



# An Exploration of the Factors that Motivate Gifted and Talented Rural Students to Engage in STEM

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# STEM

Science | Technology | Engineering | Mathematics



# Research Questions

What motivates rural students to pursue STEM?

How can we use these factors to engage more rural students in STEM?

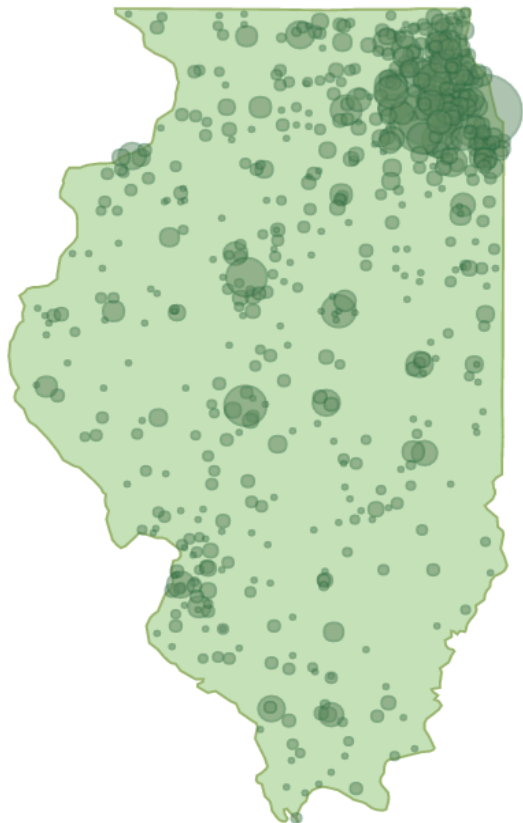


# Illinois Mathematics and Science Academy (IMSA)



*To ignite and nurture creative, ethical, scientific minds that advance the human condition*

# IMSA Demographics (Cumulative) 1989-2018



# Rural Counties in Illinois





# Significance of STEM education

According to a study by Carnegie Science Center in 2014,

- 40% of 978 surveyed parents said local schools need to better prepare kids to be successful adults
- STEM skills (collaboration, problem-solving, critical thinking) are needed in today's economy
- Collaborative problem solvers needed in real-life work settings
- STEM education can reduce the workforce gap in entry to mid-level technical jobs

# Significance of STEM education cont.

“The National Academy of Sciences suggest that, without the participation of individuals of all backgrounds, the increasing demand for workers in STEM fields will not be met, potentially compromising the position of the United States as a global leader (2012).”

“The National Association for Gifted Children (NAGC) believes that supporting gifted and talented students in a STEM talent pipeline will assist U.S. employees in filling ‘crucial national security, innovative science, and leading technology jobs’.”



# Problem Statement

Rural students are **less likely to attend selective colleges** and can **lose interest in STEM** between middle and high school due to a **loss of motivation**.

Why?

- **Poorly funded school operations**
- **Geographic isolation**
- **Poverty**
- **Drug use and violence**





# The Rural STEM Gap

In 2007, over 9 million kids enrolled in rural schools; 6 million in small town schools (Strange, 2011)

- **Student achievement**
  - Faculty less well-educated and earn lower salaries than urban counterparts (Herzog & Pittman, 1995)
  - Nonmetropolitan dropout rate: 12.7%, metropolitan: 11.6% (Hines, 2002)
  - 54% of rural students apply to college, 62% suburbans
- **School operation**
  - Smaller local tax base, high operational costs
  - State-mandated consolidation and budget cuts (Strange, 2011)
- **Poverty**
  - 244 of 250 poorest counties in America are rural (Hines, 2002)
- **Economic issues**
  - Geographic remoteness
  - Jobs in secondary labor market require little education
  - High-skilled rural people leave their hometowns



