Pathways Linking Education to Midlife Correlates of AD: Using Longitudinal Data

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Overview

• Explanations for education gradient in health and the role(s) of schools

• What do schools do?
  • What are high quality schools?
  • How are schools organized?

• Evidence for school effects

• School effects over the life course

• Implications of school effects and the changing economy

Supplemental slides
Explanations for the education gradient in health & aging

• **Selection**: Schools sort students according to background
  • Selection determines educational achievement & attainment
  • Education serves as a credential to reproduce social inequality

• **School Effects**: Schools provide access to opportunities that change people and impact achievement & attainment
  • Teach skills—cognitive and non-cognitive
  • Impart knowledge and information
  • Provide social networks and peers to reinforce or disrupt learning
  • Teach students how to engage in lifelong learning, enabling individuals to engage with other institutions over the life course
Opportunities to Learn in Formal and Informal Institutions over the Life Course

NEIGHBORHOOD
  FAMILY
    Individual

Pre-school  K-12  Higher Educ

Cognition (& correlates) at Older Age

Work & Occupation
Lifestyle, Activities, Relationships in Civic, Religious, Community
What do effective schools do?
Provide academically rich learning opportunities for students

Provide & foster:
• Academically rigorous courses
• Developmentally appropriate curriculum that builds toward developing advanced skills and knowledge
• Social climate to motivate students to engage in learning
• Teachers, administrators and staff who are knowledgeable and take students’ needs into account
Evidence of School Effects

• Pre-school
  • Results from experiments (e.g., Perry Pre-school)
  • Debate over “fade-out”

• Kindergarten through High School (partial list of evidence)
  • Summer set back
  • Catholic schools and “academic press”
  • Academic achievement (test scores, grades, coursework)
  • Class size (e.g., Tennessee Star)
  • Compulsory school laws
  • Debate over heterogeneous effects

• Higher Education
  • Four year college degree (bachelor’s degree or more)
  • Vocational college
How are schools organized?

• Age graded—as students age:
  • Schools may get larger, less neighborhood based
  • Greater complexity of curriculum and social dynamics
  • More within school stratification
  • More structured evaluation of success and failure

• Compulsory through high school

• High school to college is crucial transition for lifelong stratification
  • High school courses, esp math, determine success in higher ed
High School Academic Organization: Courses

Algebra II
Advanced Science
Honors English
Foreign Language
Honors Social Studies
Basic English
Basic Social Studies
General Math
General Science

Trends in high school curriculum levels taken by high school graduates from 1982 to 2009

High School Mathematics

Highest Level Mathematics Course Taken by the End of High School (%), HS&B, Class of 1982

<table>
<thead>
<tr>
<th>Course</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Algebra 1</td>
<td>28.7%</td>
</tr>
<tr>
<td>Algebra 1</td>
<td>20%</td>
</tr>
<tr>
<td>Geometry</td>
<td>14%</td>
</tr>
<tr>
<td>Algebra 2</td>
<td>22.7%</td>
</tr>
<tr>
<td>Advanced math/Calculus</td>
<td>14.7%</td>
</tr>
</tbody>
</table>

Percentage of Students Taking No Math Course

- 1982: 60%
- 1992: 50%
- 2004: 40%
- 2013: 30%

Data sources:
- HSB
- NELS
- ELS
- HSLS

Did Not Take Math Senior Year
- 1982: 60%
- 1992: 50%
- 2004: 40%
- 2013: 30%

Didn't Take Math Junior or Senior Year
- 1982: 30%
- 1992: 20%
- 2004: 10%
- 2013: 5%
High School Math Coursework and Early Adult Labor Force Outcomes

• A natural experiment in Denmark, Joensen and Nielsen (2009). Advanced math coursework -> 30% higher incomes in early adulthood. The most likely mechanism is development of knowledge and skills and it operates partially (but not entirely) through higher education.

• HS&B, Rose and Betts (2001, 2004) Advanced math coursework -> higher wages at age 27. An important threshold in determining higher wages was whether or not students completed Algebra 1 and geometry by the end of high school. Math coursework explained the wage gap by parents’ SES.


High School Coursework and Midlife Outcomes (early results from High School & Beyond Midlife Follow-up)

• Labor market
  • Advanced math and science predict
    • Occupational mean wage (one decile higher)
    • Likelihood of holding STEM occupation (even without a college degree)
    • Who successfully adapts to labor market changes (advancing in an occupation between early adulthood and midlife, net of early occupation)
  • Low level math predicts:
    • Unemployment after holding a bad job
    • Holding a precarious occupation (low wage (women) or occupation with high unemployment (men))

• Health status & physical functioning
  • Elite high school coursework & selective college predicts not being obese
  • Advanced math predicts being in very good or excellent health
  • Low level math predicts:
    • Lower physical functioning
    • Disability
    • Mortality

Curve is from Acemoglu and Autor (2011)

Red circles (radius) represent number of STEM and STEM-related occupations for each wage percentile

Implications of Workforce Polarization for Cognitive Aging

• To the extent that jobs offer individuals opportunities to learn and continue to grow intellectually, the greater polarization of the workforce means that a very large share of the mid-adult workforce will be in low-skill jobs that offer fewer opportunities for cognitive growth.

