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Evidence in Action

A K20 Center Research Brief

The Impact of an Out-of-School STEM Education Program on Students' Attitudes Toward STEM and STEM Careers

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Introduction

This study responds to the global call for enhancing student engagement in STEM (Science, Technology, Engineering, and Mathematics) through both formal and informal learning environments. The authors highlight the growing importance of out-of-school STEM programs in fostering student interest and positive attitudes toward STEM disciplines and careers. Drawing on prior research, they emphasize that such programs offer flexible, interdisciplinary learning opportunities that are often constrained in traditional classroom settings. The study aims to evaluate the impact of a university-based, out-of-school STEM program on sixth-grade students' attitudes toward STEM and related careers.

Methodology

Research Design:

A mixed-methods approach was used, combining quantitative (pre/post surveys) and qualitative (semi-structured interviews) data.

Sample:

40 sixth-grade students (ages 10–12) from 24 different public middle schools in Turkey. Selection criteria included no prior STEM program experience and academic diversity.

Data Analysis:

- Quantitative: Paired samples t-tests were used to compare pre- and post-program survey scores.
- Qualitative: Interview transcripts were coded and analyzed thematically to identify patterns in student responses.

Results

The program significantly improved students' attitudes toward STEM, particularly in two areas:

- Personal and social implications of STEM (e.g., career interest and perceived value of STEM in society)
- Learning of science and engineering and their relationship to STEM

Students reported:

- Increased interest in STEM careers (e.g., engineering, architecture)
- Enhanced cognitive and collaborative skills
- Stronger connections between STEM concepts and real-life applications

Although gains in attitudes toward mathematics and technology were not statistically significant, all areas showed positive trends.

Application into Practice

Replication in Schools:

To implement a similar program, schools can partner with local universities or STEM organizations STEM camps. Key components include:

- **Dosage:** 40 hours total
- **Structure:** 14 hands-on, interdisciplinary modules (e.g., egg-drop challenge, wind turbine design, scaled solar system model)
- **Instructional Design:** Use authentic learning contexts, engineering design processes (8-step model), and content integration across STEM disciplines
- **Staffing:** Involve trained facilitators and support staff to guide small student groups
- **Assessment:** Use pre/post attitude surveys and student reflections to measure impact

Work Cited

Baran, E., Canbazoglu Bilici, S., Mesutoglu, C., & Ocak, C. (2019). The impact of an out-of-school STEM education program on students' attitudes toward STEM and STEM careers. *School Science and Mathematics*, 119(4), 223–235. https://doi.org/10.1111/ssm.12330