

Fennema-Sherman Mathematics Attitudes Scales: Instruments Designed to Measure Attitudes toward the Learning of Mathematics by Females and Males

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character to allow detection of what may be no more than subtle differences. Studies designed to be more sensitive to these subtleties are needed.

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FENNEMA-SHERMAN MATHEMATICS ATTITUDES SCALES: INSTRUMENTS DESIGNED TO MEASURE ATTITUDES TOWARD THE LEARNING OF MATHEMATICS BY FEMALES AND MALES

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The importance of affective factors in partially explaining individual differences in the learning of mathematics is well recognized. This set of variables

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not only affects the amount of effort one is willing to exert to learn mathematics but also has great influence on the election of mathematics courses beyond minimum requirements in secondary school. It is also recognized that an increasing number of students who are qualified intellectually are deciding not to study mathematics beyond minimum secondary school requirements and that many more girls than boys make this decision. For these reasons, it is important to have instruments that measure certain affective variables related to the learning of mathematics and to the election of math courses.

Although many instruments have been developed that measure global attitudes, instruments with well-defined dimensions that are related specifically to the learning of mathematics have not been readily available. Described in the article referenced here is the development of nine domain-specific, Likert-type scales that measure important attitudes related to mathematics learning. Included in the article are a theoretical discussion of the importance to the learning of mathematics of the variable measured by each scale, the scales in their entirety, item statistics, and scale statistics obtained from testing two high-school-aged populations ($N = 1600$). The scales may be used as a group, individually, or in any combination desired.

The Fennema-Sherman Mathematics Attitude Scales were developed as part of a grant from the National Science Foundation. The main purpose of this project was to gain more information concerning females' learning of mathematics as well as information concerning variables related to the election of mathematics courses. To fulfill this purpose, the attitudes selected for study were those that have been hypothesized to be related to the learning of mathematics either by all students or specifically important for females. The name of each scale and the dimension it measures follows.

1. *The Attitude toward Success in Mathematics Scale (AS)* is designed to measure the degree to which students anticipate positive or negative consequences as a result of success in mathematics. They demonstrate their fear by anticipating negative consequences of success as well as by lack of acceptance or responsibility for the success—for example, "It was just luck."

2. *The Mathematics as a Male Domain Scale (MD)* is intended to measure the degree to which students see mathematics as a male, neutral, or female domain in the following ways: (a) the relative ability of the sexes to perform in mathematics; (b) the masculinity/femininity of those who achieve well in mathematics; and (c) the appropriateness of this line of study for the two sexes.

3. and 4. *The Mother (M)/Father (F) Scale* is designed to measure students' perception of their mother's/father's interest, encouragement, and confidence in the student's ability. It also includes the student's perception

of their mother's/father's example as an individual interested in, confident of, and aware of the importance of mathematics.

5. *The Teacher Scale (T)* is designed to measure students' perceptions of their teacher's attitudes toward them as learners of mathematics. It includes the teacher's interest, encouragement, and confidence in the student's ability.

6. *The Confidence in Learning Mathematics Scale (C)* is intended to measure confidence in one's ability to learn and to perform well on mathematical tasks. The dimension ranges from distinct lack of confidence to definite confidence. The scale is not intended to measure anxiety or mental confusion, interest, enjoyment, or zest in problem solving.

7. *The Mathematics Anxiety Scale (A)* is intended to measure feelings of anxiety, dread, nervousness, and associated bodily symptoms related to doing mathematics. The dimension ranges from feeling at ease to feeling distinct anxiety. The scale is not intended to measure confidence in, or enjoyment of, mathematics.

8. *The Effectance Motivation Scale in Mathematics (E)* is intended to measure effectance as applied to mathematics. The dimension ranges from lack of involvement in mathematics to active enjoyment and seeking of challenge. The scale is not intended to measure interest in, or enjoyment of, mathematics.

9. *The Mathematics Usefulness Scale (U)* is designed to measure students' beliefs about the usefulness of mathematics currently, and in relationship to their future education, vocation, or other activities.

It is recognized that the domains of these scales intersect. However, for certain purposes it is important to measure each variable separately. Included in the referenced article are correlations among the scales by sex. The results of a principal components factor analysis are also in the article.

During 1975 and 1976 two large empirical studies used all scales described except the Mathematics Anxiety Scale. The 1975 data were obtained from students in grades 9–12 ($N = 1233$), and the 1976 data were collected from students in grades 6–8 ($N =$ approximately 1500). These data are currently being analyzed and will be reported as soon as possible. Both studies have focused on gaining new insight into sex-related differences in mathematics achievement and variables related to such differences if they exist. In addition to the affective factors measured by the scales described here, selected cognitive factors were also investigated.