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Heterogeneity in Rural Youth: Associations Between STEM and Rural Profiles and Local Economic Perceptions

Angie Starrett, Matthew Irvin, Jan Yow, Christine Lotter

1

Historical Youth Outmigration

- Leavers: better educated and more highly trained (Mills & Hazarika, 2001)
- Stayers: grow into adults with lower incomes and fewer skills (Brown & Schafft, 2011)
- Rural Disadvantage: historically shrinking economies coupled with selective outmigration significantly alter socioeconomic composition of the community (Petrin, Farmer, Meece, Byun, 2011)

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Historical Youth Outmigration

- The "Rural Brain Drain"
  - Person-oriented approach to explain rural outmigration (Petrin, Schafft, & Meece, 2014)
  - 4 classes differentiated by achievers/nonachievers and stayers/leavers
  - Achievers have high rural identity but desire leaving due to negative economic perceptions
- BUT… SC is quickly changing
  - In 2016, number of rural students dropped from 41% to 16% due to change from rural to suburban designation (Showalter, Klein, Johnson & Hartman, 2017)

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The Changing Landscape

- From 2008 – 2013, $19.2 billion in capital investments with over 64,650 new jobs
- Greater need for workers with post-secondary education in STEM

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The Current Study

- Extend the "Rural Brain Drain" work of Petrin, Schafft, & Meece (2014)
- Create profiles of STEM interest**, life aspirations**, school value, rural identity and future residence aspirations (**new additions to the profiles)
- Regress positive and negative local economic perceptions on the profiles
- Do local economic perceptions impact rural youth's STEM interests and rural aspirations?

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Participants

- An ethnically diverse rural sample
  - 2,765 students; M_{age}=*14.50 years*
    - 53% female,
    - 69% ethnic minority
    - 56 % of students in math classes, 44 % in science classes

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Methods

- Response variables: Positive (3) and negative (3) local economic perceptions on a 6-point Likert scale
  - "It is easy to get a good paying job around here"
- Latent Profile Analysis was used to create classes on the 8 factors
  - STEM interest: Math/Statistics, Agriculture/Forestry, & Engineering/Computers
  - School Value
  - Life Aspirations: Rural & Nonrural
  - Rural Identity
  - Future Residence Aspirations (nonrural, don't know, rural)
- Modal assignment was used to assign each student to a class

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Latent Profile Analysis

- Seven classes emerged

Table 2

Profile Conditional Response Means and Overall Sample Means for the Variables

	Sample Mean (SD) (N=2747)	Low Life Aspirations (SD) (N=32)	Low Job/Money/ Success (SD) (N=294)	High Stem/Rural Aspirations (SD) (N=373)	High Nonrural Profile (SD) (N=462)	High Rural Profile (SD) (N=398)	High Agriculture & Rural Identity (SD) (N=238)	High Live Nonrural Profile (SD) (N=950)
Math/Statistics	2.72 (1.44)	1.97 (1.34)	2.49 (1.34)	3.88 (1.34)	2.13 (1.34)	2.46 (1.34)	2.94 (1.34)	2.68 (1.34)
Agriculture/Forestry	2.46 (1.49)	2.66 (0.90)	2.38 (.90)	4.34 (.90)	1.48 (.90)	1.90 (.90)	4.83 (.90)	1.76 (.90)
Engineering/Computers	3.10 (1.67)	2.56 (1.56)	3.13 (1.56)	4.36 (1.56)	2.37 (1.56)	2.82 (1.56)	3.44 (1.56)	2.97 (1.56)
School Value	4.80 (0.80)	4.12 (0.79)	4.72 (.79)	4.71 (.79)	4.79 (.79)	4.83 (.79)	4.77 (.79)	4.90 (.79)
Rural Life Aspirations	4.36 (0.98)	2.89 (0.76)	3.87 (0.76)	4.81 (0.76)	3.27 (.76)	4.85 (.76)	4.95 (.76)	4.59 (.76)
Nonrural Life Aspirations	5.33 (0.41)	2.81 (0.43)	4.38 (0.43)	5.53 (0.43)	5.51 (0.43)	5.40 (.43)	5.05 (.43)	5.60 (.43)
Rural Identity	3.73 (1.37)	3.05 (1.17)	3.33 (1.17)	4.20 (1.17)	2.50 (1.17)	4.22 (1.17)	4.98 (1.17)	3.75 (1.17)
Future Residence Aspirations	0.71 (0.77)	0.67 (0.49)	0.97 (0.49)	0.39 (0.49)	0.27 (0.49)	1.63 (0.49)	1.79 (0.49)	0.26 (0.49)

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Regressing Economic Perceptions on STEM/Rural Profiles

For each unit increase in positive economic perceptions, a student is 56% more likely to be in the High STEM/Rural Aspirations class compared to the High Live Nonrural

Table 3

Logistic Regression Log Odc

	Ge		:s' ion	Prior Grades	Positive Economic Perceptions	Negative Economic Perceptions
Low Life Aspirations	1			1.00	1.03	0.67
Low Job/Money/Success	1			1.01	1.05	0.62**
High Stem/Rural Aspirations	2.28**	0.73	0.91	1.00	1.29**	1.17*
High Nonrural Profile	0.61**	0.67**	0.95	1.00	0.60**	1.03
High Rural Profile	0.79	0.22**	0.95	1.01	1.23*	0.97
High Agriculture & Rural Identity	2.76**	0.13**	0.96	1.00	1.61**	0.94

*p <.05; **p <.01

Note. The High Live Nonrural class was used as the reference class

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Discussion

- Petrin, Schafft, & Meece showed that negative economic perceptions predict the "Leavers"
- This study shows that positive economic perceptions predict rural profiles, i.e. "Stayers"
- Who is the "Stayer?" - results indicate a white male
- As rural landscape becomes more factory and STEM oriented, work needs to be done to retain more females and minorities

