Evidence Based Curriculum Integration

Presented by

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NCPN

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2013 National *Technology Centers That Work* Leaders' Forum: Technology Centers of the Future

NRC CTE

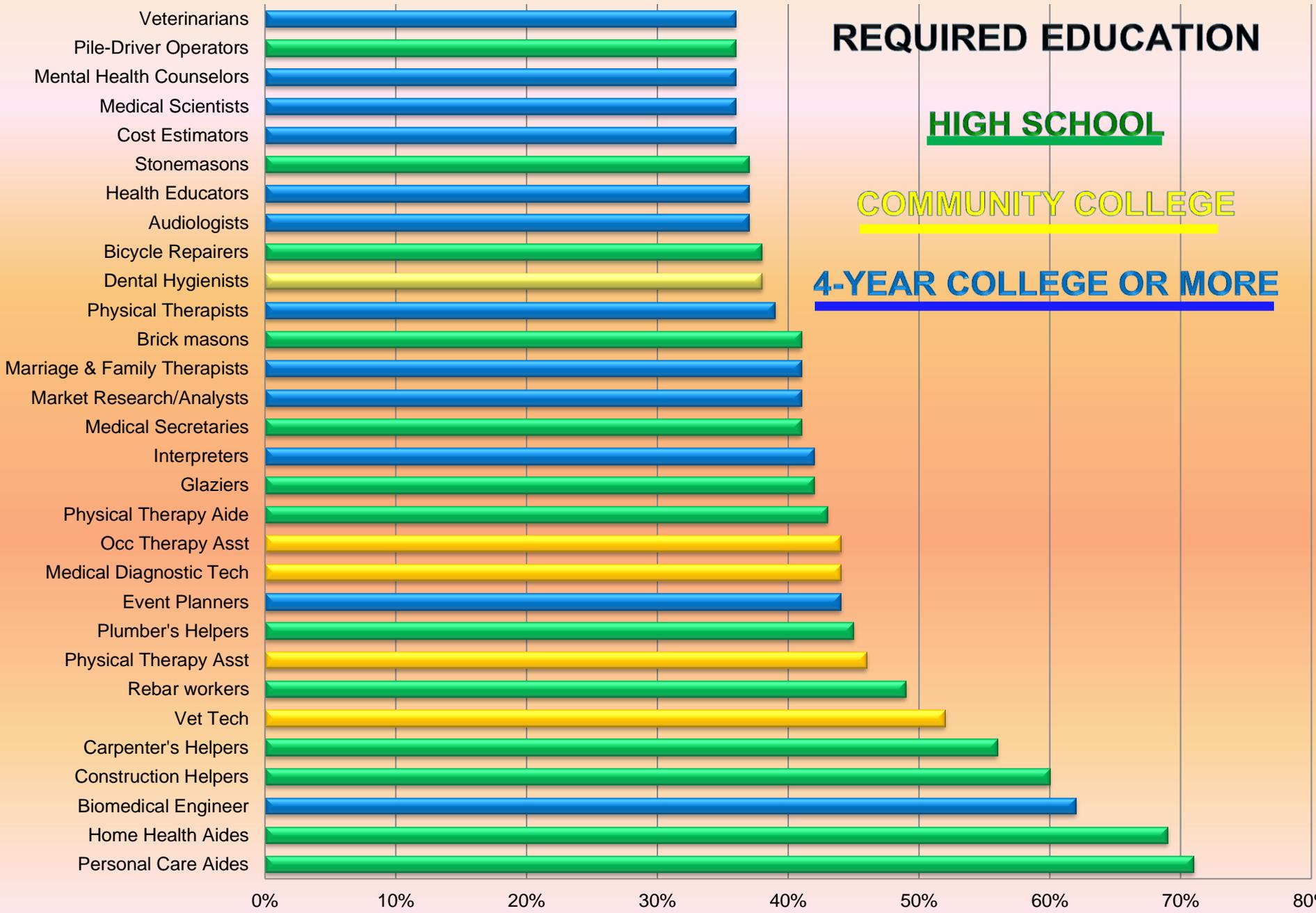National Research Center for Career and Technical Education

Agenda for Technology Centers of the Future

- Future Scan: Wither our students?

- Where have we been: 30 years of 'reform'

- Where do we need to go: Evidence based curriculum integration
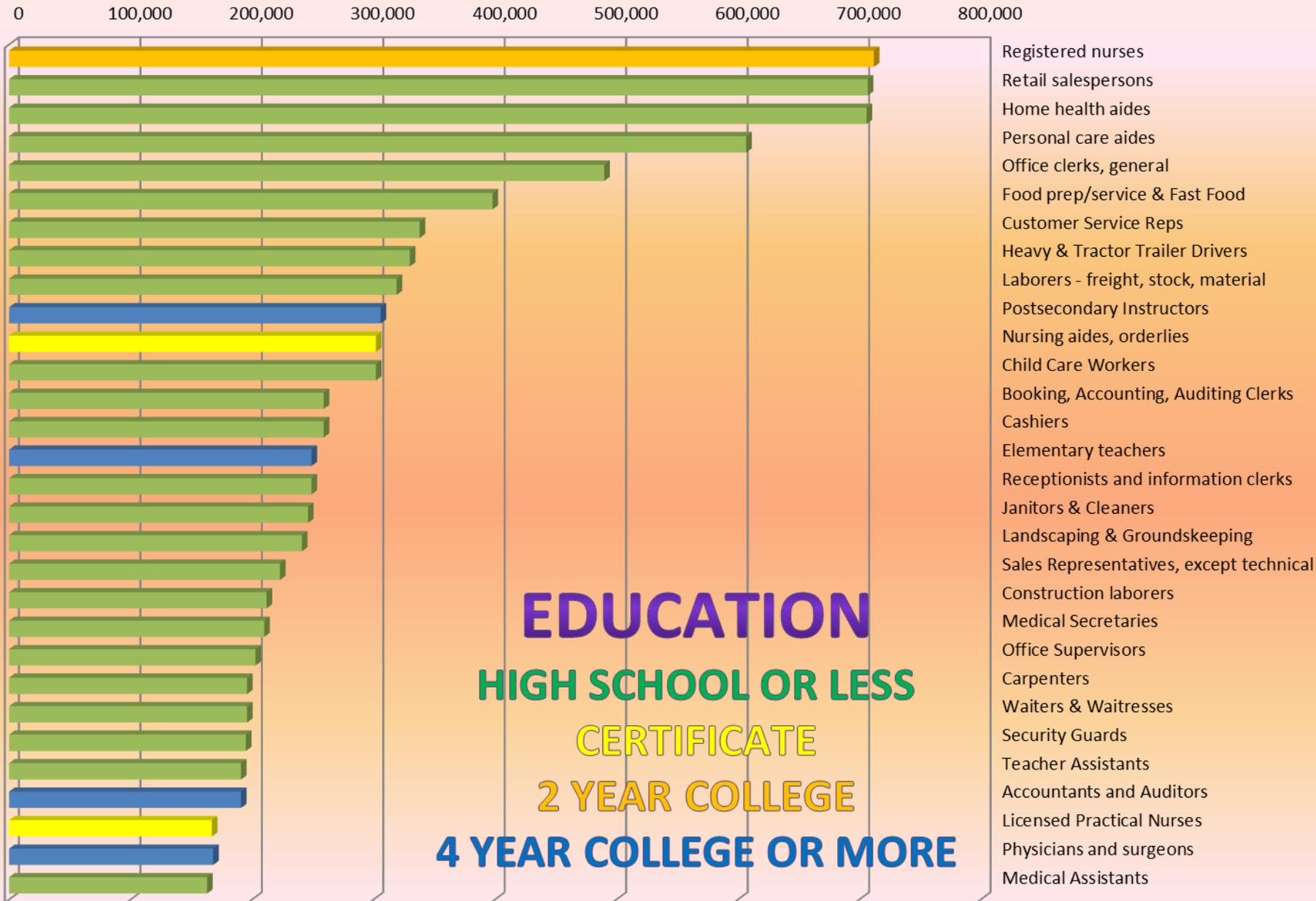
High Growth? High Demand? High Wage?