## Case Study (Versypt, 2013)

- Chemical engineering undergraduate enrollment:
  - Illinois Institute of Technology
    - **0** Rural Students / **69** Student from Illinois
  - University of Illinois – Chicago
    - **0** Rural Students / **174** Students from Illinois
  - Northwestern University
    - **0** Rural Students / **37** Students from Illinois
  - University of Illinois – Urbana-Champaign
    - **13** Rural Students / **368** Students from Illinois  
**25** Students came from Naperville

# Methods

- Qualitative study
  - Interviews and focus groups
- Current IMSA students, alumni, and parents
- Contacted over email, social media, in person
- Consent forms over SurveyMonkey
- Transcribe audio recordings
- Analyze for themes and patterns

SIR: Rural Students Consent Form

UPGRADE



SUMMARY → DESIGN SURVEY → COLLECT RESPONSES → ANALYZE RESULTS

SCORE MY SURVEY

PREVIEW & TEST

NEXT →

QUESTION BANK

Search for questions



Recommended Questions



Previously Used Questions



All Categories



Community



Customer Feedback



Customer Satisfaction



Demographics



Education



BUILDER



THEMES



LOGIC



OPTIONS



PRINT

Ward of the State

Other (please specify)

6. Describe the community in which you were raised (i.e. urban/suburban/rural, racial make-up, socioeconomic status, educational resources).

7. Describe your support system related to you being a gifted and talented rural student engaged in Science, Technology, Engineering and Mathematics (STEM)?

8. Why did you choose to enroll in a gifted, residential Science, Technology, Engineering and Mathematics (STEM) high school?

9. What dates are you available for a focus group meeting?

Tuesday, October 10, 4:30-6:00pm

Wednesday, October 11, 4:00-5:30pm

Feedback

# Breakdown

## 17 Parents

- 8 involved in STEM careers

## 17 Students

- 6 in pre-IMSA STEM enrichment programs

## 21 Alumni

- 12 continued on to STEM careers

Total No. Interviewees:

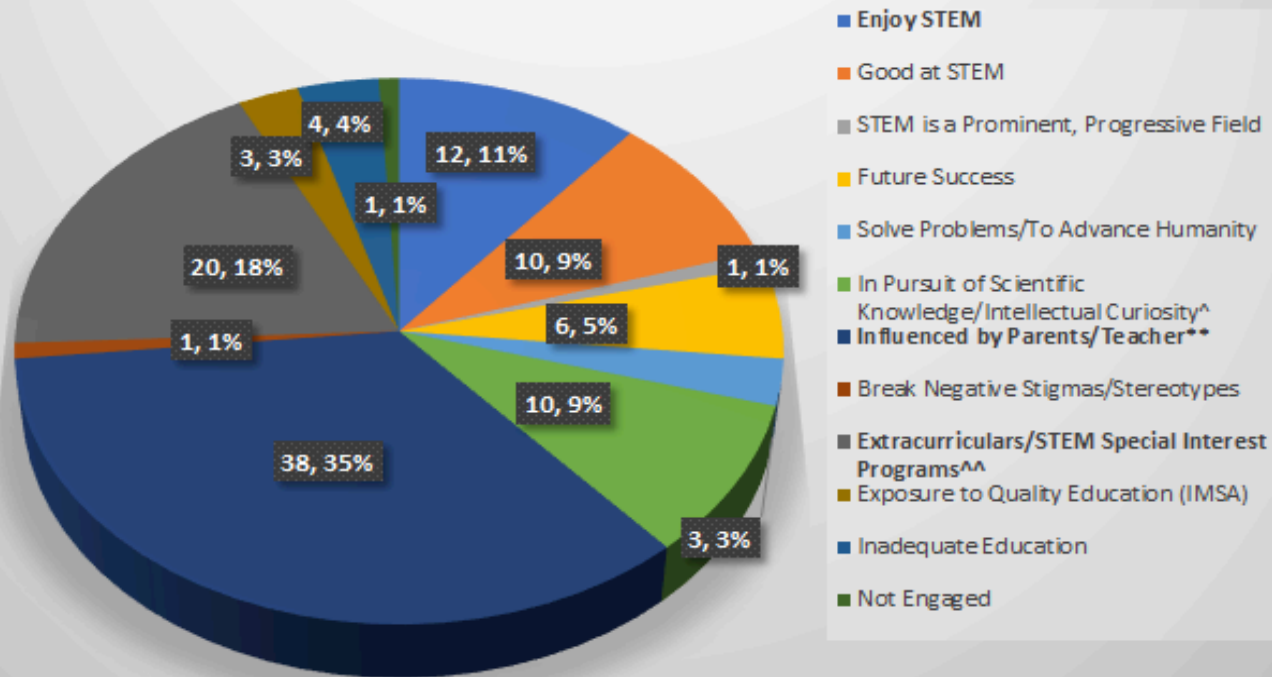
**55**

# Results

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# Why STEM? Students and Alumni

$n_t = 37$ ,  $n_s = 37$ ,  $n_r = 109$



$n_t$  = total # of participants,  $n_s$  = total # of subjects who responded,  $n_r$  = total # of responses

**“I give credit to my father, he was a high school math teacher, and my mom told me that IMSA existed, I also had really great junior high math and science teachers, who just made it interesting and kept it alive for me. My mom gave me the opportunity to go to the summer camps that had a math focus or a programming focus.”**

*~Anonymous Alum*

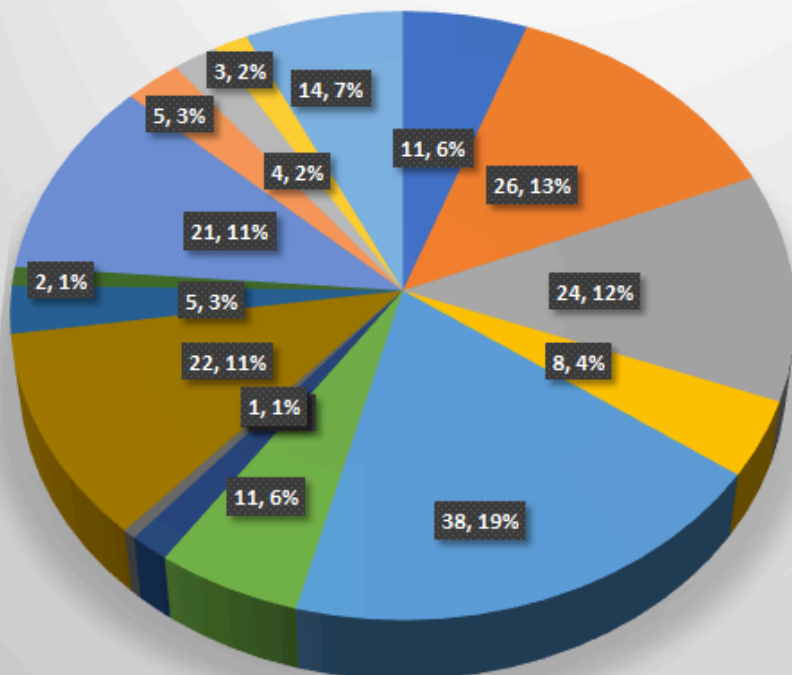
**“[T]he only times I was exposed to STEM was when we’d go into Peoria, and we’d go to a museum or some other big city and go to some sort of museum. For that hour that I was there, I thought STEM was so cool and I should do this, but when we would drive back, you totally forget about it. Now, I have access to that every day or other resources like that I feel like that would definitely inspire a person more to go into STEM.”**

*~Anonymous Student*

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## Why a STEM gap? Students, Alumni, and Parents

$n_t = 55$ ,  $n_s = 55$ ,  $n_r = 182$



- Lack of STEM vision
- Lack of STEM exposure\*
- Lack of STEM parent support&&
- Stigma/misperceptions of Rural Students
- Lack of quality STEM education^
- Lives in Negative Environment@
- There is no Gap
- Language Barrier
- STEM is Challenging/Intimidating^^
- Lack of Resources\*\*
- Focus on Farm Culture'''
- Military Involvement''''
- Attitude Towards Education/Expectations for Future Success&
- Emphasis on Sports Rather than STEM#
- College Not Seen as Important
- Willing to Give up Rural Life
- Societal Differences (Urban vs. Rural)@@

$n_t$ = total # of participants,  $n_s$ =total # of subjects who responded,  $n_r$ =total # of responses



“It was like the same for me because we didn’t really do much science stuff. They would not let me accelerate, and they did not want me to go ahead in math classes either until they absolutely had to.”

