisational work design interventions, where pre-, post-, and follow-up measurements monitor stress, burnout, well-being, and engagement (Janssen et al., 2018; Lacerda et al., 2018; Sakuraya et al., 2020; Demerouti et al., 2017; Cohen et al., 2023).

4. Applying MLA to Employee Learning Ability, Burnout Risk, and Mental Health

4.1 Learning ability profiles in employees

Within the MLA framework, the learning ability domain represents the neurophysiological foundation that shapes employees' ability to learn, absorb, and put new information into practice. Profiles showing consistent Attention and Concentration alongside moderate Brain Arousal, adequate Brain Voltage, and good Sleep Quality are viewed as signs of high learning readiness. These trends align with data suggesting that sustained attention, efficient working memory, and robust self-regulation are crucial for adult learning and addressing complex issues in professional settings (de Bruin et al., 2020; Nuckles et al., 2020; Klimesch et al., 2007). Conversely, profiles with under-arousal, low energy, and inconsistent attention tend to show variable engagement, take longer to learn new procedures, and are more susceptible to distraction. These differences imply that training design, pacing, and follow-up support could be customised based on MLA indicators, rather than assuming all staff have the same learning capacity.

4.2 Burnout risk and stress regulation

The burnout risk domain evaluates the equilibrium between continuous demands and the brain's capacity to recover. MLA profiles showing consistently high Brain Arousal, low Relaxation, poor Sleep Quality, and reduced Stress Resistance indicate accumulated strain. This pattern aligns with research indicating that in high-demand situations, prolonged stress and inadequate recovery are linked to higher levels of depression, anxiety, stress, and impairments in cognitive and role functioning (Maharaj, 2020; Wong et al., 2023). Including Inflammation Tendency reflects emerging evidence that stress-related physiological markers and immune/inflammatory activity are connected to changes in brain function and mood. Research supports this link by connecting stress proteins, NK-cell activity, EEG results, and symptoms of depression or anxiety. Additionally, research investigates the roles of systemic and neuro-inflammation in depression (Kang et al., 2023; Tsalamandris et al., 2023; Kim et al., 2023). These profiles imply that some employees may maintain outward performance while functioning close to their regulatory limits. This highlights the significance of preventive actions like adjusting workloads, planning recovery times, or referring employees to occupational health services.

4.3 Mental health vulnerability and resilience in the workplace

The mental health domain focuses on patterns associated with emotional vulnerability and resilience. A higher Anxiety Tendency, increased Depression Tendency, an unfavourable Left-Right Balance, and limited Relaxation capacity together indicate an elevated risk for internalising difficulties. These patterns align with research linking shifts in EEG oscillations to anxiety, low mood, and difficulties in attention-emotion processes. Moreover, research suggests that EEG-based neurofeedback can improve anxiety, depression, and emotion regulation (Keller, 2021; Meena et al., 2022; Abdian et al., 2021). In workplace settings, these profiles can help identify employees who might benefit from early, mild interventions like psychoeducation, counselling services, or organised peer programmes, even if they do not

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meet formal diagnostic criteria. Interpretation should always be grounded in broader psychosocial contexts: individuals in insecure roles or with limited resources are often more vulnerable due to structural stressors, emphasising the importance of equity-focused approaches (Sentell et al., 2020; Lokot & Bhatia, 2020; Yu et al., 2023).

4.4 Integrated MLA profiles and illustrative employee patterns

In practice, the MLA provides the most insight when indicators and domains are analysed together. Conceptually, an employee's working-brain profile can be depicted as a combination of learning ability, burnout risk, and mental health, all supported by underlying indicator values. For example, a high-potential but high-strain profile is characterised by strong learning-related indicators alongside elevated burnout risk markers, such as heightened arousal and poor sleep, together with moderate emotional vulnerability. These employees may have the skills, but they are increasingly becoming more exhausted. A chronic stress and anxiety profile indicates high burnout risk and signs of anxiety, coupled with moderate learning ability. These individuals often appear conscientious but anxious and find it hard to relax. Conversely, an under-aroused, low-energy profile shows low arousal, decreased vital signs, and weaker learning indicators, sometimes with increased depression tendencies. This profile may be mistaken for a lack of motivation. On the other hand, a resilient performer profile features strong learning indicators, balanced arousal, sufficient sleep, and minimal mental health risks.