What do the data say about where the jobs are?

High Growth Occupations 2010-2020

REQUIRED EDUCATION

HIGH SCHOOL

COMMUNITY COLLEGE

4-YEAR COLLEGE OR MORE

Occupation
Veterinarians
Pile-Driver Operators
Mental Health Counselors
Medical Scientists
Cost Estimators
Stonemasons
Health Educators
Audiologists
Bicycle Repairers
Dental Hygienists
Physical Therapists
Brick masons
Marriage & Family Therapists
Market Research/Analysts
Medical Secretaries
Interpreters
Glaziers
Physical Therapy Aide
Occ Therapy Asst
Medical Diagnostic Tech
Event Planners
Plumber's Helpers
Physical Therapy Asst
Rebar workers
Vet Tech
Carpenter's Helpers
Construction Helpers
Biomedical Engineer
Home Health Aides
Personal Care Aides

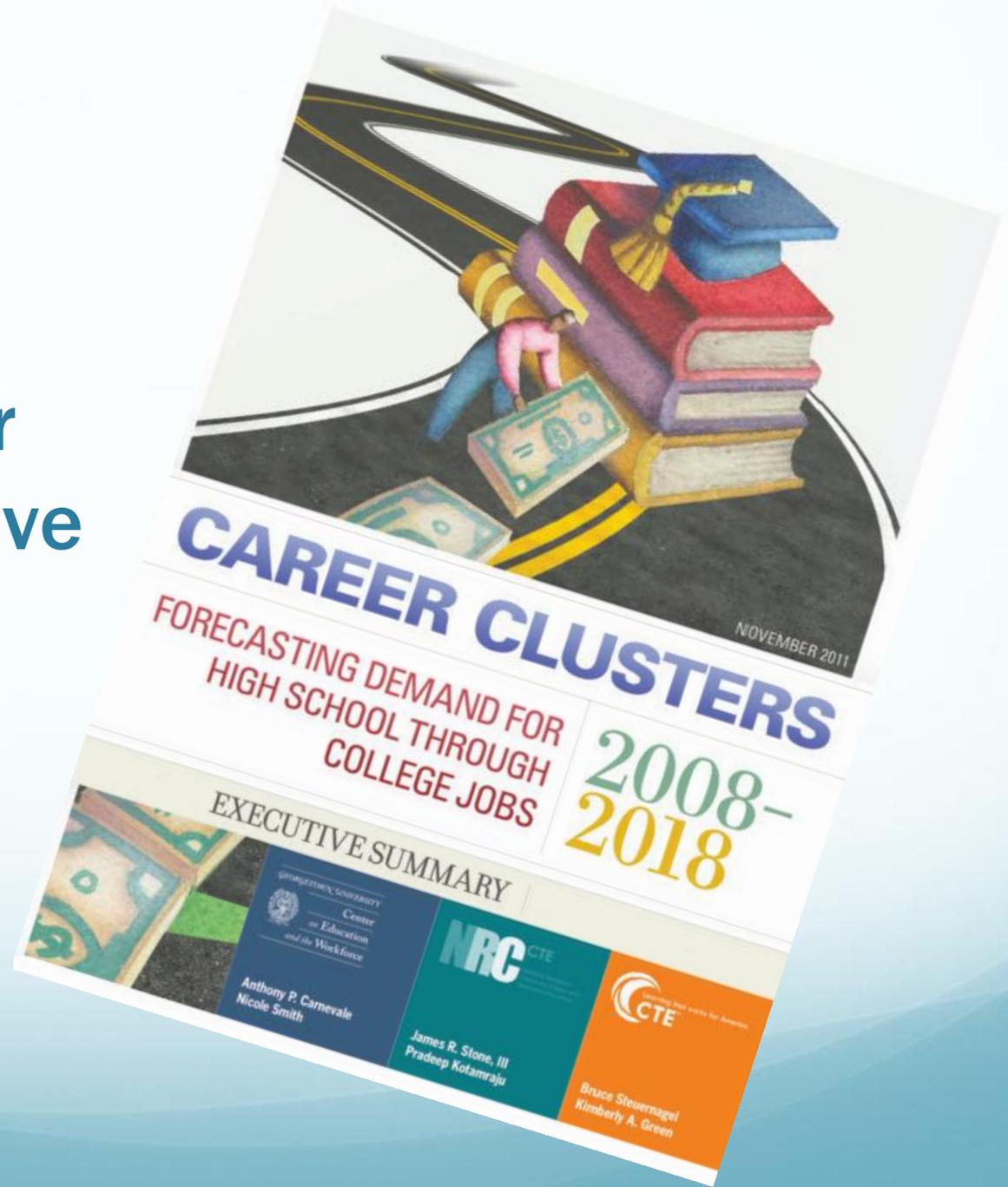0% 10% 20% 30% 40% 50% 60% 70% 80%

