

Teacher Efficacy and Attitudes toward STEM (T-STEM) Survey: *Development and Psychometric Properties*

The T-STEM survey invites teachers to give information about:

- Their self-efficacy for teaching;
- Their belief that teachers affect student learning;
- How often students use technology;
- How often they use certain STEM instructional practices;
- Their attitudes toward 21st century learning;
- Their attitudes toward teacher leadership; and
- Their awareness of STEM careers.

Five versions of the T-STEM survey have been developed: one for each teaching area of STEM (Science, Technology, Engineering, and Mathematics), and one for elementary teachers.

Table 1: *T-STEM Survey Summary*

Construct	Measurement Application
Personal Teaching Efficacy and Beliefs	self-efficacy and confidence related to teaching the specific STEM subject
Teaching Outcome Expectancy Beliefs	degree to which the respondent believes, in general, student-learning in the specific STEM subject can be impacted by actions of teachers
Student Technology Use	how often students use technology in the respondent’s classes
STEM Instruction	how often the respondent uses certain STEM instructional practices
21st Century Learning Attitudes	attitudes toward 21st century learning
Teacher Leadership Attitudes	attitudes toward teacher leadership activities
STEM Career Awareness	awareness of STEM careers and where to find resources for further information

Note: Item #5 in the Personal Teaching Efficacy and Beliefs construct, “I wonder if I have the skills necessary to teach [STEM subject],” is negatively worded. All other items are positively worded.

The Personal Teaching Efficacy and Beliefs (PTEB) construct and the Teaching Outcome Expectancy Beliefs (TOEB) constructs were derived from a well-known survey of science teachers, the Science Teaching Efficacy Belief Instrument, or the STEBI (Riggs & Enochs, 1990). The Student Technology Use construct was developed from the Student Technology Needs Assessment, or STNA (SERVE Center, 2005). The STEM Instruction construct was based on items that were developed by The Friday Institute and used in a statewide evaluation of the professional development activities of North Carolina’s Race to the Top grant (Corn, et al., 2013). The 21st century learning attitudes construct was adapted from the Friday Institute’s Student Learning Conditions Survey (2011). Finally, each item in the Teacher Leadership Attitudes construct was taken from the North Carolina Department of Public Instruction’s professional standards for educators (2012). The versions of the T-STEM Survey vary in the specific subject area referenced in the survey items. For example, one item is written in the Science T-STEM, “I am continually improving my science teaching practice,” and in the Math T-STEM the same item is written, “I am continually improving my math teaching practice.” The Elementary T-STEM includes both versions of the science-specific and math-specific items since most elementary teachers teach both. The 21st Century Learning Attitudes, Teacher Leadership Attitudes, and STEM Career Awareness sections, however, are identical across all five survey versions.

Validity and Reliability

The pilot Science, Technology, Engineering, Math, and Elementary T-STEM Surveys (which included only the PTEB and TOEB constructs) were administered to 257 science teachers, 72 technology teachers, 17 engineering teachers, 120 math teachers, and 218 elementary teachers. Formal analysis was only done on science, math, and elementary teachers due to sample sizes. Survey items were edited based on analysis uniformly across all five survey versions. Based on results from factor analysis and confirmed through feedback, four survey questions were dropped that did not load properly on any version. Other items that cross-loaded, or did not load in a consistent manner across all survey versions, were reworded and retained in the survey. Student achievement language was changed to student growth language, and negative or

confusing wording was removed. Five new constructs were added based on logic models derived from additional research and project goals for analysis: Student Technology Use, STEM Instruction, 21st Century Learning Attitudes, Teacher Leadership Attitudes, and STEM Career Awareness. When sample size permitted, the five revised teacher surveys were analyzed again using exploratory factor analysis. Each factor performed as expected and no additional changes were found necessary for the survey. The construct reliability levels, measured with Cronbach's Alpha, are:

Table 2: *T-STEM Survey Reliability*

Construct	Number of Items	Cronbach's Alpha				
		Science (n=154)	Technology (n=59)	Engineering (n=9)	Math (n=102)	Elementary (n=228)
Personal Teaching Efficacy and Beliefs	11	.908	N/A	N/A	.943	.905 (Sci) .939 (Math)
Teaching Outcome Expectancy Beliefs	9	.814	N/A	N/A	.849	.854 (Sci) .895 (Math)
Student Technology Use	8	.900	N/A	N/A	.869	.943
STEM Instruction	14	.934	N/A	N/A	.929	.95
21st Century Learning Attitudes	11	.948	.948	.948	.948	.948
Teacher Leadership Attitudes	6	.870	.870	.870	.870	.870
STEM Career Awareness	4	.945	.945	.945	.945	.945

Citation and Further Information

Recommended citation:

Friday Institute for Educational Innovation (2012). Teacher Efficacy and Beliefs toward STEM Survey. Raleigh, NC: Author.

For more information, and to find out how to access the surveys for your own use, please visit:

<http://miso.ncsu.edu/articles/evaluation-tools>

Or email Tracey Collins at tracey_collins@ncsu.edu.

References

Corn, J., et al. (2013) Second Annual Race to the Top Professional Development Evaluation Report: Part II Local Outcomes Baseline Study. Raleigh, NC: Friday Institute for Educational Innovation, North Carolina State University. Available from <http://cerenc.org>

North Carolina Department of Public Instruction. (2012). *North Carolina Professional Teaching Standards*. Raleigh, NC. Retrieved from <http://www.ncpublicschools.org/docs/effectiveness-model/ncees/standards/prof-teach-standards.pdf>

SERVE Center (2005). For more information see <https://eval.fi.ncsu.edu/school-technology-needs-assessment-stna/>

Riggs, I.M., & Enochs, L.G. (1990). Toward the development of an Elementary Teacher's Science Teaching Efficacy Belief Instrument. *Science Education*, 74(6), 625-637.

The William and Ida Friday Institute for Educational Innovation. (2011). Governor Perdue's North Carolina Student Learning Conditions Survey (SLCS): Survey Implementation Study. Raleigh, NC: Author.