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Questions

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Impact of STEM Class Belonging on Broader Motivational Constructs: A Latent Profile Analysis

Greysi Irdam, Angie Starrett, Matthew Irvin, Jan Yow, Christine Lotter

1

Self-Determination Theory and Rural Students

- According to Self-determination theory conditions that foster students competence, autonomy, and relatedness are related with higher motivation, engagement, performance and persistence (Niemiec & Ryan , 2009).
  - Only one SDT study on rural youth: whether high school students persist or drop out (Hardre & Reeve, 2003)
- Rural students experience a unique form of social capital which benefits their educational aspiration, and school belonging. (Byun, Meece, Irvin, Hutchins, 2012)

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Class Belonging

- Teachers and peers also play an important role in impacting students competence and motivation. (Goodenow, 1993)
  - Class-specific belonging has primarily been studied in early adolescents
  - A sense of **school** belonging has been positively linked to academic engagement, achievement, and learning (Goodenow & Grady, 1993).

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The Current Study

- Studies have shown a positive relationship between perceived value, relatedness, school value, and competence with motivational and academic measures, but little is known how relatedness measures impact STEM value and identity in rural students.
- To address this gap, we examined the impact of students' STEM class belonging on overall subject value and identity using a person-oriented approach

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Participants

- An ethnically diverse rural sample
  - 2,765 students; M_{age}=*14.50 years*
    - 53% female,
    - 69% ethnic minority
    - 56 % of students in math classes, 44 % in science classes

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Methods

- Response variables: Math/Science value and identity were measured on a 6-point Likert scale
- EFA and CFA confirmed Class Belonging was composed of 2 factors: peer and teacher
- Latent Profile Analysis was used to create classes on the two continuous factors
- Modal assignment was used to assign each student to a class
- Post-hoc analyses used ANOVAs to compare classes across motivation variables

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Latent Profile Analysis

- Four classes emerged for science students and five classes emerged for math students

Table 1

Profile Conditional Response Means and Overall Sample Means.

Science

	Sample Mean (SD) (N=1220)	Low Teacher and Peer Belonging (SD) (N=188)	Very Low Teacher and Peer Belonging (SD) (N=64)	High Teacher and Peer Belonging (SD) (N=623)	Average Teacher and Peer Belonging (SD) (N=345)
Teacher Belonging	4.60 (1.13)	3.20 (.11)	1.85 (.11)	5.47 (.11)	4.36 (.11)
Peer Belonging	4.24 (1.14)	3.15 (.85)	2.62 (.85)	4.92 (.85)	3.96 (.85)

Math

	Sample Mean (SD) (N=1545)	Extrmely Low Teacher and Peer Belonging (SD) (N=32)	Low Teacher and Peer Belonging (SD) (N=263)	High Teacher and Peer Belonging (SD) (N=630)	Very Low Teacher and Peer Belonging (SD) (N=136)	Average Teacher and Peer Belonging (SD) (N=484)
Teacher Belonging	4.68 (1.14)	1.58 (.34)	3.66 (.34)	5.68 (.34)	2.64 (.34)	4.72 (.34)
Peer Belonging	4.18 (1.14)	2.28 (.88)	3.35 (.88)	4.90 (.88)	3.05 (.88)	4.26 (.88)

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ANOVA results – Science Value and Identity

Table 2

Tukey p-values for Science Identity and Value given Class Belonging Profile.

	Low Teacher and Peer Belonging	Very Low Teacher and Peer Belonging	High Teacher and Peer Belonging	Average Teacher and Peer Belonging
		Science Identity		
Low Teacher and Peer Belonging		0.35	-.81**	-.33*
Very Low Teacher and Peer Belonging	-.35		-1.16**	-.68**
High Teacher and Peer Belonging	.81**	1.16**		.48**
Average Teacher and Peer Belonging	.33*	.68**	-.48**	
		Science Value		
Low Teacher and Peer Belonging		0.35	-.81**	-.33*
Very Low Teacher and Peer Belonging	-0.35		-1.16**	-.68**
High Teacher and Peer Belonging	.81**	1.16**		.48**
Average Teacher and Peer Belonging	.33*	.68**	-.48**	

*$p < .05$; **$p < .01$

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ANOVA results – Math Value and Identity

Table 3

Tukey p-values for Math Identity and Value given Class Belonging Profile.

	Extremely Low Teacher and Peer Belonging	Low Teacher and Peer Belonging	High Teacher and Peer Belonging	Very Low Teacher and Peer Belonging	Average Teacher and Peer Belonging
		Math Identity			
Extremely Low Teacher and Peer Belonging		-1.01**	-2.14**	-.60	-1.27**
Low Teacher and Peer Belonging	1.01**		-1.13**	.41*	-.26
High Teacher and Peer Belonging	2.14**	1.13**		1.54**	.87**
Very Low Teacher and Peer Belonging	0.60	-.41*	-1.54**		-.67**
Average Teacher and Peer Belonging	1.27**	0.26	-.87**	.67**	
		Math Value			
Extremely Low Teacher and Peer Belonging		-.16	.95**	-.07	-.52*
Low Teacher and Peer Belonging	0.16		-.79**	0.09	-.36**
High Teacher and Peer Belonging	.95**	.79**		.89**	.43**
Very Low Teacher and Peer Belonging	0.07	-.09	-.89**		-.45**
Average Teacher and Peer Belonging	.52*	.36**	-.43**	.45**	

*p <.05; **p <.01

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Discussion

- Rural youths' broader scopes of motivation correlate with their sense of relatedness to peers and the teacher in the classroom.
- Understanding the importance of the class belonging profile for rural adolescents can lead to greater STEM value and identity
- Classroom relationships are key to broader motivational constructs

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Efficacy of an Inquiry-Based Intervention to Improve STEM Teaching and Learning in Rural Schools

Gina M. Kunz, PhD
University of South Carolina
March 1, 2019
SCEPUR

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Overview

- It is critical for teachers to acquire instructional approaches that enhance STEM learning and motivation for students by engaging them in "science practice skills" as identified by Next Generation Science Standards (NGSS; National Research Council, 2013).
- This study (funded by IES) examined the efficacy of a summer institute plus follow-up distance-based coaching on teacher and student outcomes in rural schools (Nugent, Kunz et al., 2018).