High Demand Occupations 2010-2020
The BLS Perspective

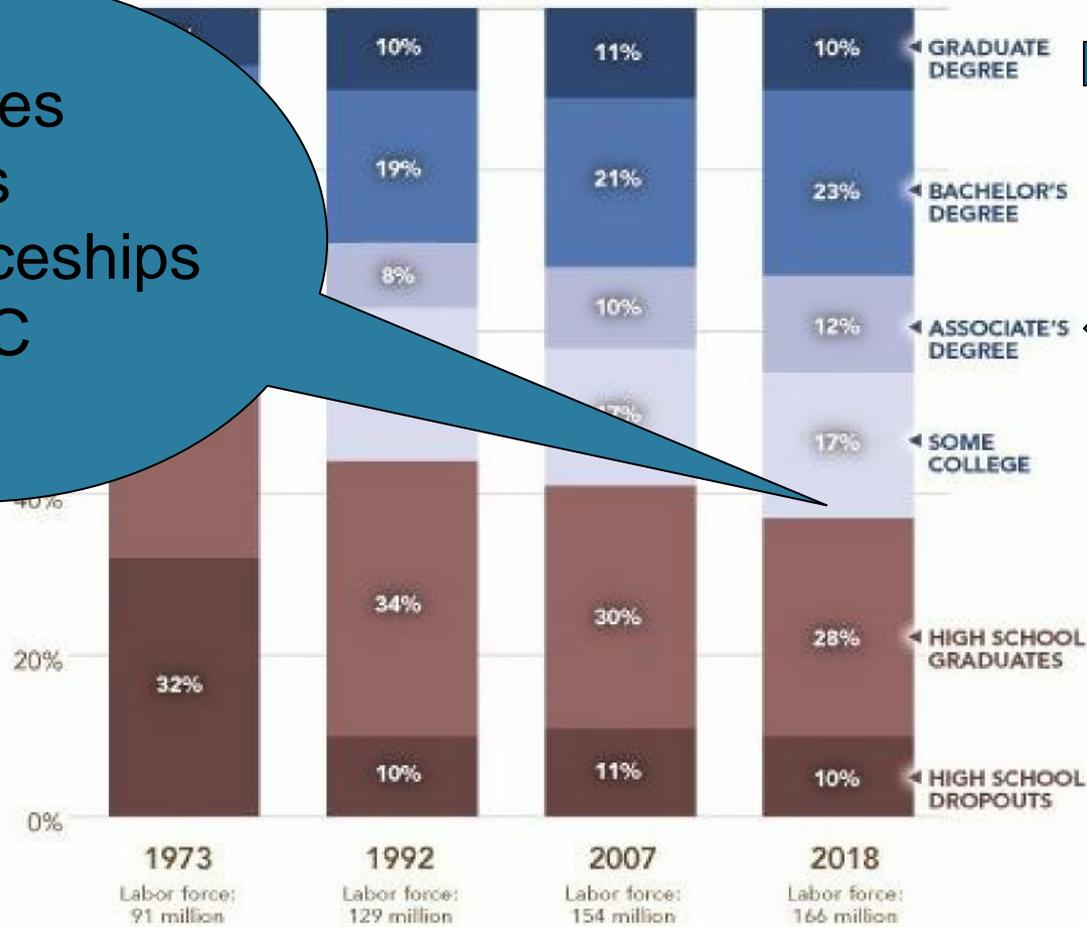# Another Perspective

63% of all jobs will require some college or better by 2018.
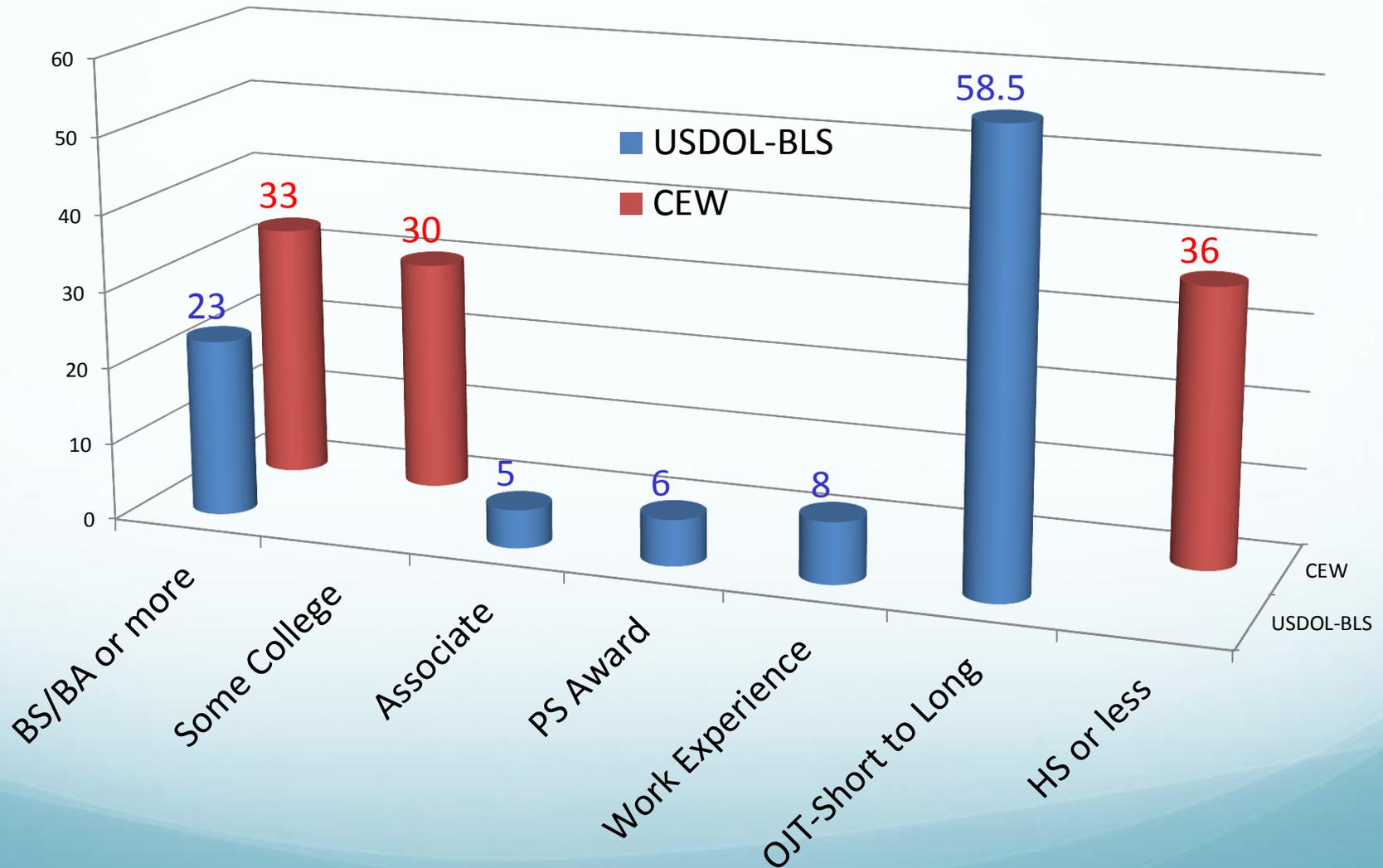

Certificates
Diplomas
Apprenticeships
Other IRC

	1973	1992	2007	2018	
GRADUATE DEGREE		10%	11%	10%	
BACHELOR'S DEGREE		19%	21%	23%	
ASSOCIATE'S DEGREE		8%	10%	12%	
SOME COLLEGE				17%	
HIGH SCHOOL GRADUATES	32%	34%	30%	28%	
HIGH SCHOOL DROPOUTS		10%	11%	10%	

Labor force:
91 million (1973)
129 million (1992)
154 million (2007)
166 million (2018)

•Source: Analysis of March CPS data, various years,
•Center on Education and the Workforce forecasts of education demand to 2018.
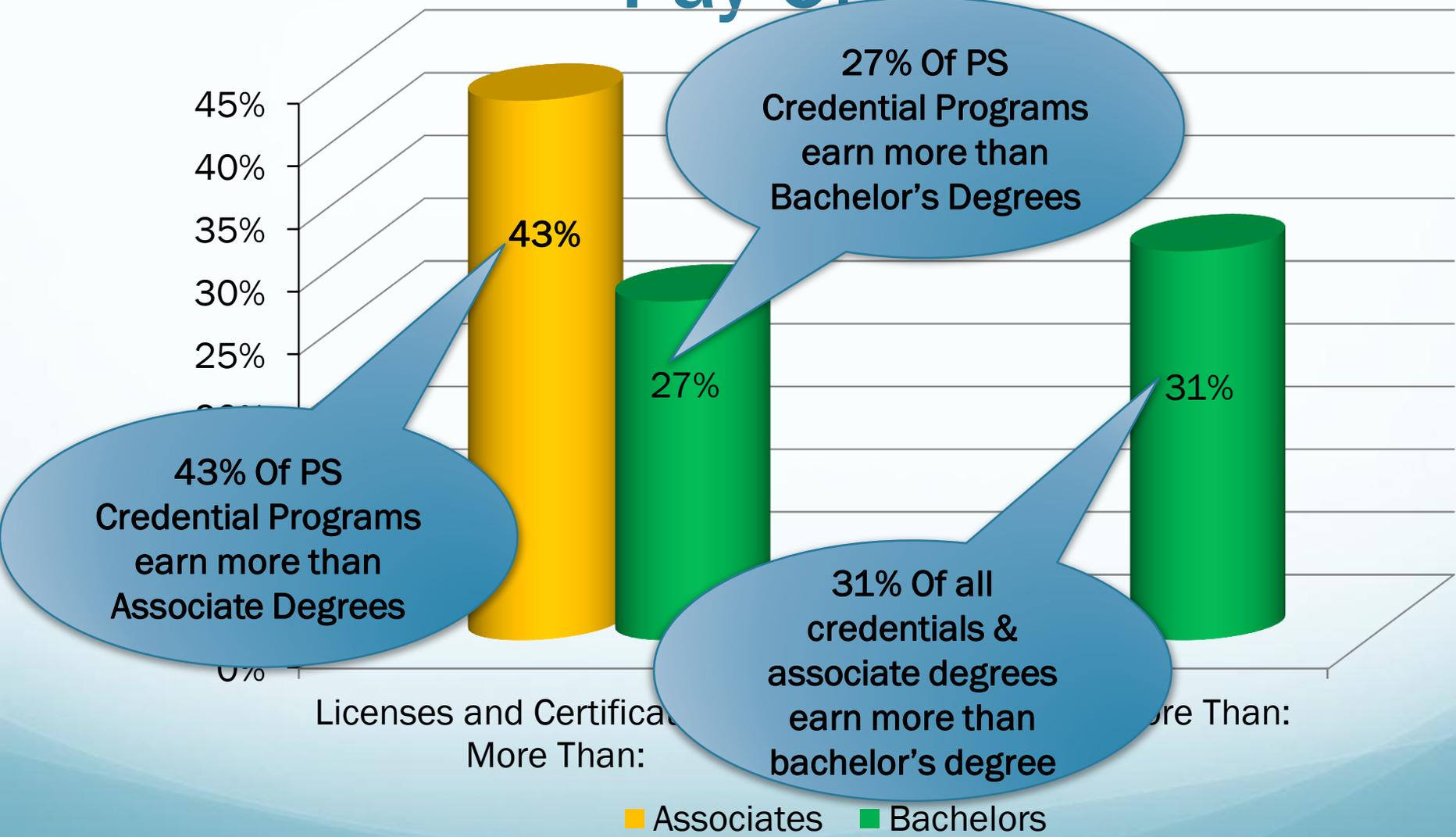
Education and Future Work: BLS & CEW

