Programs of Study

If POS is the Solution, What is the Problem?

James R. Stone III
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National Research Center for CTE
THE PROBLEM: THE LABOR MARKET & THE CONDITION OF EDUCATION
S&E occupations make up only about one-twentieth (5%) of all workers (5.3%) in 2018. (5% in 2018, Carnevale, 2010.)

435,000 U.S. citizens and permanent residents a year graduated with bachelor's, master's, and doctoral degrees in science and engineering. Over the same period, there were about 150,000 jobs added annually to the science and engineering workforce.

http://www.businessweek.com/print/smallbiz/content/oct2007/sb20071025_827398.htm
Murray said that none of the companies she has talked with has suggested that there is a shortage of qualified chemists or life scientists. She said that employers’ greatest concern “is not numbers, it is training.” She cited the example of managers who told her they could interview hundreds of candidates for an organic chemistry position but wish they knew how to identify those candidates who “can behave collaboratively” and have the other broad competencies discussed at the workshop. She argued that the degree to which scientists have these other capabilities “really seems to be the problem.”

IS THERE A SHORTAGE OF SCIENTISTS?

What do the data say about where the jobs are?

High growth? High demand? High wage?

High Demand Occupations 2010-2020
The BLS Perspective

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Education Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registered nurses</td>
<td>High school</td>
</tr>
<tr>
<td>Retail salespersons</td>
<td>High school</td>
</tr>
<tr>
<td>Home health aides</td>
<td>High school</td>
</tr>
<tr>
<td>Personal care aides</td>
<td>High school</td>
</tr>
<tr>
<td>Office clerks, general</td>
<td>High school</td>
</tr>
<tr>
<td>Food prep/service &amp; Fast Food</td>
<td>High school</td>
</tr>
<tr>
<td>Customer Service Reps</td>
<td>High school</td>
</tr>
<tr>
<td>Heavy &amp; Tractor Trailer Drivers</td>
<td>High school</td>
</tr>
<tr>
<td>Laborers - freight, stock, material</td>
<td>High school</td>
</tr>
<tr>
<td>Postsecondary Instructors</td>
<td>High school</td>
</tr>
<tr>
<td>Nursing aides, orderlies</td>
<td>High school</td>
</tr>
<tr>
<td>Child Care Workers</td>
<td>High school</td>
</tr>
<tr>
<td>Booking, Accounting, Auditing Clerks</td>
<td>High school</td>
</tr>
<tr>
<td>Cashiers</td>
<td>High school</td>
</tr>
<tr>
<td>Elementary teachers</td>
<td>High school</td>
</tr>
<tr>
<td>Receptionists and information clerks</td>
<td>High school</td>
</tr>
<tr>
<td>Janitors &amp; Cleaners</td>
<td>High school</td>
</tr>
<tr>
<td>Landscaping &amp; Groundskeeping</td>
<td>High school</td>
</tr>
<tr>
<td>Sales Representatives, except technical</td>
<td>High school</td>
</tr>
<tr>
<td>Construction laborers</td>
<td>High school</td>
</tr>
<tr>
<td>Medical Secretaries</td>
<td>High school</td>
</tr>
<tr>
<td>Office Supervisors</td>
<td>High school</td>
</tr>
<tr>
<td>Carpenters</td>
<td>High school</td>
</tr>
<tr>
<td>Waiters &amp; Waitresses</td>
<td>High school</td>
</tr>
<tr>
<td>Security Guards</td>
<td>High school</td>
</tr>
<tr>
<td>Teacher Assistants</td>
<td>High school</td>
</tr>
<tr>
<td>Accountants and Auditors</td>
<td>High school</td>
</tr>
<tr>
<td>Licensed Practical Nurses</td>
<td>High school</td>
</tr>
<tr>
<td>Physicians and surgeons</td>
<td>High school</td>
</tr>
<tr>
<td>Medical Assistants</td>
<td>High school</td>
</tr>
</tbody>
</table>
The Other Perspective
Education and Future Work: BLS & CEW

- BS/BA or more: USDOL-BLS 23, CEW 33
- Some College: USDOL-BLS 30, CEW 30
- Associate: USDOL-BLS 5, CEW 6
- PS Award: USDOL-BLS 6, CEW 8
- Work Experience: USDOL-BLS 58.5, CEW 36
- OJT-Short to Long: USDOL-BLS 58.5, CEW 36
- HS or less: USDOL-BLS 58.5, CEW 36
Teens and Young Adults have been hit the hardest by the Great Recession!