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Method

- 124 middle/high school rural science teachers across 109 Midwest schools (63 treatment; 61 control)
- Randomized at the school level (summer institute plus distance-based follow-up instructional coaching vs. business-as-usual control)
- 1800 students

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Research Design

- Two-cohort, randomized experimental group design examining differences between a treatment (participated in CSI) and control group (business as usual)
- Participants were randomized at the school level; students were in the class period the teachers identified as their "target" class
  - Teachers selected target class of their choice, with no parameters

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Teacher Measures

- Teachers completed three measures to determine effects on beliefs, knowledge, and self-efficacy in promoting student science practice skills
- Direct observations of teacher instruction (video-recordings of classroom) were conducted with three measures: Teacher Inquiry Rubric (TIR; project-developed), Partial Interval Classroom Inquiry Observation System–Teacher Version (PICI-T; project-developed), and the Electronic Quality of Inquiry Protocol (EQUIP; Marshall, Smart, & Horton, 2009)

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Student Measures

- Science Knowledge (student-completed)
- Practice Skills (teacher-completed)
- Engagement (direct observation of classroom engagement via video-recordings)

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Data Analyses

- Multilevel modeling with residual maximum likelihood estimation and the Kenward-Roger adjustment for standard errors and denominator degrees of freedom
- Predictors included group (treatment vs. control), time point (baseline, post summer institute, post implementation of unit and end of the year) and their interaction
- Cohort was included as covariate for all outcomes

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Teacher Results

- Significant increases were found in **teacher beliefs** ($p<.001$, effect size [d] =1.03), **knowledge** ($p<.0001$, d=1.09) and **self-efficacy** ($p<.0001$, d=1.29)
- Significant increases in **three direct observation measures** ($p < .0001$)

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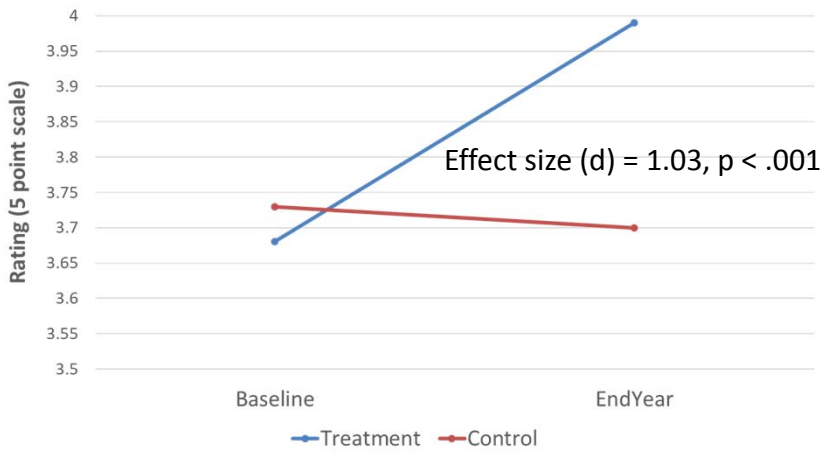
Teacher Inquiry Beliefs



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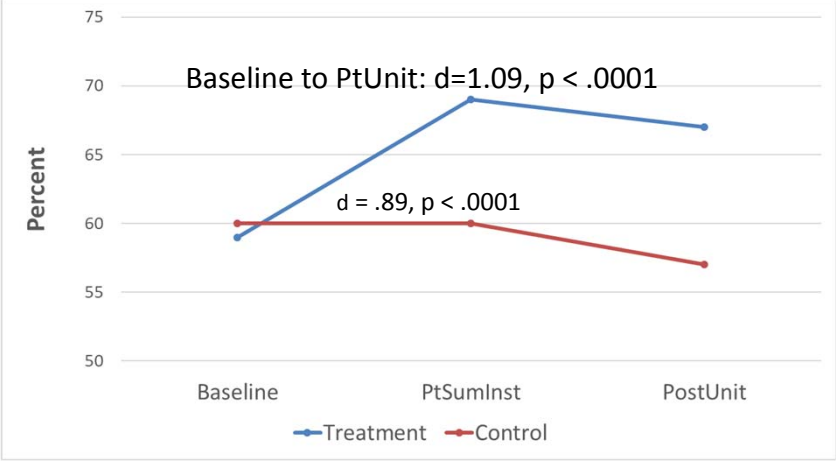
Teacher Knowledge



