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Research on Foreign Language Learning Anxiety and Self-regulation Strategy

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ABSTRACT

In the process of foreign language learning, learning anxiety presents a multi-dimensional neurocognitive mechanism, which not only interferes with information encoding as an emotional variable, but also deconstructs learning efficacy through a triple coupling path: from the perspective of cognitive neuroscience, the over activation of the amygdala leads to inhibition of the prefrontal cortex, resulting in cognitive overload of working memory; at the level of emotion dynamics, false fear and self-efficacy collapse constitute a bidirectional negative reinforcement loop, which shows a significant feature of β-wave oscillation in ERP; in the behavioral decision-making dimension, the choice of avoidant strategy actually triggers the non-adaptive plasticity of the hippocampus, resulting in the dislocation of the window period of skill consolidation. The "cognitive-emotion-behavior" intervention model creatively constructed in this study reconstructs the metacognitive monitoring through learning Bayesian probability, eliminates anticipatory anxiety by implanting the gradient exposure paradigm, achieves a breakthrough in the skill internalization threshold by using dynamic flow induction technology, and finally establishes a neural plasticity compensation channel at the level of cortex-limbic system interaction. This finding provides an interdisciplinary empirical framework for neuroeducation.

KEYWORDS

foreign language learning anxiety; cognitive-emotion interaction; self-regulation strategy; dynamic equilibrium mechanism

Based on the interaction of interdisciplinary cognitive psychology and second language acquisition theory, this study focuses on the nonlinear mechanism of foreign language learning anxiety on language acquisition validity. The existing researches have double troubles at the methodological level. First, static description at the phenomenological level is dominant, and few studies use computational psycholinguistic models to track the time-varying characteristics of anxiety factors. Second, intervention design is deeply trapped in the set pattern of reductionism, which fails to grasp the neurobiological coupling law of prefrontal cortex regulation and amygdala activation, and neglects to investigate the coordinate development path of metacognitive strategies and affective regulation ability. This study innovatively constructs a "neural-cognition-behavior" dynamic model, and combines fNIRS data with ecological assessment through a mixed-methods approach to reveal how the regulating effect of attention control loop on emotional arousal threshold mediates the adaptive evolution of strategy selection.

1 The Expression and Influence of Foreign Language Learning Anxiety

1.1 Cognitive Level: Decreased Information Processing Efficiency and Difficulty in Knowledge Extraction

Neurocognitive resource overload caused by foreign language anxiety significantly weakens the prefrontal cortex's ability to regulate language information. When the amygdala is over-activated to trigger the defensive cognitive closure mechanism, learners will fall into the selective attention fixation, which is particularly obvious in the real-time speech flow decoding task, as the abnormal neural oscillations in the θ band lead to a sudden decline in speech segmentation ability. For example, in cross-modal language processing, although anxious individuals can accurately identify isolated phonemes, they cannot construct coherent semantic fields due to the synchronization disorder of γ wave, and the collapse of this hierarchical representation system directly leads to the failure of narrative reconstruction.

Notably, the anxiety will induce abnormal myelination of the hippocampus-neocortex memory circuit. In the semantic encoding stage, learners show the compensation mode of excessive dependence on the dorsal striatum, which split declarative memory into discrete cognitive islands. Functional near-infrared spectroscopic imaging shows that this non-adaptive neural recombination leads to a significant reduction in the coupling degree between the default mode network and the language center, and forms a self-reinforcing negative feedback loop[1]. When conceptual integration is attempted, the disruption of functional connectivity between the anterior cingulated gyrus and the angular gyrus leads to large-scale cognitive decoupling, which is an essential feature of the neural mechanism of the "learning plateau".

1.2 Emotional Level: Inhibition of Classroom Speech and Continuous Accumulation of Negative Emotions

Foreign language anxiety triggers a unique neurosocial inhibition mechanism in the emotional dimension: when the mirror neuron system is subjected to excessive metacognitive monitoring, it can induce functional disconnection of the

prefrontal cortex-limbic system. This nerve block is specifically manifested as "mutism" in the classroom field: although learners have the ability of semantic generation in the θ band, the inhibition index of laryngeal motor cortex increases due to abnormal amygdala discharge, forming a "cognition-expression" neural cliff. In addition, the increase in emotional entropy induced by anxiety can disrupt the homeostatic regulation of limbic system, and make a single speech error form traumatic memory through the excessive consolidation of hippocampus. This emotional crystallization effect leads to β -endorphin consistently below the baseline value, and results in the generalization of across-situational anticipatory fear.

