

Measuring STEM Attitudes and Career Interests

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Why are STEM Attitudes Important?

1. Most projects last three or four years. There is no time to determine if more students enter the career workforce as a result of the project.
2. High achievement in STEM in school doesn't necessarily translate into a STEM career choice.
3. For continued funding, there is a need to measure change.
4. ITEST was founded to address the shortage of information technology workers in the US. STEM attitudes and the relationship of those attitudes to employment is critical.
5. ITEST projects face the research challenge of “assess[ing] and predict[ing] inclination to participate in the STEM fields and ... measure[ing] and study[ing] the impact of various models to encourage that participation” (NSF, 2009)

The Need for Instrumentation

- ▶ Middle Schoolers Out to Save the World (MSOSW) ITEST Project (2008 – 2011), spent its first year focused on the development of reliable and valid instruments to assess interest in STEM content areas and STEM careers.
- ▶ The outcome of interest is changes in student STEM career interest, and instruments were developed toward that end.
- ▶ MSOSW focused on the measurement properties of two instruments: the STEM Semantics Survey and the Career Interest Questionnaire.
- ▶ Both instruments are intended to serve as major indicators for perceptions of STEM disciplines and careers.

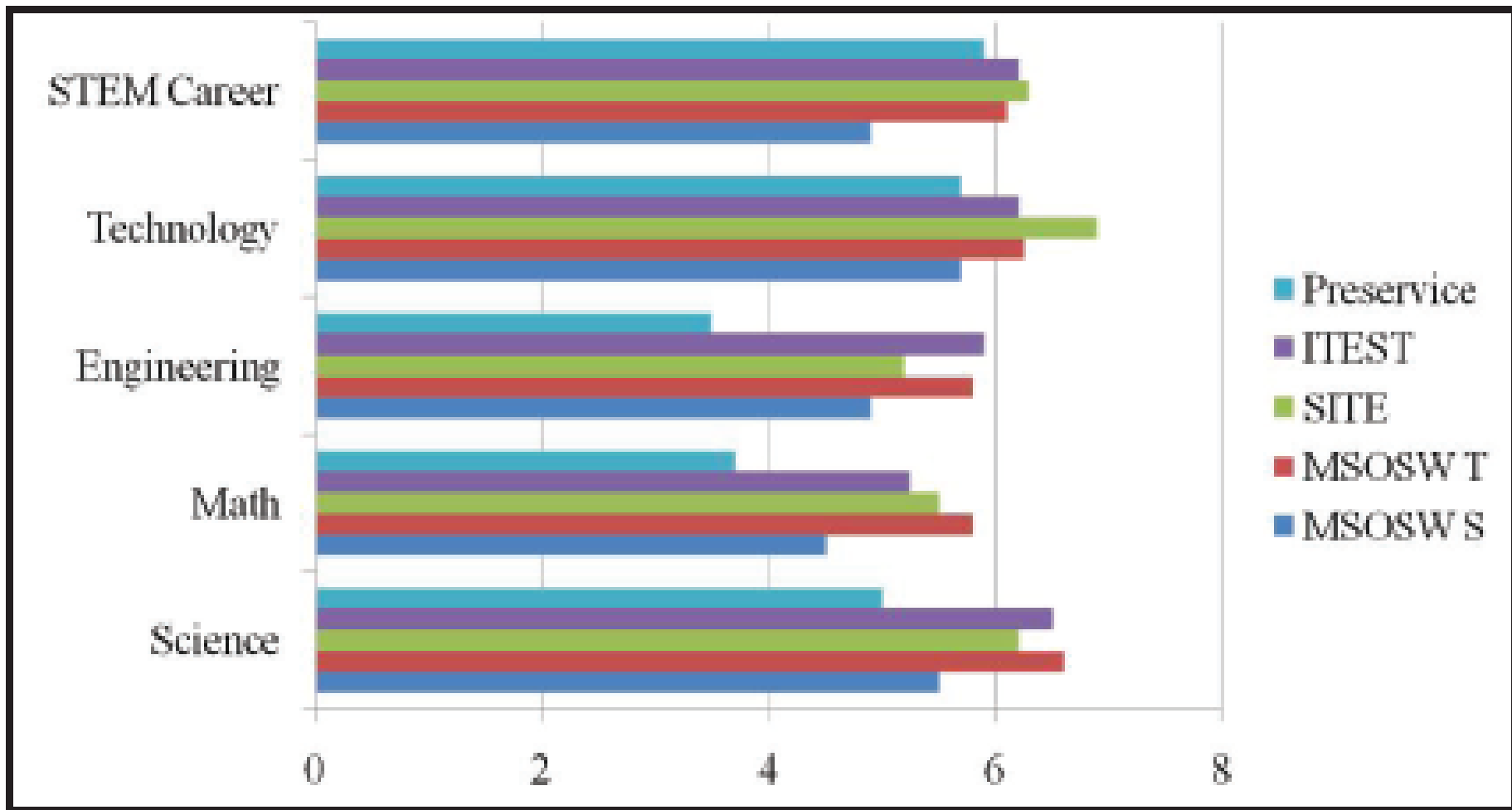
Two Instruments Developed to Fulfill a Gap