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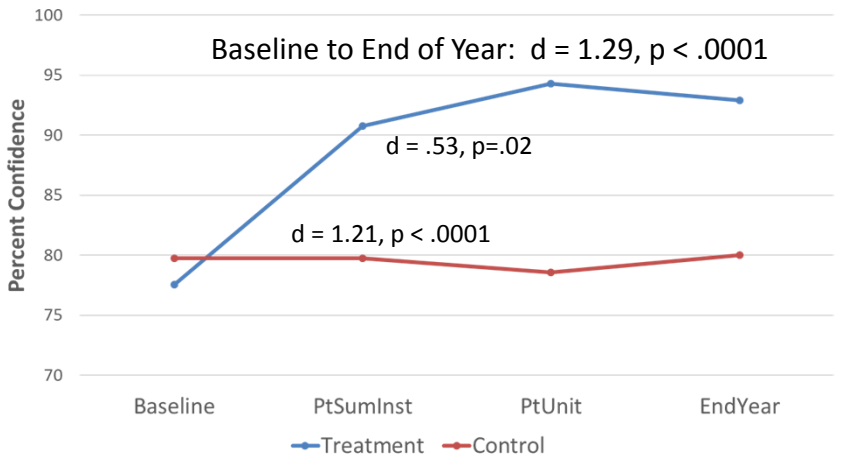
Teacher Self-Efficacy



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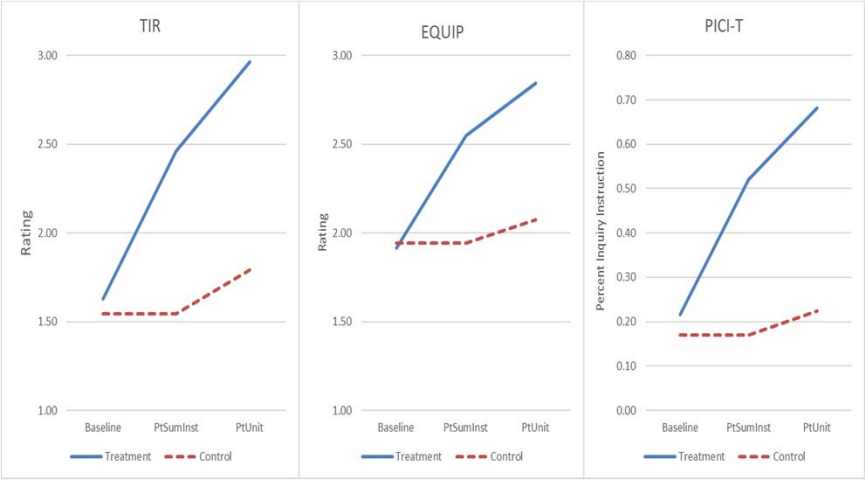
Teacher CSI Guided Inquiry Instruction



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Student Results

- Student treatment-control comparisons (~900 treatment and ~900 control) showed significantly higher increases for treatment in middle school knowledge of science practices.
- Student practice of science, measured by teachers' ratings, was significantly higher for treatment at the high school level.
- Student inquiry engagement was higher in the treatment (67%) compared to the control group (22%) ($t(108) = 9.38$, $p < .0001$, $d = 1.8$).

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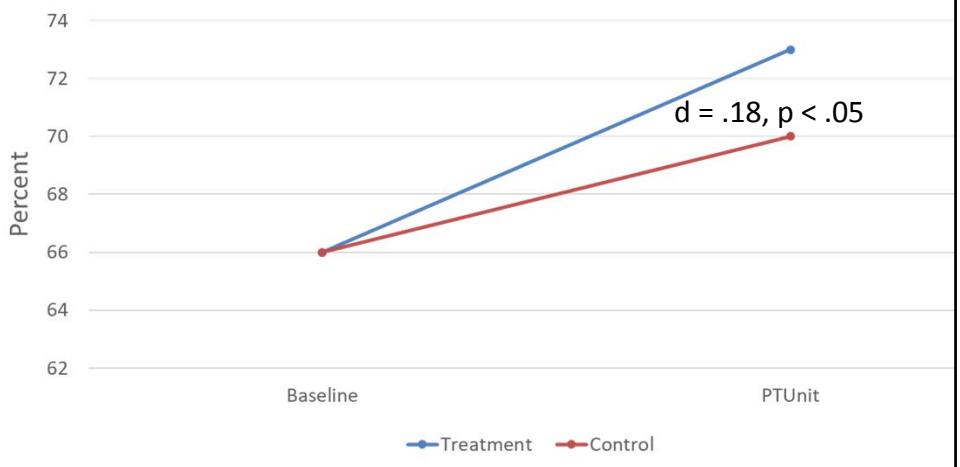
Middle School Inquiry Knowledge



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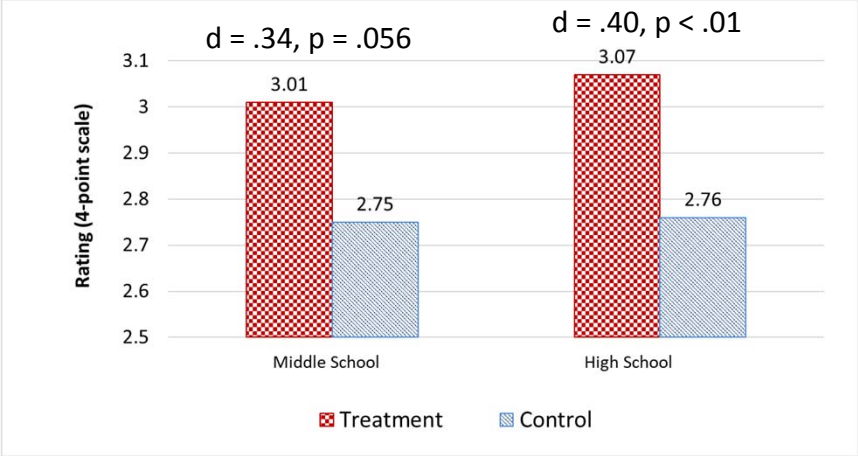
Student Inquiry Rubric (SIR) Results