*~Anonymous Student*

“That, and say when you live in a suburb of a big city, you can go to the Museum of Science and Industry or whatever science things that Chicago has. But those opportunities just do not exist down south...[f]or the most part, there are just no good STEM opportunities outside of summer programs about tracking animals. There’s just really no opportunities for us to see how wide the STEM field really is.”

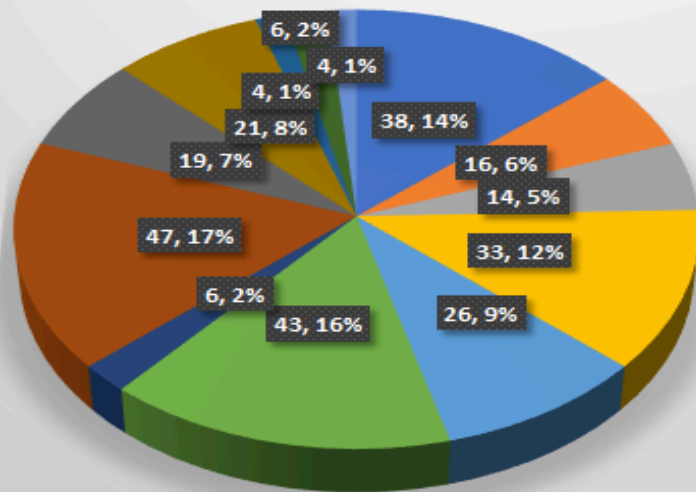
*~Anonymous Student*

“There's not so much of an emphasis or push for kids to be able to get into college. College is really not seen as something that is that important as it is for families who live in more urban areas and have white-collar parents who have jobs like that.”

*~Anonymous Parent*

## STEM motivation Students, Alumni, and Parents

$n_t=55$ ,  $n_s=55$ ,  $n_r=157$



- Learning: Discovery of Knowledge^^^
- Solve Problems/ To Advance Humanity^^
- Money
- Future Success/STEM is a Prominent, Progressive Field'''
- Challenge/Competitive Nature of STEM
- STEM Passion/Enjoyment\*
- Obligation to Rural Community/Break Negative Stigma^
- Family/ Teacher Influence\*\*
- Self Motivation/ Self-Worth
- Extracurriculars/STEM Special Interest Programs&
- STEM Exposure in Media&&
- Self Realization/Independence
- Balances Uneven Playing Field for Rural Students

$n_t$ = total # of participants,  $n_s$ = total # of subjects who responded,  $n_r$ = total # of responses

**“My father lost his job in the eighties, when I was in grade school, like a lot of people did in the eighties. Early eighties recession. And as a young child, trying to make sense of the world, I thought, ‘Well, if I do well in school, I get into a good college, and I get a good job that’s how I can help my family.’”**

*~Anonymous Alum*

**“I feel like we have to be more motivated generally than suburban and urban STEM students because we have to go find it for ourselves almost.”**