• Job polarization is related to resources, safety nets, opportunity through
  • Access to other societal institutions
  • Spatial stratification
Conclusions

• A substantial body of research has established effects of schools on
  • Early adult outcomes

• More limited research on long run effects on
  • Ability to adapt to societal changes
  • Individual’s interactions with formal institutions (e.g., work/employment, health care)

• Society is becoming increasingly stratified (economically polarized) and segregated, which could exacerbate long run effects of education on correlates of AD
Collaborators

Co-Investigators

• Sandy Black, Economics, UT Austin
• Eric Grodsky, Sociology, UW Madison
• Rob Warren, Sociology, UMN Twin Cities

Others

• Amanda Bosky, UT (sociology)
• Jamie Carroll, UT (sociology)
• Michelle Frisco, PhD, Penn State
• Ziwei He, UT (economics)
• Koit Hung, UT (sociology)
• Eve Pattison, UT (sociology)
• Robert Reynolds, PhD, UT
• April Sutton, PhD, UCSD
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Supplementary Slides
References

• Carroll, Jamie M., Chandra Muller, Eric Grodsky and John Robert Warren. Working Paper. "Tracking Health Inequalities from High School to Midlife." University of Texas at Austin, Austin, TX.
References cont.

High School and Beyond (sophomores): The Class of 1982

Unemployment=7.8% (1990)

Unemployment=6.3% (2001)

Unemployment=10% (2008)

Unemployment=10.8% (July 1981)


*Computerization of Workplace
Migration: Where do they live then and now?

Then: 1980

Now: 2014
### Labor Force: 2013 Occupation Wage Percentile

OLS regression coefficients

All models include locus of control, number of mathematics credits, science credits, and foreign language credits & background characteristics (race/ethnicity, gender, age, mother’s education, and number of siblings), 1992 educational attainment

<table>
<thead>
<tr>
<th>Highest math course (reference=below Alg 1)</th>
<th>Adaptation Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra 1</td>
<td>3.301*</td>
</tr>
<tr>
<td>Geometry</td>
<td>5.567***</td>
</tr>
<tr>
<td>Algebra 2</td>
<td>5.609***</td>
</tr>
<tr>
<td>Adv math/Calculus</td>
<td>8.589***</td>
</tr>
<tr>
<td>Algebra 2</td>
<td>3.301*</td>
</tr>
<tr>
<td>Geometry</td>
<td>5.567***</td>
</tr>
<tr>
<td>Algebra 2</td>
<td>5.609***</td>
</tr>
<tr>
<td>Adv math/Calculus</td>
<td>8.589***</td>
</tr>
<tr>
<td>Math test score</td>
<td>3.223***</td>
</tr>
<tr>
<td>STEM occup 1991</td>
<td>11.40***</td>
</tr>
<tr>
<td>Biology</td>
<td>2.111</td>
</tr>
<tr>
<td>Chemistry</td>
<td>1.611</td>
</tr>
<tr>
<td>Physics</td>
<td>3.980*</td>
</tr>
<tr>
<td>Advanced science</td>
<td>2.664</td>
</tr>
<tr>
<td>Math test score</td>
<td>3.223***</td>
</tr>
<tr>
<td>STEM occup 1991</td>
<td>11.40***</td>
</tr>
<tr>
<td>HS Fixed effect</td>
<td>No</td>
</tr>
<tr>
<td>STEM 1991=0</td>
<td>No</td>
</tr>
<tr>
<td>R²</td>
<td>0.229</td>
</tr>
<tr>
<td>N</td>
<td>7,240</td>
</tr>
</tbody>
</table>

# Labor Force: 2013 Low-wage & High Unemployment Occupation--AMEs

<table>
<thead>
<tr>
<th></th>
<th>Low Wage Occupation</th>
<th>High Unemployment Rate Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High/Aver $20/hr+</td>
<td>Low &lt;$20/hr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unemployed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unemployed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unemployed</td>
</tr>
</tbody>
</table>