54.3% of 18- to 24-year-olds (54.3%) were employed in 2011, compared with 62.4% in 2007, a 13% decrease. The lowest employment-to-population ratio for young adults since 1948.

Pew Research Center, 2012. *Coming of Age, Slowly, in a Tough Economy*
Sub-Baccalaureate Credentials Pay Off

Licenses and Certificates Earn More Than:
- 43% Associates
- 27% Bachelors

Associates Earn More Than:
- 31%
Race Against the Machine: The Machines are Winning

- The Google car (truck?)
- IBM Watson
- Deep Blue
- The “Square”
- Text readers/Pattern recognition (goodbye legions of lawyers - only 60% accurate)
- Automated ‘call centers’ (goodbye India)
- GeoFluent (goodbye translators)
- Vending machines for … everything
The Economic Context

Technology Impact

Winners

- High Skilled
- “Superstars”
  - Top 1% - 65% of wealth growth since 2002
  - Top .01%(n=15,000) share of national income doubled to 6%
  - CEO pay: 70x to 300x worker

- Capital
  - Equipment +26%
  - Payrolls flat
  - Corporate profits at 50 year high
  - Wages & Benefits at 50 year low

Losers

- Low Skilled
- Everyone else
- Labor
Can People Win?

- Instructional methods
- Softer skills
- Instructional focus
- The Human Advantage (for now)

- Khan Academy
- CTSOs
- Hyperspecialists, entrepreneurship
- Physicality of work
- Advanced pattern recognition
- General problem solving
- Creativity
The Education Solution/Problem

Rigor = MORE

What has 25 years of education “reform” accomplished?
Since the mid-1980s we have

- Added the equivalent of one full year of core academics (math, science, language arts) to high school graduation requirements.
- (NAEP) *Reading scores have significantly declined*
- (NAEP) *Science scores have significantly declined*
- (NAEP) *Math scores have remained relatively unchanged*
12th Grade Math Scores 2005

Scale score

[Diagram showing the distribution of scale scores with specific values for average, 10th, 25th, 50th, 75th, and 90th percentiles.

- Average score: 150
- 10th percentile: 105
- 25th percentile: 127
- 50th percentile: 151
- 75th percentile: 174
- 90th percentile: 194]
One solution?

Be born to smarter parents!
It is getting worse

The United States, once the world leader in high-school completion, now trails 22 other leading industrialized countries that have graduation rates higher than the American rate of 72 per cent, according to a report released last week by the Organization for Economic Cooperation and Development. 
*Chronicle of Higher Education* (December 4, 2008)

Source: *One-Third of a Nation* (ETS, 2005)
The Education Challenge

- Engagement - Completing secondary education; completing postsecondary credential

- Achievement - test scores and industry recognized credentials

- Transition - to continued education and training and/or the workplace
The Solution

PROGRAMS OF STUDY
Rigorous, Longitudinal POS Studies: Mixed Method Studies*

- A longitudinal study of three cohorts in SC (6th, 9th, 11th graders) in three diverse WIAs
- A backward mapping (from CC) study of three sites with 15 years of history of POS-like programs
- A random assignment or propensity match study in five sites (3 states)

* Systems Data (transcript) & Interview, Survey Data
Caveats

- These are longitudinal studies
- Data collection lags actual events
  - Students have to complete the “thing”
  - A true POS includes HS&PS – 4+ 2-3 years minimum
  - Release of system lags by 4 months to 4 years.
- Early findings will point toward proximal variables
  - Progress toward graduation
  - Behaviors
  - Self-efficacy
  - Academic & Technical Achievement
- Evidence on distal variables 5+ years(?)
Research Teams

Clemson – SC Pathways
- Cathy Hammond
- Sam Drew
- Cairen Withington
- Catherine Mobley
- Julia L. Sharp
- Cathy Griffith
- Clemson University

U of L – Rigorous Test
- Marisa Castellano
- Kirsten Sundell
- Oscar Aliaga
- Laura Overman

FHI360 – Mature Programs
- Corinne Alfeld
- Sharika Bhattacharya
- Katie Ellison

- Samuel C. Stringfield
- Natalie Stipanovic
- University of Louisville
POS Questions Across the Studies

- Impact of POS on:
  - Engagement – completion of education
  - Achievement – academic, occupational, technical
  - Transition from HS to PS and/or work
  - Completion of HS and Credential

- Impact of economic resources on POS

- What are the key components of POS in practice?
At the comprehensive HS one student’s brother attends, “they don’t think about their future as much as they do here.”

