When I Grow Up: The Relationship of Science Learning Activation to STEM Career Affinity and Goals

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WHY STUDY THIS?
Two trends have led to increased efforts to create STEM learning experiences/interventions that are focused on early career interest.

- The STEM workforce needs to change in various ways (more in some fields and more diverse)
- Early career interest (especially by 8th grade) has been demonstrated to be an important predictor of participation in the STEM workforce.

Accordingly this paper considers:

What influences early STEM career interest?
In other words...

Science (STEM) learning activation =
A composition of *dispositions, skills, and knowledge* that enables success in proximal science (STEM) learning experiences.
Career Interest

- Phrase “career interest” is a catch all phrase that refers to multiple elements that make it more likely that a young person will end up pursuing a specific career.
- Wide range of what is meant by career interest when adults use it to describe an important outcome set for science learning
- Wider range in what is meant when young people think about their future careers
  - May not really understand what’s involved in a particular career they are interested in
  - May not have an interest in the lifestyle they perceive to accompany a particular career
  - May know what kinds of things they want to spend their time on, but now know which careers allow them to do so.
“What do you think a scientist does?

...theoretical physicists, for some reason, I imagine they all have beards and they sit around like drinking wine out of fancy glasses, thinking like, coming up with genius theories. But in reality it’s probably more like white boards, no sleep, a lot of expo markers and like frantically scribbling equations before you forget them. And then like astrophysicists, again like I was thinking looking at telescopes and like ‘oh look, alien life!’ But in reality it’s probably like hours of sifting through satellite data. Like looking for, like I don’t know, whatever astrophysicists do.

--A 13 year-old girl from a Bay Area middle school

- Her fantasy of the plus sides of a physicists work life includes fancy intellectuals who make great discoveries
- She also imagines that there are many hours of boring, sleep-deprived, and frantic slogging.
- She pays minimal attention to the actual substance.
WHAT ARE WE STUDYING?

Conceptual Framework
STEM Career Likelihood

What’s involved in the development of early career interest? We hypothesize 5 dimensions of STEM career likelihood.

- **Career Awareness.** What a person knows about STEM careers.

- **Career Interest.** The degree to which a person wants to know more about STEM careers, in general, or a STEM career, in particular.

- **Career Affinity.** The kinds of content areas a person wants to pursue in his/her career.

- **Career Goal.** What career a person wants to have when s/he grows up.

- **Career Expectation.** The career a person expects to have when s/he grows up.
Science (STEM) learning activation =
A composition of *dispositions, skills, and knowledge* that enables success in proximal science (STEM) learning experiences.

In general, would you like to have a job related to: S, T, E, M?

What do you want to be when you grow up?
Measures

HOW DID WE MEASURE CAREER AFFINITY & GOALS?
## Career Affinity Measure

In general, would you like to have a job related to:

<table>
<thead>
<tr>
<th></th>
<th>YES!</th>
<th>yes</th>
<th>no</th>
<th>NO!</th>
</tr>
</thead>
<tbody>
<tr>
<td>science</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
</tr>
<tr>
<td>math</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
</tr>
<tr>
<td>engineering</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
</tr>
<tr>
<td>how to design technology</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
</tr>
<tr>
<td>how to program computers</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
<td>♡</td>
</tr>
</tbody>
</table>

Combined into technology
1. Do you know what kind of job you want to have when you grow up?
   ___Yes  ___No