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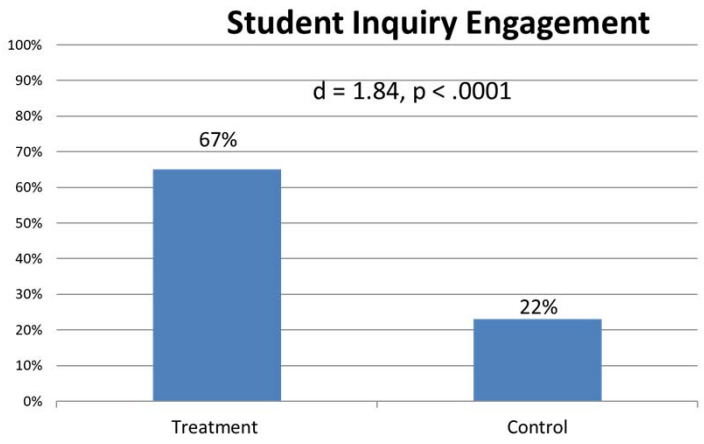
PICI-S



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Discussion

- The summer institute plus follow-up coaching increased teachers' knowledge, skills and beliefs in instruction for science practice skills.
- Positive effects on students' science practice knowledge (middle school) and practice skills (high school).
- Teachers play a critical role in STEM student learning (as seen in the student-completed and teacher-completed measures) and motivation (as seen in direct classroom observations of engagement).

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Thank You

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Resources

Kunz, G. M., White, A. S., Howell Smith, M., & Nugent, G. (2014). *Coaching Science Inquiry: Validating a strengths-based approach to coaching* (R^2Ed Working Paper No. 2014-9). Retrieved from r2ed.unl.edu

Nugent, G., **Kunz, G. M.,** Houston, J., Kalutskaya, I., Wu, C., DeChenne-Peters, S. E., Lee, S., & C. Luo, L. (2018). The effectiveness of a summer institute and remotely delivered science instructional coaching in middle and high school. *Journal of Science Teacher Education, 29*(8), 760-784. DOI: 10.1080/1046560X.2018.1514193

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18

Learning in Informal Environments:

The Role of Youth Educators in Promoting Learning Among Young Visitors

STUDY
PRACTICAL
HLM
ANOVA
AERA
SCEPUR
RESEARCH
POLICY
TEACHING

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Informal STEM Education

Learning in that takes place in an environment outside of the formal classroom (Zoos, Aquariums, Museums, Etc.)

ISLS = Informal Science Learning Sites

Students report

- Disconnect between their daily lives and "school science" (Roth and Tobin 2007)
- Classroom experiences are not relevant to their lives or do not relate what they are learning to real-world problems (Orfield 2004; Diemer et al. 2016)
- Assisting students in making these connections has led to an increase in academic performance and overall interest in STEM topics (Hulleman and Harackiewicz 2009)

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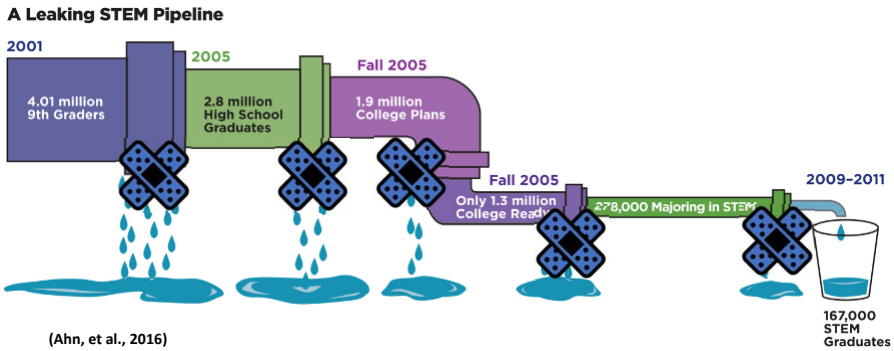
STEM Graduation Rates



(Ahn, et al., 2016)

- We know interactions at ISLS lead to positive learning outcomes in visitors.
  - However, less is known about the specifics of those interactions.

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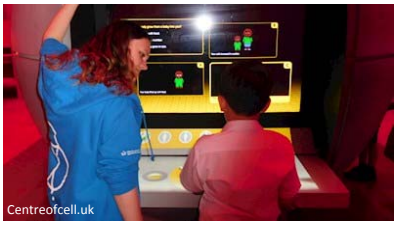
The Role of Youth Educators in Promoting Learning Among Young Visitors

Virginiaaquarium.org


Centreofcell.uk

- Previous reports show **interactions** at ISLS increase content knowledge of visitors (Schwan, Grajal, and Lewalter 2014)
- Many of these **interactions** are lead by **educators**.....however the definition of educator can vary by site.
- Do learning outcomes for young visitors differ when ISLS interactions are led by adult educators, youth educators, or without the help of an educator?

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Survey Distribution

- Surveys were distributed to visitors at six different informal STEM learning sites.
  - 3 US Sites
  - 3 UK Sites
- Participants were asked to interact with the exhibit and return to complete the study survey.
- Conducted across three conditions.
  - Adult Educator (aged 19+)
  - Youth Educator (14-18 years old)
  - No Educator Present
- Young Visitors divided by age.
  - Early Childhood (5-8 yo)
  - Middle Childhood (9-12 yo)
  - Adolescent (13 -18 yo)

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Sample Measures

- **Demographics**
  - Ethnicity
  - Age
  - School
  - ISLS visitation
- **Topic Interest and Engagement**
  - How interested are you in the topic of this exhibit?
  - How much did you know about the topic of this exhibit prior to your visit?
  - How long did you spend at this exhibit?
- **Stereotype Acceptance and Welcoming Data**
  - I think that women can/usually/should do "this" well in science (Rowley et al. 2007)
  - How welcoming do you think centers such as this are to people most like your group?
- **Learning Data**
  - How much do you think you think you learned today?
  - Content questions specific to the exhibit.
    - Scaled for age group.