Why Technical Education Matters

Labor Market Demand

41.7

50

28.6

0

2010

- College Graduate Supply
- College Graduate Demand

Credential Growth

31%   24%   45% 43%

50%

40%

30%

20%

10%

0%

2001-12

- Associates
- Bachelor's
- Master's
- Doctorate

Labor Market Demand B

30%

25%

20%

15%

10%

1%   5%   0%

5%

0%

1970   2010

- Taxi Drivers w/ BA/BS
- Sales Clerks
- Janitors
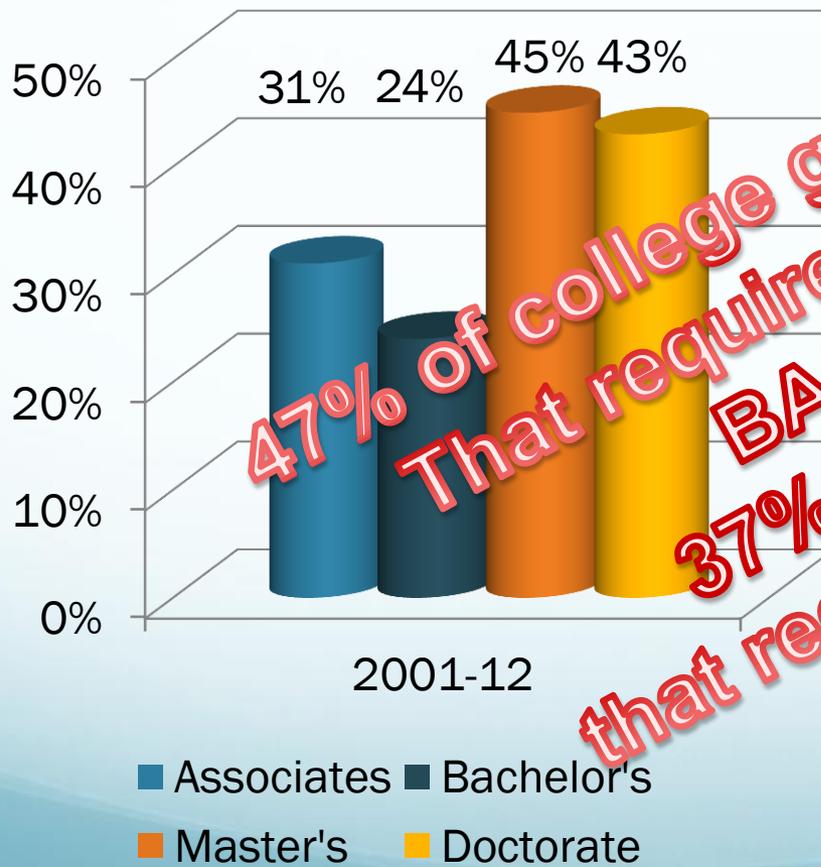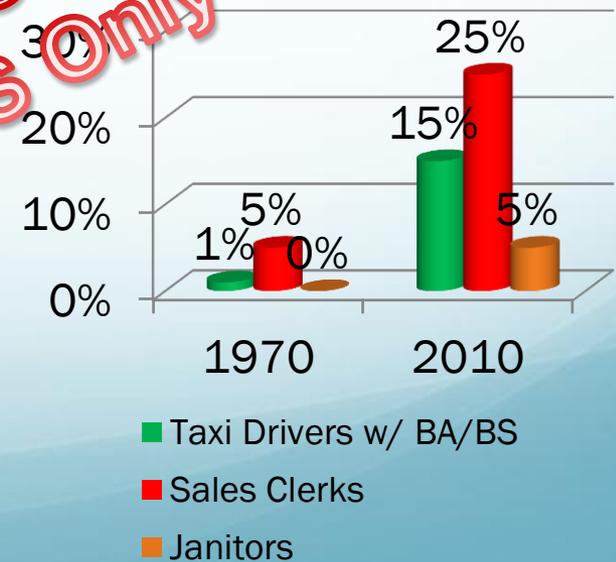
47% of college grads in jobs That require less than BA/BS; 37% in Jobs that require HS Only

Vedder, R., Denhart, C., Robe, J. (2010).
Why are recent college graduates unemployed

College for all? Only 40% of 27-year olds have earned an

Educational Attainment, by Age 26-27
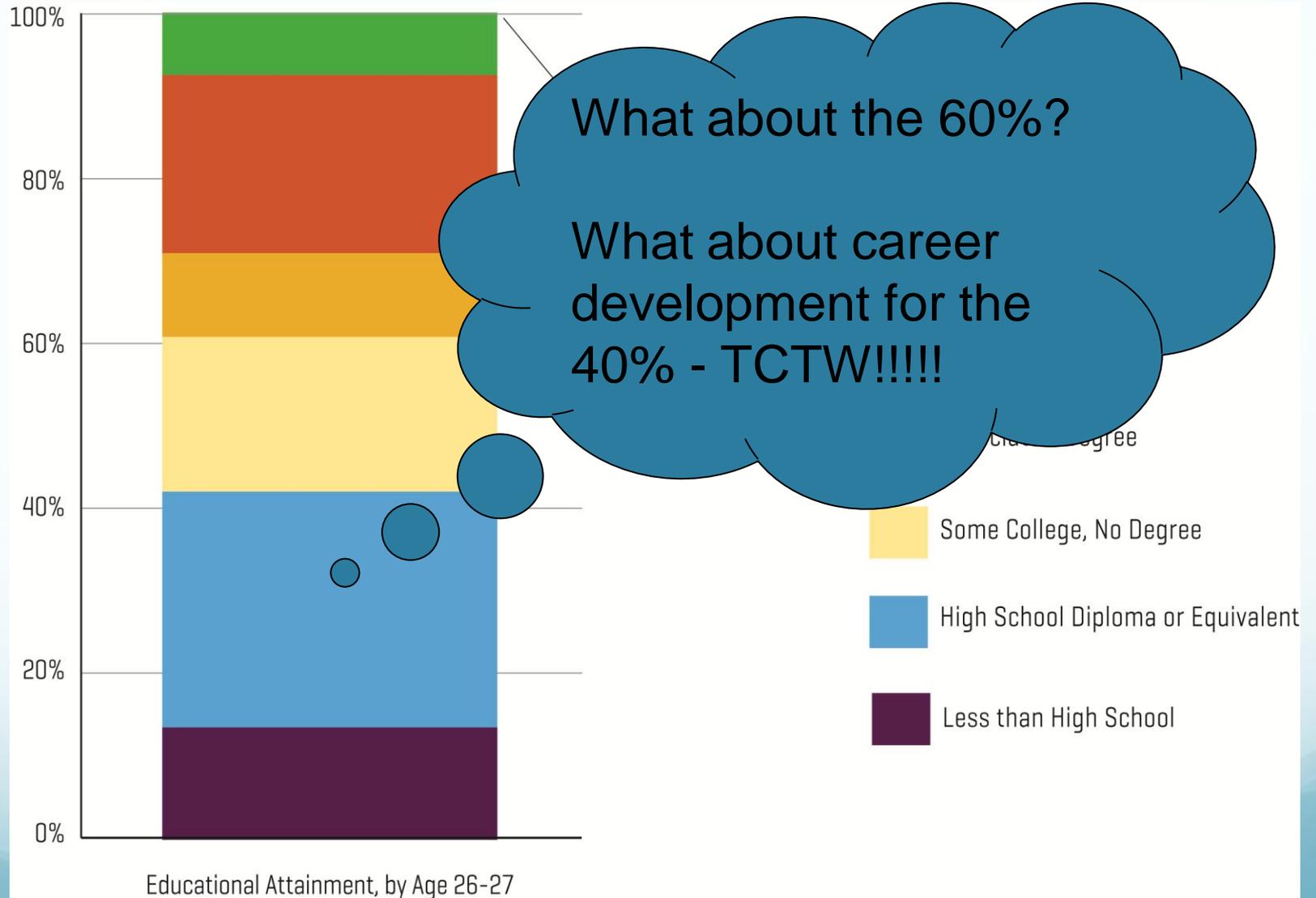
Note: Represents data collected in surveys between 2006-2008; GED is approximation based on data from GED Testing Program.
Source: Current Population Survey Annual Social and Economic Supplement.