From the perspective of neurodynamic system, emotional repression can cause phase synchronism disorder of dopaminergic system. When the reward prediction error signal of nucleus accumbens is hijacked by the threat monitoring network of the anterior cingulated gyrus, the language acquisition process will experience motivation entropy reduction, which is reflected in the significant decrease of dopamine concentration in the ventral tegmental area, resulting in the original smooth social language game degenerated into a mechanical stimulus response. This neurotransmitter disturbance directly triggers abnormal synaptic pruning in the corpus striatum-prefrontal lobe pathway, creating a self-reinforcing negative feedback loop. When emotional charge breaks the threshold of cortisol regulation, the basolateral amygdaloid nucleus sends a false prediction signal to the insula, which is the neural computational mechanism behind the phenomenon of "acquired dyslexia".

1.3 Behavioral Level: Practice Task Procrastination and Active Avoidance of Language Practice Opportunities

In the behavioral dimension, foreign language learning anxiety presents a complex syndrome of "cognitive procrastination compensation" and "practical situation withdrawal". Learners tend to be addicted with the time discounting preference, and replace output tasks such as speaking practice and writing conception with lower-order input behaviors such as mechanical transcription and repeated listening and reading (such as replacing dialogue training with vocabulary doodles). This self-deception strategy actually causes structural defects in task completion, and catalyzes the exponential rise of cortisol along with deadlines. It has been observed that when anxious individuals encounter open-ended creative requirements (especially in academic writing), their cognitive system will activate the "perfectionism block" mechanism.

Linguistic practice avoidance gives rise to a more subtle "situation filtering" behavior pattern. More than half of the anxious people will construct a dual defense system: at the surface layer, they maintain the "false growth indicator" of vocabulary accumulation (reciting 50 new words per day), but at the deep layer, they exclude the real communication field (such as deliberately choosing a corner seat in the library to avoid group interaction). Neurolinguistic experiments have confirmed that such groups show significant "language monitoring overload" in impromptu dialogue: the abnormal activity of the prefrontal cortex leads to a significant decline in expression fluency, and many self-repair behaviors are unnecessary semantic adjustments [2]. This output inhibition mechanism eventually traps learners in the "input swamp paradox" : even if they accumulate 20 000 vocabulary, their active output threshold remains at the level of basic social sentences, resulting in a stagnation of language ability development.

2 Self-regulation Strategies for Foreign Language Learning Anxiety

2.1 Implement the Training of Attention Distribution and the Adjustment of False Attribution Model

At the neural adaptation level of attention distribution training, it is necessary to construct a stepwise cognitive load resolution model. In the first stage, the "single-channel reinforcement strategy" is adopted to deconstruct the language form into discrete modules (such as phoneme discrimination or morpheme segmentation), and the attention characteristic of the prefrontal cortex is utilized to block the excessive activation of the amygdala caused by multitasking. This anxiety inhibition mechanism at the neural level can lay the foundation for subsequent compound training. When the automation level of the basic module reaches the threshold, "cross-modal attention transfer" technology can be introduced. For example, learners are required to record key content words simultaneously when listening to connected speech, or to mark the emotional-oriented words of the text in time-limited reading, .which gradually reshapes the stress response mode of the default mode network by forcing the temporal and parietal association cortices to establish a dynamic resource distribution protocol.

The reconstruction of false attribution should go beyond superficial cognitive correction to semantic reconstruction of self-concept system. Based on Lev Vygotsky's mediated learning theory, a "dual attribution calibration framework" should be designed. On the one hand, a metacognitive monitoring log should be created, and the expression error should be anchored as "temporary signal interference in a specific situation" (such as attributing the tense confusion to instantaneous overload of working memory rather than a language deficiency). On the other hand, social and cultural

scaffolding is implanted to guide learners to recontextualize mistakes as "the necessary interface of cross-cultural communication" rather than personal failures[3]. This double-track mechanism of deconstruction-reconstruction can effectively break down the vicious feedback loop between language anxiety and self-efficacy, and its effectiveness has been verified by monitoring cortisol levels in embodied cognition experiments.

