The Adolescent STEM Anxiety Scale: Construction, validation, and gender differences

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Student participation has been shifting from subjects such as calculus-based mathematics towards non-calculus-based mathematics, with similar shifts in the sciences and technologies. Declining participation in subjects is of concern given the projected importance of STEM knowledge and skills for the future workforce. Furthermore, gender differences continue to persist in some STEM subjects and careers, and research attention has focused on examining factors that are implicated in these gender differences. While a range of factors are implicated in students' choices to study STEM subjects, students' affective responses to these subjects is an important factor. There is evidence to suggest that student enjoyment or fear of a subject will influence their subject choices and for some students, fear of a subject can develop into subject-specific anxiety. There has been substantial research attention on anxiety towards mathematics, involving both cognitive and affective reactions to learning and performance in mathematics. Comparatively fewer studies have examined anxiety in other STEM subjects, notably science and technology. In an era of increasing curriculum integration across these subjects, we argue that a more nuanced understanding of students' underlying concerns about their abilities in one or more STEM subjects is required.

In this study we designed a measure of domain-specific anxiety elicited by science (biology, chemistry, and physics), technology, and mathematics for use with secondary school students. An initial version of the Adolescent STEM Anxiety Scale was developed and piloted with NSW secondary school students in Years 7-10, and changes were made to minimise measurement error. In this paper, we report on the validation of the second version of the Adolescent STEM Anxiety Scale with a new cohort of students from NSW secondary schools. Exploratory factor analyses were used to investigate factor structures, revealing five factors: mathematics anxiety (including learning and testing in mathematics), technology anxiety (including learning, testing, and manipulation of components in technology), science (biology, chemistry, and physics) testing anxiety, physics anxiety (including learning and completing practical work in physics), and biology/chemistry practical work anxiety. This structure was also investigated using confirmatory factor analysis with a different cohort of students. Gender differences in the various STEM anxiety factors were identified, and implications for practice and theory will be discussed. An understanding of STEM anxiety has the capacity to guide intervention efforts in improving participation in senior STEM subjects and improving student wellbeing more generally.