Regarding her POS HS, another student said: “I feel really prepared because of the workload and the different ways that we are learning why we’re doing something. Not just learning the actual topic…[but] the reasons behind it.”
One student said she’d been disengaged from school freshman year but by senior year, she loved school and looked forward to her nursing career:

“This school has really changed – could really change someone. It gets you to the career path that you want and if you’re around people that want to do it and succeed you’ll want to succeed.”
Do POS make a difference for students?

- Over 70% of high school students reported being in a POS made them more engaged in school and better prepared for college and careers.

- 35% of sample enrolled in the local (POS affiliated) college. Of these:
  - 45 - 57% continued to study in their POS area (next slide)
  - 29% of our sample (compared with 17% of students from non-POS affiliated HS), reported feeling “very” prepared for college level studies.
Student Behavior-Engagement
Percentage of POS1 2011 Cohort Switching IGP Career Clusters, by School Poverty Index (POV)

Percent who Switched IGP Area

Poverty Index (Higher Score -> Higher Poverty)
ACHIEVEMENT
West District 10th Grade Test Scores

- Math: 303.36
- Science: 333.27

Control: 291.42, 328.45
East District 10th Grade Test Scores

<table>
<thead>
<tr>
<th>Subject</th>
<th>POS School</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>153.40</td>
<td>153.49</td>
</tr>
<tr>
<td>Algebra 1</td>
<td>154.98</td>
<td>153.92</td>
</tr>
<tr>
<td>Biology</td>
<td>153.54</td>
<td>154.25</td>
</tr>
</tbody>
</table>
“Mature POS” High School Students

- Taking more CTE courses is related to taking more math and science credits, and to a higher GPA in science.
- CTE course taking has a positive relationship (i.e., not detrimental) with academic motivation and skills.

[Further transcript analyses, including HS to college longitudinal analyses, are forthcoming.]
Numbers of CTE Program Completers
2008-09, 2009-10, & 2010-11
Academic/CTE Content in Non-Duplicative Progression of Courses (e.g. concentrator)

% of students completing a CTE course sequence in SC study sites
Transition to Affiliated College (35% of sample)

Of those who entered affiliated college, 45% stayed in the same POS (e.g., culinary) as in HS.

57% stayed in the same career cluster (e.g., hospitality) as their HS POS.
Did they do what they planned?

<table>
<thead>
<tr>
<th></th>
<th>2009 plans</th>
<th>2012 actual status*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical/trade school</td>
<td>8%</td>
<td>12%</td>
</tr>
<tr>
<td>2 year college</td>
<td>28%</td>
<td>41%</td>
</tr>
<tr>
<td>4 year college</td>
<td>45%</td>
<td>29%</td>
</tr>
<tr>
<td>Work</td>
<td>5%</td>
<td>13%</td>
</tr>
<tr>
<td>Military</td>
<td>6%</td>
<td>2%</td>
</tr>
<tr>
<td>Not sure</td>
<td>7%</td>
<td>N/A</td>
</tr>
<tr>
<td>Unemployed &amp; Not in school</td>
<td>N/A</td>
<td>4%</td>
</tr>
</tbody>
</table>

* Based on final survey responses and other means of tracking students
Factors Most Strongly Associated with Student Retention and Completion at Three Community Colleges

- Math placement test scores
- Age (older students do better)
- Receipt of financial aid
- Status as occupational major
- Use of tutoring services in first term in college

From Bremer, C. D., Center, B. A., Medhanie, A., Opsal, C. L., Geise, A., & Jang, Y. J. (in review). Outcome Trajectories of Developmental Reading and Writing Students in Community Colleges
FINDINGS: THE 10 ELEMENTS
### Guidance & Counseling: A Critical Component

<table>
<thead>
<tr>
<th>Percentage of Respondents</th>
<th>Class of 2009</th>
<th>Class of 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>No One</td>
<td>12%</td>
<td>4%</td>
</tr>
<tr>
<td>Parent</td>
<td>34%</td>
<td>29%</td>
</tr>
<tr>
<td>Teacher</td>
<td>9%</td>
<td>5%</td>
</tr>
<tr>
<td>Guidance</td>
<td>36%</td>
<td>58%</td>
</tr>
<tr>
<td>Friends</td>
<td>6%</td>
<td>2%</td>
</tr>
<tr>
<td>Multiple Responses</td>
<td>4%</td>
<td>2%</td>
</tr>
</tbody>
</table>
## Typical “Progression of courses” template

