



**Title:** Synthesis: A quantitative meta-analysis and qualitative synthesis on the impacts of informal STEM and ICT programs on cognitive and social-emotional outcomes of youth participants

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**Project Overview:** Our goal is to perform a quantitative meta-analysis and qualitative synthesis of research on youth participants of informal STEM and ICT programs. We focus on two research questions: (1) How and to what extent do informal, out-of-school time (OST) STEM and ICT learning experiences impact K-12 participants' awareness, interest, and engagement in STEM majors and STEM careers? (2) What aspects of programs were most effective in maximizing impact and broadening participation of underrepresented groups?

### Preliminary Outcomes:

From a subset of studies that exhibited strong or exemplary research design and evidence of impact, three important patterns emerged: (1) long-term participation in ISE programs was associated with broadening participation in STEM; (2) research-based apprenticeship models and (3) youth docent/explainer models were found to be effective strategies for attracting and retaining students from historically underrepresented groups in STEM trajectories.

### Lessons Learned & Insights Gained

To date, we have created a database summarizing nearly 700 studies of informal STEM and ICT programs. From a subset of these studies that exhibited exemplary evidence of impact, we conducted a **qualitative meta-synthesis** by working collaboratively to identify program design principles and best practices for adoption by STEM and ICT practitioners to maximize impact and broaden participation of underrepresented groups.

### Equity

Our meta-synthesis study is grounded in **social identity theory** (Tajfel and Turner 1979), which posits that persistence in a STEM trajectory is a function of how individuals form a sense of who they are based on their group membership. We hypothesize that not all practices work universally and that specific strategies are needed to foster persistence for groups historically marginalized from STEM and ICT fields.

### New Challenges & Next Steps

One challenge is that studies of STEM and ICT programs differ in research design quality and evidence of impact. To address this challenge, we used two recently validated rubrics developed by our team (Habig 2020) to identify studies that exhibited exemplary evidence of research design quality and impact. From these studies, we extracted program design principles, technology-based innovations, theoretical underpinnings, and best practices that can be adopted by STEM and ICT practitioners to maximize impact and broaden participation of females and members of historically marginalized racial and ethnic groups.