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Sample Measures

- **Demographics**
  - Ethnicity
  - Age
  - School
  - ISLS visitation
- **Topic Interest and Engagement**
  - How interested are you in the topic of this exhibit?
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  - How long did you spend at this exhibit?
- **Stereotype Acceptance and Welcoming Data**
  - I think that women can/usually/should do "this" well in science (Rowley et al. 2007)
  - How welcoming do you think centers such as this are to people most like your group?
- **Learning Data**
  - How much do you think you think you learned today? **Perceived Competence**
  - Content questions specific to the exhibit. **Content Recall**
    - Scaled for age group.

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Sample Measures

Sample Content Questions Adjusted for Age Group		
Age group	Question	Answer options
5-9 Years old	Their small home range causes danger to the Komodo Dragons because ……	a.) their homes easily flood.
		b.) volcanoes in the area can kill them.
		c.) they get sick easily.
		d.) of lots of competition.
10+ Years old	Which of the following aspects of their small home range makes Komodo Dragons particularly vulnerable?	a.) Their habitats are very low lying and thus they are in particular danger from sea level rise.
		b.) There is a lot of volcanic activity in their region and a volcanic eruption could kill a large portion of their population.
		c.) There is a kind of virus that is being transmitted between animals in their isolated populations.
		d.) Competition for land with other animals can threaten their numbers.

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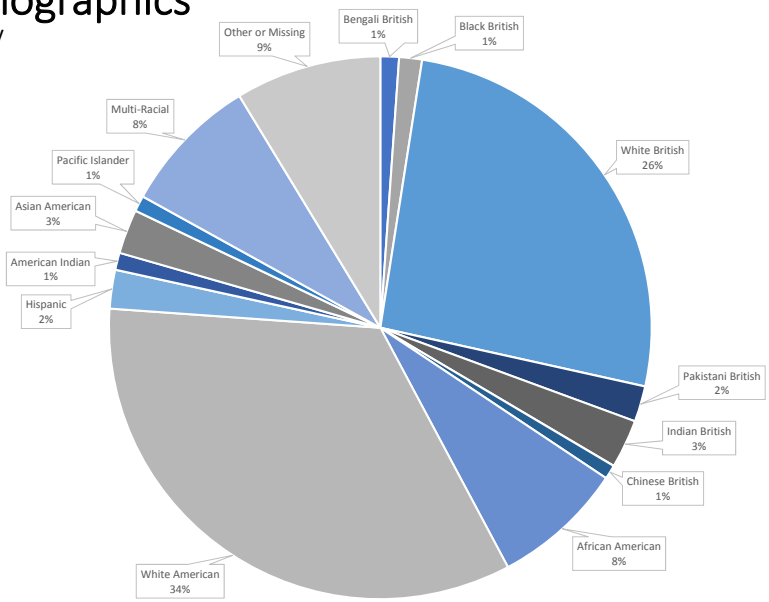
Demographics

Ethnicity



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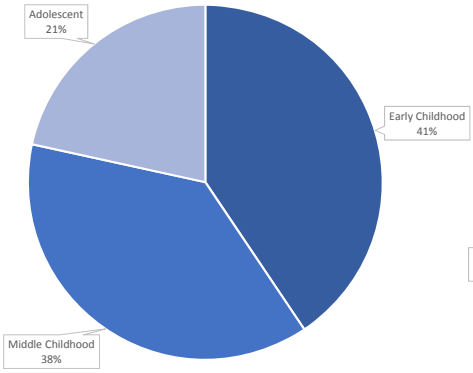
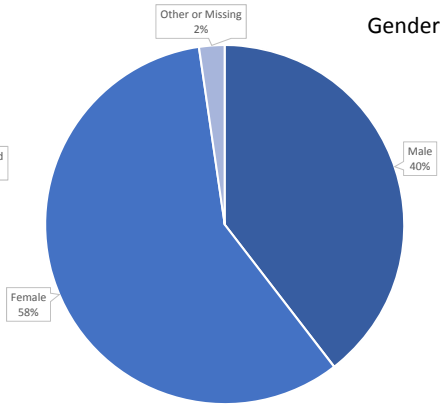
Demographics

Age



Gender



n = 1173

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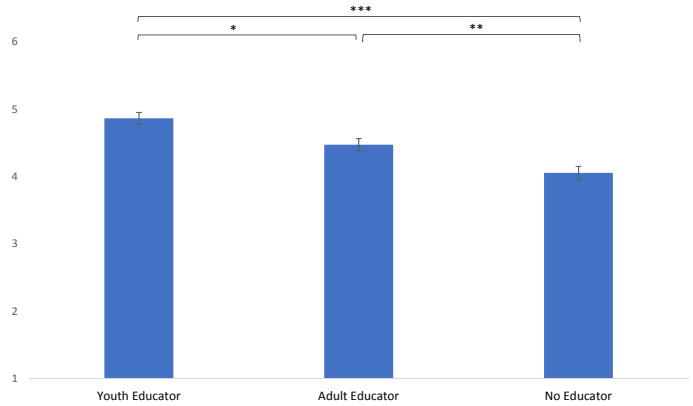
Results

Perceived Learning By Condition



"How much did you learn from the exhibit?"
(Likert scale, 1 = nothing, 6 = a lot)

(n.s. = no significance, * < 0.05, ** < 0.01, *** < 0.001).

