

Motivation, Achievement Emotions, and School Results in High School STEM Study

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INTRODUCTION & AIM

Context: STEM (Science, Technology, Engineering, Mathematics) disciplines involve high structural complexity, demanding superior levels of abstract reasoning and persistence in problem-solving from students.

Objective: To investigate the complex transition from latent cognitive potential to actual academic achievement (STEM Performance) through the lens of multidimensional motivational and affective constructs.

Conceptual Framework: Grounded in the *Control-Value Theory of Achievement Emotions*, this study explores the synergy between motivational beliefs and emotional states, analyzing how subjective appraisals of control and value shape classroom experiences and stimulate self-regulated learning.

METHOD

Sample: A quantitative approach conducted on a representative sample of **N = 150** high school students enrolled in a STEM curriculum.

Psychometric Instruments (adapted for STEM):

- **MSLQ** (*Motivated Strategies for Learning Questionnaire*) – to assess self-regulated learning strategies.
- **GO** (*Goal Orientation Scales*) – to analyze mastery vs. performance goal orientation.
- **IMPL** (*Implicit Theories of Intelligence*) – to evaluate mindset types.
- **AEQ** (*Achievement Emotions Questionnaire*) – to measure discrete academic emotions.

Statistical Analysis: Data were processed and analyzed using the **IBM SPSS Statistics** software package, employing Pearson correlation analyses and multiple linear regression models.

RESULTS & DISCUSSION

A. Correlations Between Emotions and STEM Performance (Pearson Analysis)

Statistical analysis indicates that the affective states experienced by students in the classroom have a direct impact on their academic success:

- **Pride as a Catalyst:** It exhibits the most stable, positive, and significant correlation with academic success ($r = .217$). Enjoyment ($r = .154$) and hope act complementarily, forming a stable, activating positive affective cluster.
- **Fear as a Major Barrier:** It represents the strongest inhibitor of performance ($r = -.339$). Intense fear directly impairs concentration capabilities and abstract reasoning in STEM tasks.
- **The Impact of Shame and Boredom:** Both states actively sabotage academic outcomes, showing significant negative correlations (Shame: $r = -.263$; Boredom: $r = -.246$). Boredom induces disengagement, whereas shame triggers personal devaluations.

B. The Impact of Self-Regulated Strategies (MSLQ Regression Model)

The multiple linear regression model demonstrated that cognitive and metacognitive strategies combined explain **13.9 %** of the variance in STEM performance, revealing two opposing behavioral patterns:

- **Elaborative Learning (Positive Predictor):** It is the strongest factor for success ($\beta = .401$). Students who make logical connections, associate new knowledge with prior information, and deeply process the material achieve significantly higher grades.
- **Rigid Organization (Negative Predictor):** It recorded an unexpected negative impact ($\beta = -.321$). This suggests that purely mechanical organization (such as formal copying of diagrams or underlining text without deep reflection) is ineffective for abstract STEM tasks and can even hinder performance.
- **Metacognitive Self-Regulation:** It did not show a significant direct isolated impact ($\beta = -.046$), as its influence was likely absorbed or mediated by the practical application of elaboration techniques.

CONCLUSION

Paradigm Shift: The findings underscore the imperative for an integrated instructional design in STEM education that moves beyond the mere transmission of technical content to support emotional resilience.

Pedagogical Focus: Combating negative states (Fear, Shame) alone is insufficient; educators must actively stimulate deep information elaboration strategies over rote memorization or rigid structural organization.

Targeted Interventions: By fostering academic pride, mitigating a classroom climate driven by the fear of failure, and guiding students toward autonomous learning techniques, educators can tangibly optimize academic success in the STEM pipeline.

FUTURE WORK / REFERENCES

1. Dweck, C. S. (2006). *The new psychology of success*. NY: Random House.
2. Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational psychology review*, 18(4), 315-341.
3. Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary educational psychology*, 36(1), 36-48.
4. Pintrich, P. R., Smith, D. A., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and psychological measurement*, 53(3), 801-813.