A 3rd Disconcerting Perspective

Erik Brynjolfsson
Andrew McAfee

Race Against The Machine

How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy
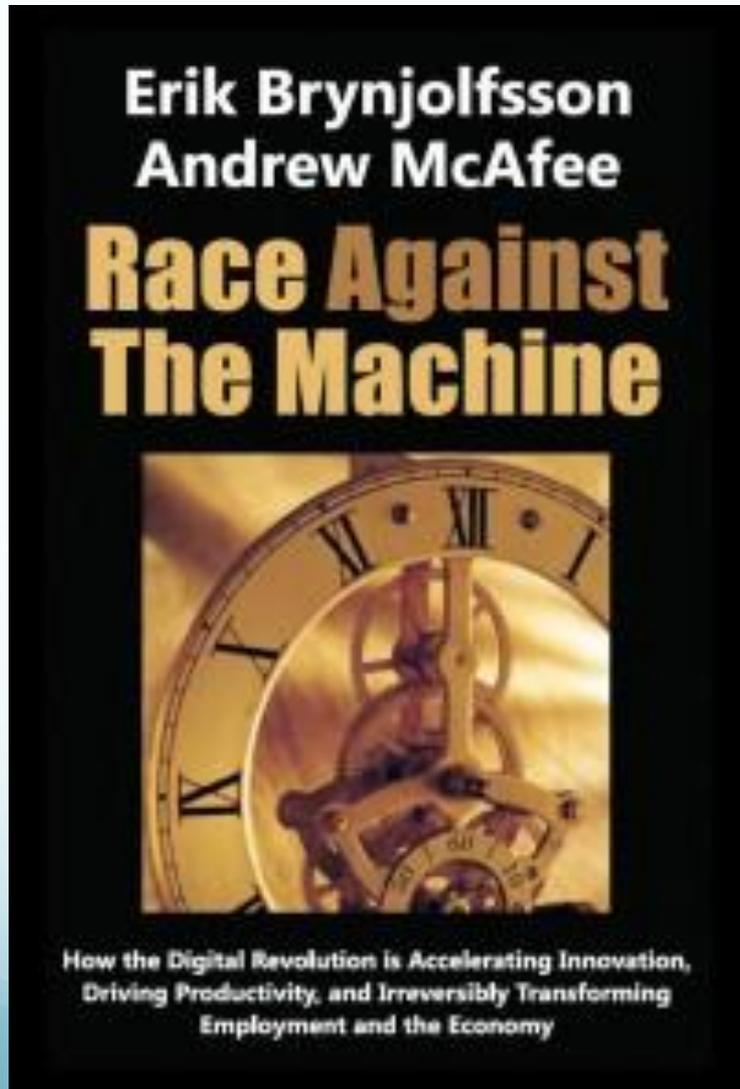
Computers now exhibit human-like capabilities not just in games such as chess, but also in complex communication such as linguistic translation and speech (Think Siri)

A 3rd Perspective: The 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

Can People Win?

- Instructional methods

- Softer skills

- Instructional focus

- The Human Advantage (for now)

- Khan Academy

- CTSOs/WBL

- Hyperspecialists, entreprenuership

- Physicality of work

- Advanced pattern recognition

- General problem solving

- Creativity

Getting students ready for careers and college :
Their future

Academic
Mathematics
Science
Communications

Technical
Job specific skills valued by employers

Occupational
SCANS
21st Century Skills
"Soft" Skills
Employability Skills

College & Career Ready

Required skills

Rigor= More

A narrow curriculum
High school has become the new middle school

Where Have We Been: 30 Years of "Reform"

Context: 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 not improved or significantly declined**

- (NAEP) *Science scores have not improved or significantly declined**

- (NAEP) *math scores have remained relatively unchanged*

*Depends on the starting and ending timeframe

Taking more math is no guarantee

- Only 13% of students who took Alg I, II & Geometry scored a 22 on the ACT exam[1]

- Adding Trig increases to 37%[1]

- 43% of ACT-tested Class of 2005[1] who earned A or B grades in Algebra II did not meet ACT College Readiness Benchmarks in math[2] (75% chance of earning a C or better; 50% chance of earning a B or better in college math)

1. ACT, Inc (2004) *Crisis at the Core*
2. ACT, Inc. (2007) *Rigor at Risk.*

It is not getting much better

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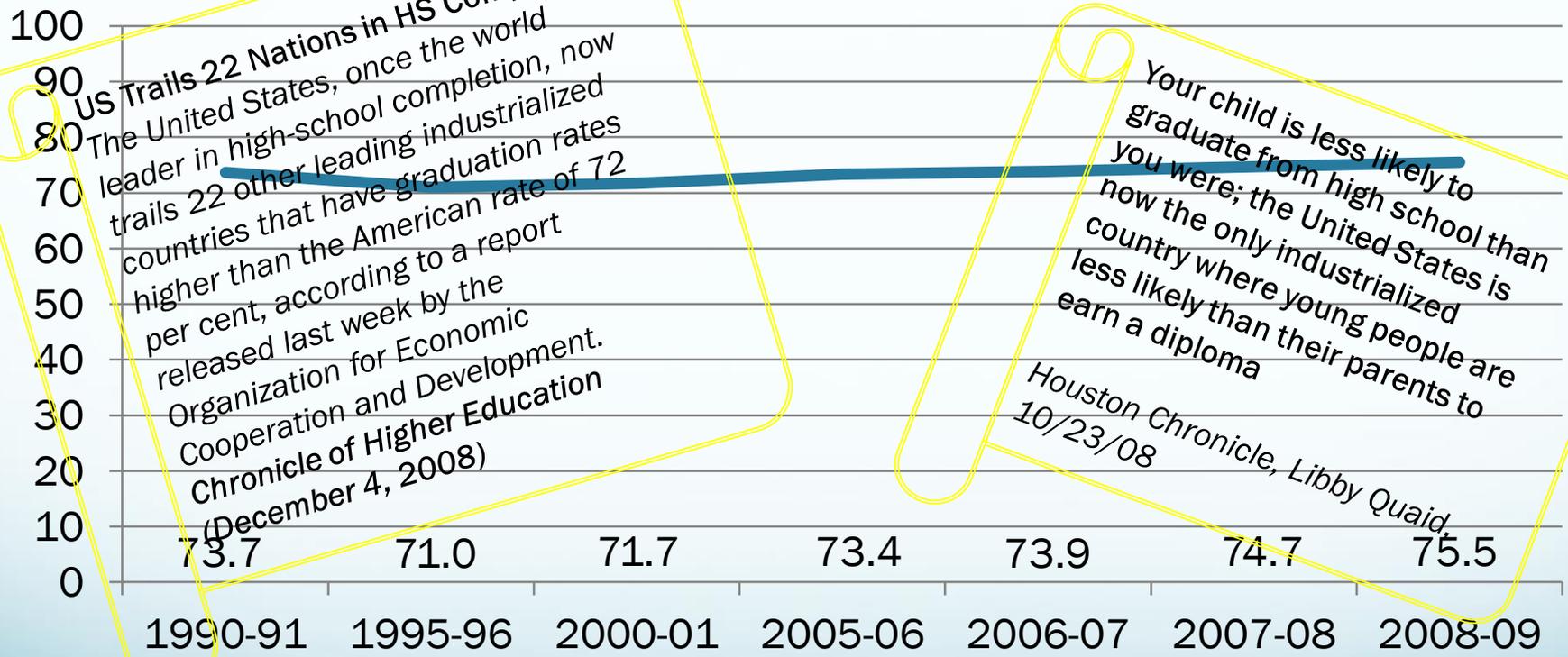
US Trails 22 Nations in HS Completion
The United States, once the world leader in high-school completion, now trails 22 other leading industrialized countries that have graduation rates higher than the American rate of 72 per cent, according to a report released last week by the Organization for Economic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