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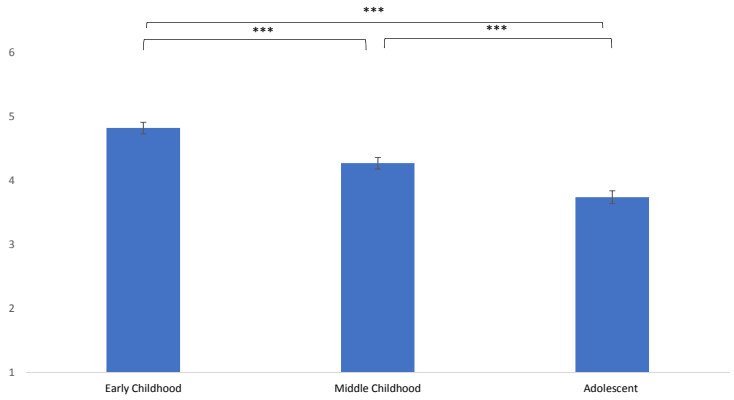
Results

Perceived Learning By Age Group



"How much did you learn from the exhibit?"
(Likert scale, 1 = nothing, 6 = a lot)

(n.s. = no significance, * < 0.05, ** < 0.01, *** < 0.001).

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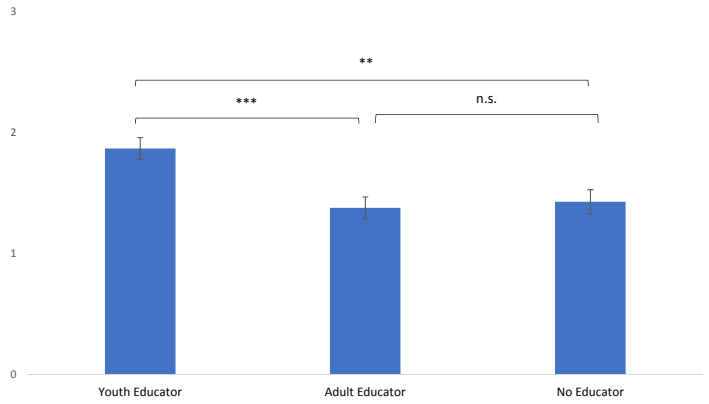
Results

Content Recall by Condition



Participants were asked a series of three content-based questions that were specific to the exhibit that they visited.

(n.s. = no significance, * < 0.05, ** < 0.01, *** < 0.001).

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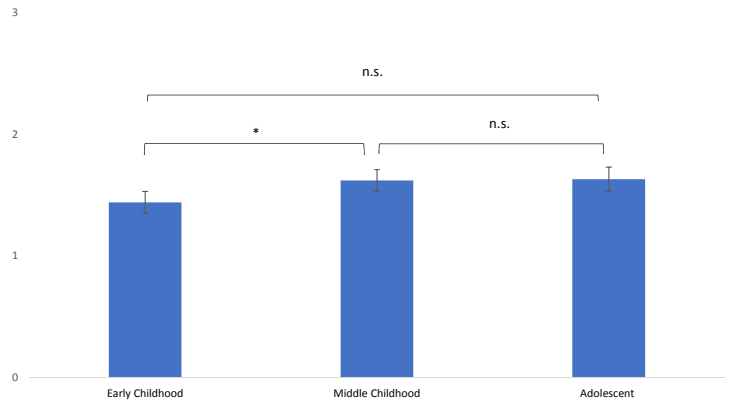
Results

Content Recall by Age Group



Participants were asked a series of three content-based questions that were specific to the exhibit that they visited.

(n.s. = no significance, * < 0.05, ** < 0.01, *** < 0.001).

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Conclusions

- Results show that **young visitors** who **interacted** with **youth educators** reported both **higher perceived competence** as well as **higher content recall** than those in either the adult condition or the no educator condition.

- Results also show that young visitors in the early childhood group reported higher perceived learning than either of the other two age groups, however their scores on content recall questions were lower.

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Implications

- This suggests the importance of youth educator programs on learning outcomes of young visitors.
- What drives this?
  - Zone of Proximal Development (Vygotsky, 1978)
- Need to think creatively about development of youth educator programs and what drives learning in informal environments.
- Age differences?

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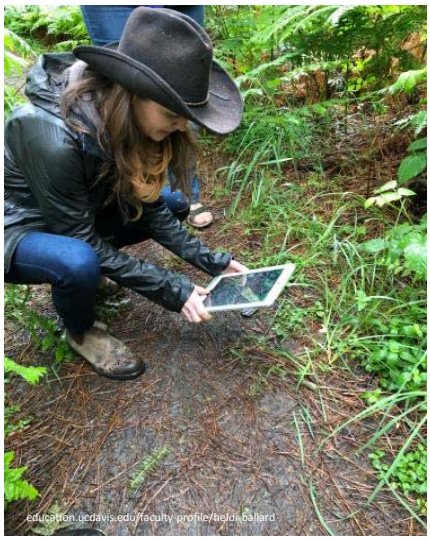
Further Extensions



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Learning in Informal Environments:

The Role of Youth Educators in Promoting Learning Among Young Visitors

Thank you!

Thanks also to the National Science Foundation, the Wellcome Trust, all participating informal sites and all of those who assisted in data collection and analysis.

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Peer Influences on STEM Career Interests Among Adolescents

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Acknowledgement

- Thank you for support for this research by the National Science Foundation, the Wellcome Trust, all participating informal sites and all of those who assisted in data collection and analysis.