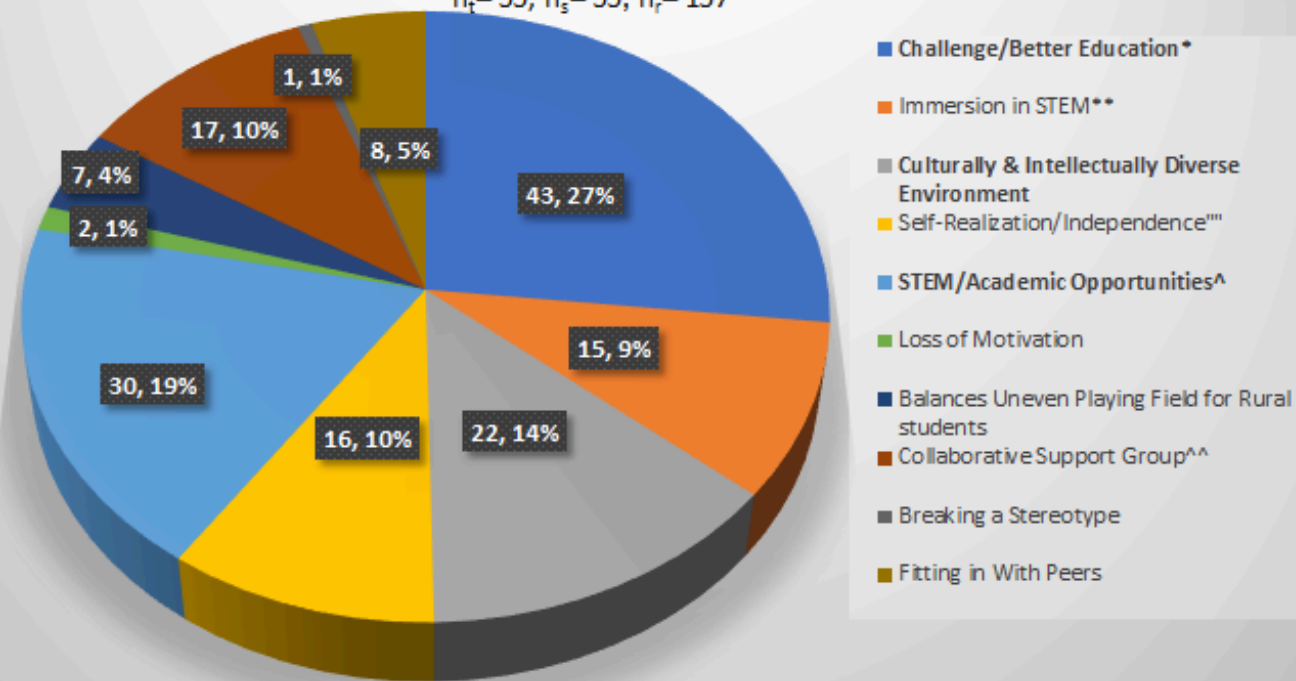
*~Anonymous Student*

**“She just loved seeing how the world works and connections from here to there and that ‘aha’ moment when you know how something works. If somebody describes how something is engineered she gets excited about that knowledge.”**

*~Anonymous Parent*

## IMSA's contribution to STEM motivation Students, Alumni, and Parents

$n_t = 55$ ,  $n_s = 55$ ,  $n_r = 157$



$n_t$  = total # of participants,  $n_s$  = total # of subjects who responded,  $n_r$  = total # of responses

**“...it was just the coolest thing to walk in and have an entire school of people who liked school...the school I came from, the people dreaded being there. On a given day, 80% might show up and they would all text through class, or sleep through class, pass notes because a lot of them couldn't afford phones, which is a sad reality.”**