- ▶ STEM Semantics Survey and the Career Interest Questionnaire are intended to serve as major indicators for perceptions of STEM disciplines and careers.
 - ▶ The STEM Semantic Survey is a 25-item instrument that measures interest in science, technology engineering and mathematics as well as interest in STEM careers more generally.
 - ▶ The Career Interest Questionnaire is a 12-item instrument that measures interest in careers in broad science areas.
 - ▶ The STEM Semantics Survey has the benefit of being appropriate for both teachers and students, while the Career Interest Questionnaire targets students only

Types of Validity Important to the Instruments

- ▶ **Content validity** refers to the extent to which a measure represents all facets of a given construct
- ▶ **Construct validity** refers to the degree to which a test measures what it claims, or purports, to be measuring
- ▶ **Differential validity** refers to the possibility that different prediction equations can be generated for different subgroups of a population, as defined by factors such as race, sex, ethnic group, or religion.

Career Interest Inventory



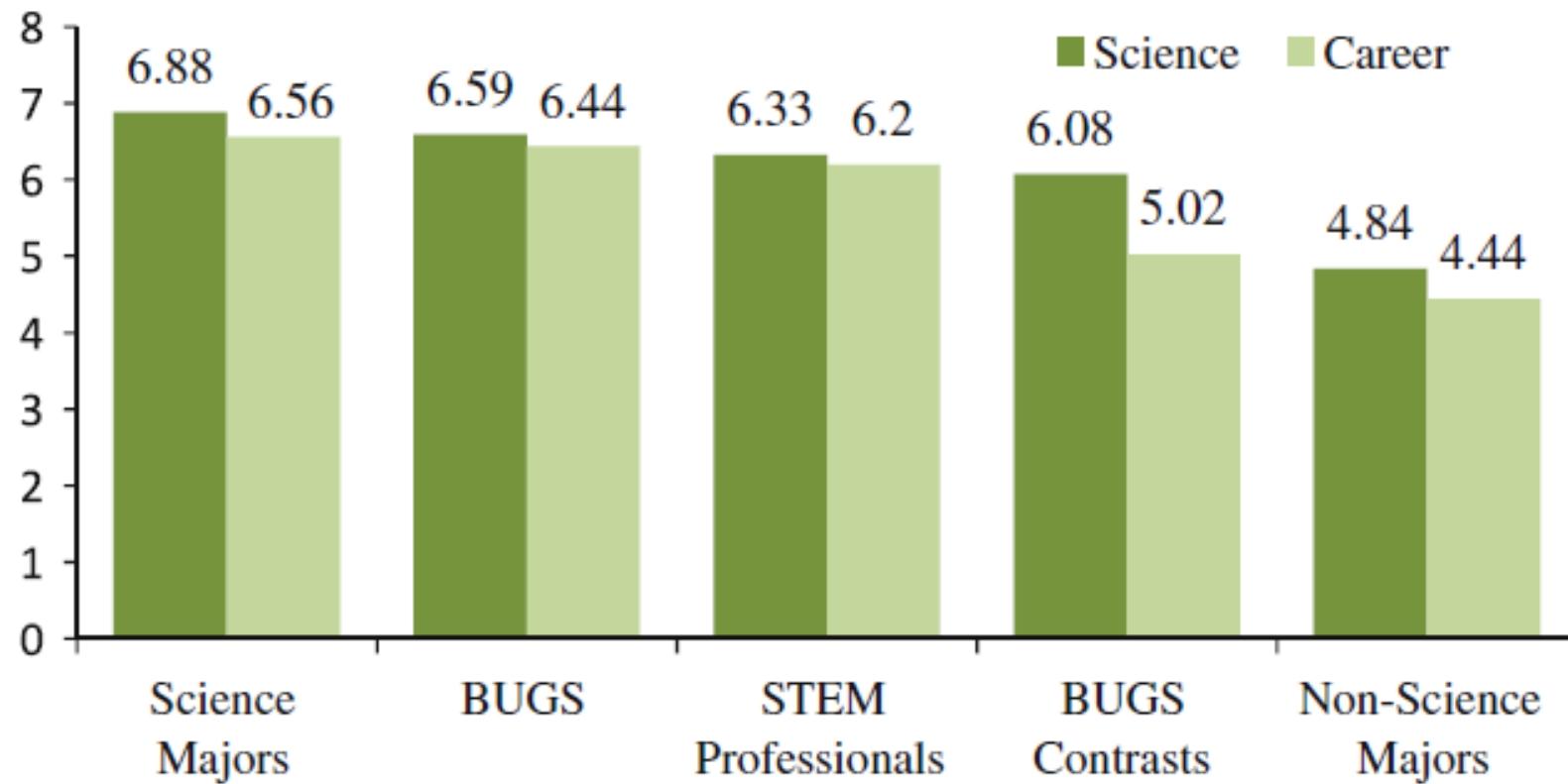
Bringing Up Girls in Science (BUGS)