2. If yes, please write the name of the job you want here:
   ____________________

<table>
<thead>
<tr>
<th>Category</th>
<th>Requirements</th>
<th>Examples</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEM Jobs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEM Professional</td>
<td>Bachelors, masters, doctorate</td>
<td>Scientist, engineer, programmer, astronaut, biotech</td>
<td>16%</td>
</tr>
<tr>
<td>STEM Technician/ Middle Job</td>
<td>Associate or technical degree; may have BA or advanced degree, but not required</td>
<td>Lab assistant/technician, game designer, computer help, mechanic</td>
<td>2%</td>
</tr>
<tr>
<td>STEM Related Job</td>
<td>Varies by job</td>
<td>Science teacher, architect, industrial designer; includes high science or technology companies without specifying particular job (e.g., Google, Apple, NASA, science center)</td>
<td>3%</td>
</tr>
<tr>
<td>Health Jobs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Professional</td>
<td>Bachelors, masters, doctorate</td>
<td>Doctor, nurse, vet, dentist, pharmacist, psychiatrist; does not include social worker or social services</td>
<td>19%</td>
</tr>
<tr>
<td>Health Technician/ Middle Job</td>
<td>Associate or technical degree; may have BA or advanced degree, but not required</td>
<td>EMT, dental hygienist, e-ray tech; includes health locations without listing specific job (e.g., VA hospital, elder care)</td>
<td>1%</td>
</tr>
<tr>
<td>Other jobs</td>
<td>Varies by job</td>
<td>Social services, massage therapy, accountant, artist, humanities</td>
<td>977</td>
</tr>
</tbody>
</table>

Total codable responses 1,656

Notes: 191 responses were not a serious answer, unclear, or listed more than one job that excluded clear categorization.
Results

WHAT DID WE LEARN?
Activation \rightarrow Career Affinity

Logistic regression beta weights showing the relationship among Activation to Career Affinity, accounting for control variables

Note. Thicker arrows in figure represent larger relationships between variables; broken line indicates higher p-value
### Career Affinity to Career Goal

<table>
<thead>
<tr>
<th></th>
<th>STEM vs. Other</th>
<th>Health vs. Other</th>
<th>STEM vs. Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>2.41***</td>
<td>2.23***</td>
<td>1.30**</td>
</tr>
<tr>
<td>Engineering</td>
<td>1.80***</td>
<td>0.79**</td>
<td>2.15***</td>
</tr>
<tr>
<td>Technology</td>
<td>1.33***</td>
<td>0.76**</td>
<td>1.74***</td>
</tr>
<tr>
<td>Math</td>
<td>1.02</td>
<td>1.15+</td>
<td>0.90</td>
</tr>
<tr>
<td><strong>Total N</strong></td>
<td><strong>1,280</strong></td>
<td><strong>1,271</strong></td>
<td><strong>647</strong></td>
</tr>
<tr>
<td><strong>Nagelkerke R²</strong></td>
<td><strong>34%</strong></td>
<td><strong>14%</strong></td>
<td><strong>31%</strong></td>
</tr>
</tbody>
</table>

***p≤.001, **p≤.01, *p≤.05, +p≤.10
Activation → Career Goal

Logistic regression beta weights showing the relationship among Activation to Career Goals, accounting for control variables

Note. Thicker arrows in figure represent larger relationships between variables; broken lines indicates higher p-value; red lines indicate negative relationship.
Other Trends

- **Gender**
  - Being *male* is associated with higher affinity scores related to S, T, E, and M
  - Being *female* is associated with being less certain of one’s career goals, even controlling for activation levels

- **Minority status**
  - is associated with a slight increase in affinity towards T, E, & M careers
  - Higher degree of certainty about one’s career goals

- **Older students**
  - More likely to have science career affinity
  - Less likely to have affinity towards T, E, & M
  - More likely to have health career goals than other goals

- **Home resources**
  - Associated with modest increases in math affinity
Discussion

- Warrants further study
  - Does valuing science persist as a more compelling driver towards T & E careers than fascination?
  - Does fascination persist as a more compelling driver towards health careers than valuing science?
  - Why doesn’t competency belief play a more important role in developing career affinities and goals?
  - Why isn’t scientific sensemaking related to STEM career affinity?

- Implications for *career likelihood* construct
  - Evidence of the value of disentangling the conceptual melting pot of what has simply been known as “career interest” in the past.
  - In future work, plan to flesh out this construct as well as build and improve measures for the each of the five dimensions

- Implications for intervention design
  - Understanding the drivers of STEM career likelihood, as well as for whom and under what conditions these drivers are most powerful will support more effective program design.