

Effects of STEM Guest Speaker Sessions on Student Interest in STEM

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Introduction

The most in-demand technical skills in the modern job market are in STEM (science, technology, engineering, and math) (Noonan, 2017; Smithsonian, n.d.). A major reason for the STEM labor shortage is declining student interest in STEM (Kim, 2018). However, common types of STEM education fail to teach passion in addition to content. This research is a case study in Putnam County, Tennessee, of the effectiveness of STEM guest speakers at increasing student interest in STEM and STEM careers.

Benefits of Guest Speakers

Traditional classroom instruction is too standards-focused to foster enthusiasm for STEM, while nontraditional forms of STEM education, such as extracurriculars and field trips, can be exclusive or costly. The literature reveals the following other benefits guest speakers bring to students:

- Networking and role modelling (Kamoun & Selim, 2007)
- Exposure to “real-world” applications of content (Kamoun & Selim, 2007)
- Nonroutine teaching style (Leor, 2015)
- Increased confidence in the speaker’s field (Kamoun & Selim, 2007)

Many students are disinterested in STEM due to common misconceptions. Guest speakers can easily dispel (implicitly and explicitly) the following myths:

- STEM is “too hard” (Kim, 2018)
- STEM careers always require higher education (Kim, 2018; Noonan, 2017)
- STEM is not altruistic (Kim, 2018)
- STEM is “boring” (Kennedy, Hefferon, & Funk, 2018)

Research Questions

Much previous research has been done on guest speakers in the college classroom, but my research focuses on the Pre-K–12 classroom and examines on benefits to teachers and speakers as well as students. It also judges effectiveness based on interest rather than on academic outcomes. My research questions are as follows:

1. How effective are STEM guest speaker sessions at improving student attitudes toward STEM, STEM careers, and their relation to them?
2. Are teachers and speakers empowered by speaker sessions?
3. Do results depend on demographics: student grade level, school poverty rate, STEM opportunities at the school, or speaker’s area of STEM?

Methodology

All data comes from pre- and post-intervention questionnaires by voluntary response samples of Putnam County teachers (N=8) and area STEM professionals (employees and university students) (N=5). All recruitment materials included a link to a website (Figure 1) that walked participants through the steps of the study and provided teachers with a list of speakers’ names, fields, and contact information (Figure 2) so they could schedule a session. It was participants’ responsibility to complete all study tasks by the study deadline.

Speaker Dashboard

Study procedures

Before you do anything else, fill out the Pre-Session Speaker Questionnaire. When you click the link, you’ll be redirected to Qualtrics, where you’ll read the informed consent document and fill out the questionnaire. Once you’ve filled it out, teachers will be able to view your information (name, occupation or field of study, and email) in the list of speakers and may email you to schedule a session. After you are scheduled and speak at the session, you will fill out the Post-Session Speaker Questionnaire. Note that you are not guaranteed to be scheduled. If you are not scheduled, you will not be able to complete the study. The “To-do” list below shows your remaining tasks. **The deadline for completion of surveys is December 5.**

Note: Surveys open in a new tab. To update the to-do list after clicking on a link, refresh this page. **The link will disappear after you refresh the page.**

To-do

1. Fill out the [Pre-Session Speaker Questionnaire](#)
2. Fill out the [Post-Session Speaker Questionnaire](#)

Speaker material

The goal of a session is to increase student awareness of STEM careers, dispel myths about STEM, and interest students in the your occupation or field of study. You should do all of the following:

- Describe to students your occupation or field of study. What does that look like on a daily basis?
- Show enthusiasm for your occupation or field of study. Why is it interesting to do that job or study that field?
- Consider the audience. The teacher should properly inform you about what kind of audience you will be speaking to, so that you can choose material accordingly. For example, an electrical engineer might pass around circuit boards for a kindergarten class and mention his prerequisite education to high school juniors.
- Answer questions. You and the teacher may agree on a designated time for questions, or you may answer questions throughout the session. An important thing to remember is that the younger the audience, the more questions they will have, so it may be best to save questions for the end.
- Have fun! If you remember that your goal is to interest others in what interests you, the rest should follow smoothly.

How to withdraw from the study

If you do not fill out both surveys (because you choose not to or because you don’t end up being scheduled), your responses cannot be included in the study. If you know you don’t want to complete the study, you may delete your account, but having an account doesn’t automatically make you a participant, and deleting it doesn’t withdraw you from the study.

