

ANALYSIS OF HOW STRESS AFFECTS LEARNING OUTCOMES DURING THE LEARNING PROCESS

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SUBTHEME: Assessment

BACKGROUND

Stress is a physiological and psychological response to environmental, physical, mental, and social stimuli. While moderate stress can improve resilience and cognition, excessive stress may impede learning. This study investigates how different stress levels affect learning effectiveness in information engineering students by analyzing physiological responses during varied learning tasks.

AIMS

This study aims to explore the relationship between stress levels and learning outcomes. It examines whether moderate stress enhances comprehension and performance during academic tasks compared to low or high stress.

DESIGN AND METHODS

Participants: Ten male university students in their early twenties from the Umezawa Laboratory.

Procedure: Each participant completed nine sessions (three subjects × three stress levels), involving instructional videos in: History (familiar but long unpracticed), Java (moderately familiar), and Ruby (unfamiliar). Stress levels were induced as follows:

- ✓ Low (no prior test warning),
- ✓ Moderate (warned about an upcoming test),
- ✓ High (warned of penalties for poor performance).

Each session was followed by a comprehension test.

Data Collection: EEG (FocusCalm headset) was continuously recorded; HRV (COOSPO HW807) was measured in 2-minute intervals at the start and end of each session.

Metrics:

EEG: Beta-to-alpha (β/α) ratio as a cognitive load indicator.

HRV: rMSSD as a marker of parasympathetic activity and stress.

Analysis: Statistical evaluation of the relationship between physiological stress indicators and comprehension test scores.

RESULTS

The EEG β/α ratio showed peak comprehension under moderate stress in the History domain, supporting the inverted-U hypothesis (optimal performance at moderate stress). However, EEG and HRV data revealed substantial individual differences in stress responses, limiting generalizability. Additionally, ceiling effects in Java and Ruby test scores suggested the assessments were too easy, reducing detectable impact.

CONCLUSIONS

Moderate stress may enhance learning, especially in subjects previously studied but not recently practiced. However, high individual variability and low test difficulty influenced the outcomes. Future research should involve more participants, improved assessment tools, and a wider subject range to clarify the relationship between stress and learning.