Your child is less likely to graduate from high school than you were; the United States is now the only industrialized country where young people are less likely than their parents to earn a diploma
Houston Chronicle, Libby Quaid 10/23/08

	1990-91	1995-96	2000-01	2005-06	2006-07	2007-08	2008-09
	73.7	71.0	71.7	73.4	73.9	74.7	75.5

*NCES, 2012

To Address College & Career Readiness: *Make High School Matter*

Increase Engagement
Completing HS
Completing PS/ industry credential

Improve Achievement
Academic
Occupational
Technical

Enhance Transition
Through School
To continuing education
To the workplace
To a successful adulthood

TCTW Key Practices

What-Academic studies

- Teach more students the **essential concepts** of the college-preparatory curriculum by

- encouraging them to apply academic content and skills to real-world problems and projects within their CT studies

How- Students actively engaged

- Engage students in CT

- and academic classrooms in rigorous and challenging assignments using research-based strategies and technology.

3 Integrations for TCTW

System

- Vertical Alignment, "Articulation"
- Career Clusters/Pathways
- Dual Credit/Enrollment
- Career Academies/MCHS

Curricular

- Incorporate more academics into CTE
- Incorporate more CTE into Academics
- Senior projects

Instructional

- CTE to Academic & Academic to CTE
- Pedagogic framework
- Teacher skill/performance

Curriculum Integration Experimental Research
(Instructional)

- Math-in-CTE: complete
  - Technical Assistance – 7 yrs

- Literacy-in-CTE: complete
  - Technical Assistance – 2 yrs

- Science-in-CTE:
  - Study recently concluded

Why We do Experimental Research: A Cautionary Tale

- The Japanese eat very little fat and suffer fewer heart attacks than the British or Americans.

- The Mexicans eat a lot of fat and also suffer fewer heart attacks than the British or Americans

- The French eat a diet rich in calories, fats and wine but suffer fewer heart attacks than British or Americans

- The Italians drink excessive amounts of red wine and also suffer fewer heart attacks than the British or Americans

- The Germans drink a lot of beer and eat lots of sausages and fats and suffer fewer heart attacks than the British or Americans

- CONCLUSION: Eat and drink what you like.

- *Speaking English is apparently what kills you.*

Experimental design

- Random Assignment (classroom level)

- Pretest and posttest using established tests

- Fidelity of treatment

- Monitoring of counterfactual group(s)

What we tested:
Math Pedagogic Framework

1. Introduce the CTE lesson

2. Assess students' math awareness

3. Work through the *embedded* example

4. Work through *related, contextual* examples

5. Work through *traditional math* examples

6. Students demonstrate understanding

7. Formal assessment

Transfer of Learning

The students whose teachers used the **problem based curriculum** in their classrooms scored significantly higher on measures of problem-solving skills (Institute Of Education Sciences, August 9,2010)

Authentic Literacy: What we tested

	MAX	ASH
Before Reading	**M**otivation Reducing the anxiety and improving the probability of success in reading	Introduction and modeling of the skill
During Reading	**A**cquisition Individual silent reading for personal interpretation	Guided practice in learning skill
After Reading	E**X**tension Cooperative construction of meaning through discussion, writing, etc.	Reflection on how the skill worked

# Science-in-CTE "Six Elements" What We Tested

1. Introduce the CTE lesson

2. Assess students' pre-understandings of CTE and the embedded science

3. Walk through the CTE content and the *embedded science* within it

4. Students participate in an *authentic application* of the CTE using inquiry approach

5. Students demonstrate what they have learned about the *explicit science*

6. Formal assessment of CTE and science knowledge and skills

What We Learned:
Experimental Test of Math Integration

- Students in the experimental classes scored significantly higher on Terra Nova and Accuplacer

- The effect: 71st percentile & 67th percentile

- No negative effect on technical skills

- 11% of class time devoted to enhanced math lessons

Power of the New Professional Development Model
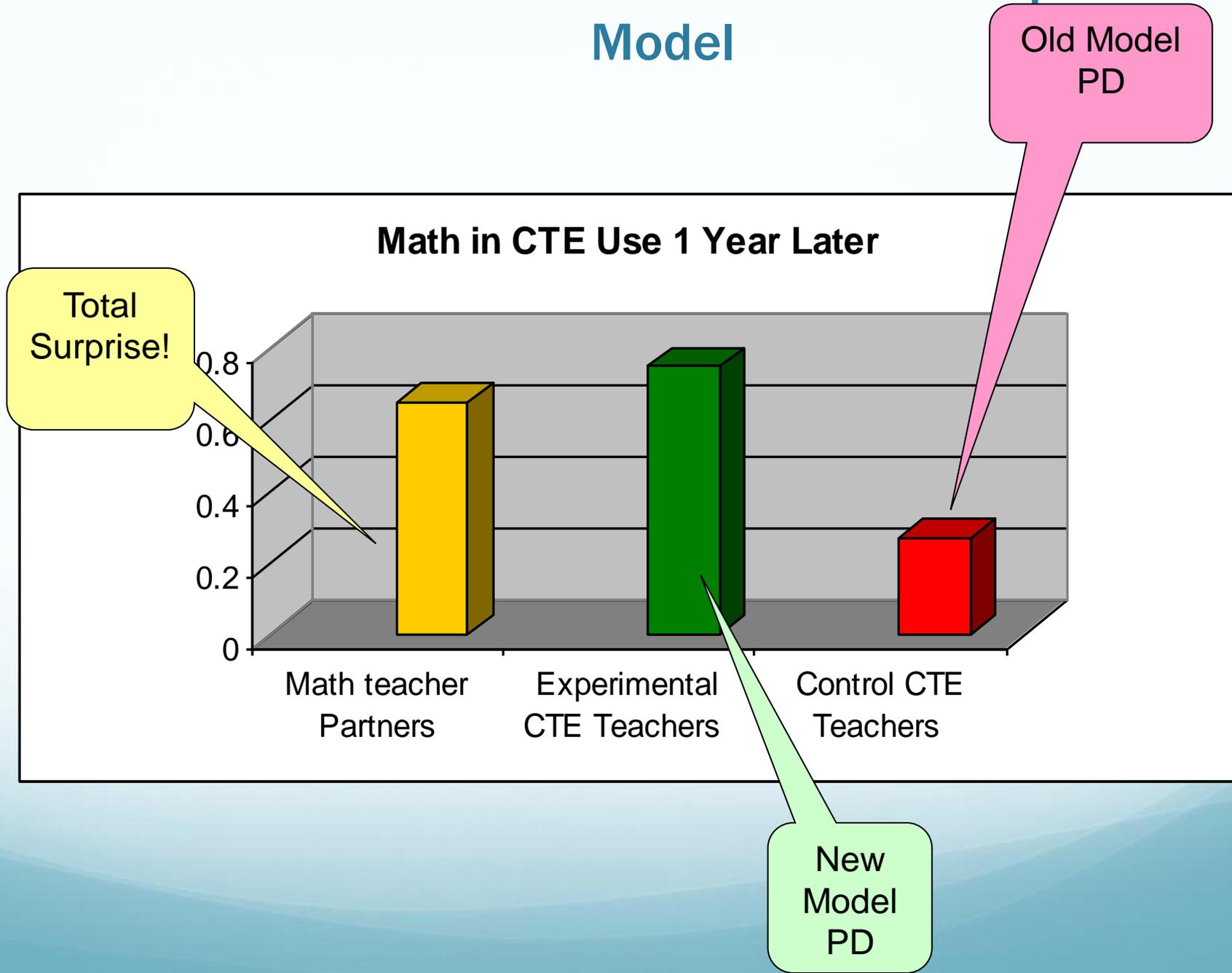
What We Learned: Experimental Test of Science Integration

