

# STEM Learning Activation: Measuring Student Activity Across Time and Space

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## What is *Activation*?

SCIENCE LEARNING

## ACTIVATION LAB

**Learning Activation:** the set of dispositions, practices, and knowledge that enable success in proximal science, technology, engineering, art, and mathematics experiences. "Success" refers to learners' choice to participate in learning opportunities when presented, their positive engagement during a learning experience, perceived success during a learning activity, and learning from the experience. To date, literature reviews and empirical study has revealed five *dimensions* described below that can be measured via surveys and observation protocols. They can be measured independently, or together to assess learners' overall Activation.

### Dimensions of Activation:

- **Fascination:** interest and positive affect toward science, curiosity about the natural world, and goals of acquiring and mastering skills and ideas.
- **Values:** the importance placed on being able to know or do science because of its utility in being able to meet personal goals, and its utility to society.
- **Competency Beliefs:** the learner's beliefs about their ability to successfully participate in diverse learning situations as well as their beliefs about having core skills.
- **Scientific Sensemaking** (science learning only): interacting with text and tasks using methods generally aligned with science, like: asking good questions, seeking explanations, engaging in argumentation, and interpreting data.
- **Innovation Stance** (STEM learning only): enthusiasm for new STEM-related ideas, for trying new ways of doing things in STEM, and for sharing STEM ideas with others.



### Other constructs measured via survey:

**Engagement:** administered immediately post-experience. Includes affective (intending to produce a result, i.e. persistence), behavioral (participation in experience), and cognitive (psychological thinking).

**Perceived success:** administered immediately post-experience. the degree to which participant felt they succeeded at a particular STEM learning experience.

**Choice preference:** extent to which learners wish to participate in a science-related activity.

**Background:** demographic characteristics and past experiences



### Emerging Activation

We theorize that the dimensions of Activation do not differentiate themselves until the pre-teen years. Prior to that, Activation may be measured as a single construct in learners. As such, we have developed a survey that measures the entire construct using items derived from the individual dimension surveys called the *Emerging Activation* survey. Because the survey is administered to younger learners, we use a modified response scale and advise that an adult facilitator read the individual questions and help respondents answer, if needed.

1. Please rate these according to YES!, yes, no, NOI!				
	YES!	yes	no	NOI
a. I love designing things!	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I like to figure out how things work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sample item from Fascination survey.

Circle the one that describes you the best.				
1. I figure out new ways to do things.				
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sample item from Emerging Activation survey.



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Nancy Boyer, Ph.D., Director of Evaluation & Impact  
**FIRST®**

## Case Study: *Activation* and *FIRST®*

### History of Activation and FIRST

The Hall started working with *FIRST®* in 2013 to assess the impact of the *FIRST®* LEGO® League Jr. program. Using a pretest-posttest format, the Hall simplified the STEM Learning Activation instruments to a more user-friendly format for youth ages 6-10.

In following years, *FIRST* needed an instrument that would be easy to administer and would provide data that assessed the outcomes of program participation across multiple settings, age groups, and demographics.

The Hall developed a retrospective pre at post instrument that would make administration easier (no tracking of participant data). The STEM Learning Activation instrument was shortened, new response categories added (a "now" and "before" section for each question), and tested through cognitive labs.

*FIRST* has successfully used the retrospective pre at post instrument over the last three years and has been able to use the data to make decisions on program effectiveness across age groups, geography, and demographic characteristics.

### Why do we use these instruments?

In many of the cases where *FIRST* wants to assess how well their programs ignite learning, engagement, and interest in STEM, they have **limited evaluation resources** to implement a formal study.

The **simplicity of the instruments** allows teachers, coaches (*FIRST* program group leaders), and other adults to administer the survey easily.

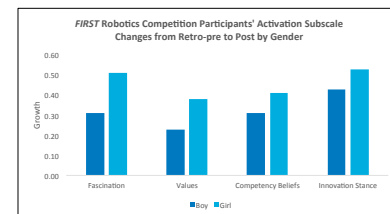
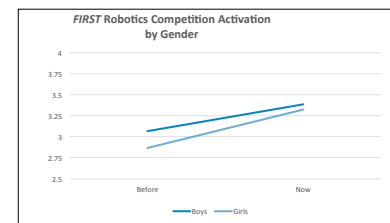
The results provide them with **student-level data**, which is often difficult to gather through their routine internal evaluation process.

Often, when they do not have the resources or ability to track students and monitor outcomes over time, this tool **predicts future engagement in STEM** – helping them to **better assess the longer term outcomes** of program participation.

Results help us determine if **impact is consistent** across demographic groups, sites, and ages.

Examples of how *FIRST* has made sense of this data can be found to the right.

Remember, the left (-) side is for how you felt before <b>BEFORE</b> you started this program and the right (+) side is for how you think and feel <b>NOW</b> .									
BEFORE					NOW				
YES!	yes	no	NOI		YES!	yes	no	NOI	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I'm really good at science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I find new ways to solve problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	



Visit [activationlab.org](http://activationlab.org) for technical reports and more information about the instruments

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*FIRST* is the world's leading youth-serving nonprofit advancing science, technology, engineering, and math (STEM). For nearly 30 years, *FIRST* has evolved into a global movement by engaging millions of people with a proven game-changer for preparing kids to solve the world's greatest problems. *FIRST* programs inspire innovation and leadership through engaging, hands-on robotics challenges developed to ignite curiosity and passion in students in grade K-12.