<table>
<thead>
<tr>
<th>9th Grade</th>
<th>10th Grade</th>
<th>11th Grade</th>
<th>12th Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>English I or English I-Honors</td>
<td>English II, World Lit. Honors, or Business Communications</td>
<td>American Lit., AP English, or Applied Communication</td>
<td>English IV or Technical Report Writing</td>
</tr>
<tr>
<td>Principles of Science or Biology I-Honors</td>
<td>Biology I, Biology I-Honors, Chemistry I, or Chemistry I-Honors</td>
<td>Chemistry I, Chemistry I-Honors, AP Chemistry, Physics I, or Physics I-Honors</td>
<td>Physics or AP Physics</td>
</tr>
<tr>
<td>World History or AP World History</td>
<td>US History or AP US History</td>
<td>US Government</td>
<td>Foreign Language</td>
</tr>
<tr>
<td>Physical Education I</td>
<td>Physical Education II</td>
<td>Accounting I (1 credit)</td>
<td>*Office Technology II (2 credits)</td>
</tr>
<tr>
<td>Freshman Academy</td>
<td>Intro to Business Technology (semester)</td>
<td>Office Technology I (2 credits)</td>
<td>or *Computerized Accounting (2 credits)</td>
</tr>
<tr>
<td>Health/Drivers’ Ed (semester)</td>
<td>Multimedia &amp; Desktop Publishing (semester)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introductory Computer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Certifications
- MCAS (Microsoft Certified Applications Specialist)

### Possible Articulated Courses
- ACC135B – Bookkeeping I IS 101

### Post Secondary Options
- CC – Division of Business
- State College – Business Administration
- University – College of Business Administration
Opportunity to Acquire PS Credits

DUAL CREDIT

- At West, college credit is immediately granted if students pass the HS course with an A or a B; the credits are portable
- At East and South, students must pass an extra exam and/or show an IRC, and they must attend that CC to get the credits

DUAL ENROLLMENT

- At West, students are free to enroll in college courses and earn credits
- At East and South, only gen ed courses are available to HS students
## Options for College Credit: SC Pathways

### Table 11. Change in Course-Taking Over Time

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2011</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-POS Students</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent Students AP/IB</td>
<td>26%</td>
<td>28%</td>
<td>2%</td>
</tr>
<tr>
<td>Average Number of AP/IB Credits</td>
<td>3.4</td>
<td>3.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Percent Dual Credit</td>
<td>10%</td>
<td>9%</td>
<td>-1%</td>
</tr>
<tr>
<td>Average Number of Dual Credits</td>
<td>2.3</td>
<td>2.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Number of 10/11th Credits</td>
<td>7.0</td>
<td>7.2</td>
<td>0.27***</td>
</tr>
<tr>
<td><strong>POS Students</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent Students AP/IB</td>
<td>11%</td>
<td>9%</td>
<td>-2%</td>
</tr>
<tr>
<td>Average Number of AP/IB Credits</td>
<td>2.0</td>
<td>1.5</td>
<td>-0.5</td>
</tr>
<tr>
<td>Percent Dual Credit</td>
<td>9%</td>
<td>16%</td>
<td>7%**</td>
</tr>
<tr>
<td>Average Number of Dual Credits</td>
<td>2.1</td>
<td>2.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Number of 10/11th Credits</td>
<td>8.0</td>
<td>8.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Lead to Industry-Recognized Credential, Certificate, AA, or BA

- All POS in the study lead to IRC in HS or CC, or AA/AAS or BA/BS programs
- Many IRCs can be earned in HS – South District’s goal is to have students graduate with HS diploma “and something else”
- Time, personnel, and funding cited as problematic: *East District can no longer cover exam costs* and have downplayed this aspect of POS
Actual Mature POS vs. POS Conceptual Framework

Shared vision
Flexibility
Relationships
Industry involvement
Credit transcription
Need Career Guidance
Dedicated staff
Grant funding
Students on campus

Legislation and Policies
Course Sequences
Partnerships
Credit Transfer Agreements
Guidance Counseling
Professional Development
Technical Skills Assessments
Teaching/Learning Strategies
Accountability/Evaluation
College/Career Ready Standards
INDUSTRY DRIVEN POS-TOYOTA

THE SKILL PIPELINE PROBLEM

The U.S. community college system produces less capable graduates than parallel systems in competitor nations.

Intentional preparation consists mostly of academic education only, i.e. pass technical courses and get a degree.