[Logout](#)
[Delete account](#)

Figure 1. Speaker homepage (dashboard) of the study website. Links in the “To-do” list became available when all previous links had been visited.

Speakers List

Find a speaker you’d like to host in your classroom, and send them an email to schedule a session.

Name	Occupation/Field of Study	Email
Miaam Dixon	Web development	dolpin@example.com
Louisa Jones	Nuclear physicist	ljones@example.com
Bob Roberts	Computer Engineering	bob@example.com
Gregory Silvers	Math	gs@example.com
Haley Smith	pharmacist	haley-smith@example.com

[Back to dashboard](#)
[Logout](#)
[Delete account](#)

Figure 2. Example list of speakers as seen from a teacher account. Note that this data is fabricated.

Questionnaires

Participants filled out a questionnaire before and after a speaking session. The types of questions are shown in Table 1. Likert ratings are on a scale of 1 (strongly disagree) to 5 (strongly agree).

Table 1

Question types on the four surveys

Question type	Description	Pre-Session Questionnaire items	Post-Session Questionnaire items	Evidence in favor of hypotheses	Example
Student Attitude	Likert questions about student perceptions of STEM, STEM careers, and students’ relation to them	Teacher: 9–14 Speaker: 8–13	Teacher: 16–21 Speaker: 15–20	Difference ^a in mean ratings pre- versus post-session	“The students believe stereotypes about STEM.”
Teacher/Speaker Attitude	Likert questions about teacher and speaker attitudes toward STEM education and their role in it	Teacher: 4–8 Speaker: 2–7	Teacher: 11–15 Speaker: 9–14	Increase in mean ratings pre- versus post-session	“I believe STEM education is important.”
Demographic	Student, school, and speaker characteristics	Teacher: 1–3 Speaker: 1	N/A	Depending on demographics, analysis of Likert questions yields different results	“Which component of STEM most closely aligns to your job title?”
Session	Likert questions about the quality of the speaking session	N/A	Teacher: 1–10 Speaker: 1–8	High mean ratings	“I enjoyed the session.”

Notes: ^aAll mean ratings should increase except “Students lack confidence in their STEM abilities” and “Students believe stereotypes about STEM.”

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Limitations

Due to short study duration, only three teachers were able to host a speaker and fill out the post-session survey. No speakers filled out the post-session survey.

The teacher sample is also very homogenous. Seven of the eight – and all three who filled out both surveys – teach grades 2–4 at a high-poverty school with no STEM-related clubs or electives.

Due to these limitations, I cannot analyze results based on Demographic items and cannot generalize the results beyond the student and teacher demographics in the study.

Results

Student Attitudes

The following Teacher Questionnaire Student Attitude items show a statistically significant increase ($\alpha=0.05$) in mean Likert rating from the Pre-Session to Post-Session Teacher Questionnaire:

- The students are interested in STEM as a discipline ($p=0.029$).
- The students are aware of many STEM careers ($p=0.029$).
- Many of the students want to enter a STEM career ($p=0.019$).

The following Student Attitude item shows a significant decrease in mean:

- The students believe stereotypes about STEM ($p=0.029$).

Teacher and Speaker Empowerment

The Pre-Session Speaker Questionnaire Speaker Attitude questions suggest little room for speaker attitude improvement: all means are above the assumed average of 3. Speakers’ passion for STEM education is also seen in their above-average rating for the following Student Attitude questions:

- Students believe stereotypes about STEM ($p=0.0081$) and their below-average rating for the following:
- Students are aware of many STEM careers ($p=0.011$).

The only evidence for teacher empowerment is the above-average ratings for all Session items.

Discussion and Conclusion

The results of this case study suggest that for students in grades 2–4 at high-poverty rural schools with few STEM opportunities, STEM guest speaker sessions are effective at increasing their interest in STEM and STEM careers. However, the statistically significant improvements in student attitude could result not from students’ improved attitudes, but from the teachers’ noticing students’ interest in the session. Regardless, the results suggest that a greater partnership between the Putnam County School System and passionate area STEM professionals can bolster STEM education by improving student attitudes and empowering teachers. Future studies with larger samples or samples with different demographics are also suggested.