## Highest math course (reference <Algebra 1)

<table>
<thead>
<tr>
<th>Course</th>
<th>Low/Wage</th>
<th>High Unemployment Rate</th>
<th>Low unemp</th>
<th>High unemp</th>
<th>Unemployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alg 1</td>
<td>0.068**</td>
<td>-0.013</td>
<td>-0.027*</td>
<td>0.080***</td>
<td>-0.024</td>
</tr>
<tr>
<td>Geometry</td>
<td>0.086**</td>
<td>-0.024</td>
<td>-0.027</td>
<td>0.099***</td>
<td>-0.037</td>
</tr>
<tr>
<td>Alg 2</td>
<td>0.091***</td>
<td>-0.048</td>
<td>-0.012</td>
<td>0.100***</td>
<td>-0.059**</td>
</tr>
<tr>
<td>Advanced Math +</td>
<td>0.106***</td>
<td>-0.067*</td>
<td>-0.016</td>
<td>0.094**</td>
<td>-0.051*</td>
</tr>
<tr>
<td>Math test score</td>
<td>0.055***</td>
<td>-0.027*</td>
<td>-0.010</td>
<td>0.034**</td>
<td>-0.005</td>
</tr>
</tbody>
</table>

*Note: Outcome categories not shown are disability & out of labor force/homemaker.*

All models include background characteristics (race/ethnicity, gender, age, parents’ education, and family structure, disability in adolescence), locus of control, science and foreign language coursework, GPA, public/private high school, urbanicity, 1992 educational attainment, 1991 unemployment.

### Health: 2013 Health Status & Physical Functioning

**OLS regression coefficients**

All models include background characteristics (race/ethnicity, gender, age, parents’ education, family income, father’s occupation, home ownership, number of siblings and family structure), adolescent health, high school drop out status, school characteristics.

Models with degree attainment also include change in locus of control, test scores and grades from sophomore to senior year.

<table>
<thead>
<tr>
<th>Course-taking Pattern (reference all low-level courses)</th>
<th>Health Status</th>
<th>Physical Functioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed Low-Level Courses</td>
<td>.105*</td>
<td>.084~</td>
</tr>
<tr>
<td>All Medium-Level Courses</td>
<td>.141*</td>
<td>.088</td>
</tr>
<tr>
<td>Mixed High-Level Courses</td>
<td>.191***</td>
<td>.137*</td>
</tr>
<tr>
<td>All High-Level Courses</td>
<td>.221**</td>
<td>.141*</td>
</tr>
<tr>
<td>Locus of Control</td>
<td>.084**</td>
<td>.175***</td>
</tr>
<tr>
<td>Test Scores</td>
<td>-.002</td>
<td>-.006**</td>
</tr>
<tr>
<td>GPA</td>
<td>.078**</td>
<td>.084**</td>
</tr>
<tr>
<td>Degree Attainment</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>R²</td>
<td>.100</td>
<td>.116</td>
</tr>
<tr>
<td>N</td>
<td>6850</td>
<td>2990</td>
</tr>
</tbody>
</table>

*** p<.001, ** p<.01, * p<.05, ~ p<.1

Health: Mortality

Odds Ratios

Both models include background characteristics (race/ethnicity, gender, age, parents’ education, father’s occupation, parents’ home ownership, number of siblings and family structure), adolescent health.

Model with educational attainment also includes science courses, locus of control, self-concept, test scores, grades, school effort, and peer characteristics.

<table>
<thead>
<tr>
<th>Math Coursework (reference is &lt;Algebra I)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra I</td>
<td>0.59**</td>
</tr>
<tr>
<td>Geometry</td>
<td>0.61*</td>
</tr>
<tr>
<td>Algebra II</td>
<td>0.41**</td>
</tr>
<tr>
<td>&gt;Algebra II</td>
<td>0.41**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Educational Attainment (ref= HS degree, no college)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Did Not Complete High School</td>
<td>1.25</td>
</tr>
<tr>
<td>Some College, No Degree</td>
<td>0.93</td>
</tr>
<tr>
<td>Bachelor's Degree or More</td>
<td>0.49*</td>
</tr>
</tbody>
</table>

N=13,040

Selection Effects Go Beyond Family Background

School Processes – Degree Preparation:
- Coursework
- Achievement Test Scores
- Grades
- Non-Cognitive Skills

Academic Degree

Health

Childhood & Adolescence → Early Adulthood → Midlife & Older Adulthood
Course-taking by Adolescent Weight Status

Source: High School and Beyond

![Bar chart showing course-taking by adolescent weight status. General Algebra 1, Geometry, Algebra 2, and Advanced courses are compared for healthy weight and overweight status.]
Course-taking by Adolescent Disability Status

Source: High School and Beyond
College Preparatory Coursework End of High School for Students with a Learning Disability

Source: Education Longitudinal Study of 2002