- ▶ BUGS was an afterschool program for 4th and 5th grade girls that provided authentic learning experiences in environmental science as well as valuable female mentoring opportunities in an effort to increase participants' academic achievement in science. The original BUGS participants and contrasts have now completed high school and entered college, allowing researchers to assess the long-term impact of the BUGS program

Follow-up Study

- ▶ Fourteen former BUGS participants completed the STEM Semantic Survey. Their results were compared to four contrast groups composed entirely of females: 12 former BUGS contrasts, 10 college science majors, 10 non-science majors, and 9 current STEM professionals. Results indicate that BUGS participants have higher perceptions of science careers than BUGS contrasts.
- ▶ The instrument is capable of measuring differences in various populations.

Bringing Up Girls in Science Data: STEM Semantic Survey



Limited Value of an Instrument

- ▶ Novodovorsky (1993) after a review of literature resulted in her conclusion that “many existing instruments are based on ill-defined theoretical constructs, and include statements that do not appear to be assessing the single construct of attitude toward science.” After an item analysis, her initial 60 item scale was honed down to 20 items describing three factors: 1. Interest in science classes and activities in science classes 2. Confidence in the ability to perform science tasks 3. Interest in science-related activities outside of school. The items were found to yield good reliability, but inadequate information was reported for the construct and criterion related validity of the instrument.

The Concept to Be Measured

- ▶ The concept or construct to be measured should be appropriately defined in your study.
- ▶ The instrument you select should match your research questions.
- ▶ The manual or documentation of the instrument should match your defined constructs/concepts.



Measuring STEM Affinity

- ▶ Two Instruments from UNT:
 - ▶ Career Interest Inventory
 - ▶ STEM Sematic Survey (IITTL, <http://iittl.unt.edu/content/instruments>)
- ▶ Additional Instruments for Consideration
 - ▶ Students' Attitudes Toward STEM: An Instrument for High School STEM-Based Programs (Mahoney, 2010)
 - ▶ CBAM (Concerns Based Adoption Model)
 - ▶ originally was used to understand how a person, reacts to a change in instruction or educational format. The instrument is designed to be to gauge change over time (Hall, 1978)
 - ▶ Kuder Occupational Interest Survey Form DD
 - ▶ Ohio Vocational Interest Survey

STEM Instruments are Gaining Popularity in the General Population

[http://stemcareer.com/
2011/05/instruments-to-
measure-stem-interest-and-
more/](http://stemcareer.com/2011/05/instruments-to-measure-stem-interest-and-more/)



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