



The Innovative Technology Experiences for Students and Teachers (ITEST) program was established by the National Science Foundation (NSF) in direct response to current concerns and projections about the growing demand for and current shortages of STEM (Science, Technology, Engineering and Mathematics) professionals in the U.S. and seeks solutions to help ensure the breadth and depth of the STEM workforce. The ITEST National Learning Resource Center (LRC) at Education Development Center, Inc., supports projects and synthesizes and disseminates the program's learnings to a wide audience.

This Data Brief explores project level findings reported in the 2011–2012 Management Information Systems (MIS). Overall, these results shed light on the collective findings from the ITEST program, and provide examples of successful participant outcomes and project implementation strategies of interest to the ITEST Community and NSF. Additional and more in-depth analyses of MIS questionnaire data will likely uncover further evidence of replicable models from ITEST that contribute to the knowledge base on science, technology, engineering and mathematics (STEM) education and workforce development.



Published Instruments Used by ITEST Projects to Measure Impact

This Data Brief explores findings reported in the 2011-2012 Management Information System (MIS). In this edition we focus on the topic of validated instruments, by analyzing information reported by the projects regarding their use of instruments to measure youth and teacher outcomes, their research questions and their evaluation questions. The MIS asked project Principal Investigators (PIs) whether or not they use externally developed and validated instruments to measure youth or teacher outcomes. For those projects using external instruments, the MIS asked the PI to specify the instrument name. 27 PIs said they use externally validated instruments to measure youth outcomes, and 29 PIs said they do so to measure teacher outcomes. The PIs identified a total of 84 different validated instruments currently in use (12 different instruments were identified by more than one PI).

Of the 84 instruments, we were able to access 44 of them in an online search. A content analysis of the instruments found that the validated instruments used by ITEST projects measure 18 individual constructs which can be categorized in five domains: Affective, Content Knowledge and Skills, Career Development, Teaching Practices and 21st Century Skills. This list of constructs was developed by reviewing the STEM literature, looking into constructs used by other instrument databases, and specific knowledge of the constructs being measured by ITEST projects.

Figure 1. Constructs measured by externally validated instruments listed by domain

Affective Domains	Career Development	Content Knowledge and Skills
attitude	career decision-making	STEM subject matter knowledge
confidence	career interest	
interest	career knowledge	
motivation		
persistence		
self-concept (self-efficacy)		
Teaching Practices	21st Century Skills	Other
effectiveness of teaching	creativity	learning strategies
pedagogical knowledge	leadership	support
pedagogical practice		

Instruments used by ITEST Projects

In addition to asking about validated instruments, the MIS asked projects to list their research and evaluation questions. These questions were reviewed and categorized into 18 outcome areas. A cross-walk of the outcome areas with the instrument domains above shows that of the 18 outcome areas, 12 are included in the 44 instruments that we located (Figure 2). The six outcome areas not represented in the instruments include two outcome areas related to technology/cyberinfrastructure and two outcome areas related to youth interaction with STEM beyond the classroom.

Figure 2. Domains by outcome area and reported instruments

Domain	Outcome measured by validated instrument(s)	Outcome not measured by validated instrument(s)
Affective	<ul style="list-style-type: none"> Youth interest in STEM Youth interest STEM careers Youth self-efficacy in STEM Changes in teacher perception of STEM Changes in self-efficacy in teaching STEM content 	
Career Development	<ul style="list-style-type: none"> Youth knowledge of STEM careers, preparation and/or workplace demands Changes in teacher knowledge of STEM career information and/ or workplace demands 	<ul style="list-style-type: none"> Changes in youth participation in STEM related activities Youth entry into STEM career paths
Content Knowledge and Skills	<ul style="list-style-type: none"> Youth STEM content knowledge Changes in youth skills applying STEM concepts Changes in teacher STEM content knowledge 	<ul style="list-style-type: none"> Youth skills using technology tools
Teaching Practices	<ul style="list-style-type: none"> Teacher practice/pedagogy Changes in teacher knowledge of how to use cyberinfrastructure/ technology tools in the context of STEM teaching 	<ul style="list-style-type: none"> Teacher implementation of ITEST materials Changes in teacher use of cyberinfrastructure/ technology tools
21st Century Skills	<ul style="list-style-type: none"> Changes in youth ways of thinking and problem-solving 	

*This table represents an attempt by the LRC to bring together the collective knowledge of the ITEST community regarding the validated instruments available to measure constructs of interest to the group. Outcome areas measured and validated instruments used were not matched in a project by project basis.

The ITEST LRC has developed a [database](#) of the 44 externally validated instruments used by ITEST projects that we were able to access in an online search. For these 44 instruments we gathered publically-available information regarding the constructs they measure, information about their validity and reliability, and in some cases links to the instruments themselves. We plan to keep adding validated instruments of interest to the ITEST community as well as STEM educators in general.

Listed below is a brief sample of instruments reported on the MIS. Included is the type of information you will find for each instrument in the database developed by the LRC.

Figure 3. Sample of instruments reported on the MIS

Instrument Name	Constructs Measured	Description of Instrument
Self-Efficacy in Technology and Science (SETS)	Affective Domains—self-concept (self-efficacy)	Specific measure of self-efficacy in science inquiry and technology for middle school students. The instrument has content and construct validity and has internal consistency of 0.86.
Career Interest Questionnaire	Career Development—career interest Affective Domains—interest	Instrument for assessing interest in STEM content and careers. Validity studies for this instrument show evidence of construct and criterion validity, and preliminary evidence of discriminant validity.
Reformed Teaching Observation Protocol (RTOP)	Teaching Practice—pedagogical practice	Developed as an observation instrument to provide a standardized means for detecting the degree to which K-20 classroom instruction in mathematics or science is reformed. There is strong support for the inquiry-based construct validity and the estimate for reliability is very high as well.

Summary

This Data Brief discussed the LRC’s findings regarding the use of published instruments by ITEST projects. The main findings include the following:

- There are at least 84 validated instruments currently being used by ITEST projects, 44 of which we were able to locate.
- Instruments being used measure 18 individual constructs of interest in five construct areas: Affective Domains, Career Development, Content Knowledge and Skills, Teaching Practice, and 21st Century Skills
- We identified validated instruments corresponding to two thirds (2/3) of the outcome areas currently being addressed by the research and evaluation questions of the community.
- The ITEST LRC has established an [online repository](#) of the instruments, and will continue to add to it.



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