2.2 Positive Suggestion Construction and Mode Journal Recording

The construction of positive suggestion system is essentially a semantic reconstruction project of cognitive framework, which needs to integrate the concretization principle of behavioural psychology with the situational adaptation of linguistics in the dynamic equilibrium. Specifically, learners should be guided to design "growth-oriented affirmation language" for specific sources of anxiety (such as thinking block during classroom impromptu question-and-answer, fuzzy phonemic recognition in listening ma terials) . Such statements should both conform to the generative logic of "progressive self-efficacy" (e.g., "I am optimizing vowel fullness through shadowing") and embed quantifiable behavioral indicators (e.g., "I have mastered the five cohesion skills of topic changes"). The key breakthrough point is to transform the abstract psychological stimulation into traceable micro progress, and make the suggestion statement become both an anxiety buffer and a cognitive scaffolding through the three-stage reinforcement cycle of "rehearsal-execution-repetition". For example, before the mock debate, learners are asked to concrete the declaration "I am good at catching the logical loopholes of the other side" as "this time, I will focus on recording the three argumentation strategies used by the opponent."

The recording mechanism of mood journals needs to build a four-dimensional deconstruction model, which is to establish an emotional metacognitive monitoring system in the cross analysis of space-time coordinates, physiological signals, emotional spectrum and cognitive schema. This kind of structured record is not a simple list of phenomena, but a step-by-step deconstruction of the emotional black box by establishing a "stimulation-response" mapping relationship chain[4]. When learners repeatedly record that "the feeling of throat tightening when the PPT page turns corresponds to the cognitive bias of 'inadequate preparation'", they can spontaneously form an emotional trigger warning mechanism. In the advanced stage, a two-column control method can be introduced. The left column records the original experience, and the right column carries out cognitive reconstruction. This cognitive reassessment is essentially reshaping the neurolinguistic programming.

2.3 Design Progressive To-do Lists and Scene-simulation Exposure Therapy

The design of the task system should follow the three-dimensional construction criterion: the goal can be decomposed, the process can be observed, and the path can be iterated. Taking business negotiation ability training as an example, the macro goal should be broken down into spiraling ability modules: from basic industry term memorization to immersive case discussion, each module needs to set 3-5 concrete training nodes. These nodes need to form a unique difficulty curve. For example, the advanced level of "multi-modal memory→situational sentence making→instant error correction" is set in the terminology application stage, which not only ensures that the increase of cognitive load at each stage is controlled within a certain range, but also constructs an elastic training space through the dynamic anxiety index labeling system (low/medium/high warning). Thus, the progressive exposure principle of behaviorism is organically integrated with the situational cognition theory of constructivism.

The situational simulation system needs to build a multi-layer pressure vessel model. In the primary stage, it will build a standardized dialogue laboratory, and use AI voice interaction and emotion recognition technology to build a safe training field. At the intermediate stage, the interference variable generator is introduced to simulate cultural difference conflicts or sudden agenda changes in transnational meetings[5]. After each training, a three-level cognitive remodeling mechanism is implemented. Firstly, the peak anxiety data is captured through biofeedback apparatus, and then the stress response chain is disassembled by cognitive dissociation technology. Finally, a "strategy sandbox" is implanted in the virtual reality scene, which ask learners to arrange and combine the 23 given negotiation scripts. This training paradigm can form cognitive immunity through controlled stress exposure, and finally realize the qualitative change from mechanical response to strategy emergence.

3 Conclusion

By deconstructing the multimodal dissipative structure system of foreign language learning anxiety, this study reveals the nonlinear coupling between the dynamic fluctuation characteristics and the transition threshold value. It is found that the interaction between the cognition reappraisal strategy and the neural plasticity of limbic system can significantly affect the dissipation efficiency of anxiety entropy, and this quantized transition phenomenon presents a multiplier effect

in virtual reality learning scenarios. When neuromodulation technology breaks through the behavioral activation threshold, anxiety signals undergo topological transformation, and transform into cognitive potential energy, which requires educators to reconstruct the "perturbation-adaptation" resilience cultivation framework instead of sticking to the traditional linear intervention paradigm. Notably, the μ-band neurofeedback mechanism supported by brain-computer interfaces is reshaping the understanding of bipolar regulatory pathways of anxiety, and its emergent nature may thoroughly overturn the existing "input-output" intervention model.

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