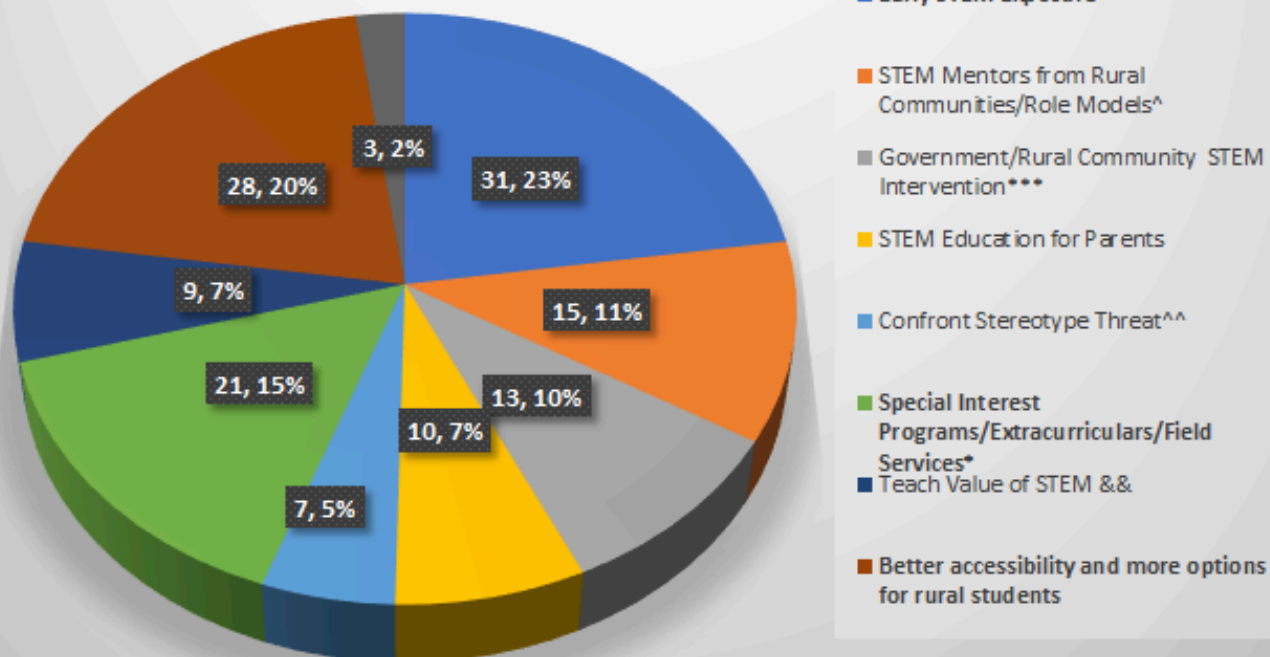
*~Anonymous Student*

**“One of the advantages of IMSA is that it is much more diverse than the rural high school so being in an environment with a lot of smart kids from many different backgrounds is very stimulating and just broadening for my student.”**

*~Anonymous Parent*

## How to address rural STEM gap Students, Alumni, and Parents

$n_t = 52$ ,  $n_s = 44$ ,  $n_r = 131$



$n_t$  = total # of participants,  $n_s$  = total # of subjects who responded,  $n_r$  = total # of responses

**“So I think the core question is are you willing to leave home, leave your family, leave your friends, and go where the STEM jobs are.”**

*~Anonymous Alum*

**“I think it’s a lot of early exposure. The younger that you’re exposed to it, it’s like when you’re still really interested in everything, the more likely you’re going to wanna continue.”**

*~Anonymous Student*

**“I think having more hands on maker lab types of things, open ended inquiry based exploration – those sorts of things where it’s viewed as something everybody can do where it’s just part of the environment and not something you need to seek out would help the motivation.”**

*~Anonymous Parent*

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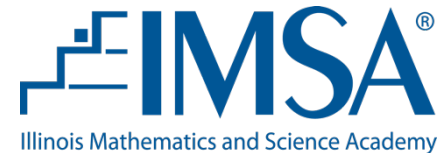
# How IMSA has addressed the STEM gap in rural communities

- PROMISE
  - Grades 7-9
  - Serves underrepresented and economically disadvantaged students
  - Math, science, english, and SAT prep
- FUSION
  - Agronomic STEM for grades 4-8
    - Crop rotation, tractor w/ working motor
  - 111 programs in 84 schools throughout Illinois
  - Trained observer, prof. development



# Implications

- 1. Early STEM Exposure**
  - a. Outlets for organic interest
    - i. Internet, TV, camps
- 2. Special interest programs/extracurriculars/field services**
  - a. Leaving the “rural bubble”
- 3. Better educated STEM teachers/mentors**
  - a. More knowledgeable and enthusiastic
  - b. Better pay + more government funding
  - c. Professional development
- 4. More challenging curriculum for faster learners**
  - a. More motivating → no ceiling
  - b. Fast/advanced tracks



# Questions?





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