Table 2. Illustrative MLA-based employee profiles and suggested organisational responses

Profile type	Characteristic MLA pattern (indicators/domains)	Typical workplace presentation	Suggested organisational responses
High-potential, high-strain employee	Learning Ability: High Attention and Concentration, adequate Brain Voltage, moderate-high Brain Arousal. Burnout Risk: Low Stress Resistance, low Relaxation, poor Sleep Quality, elevated Inflammation Tendency. Mental Health: Mildly elevated Anxiety Tendency.	Highly capable, fast learner, takes on complex tasks; increasingly tired, irritable, or "always on"; may skip breaks and work long hours; occasional somatic complaints (e.g., headaches, tension).	Organisational level: Review workload and role expectations; formalise recovery time, breaks, and leave; ensure fair task distribution; introduce brain-health and fatigue management policies. Individual level: Offer stress-management or neurofeedback programmes; coaching on boundaries and pacing; support for sleep hygiene and basic health behaviours.
Chronic stress and anxiety profile	Learning Ability: Moderate Attention and Concentration, variable Brain Arousal. Burnout Risk: Elevated Brain Arousal, low Relaxation, impaired Sleep Quality, moderate Stress Resistance. Mental Health: High Anxiety Tendency, unfavourable Left-Right Balance.	Conscientious but tense; worries about performance and evaluation; reports sleep disruption and constant mental "overthinking"; may over-prepare and have difficulty switching off after work.	Organisational level: Clarify role expectations and feedback processes; reduce unnecessary uncertainty; promote psychologically safe communication. Individual level: Access to counselling or employee assistance programmes; psychoeducation on anxiety and stress; targeted brain-based interventions (e.g., relaxation and arousal-regulation training).
Under-aroused, low-energy profile	Learning Ability: Low-moderate Attention and Concentration, low Brain Arousal and Brain Voltage, poor Sleep Quality. Burnout Risk: Moderately elevated Inflammation Tendency; low-moderate Stress Resistance. Mental Health: Elevated Depression Tendency, reduced Relaxation.	Appears disengaged or slow to start tasks; reports "brain fog", low motivation, and difficulty sustaining effort; may be perceived as unmotivated or indifferent despite underlying fatigue.	Organisational level: Review fit between role demands and employee strengths; reduce monotonous overload; create structured routines and clear priorities. Individual level: Encourage medical and mental-health evaluation where appropriate; coaching on activation strategies, physical activity, and sleep; gradual, scaffolded goals with regular supportive feedback.
Resilient performer	Learning Ability: Balanced Attention and Concentration, adequate Brain Voltage, optimal Brain Arousal, good Sleep Quality. Burnout Risk: High Stress Resistance, good Relaxation, low Inflammation Tendency. Mental Health: Low Anxiety and Depression Tendencies, balanced Left-Right activity.	Consistent performance, stable mood, flexible under pressure; uses breaks effectively; usually recovers well after intensive periods; low rates of stress-related complaints.	Organisational level: Maintain manageable workload and supportive leadership; involve the employee in mentoring or peer support without overloading; recognise contribution to team climate. Individual level: Reinforce effective self-regulation strategies; offer optional opportunities for development and leadership; monitor for early signs of overload if responsibilities increase.

Source: Conceptual framework developed for the present study (MLA framework)

These profiles are not rigid categories; instead, they act as starting points for developing hypotheses and assisting with planning. Over time, the MLA framework can be used to track how individual profiles change in response to targeted interventions, such as EEG neurofeedback and technology-based cognitive or game-based strategies, where repeated assessments of brain activity and functioning before and after intervention are commonly used (Viviani & Vallesi, 2021; Townsend et al., 2022). Similarly, this method could also be used to evaluate how workplace interventions impact employee well-being.