Reading

- Two approaches tested

- Both significantly improved reading scores

- Students of teachers' with years of PD significantly out performed groups

Science

- Overall, no effect

- Significant effect for nonwhite males and females

What We Have Learned: From Research to Technical Assistance

How to Make Curriculum Integration Effective

Core Principles

- Begin with the CTE curricula, not with academics

- Approach academics as essential workplace skills

- Maximize the academics in CTE

- Support CTE teachers as "teachers of academics-in-CTE"; not as academic teachers

- Foster and sustain a Community of Practice

Begin with the CTE curricula, not with the academics

What is Curriculum Mapping?

- Genesis of the academic integration
  - You have to know where the academic opportunities are located to begin the process
  - Precedes integrated lesson development

- A "process" of investigating the CTE curriculum:
  - What do I teach and
  - Where do the academics naturally occur?

- An ongoing process (not a one-time only)
  - Growing with the process; Revisiting the maps

The Mapping Process…

- Create a "map" for the term or school year in the course/program selected
  - Use the mapping template

- Identify the CTE concepts worthy of academic enhancement.
  - Opportunities may outweigh the time available: Think about what will most help CTE students.
  - Maintain authenticity: Avoid "academics for the sake of academics"

CURRICULUM MAPPING

CTE PROGRAM: <u>HEALTH OCCUPATIONS</u>

CTE UNIT/TOPIC	CTE CONCEPTS	MATH CONCEPTS	ACADEMIC STANDARDS
Human Structure and Function	Compare cell, tissue, organ and body systems relationships	Solve linear equations Read and interpret graphs and charts Problem solving using statistical data Ratio and proportion	
		statistical data, ratio and proportion	

Map the Math onto the CTE

y then do you "align" standards (e.g. CCSS)

Creating opportunities for students to apply academic knowledge:

- generate examples and lessons in which students solve *authentic workplace problems*

- introduce and reinforce academic skills as *"tools" needed in the "real world"*

- *bridge CTE and academic vocabulary* in developing and teaching integrated lessons

Maximize the academics in CTE

Approach Academics as a Workplace Skill

The Occupational Expression of Academics

A career ready person is proficient in the core academic subjects, as well as in technical topics. This foundational knowledge base includes competence in a broad range of academic subjects grounded in rigorous internationally benchmarked state standards... Career Readiness Council 2012

Math-in-CTE Curriculum Map: Health Science

CTE Course/Unit	CTE Concepts	Math Concepts	Common Core Math Standards Middle School	Common Core Math Standards High School
Patient assessment	Input/output; Vital signs; Height/weight; Conversions; Instrument reading	Reading measurement; Basic operations; Ratio/ Proportion; Solving equations; Scales	6.NS.2; 6.NS.3; 7.NS.1; 6.RP.1; 6.RP.2; 6.RP.3; 7.RP.1; 7.RP.2; 7.RP.3; 6.EE.2; 7.EE.3	A.APR.1; A.APR.7; N.RN.3; N.Q.1; G.MG.3; A.CED.4

http://www.nrccte.org/professional-development/math-cte/curriculum-maps

A Process and A Pedagogy

"More than a set of lesson plans…"

a *continuous process…*

…using pedagogic frameworks through which to enhance and teach the embedded academics

Support CTE teachers as "teachers of academics-in-CTE"; not as academic teachers

OTHER LESSONS

- Maintaining the CTE in integration

- Not a replacement of CTE curriculum

- Rather, an enhancement of existing curricula

- Do-able for CTE teachers

- The tipping point

- Maintaining authenticity

Foster and sustain a Community of Practice

Extended Professional Development

- Convening teachers on a regular basis
  - Offering opportunities for partnerships with academic teachers to grow
  - Clustering CTE teachers of common content – sharing the load

- Extended PD = 10 days per year
  - Summer = 5 days
  - Fall = 2 days
  - Winter = 2 days
  - Spring = 1 day

- Ongoing accountability

- Long-term planning for sustainability

Changing the Paradigm in Practice

Old Models

- A *box* of curriculum

- Short term "training"

- Little or no support after the "sage on the stage" goes away

- Replicable by individual teachers (assumed)

New Models

- Process not an event

- Built on communities of practice

- On-going support – the learning curve

- Requires teams of committed teachers working together over time
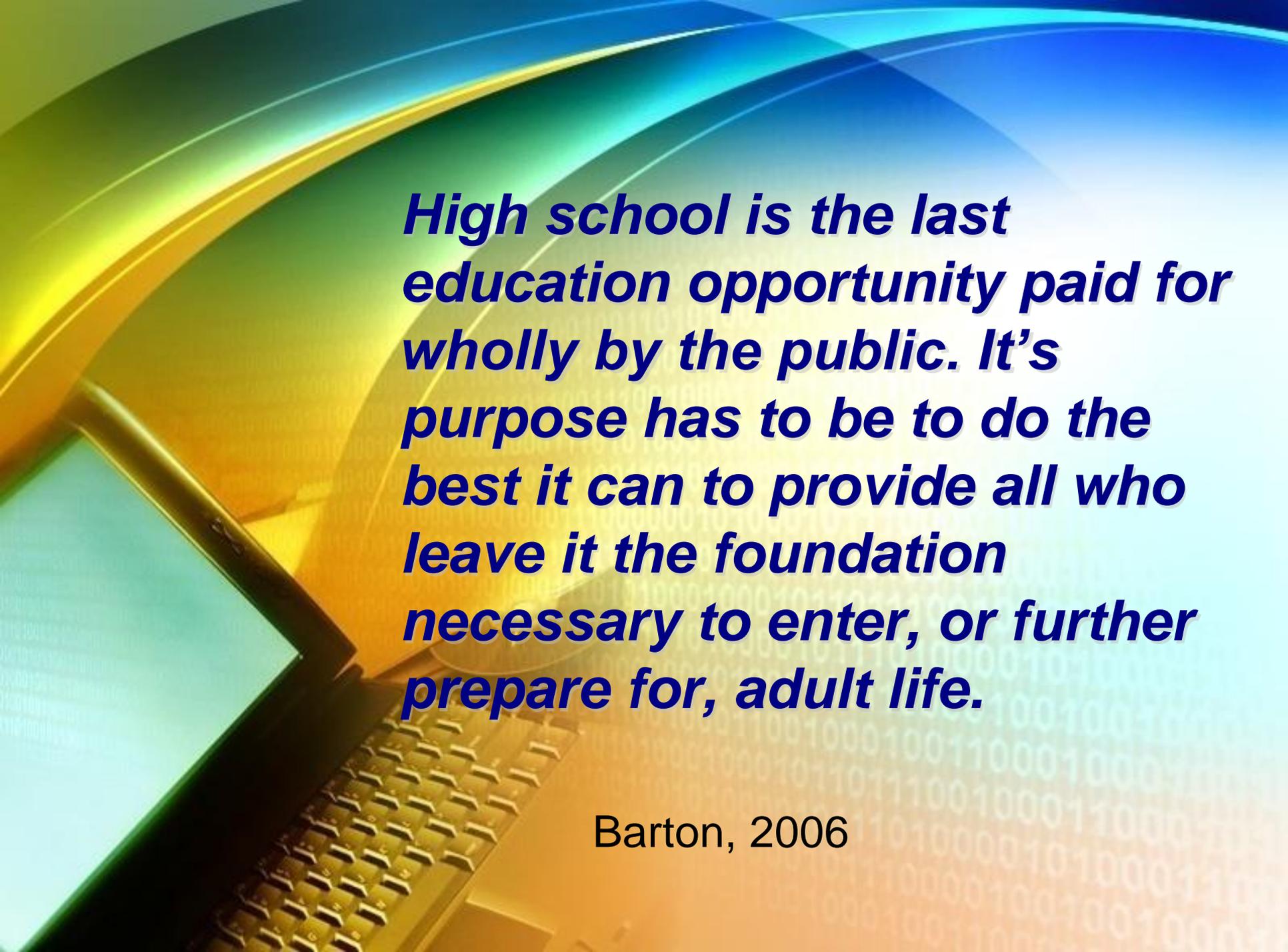
High school is the last education opportunity paid for wholly by the public. It's purpose has to be to do the best it can to provide all who leave it the foundation necessary to enter, or further prepare for, adult life.

