

# Exploring antecedents of gendered attrition from STEM fields\*

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**Summary** A pluralistic and diverse society must proactively seek to access and develop the talents of all its members, rather than perpetuating the current gender imbalance in sectors like science and innovation. Despite repeated research demonstrating that ability in math and science does not differ between genders, female attrition from STEM programs continues to be worrisome, compounded by a “leaky pipeline” for women in science careers.

## 1. Relevance

Research suggests that this attrition may have emotional rather than academic reasons, but the relationships between emotions and achievement goals, and whether these differ by gender, are not clear.

## 2. Aims & Objectives

The objective of the present research was to explore gender differences in achievement emotions and goals in higher education, as well as differences in the pattern of how academic emotions influence the adoption of achievement goals; and finally whether these emotions and goals impact student grades.

## 3. Methods

The sample consisted of 194 first-year STEM students at a large Canadian research university (83 male, 111 female;  $M_{AGE} = 18.69$ ,  $SD = 1.34$ ). Participants completed two Likert scale questionnaires: a) the 45-item Academic Emotion Questionnaire (AEQ) measuring enjoyment, pride, boredom, anger, hope, hopelessness, anxiety, and shame [sample items: “I enjoy acquiring new knowledge” and “I feel ashamed when I realize that I lack ability”]; and b) the 12-item Achievement Goal Orientation (AGO) scale measuring mastery approach, performance approach, mastery avoidance, and performance avoidance [sample items: “My goal is to learn as much as possible” and “My aim is to avoid performing poorly compared to others”]. We also collected the students’ end-of-term GPA.

## 4. Results

MANOVAs were conducted to explore gender influence on achievement emotions and goals. Female students reported significantly higher levels of anger ( $F(1, 193) = 5.42$ ,  $p = .021$ ), anxiety ( $F(1, 193) = 19.17$ ,  $p < .001$ ), shame ( $F(1, 193) = 18.96$ ,  $p < .001$ ), and hopelessness ( $F(1, 193) = 10.34$ ,  $p = .002$ ), as well as significantly lower levels of hope ( $F(1, 193) = 6.38$ ,  $p = .012$ ). They also reported significantly higher levels of goal avoidance behaviours. Path analyses were then conducted to explore gender differences in the potential mediating effect of emotions on goal adoption, and gender showed a significant indirect effect on performance avoidance, fully mediated by shame ( $P_M = .42$ ). This suggests that shame as the mediating emotion could account for almost half the finding that female STEM students are significantly more likely to adopt performance avoidant behaviours. No gender differences were found in academic results.

## 5. Conclusions

These findings may help clarify why female STEM students and scientists do not, on average, have the same longevity in the field as their male counterparts: the AEQ revealed higher levels of negative achievement emotions among female STEM students, and the AGO data, in turn, suggested resultant avoidance behaviours. Performance avoidance is not usually associated with innovation – but research could help address the root causes of these challenges and support female scientists from the beginning of their studies and into creative, innovative careers.

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\* Some of this data will be discussed at a conference roundtable (JURE/EARLI)