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BACKGROUND

- Pressing need for a diverse, skilled and competent science, technology, engineering and mathematics (STEM) workforce
- Women and ethnic minorities have exceedingly low representation in STEM majors and in the STEM workforce
  - women 24% STEM jobs in US & 23% in UK
  - ethnic minorities 10% STEM jobs in US & 8% in UK

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BACKGROUND

- Research indicates these disparities not due to lack of ability in STEM fields but rather may be because of different interests and motivations
- Peer attitudes towards STEM can impact adolescents' career interests
- Need to better understand STEM career interests & factors affecting during developmental period when make decisions about career trajectories
  - adolescence

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BACKGROUND

- Research largely involved diverse adolescents who substantially vary in STEM ability & interest
- Important new avenue examine why individuals with high interest in STEM often do not pursue STEM careers & how other factors may affect STEM career interests (e.g., peers, gender, ethnicity)

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PURPOSE OF STUDY

- Examine whether adolescents who are high in science and math self-efficacy differ in STEM career interest by gender and ethnicity
- Also examine if having more friends that perceive as scientists and mathematicians affect STEM career interests

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Method

- Participants included adolescents (*N*=223, M_{age}=*15.27* years, 67.3% female) from the UK (*N*= 93) and the US (*N*=130)
  - Youth educators/volunteers at informal science learning centers (e.g., zoo, aquarium, science museums)
- Diverse ethnicity (44% White British or European American, 29.1% Asian British or Asian American, 15.2% Black British or African American, 4.1% Bi-racial, 2.2% Hispanic or Latino, and 1.7% other)

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Self-Report Survey Measures

- Completed survey at beginning youth educator program at informal science learning sites
- ***Science and Math Friends***
  - identified closest five friends & for each selected from list of possible identity traits, including scientist or mathematician
  - ratings for scientist and mathematician were summed & mean (*M*=2.45) split (1=have many friends, 0=few friends)

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Self-Report Survey Measures

- ***STEM Career Interests***
  - indicated how interested were in pursuing 11 different types of STEM careers (1= *not at all interested* to 6 = very interested)
  - Exploratory Factor Analysis
    - Factor 1: Mathematics, Statistics, Engineering and Computer Science (MSECS, 5 items, α = .82)
    - Factor 2: Biological, Medical and Health Sciences (BMHS, 2 items, *r* = .40)
    - Factor 3: Agricultural, Veterinary Science, Marine Science and Zoology (AVMZ, 4 items, α = .85)

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Self-Report Survey Measures

- ***Math & Science Self-Efficacy***
  - 11 items for science efficacy (α = .76) and 11 items for math efficacy (α = .80; 1 = not at all good to 7 = very good) from Eccles and colleagues (Eccles & Wang, 2016; Wang et al., 2013)
  - scores summed for each subscale (range of 11-77)
- ***Background demographics***
  - Age, gender, ethnicity

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DESCRIPTIVE RESULTS

- Significantly more females than expected reported many science/math friends and more males than expected reported few science/math friends, χ^2 (1) = 9.443, p = .002
- No significant differences between observed and expected numbers of ethnic majority & minority participants regarding having many/few math/science friends, χ^2 (1) = 2.598, p = .107

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ANCOVA RESULTS

- **Overview of ANCOVA**
  - 2 (Gender: Male, Female) X 2 (Ethnicity: Majority, Minority) X 2 (Science/Math Friends (SMF): High, Low) X 3 (Career Interest: BMHS, MSECS, AVMZ) ANCOVA
  - repeated measures of STEM Career Interest & science/math self-efficacy
  - site and age covariates

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ANCOVA RESULTS

- overall differences in career interests, F(2, 424) = 5.60 p = .004, η_p^2 = .026
  - greater interest in Biological, Medical and Health Sciences careers (M = 4.53, SD = 1.28)
  - followed by Math, Statistics, Engineering and Computer Science careers (M = 3.13, SD = 1.18)
  - and finally by Agriculture, Veterinary Science, Marine Science or Zoological careers (M = 2.80, SD = 1.05)
  - all ps < .001.

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ANCOVA RESULTS

- differences between participants with many science/math friends (M = 3.61, SD = 1.25) and those with few science/math friends (M = 3.38, SD = 1.35), F(1, 212) = 4.01, p = .046, η_p^2 = .019

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ANCOVA RESULTS

- significant interaction between career interest and science/math Friends, F(2, 424) = 3.35, p = .037, η_p^2 = .016
  - participants with many science/math friends (M = 4.95, SD = 1.07) and those with few science/math friends (M = 4.25, SD = 1.37) differed in their interest in biological, medical and health science careers, p < .01

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ANCOVA RESULTS

- significant interaction between career interest and ethnicity, F(2, 424) = 5.13, p = .007, η_p^2 = .024
  - ethnic majority participants (M = 3.32, SD = 0.79) were more interested in pursuing Agriculture, Veterinary Science, Marine Science or Zoological Careers than were ethnic minority participants (M = 2.37, SD = 1.04), p < .001

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ANCOVA RESULTS

- differences in career interests for male and female participants, $F(2, 424) = 14.67$, $p < .001$, $\eta_p^2 = .065$.
  - female participants more interested in Biological, Medical and Health Sciences Careers ($p = .002$) and Agriculture, Veterinary Science, Marine Science or Zoological Careers ($p = .048$)
  - male participants were more interested in Math, Statistics, Engineering and Computer Science Careers ($p = .002$)

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DISCUSSION

- Novel findings
  - perceiving friends as having science/math identity associated with higher STEM career interest for students with high science and math self-efficacy
  - different patterns of STEM career interests for male/female and ethnic minority/majority participants

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DISCUSSION

- Implications
  - simply having high self-efficacy & volunteering in informal STEM learning sites does not ensure high interest in all types of STEM careers
  - having friends that hold science/math identities is associated with higher STEM career interests for such youth
  - important to examine interest in different types of STEM careers separately
    - Consider gender and ethnicity in doing so

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