5. Implementation and Ethical Considerations in Workplaces

5.1 Practical integration into HR and occupational health

In real-world settings, MLA works best when it is a voluntary part of wider health and performance programmes, rather than as an independent screening tool. Typically, the process includes informed enrolment, an initial MLA assessment, feedback integrated into current occupational health or employee assistance programs, and ongoing re-assessments linked to developmental reviews. Strategies that combine neurophysiological insights with psychosocial support, digital tools, and, when suitable, modifications to the work or learning environment, can improve the use of technology-based methods such as serious games and other digital interventions to support mental health and enhance performance (Doulou et al., 2025; Townsend et al., 2022). Establishing clear governance structures is crucial for defining access to MLA data, data storage, and the responsible use of findings to promote supportive and non-punitive actions.

5.2 Data protection, consent, and fairness

Since MLA relies on neurophysiological data that may be sensitive, it is crucial to obtain explicit informed consent. Participation should be voluntary, with participants able to withdraw at any time, and results must be shared exclusively with health professionals or designated practitioners. Ethical use necessitates safeguards to prevent discrimination, such as prohibiting the use of MLA profiles in hiring, promotion, or dismissal decisions. Equity-oriented perspectives in global mental health emphasise how structural stressors and social disadvantage influence both the risk of mental health issues and individuals' capacity to access suitable support and care (Sentell et al., 2020; Lokot & Bhatia, 2020; Yu et al., 2023). MLA implementation should be integrated into organisational policies that focus on reasonable adjustments, psychosocial safety, and support to reduce stigma.

5.3 Communication with employees and stakeholders

Clear communication is crucial to avoiding misunderstandings regarding MLA's purpose. Reports should highlight that profiles indicate tendencies in brain regulation rather than diagnoses, and that the most accurate interpretation of results involves considering self-report and contextual data. Framing feedback by focusing on clients' strengths, changeable challenges, and actionable self-management techniques aligns with social-cognitive self-regulation theories, which emphasise individuals' capacity to observe, evaluate, and deliberately adjust their behaviours (Bandura, 1991; Goral, 2023). Involving staff representatives, unions, and leadership in designing and reviewing MLA procedures helps build trust and encourages ethical, long-term implementation.

6. Limitations and Future Directions

6.1 Limitations

The MLA paradigm remains theoretical and needs thorough verification with employed adults. Its indicators' definitions and domain classifications are based on current EEG and neurofeedback research, rather than extensive, representative samples across various professional groups. Normative ranges can vary depending on factors such as age, sex, cultural background, and industry standards, which raises questions about how broadly these findings can be applied.

6.2 Future Directions

Future research should focus on longitudinal studies that track MLA profiles alongside important functional outcomes and responses to specific interventions. This aligns with neurofeedback meta-analyses' recommendations for more comprehensive, long-term research to examine how brain-based treatments result in lasting improvements in symptoms and overall functioning over time (Choi et al., 2023).

7. Conclusion

This paper presents the MLA EEG Framework as a systematic approach to profiling the "working brain" in employees. By grouping 12 neurophysiological indicators into three higher-level domains that reflect learning ability, burnout risk, and mental health, the framework links EEG patterns to functional capacities directly relevant to today's workplaces.

MLA is positioned as a non-diagnostic, decision-support tool that complements existing psychological and organisational assessments. It aims to provide early support, guide training and workload choices based on each person's readiness to learn, and monitor the effectiveness of stress management and brain health interventions. Simultaneously, the framework requires thorough validation, careful attention to data privacy and ethics, and alignment with broader organisational policies on mental health and equity. When appropriate safeguards are in place, MLA offers a valuable approach for integrating applied neuroscience into human resource and occupational health practices, fostering workplaces that are both high-performing and brain-healthy.

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