Barton, 2006

As I Imagine the future…

- *World class curriculum…*
  - Critical thinking developed by using academic skills to solve real problems in class and on the job
  - Builds related academic, occupational and technical skills
- *Delivered by world class teachers who*
  - are technical masters
  - can link related academics to technical content
  - supported by employers who engage your students
- *Situated in programs* that build on intensive career development, provide career pathways that link K-12 to postsecondary education and industry recognized credentials for careers that matter

High School

Community College or . . .

Business & Industry

Homework: For the "Flat World"
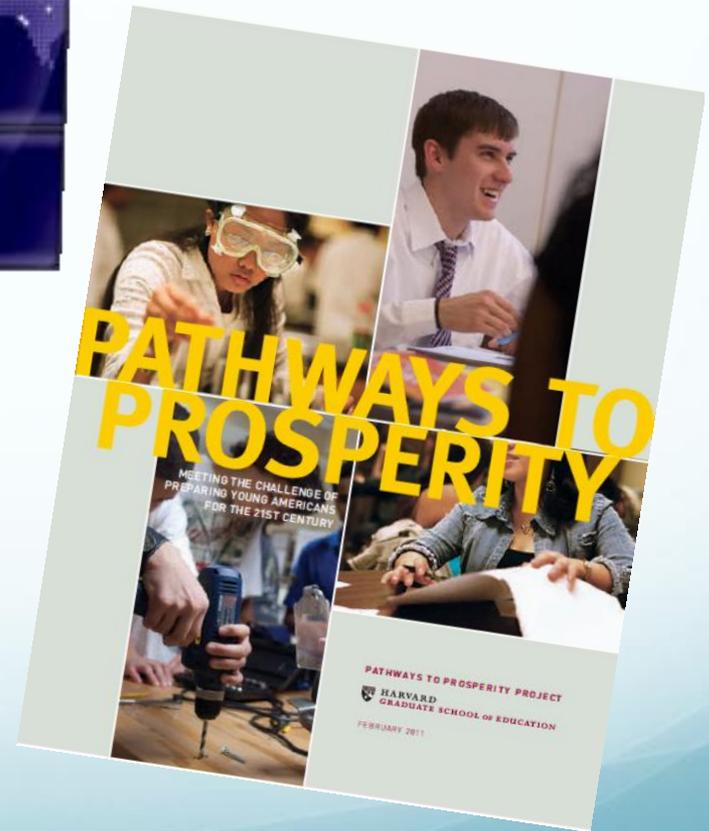
Shameless Promotion . . .
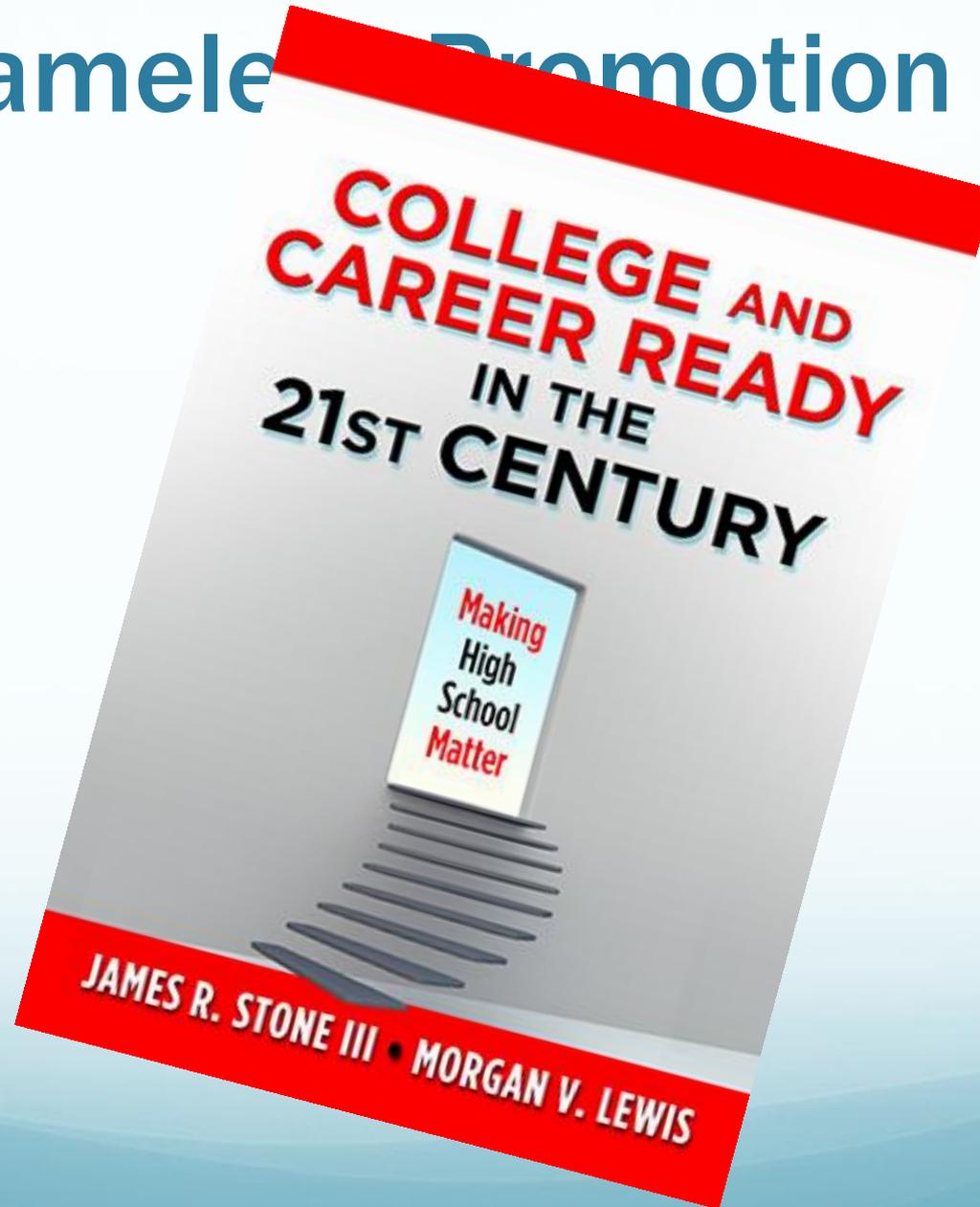
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