Schools do not produce graduates with vital preparation for workplace success, such as a highly developed safety culture, skills in workplace organization, lean work skills, and problem solving.
The Solution
Seamlessly Connect Paths for Career Long Growth
and to Strengthen the Whole Company

TOYOTA Advanced Manufacturing Career Paths

TOYOTA Maintenance Career
- MGR
- AM
- TL
- GL
- TM

TOYOTA Seibi Career
- Org Mgt.
- Seibi Mgt.
- Seibi Tech

Automotive Manufacturing
- M.B.A.

Lean Manufacturing
- Certificate

Manufacturing Management Program
- B.B.A.
- A.B.

TOYOTA Engineering Career
- Production Engineer TEMA
- Design Engineer TTC

NED
- New Engineer Development

AME
- Advanced Manufacturing Engineering Program
  - Electrical / Industrial Mechanical
  - B.S.

AMT
- Advanced Manufacturing Technician Program
- Special Toyota Degree Program
- 100% Toyota Relevant

K-12

Project Lead the Way
The Solution
Totally Redesign the Learning Environment

The New Model School
For Manufacturing

Make the
Place of Learning
look and feel like
the Place of Work
Totally Redesign The Community College Program

Next Generation Technical Degree

Advanced Manufacturing Technician Program

Associate Degree in Applied Science

TOYOTA MAINTENANCE FUNDAMENTAL SKILLS

<table>
<thead>
<tr>
<th>Selection Process</th>
<th>PLTW High School Graduates (Math ACT ≥ 19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td></td>
</tr>
<tr>
<td>Technical Core Areas</td>
<td>Intro to Electricity Fluid Power</td>
</tr>
<tr>
<td>Manufacturing Experience Program</td>
<td>Production Experience</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1st Semester</th>
<th>2nd Semester</th>
<th>3rd Semester</th>
<th>4th Semester</th>
<th>5th Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>History</td>
<td>Social Science</td>
<td>Science</td>
<td>Public Speaking</td>
</tr>
</tbody>
</table>

Safety

5S

Continue Practicing Activity

Toyota Production System for Maint.

Problem Solving

Total Productive Maintenance

Continue Practice

Coach

Work Behavior

Attendance – Diligence – Teamwork – Interpersonal Relations - Initiative

Characteristics when hired

- Communication and critical thinking skills
- Multiskilled Technical Foundation
- Floor experience and hands-on skill
- Good safety practice on hire
- 5S understanding and practice on hire
- Lean mfg thinking and practice on hire
- Problem solving thinking and use on hire
- Understanding of maintenance practice on hire
- Excellent worker behavior on hire
The Solution
Target Best Practice K-12 Programs

Tech Ed and vocational programs, as they exist now, are not part of the solution. On they whole they do not produce graduates with the capabilities that give U.S. companies advantage over off-shore based competitors and they create too much cost to up-skill when hired.

Attracts full spectrum of students
Certification driven!!
More choose STEM careers
Do better in ALL subjects

Toyota AMT Program:
1/3 drop-out rate of non-PLTW students
A Few Summary Thoughts

- Some evidence of academic achievement effect
- Mandate did not appear to have much effect on POS implementation (e.g., % of students engaged in POS, use of dual credit)
- 10 elements are not equally important or too costly to employ (e.g., TSA)
- Other elements may be more important (e.g., external funding)
A Few Summary Thoughts

- Even when the policy is required by law, implementation is uneven and may be skewed towards lower performing districts.
- Career guidance/career development is emerging as a necessary condition for RPOS
- Cost is a barrier (counseling, TSAs, professional development)
- What will POS success mean?
  - Enrolled in any college?
  - Pursuing same POS pathway?
  - Student sense of contribution of POS?
Things We Don’t Know . . . Yet

Transition to postsecondary education
- Limited evidence from the Mature POS study
- No follow up with HS cohorts in SC Pathways or U of L Rigorous Test sites

Transition to work
- Acquisition of credentials and,
- The signaling power of the earned credentials
Implicit Assumptions: With Policy Implications

- Education reforms operate independently of economic context
- Adolescents are rational, logical decision makers
- The 10 “elements” are the right elements to ensure POS success
- Accountability challenges for POS
The Future of POS Research?

**Study Cohort**

**Personal Pathways**
- Class of 2009
- Class of 2011
- Class of 2014

**Rigorous Test of POS**
- Class of 2012

**Mature POS**
- Class of 2009
- Class of 2010

**College Cohort**

**NRCCTE FUNDING 10/2007-7/2012**

“Secondary …………… Postsecondary Elements”
VISIT OUR WEBSITE OR SEND ME A NOTE

www.nrccte.org

JAMES.STONE@NRCCTE.ORG