An Examination of Higher Education Productivity

Patrick Kelly

The National Center for Higher Education Management Systems
A Time of Increased Pressure on Higher Education Productivity

• President’s Goal

• Foundation Goals (Lumina, Gates)

• College Completion Agenda

• Declining State Resources and Rising Tuition
Public FTE Enrollment, Educational Appropriations and Total Revenue per FTE
United States from 1985 to 2010

Note: Constant 2010 dollars adjusted by SHEEO Higher Education Cost Adjustment. Educational Appropriations include ARRA funds. (HECA)
Source: SHEEO
Public FTE Enrollment, Educational Appropriations and Total Revenue per FTE
Colorado from 1985 to 2010

Note: Constant 2010 dollars adjusted by SHEEO Higher Education Cost Adjustment (HECA). Educational Appropriations include ARRA funds.
Source: SHEEO
Change (%) in Tuition and Fee Revenues as a Percent of Total Public Funding (2000 to 2010)

Source: SHEEO, State Higher Education Finance Survey
# Different Approaches to Analyzing Productivity

<table>
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<th>Public Investment vs. Performance</th>
<th>Institutional Spending vs. Performance</th>
<th>Cost Savings and Efficiency</th>
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<td>Degree Production</td>
<td>Programmatic Costs</td>
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<td>Retention and Graduation Rates</td>
<td>Student/Faculty Ratios</td>
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<td>Endowment Income</td>
<td>External Research</td>
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<td>Government Grants and Contracts</td>
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<td>Faculty and Staff Attrition</td>
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<td>Administrative Staffing Patterns</td>
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<td>Other E&amp;G Revenue</td>
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<td></td>
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<td>Course Delivery Modes</td>
</tr>
<tr>
<td></td>
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<td>Space Utilization</td>
</tr>
</tbody>
</table>

- Instruction
- Student Services
- Academic Support
- Institutional Support
- Plant Operation and Maintenance
- Research
- Public Service
- Scholarships and Fellowships

- Programmatic Costs
- Student/Faculty Ratios
- Faculty Workload
- Faculty and Staff Attrition
- Administrative Staffing Patterns
- Academic Program Mix
- Course Delivery Modes
- Space Utilization
Different Approaches to Analyzing Productivity

- **Public Investment vs. Performance**
  - State and Local Appropriations
  - Tuition and Fees
  - Endowment Income
  - Government Grants and Contracts
  - Private Gifts, Grants and Contracts
  - Other E&G Revenue

- **Institutional Spending vs. Performance**

- **Cost Savings and Efficiency**
  - Outcomes and Performance
    - Degree Production
    - Retention and Graduation Rates
    - External Research

**General Revenues**

**General Expenditures**
- Instruction
- Student Services
- Academic Support
- Institutional Support
- Plant Operation and Maintenance
- Research
- Public Service
- Scholarships and Fellowships

**Internal Operations**
- Programmatic Costs
- Student/Faculty Ratios
- Faculty Workload
- Faculty and Staff Attrition
- Administrative Staffing Patterns
- Academic Program Mix
- Course Delivery Modes
- Space Utilization
Different Approaches to Analyzing Productivity

Public Investment vs. Performance

State and Local Appropriations
Tuition and Fees
Endowment Income
Government Grants and Contracts
Private Gifts, Grants and Contracts
Other E&G Revenue

General Revenues

Institutional Spending vs. Performance

Outcomes and Performance
Degree Production
Retention and Graduation Rates
External Research

Cost Savings and Efficiency

General Expenditures

Instruction
Student Services
Academic Support
Institutional Support
Plant Operation and Maintenance
Research
Public Service
Scholarships and Fellowships

Education Related Expenses

Programmatic Costs
Student/Faculty Ratios
Faculty Workload
Faculty and Staff Attrition
Administrative Staffing Patterns
Academic Program Mix
Course Delivery Modes
Space Utilization

Internal Operations
Different Approaches to Analyzing Productivity

Public Investment vs. Performance

State and Local Appropriations
Tuition and Fees
Endowment Income
Government Grants and Contracts
Private Gifts, Grants and Contracts
Other E&G Revenue

Institutional Spending vs. Performance

General Revenues

State and Local Appropriations
Tuition and Fees
Endowment Income
Government Grants and Contracts
Private Gifts, Grants and Contracts
Other E&G Revenue

General Expenditures

Instruction
Student Services
Academic Support
Institutional Support
Plant Operation and Maintenance
Research
Public Service
Scholarships and Fellowships

Cost Savings and Efficiency

Outcomes and Performance

Degree Production
Retention and Graduation Rates
External Research

Internal Operations

Programmatic Costs
Student/Faculty Ratios
Faculty Workload
Faculty and Staff Attrition
Administrative Staffing Patterns
Academic Program Mix
Course Delivery Modes
Space Utilization
NCHEMS Reports/Work on Higher Education Productivity


The Dreaded “P” Word: An Examination of Productivity in Public Postsecondary Education (2009)

On-going work with state policymakers in Colorado, Indiana, Kentucky, Virginia

Available at www.nchems.org
Two Types of Productivity Analyses

1. Performance relative to funding and expenditures
   - Unrestricted funds available to institutions
   - Expenditures on student-related activities

2. Funding and Expenditures per Degree
   - Weighted by the value of the degree in the state
   - Weighted by STEM and Health
Measures of Funding and Expenditures

• State, local, and Tuition and Fee Revenues (unrestricted public funds provided by the state and students)

• Education and Related Expenditures (expenditures on instruction, student service and part academic support, institutional support, and plant operation and maintenance) – calculation provided by the Delta Project on College Costs

Source: NCES, IPEDS
Performance Relative to Total Public Revenues
Measures of Performance

- First-Year Retention Rates
- Graduation Rates within 150% of Program Time
- Undergraduate Credentials and Degrees per 100 Undergraduate FTE Students
- Research Expenditures per 100 FTE Faculty (Research Institutions Only)

Source: NCES, IPEDS
Public Two-Year Institutions: Undergraduate Credentials per 100 FTE Undergraduates and Total Funding per FTE Student (2007-08)

Source: NCES, IPEDS 2007-08 Completions Survey
Public Research Institutions: Undergraduate Credentials per 100 FTE Undergraduates and Total Funding per FTE Student (2007-08)

Source: NCES, IPEDS 2007-08 Completions Survey
Public Bachelors and Masters Institutions: Undergraduate Credentials per 100 FTE Undergraduates and Total Funding per FTE Student (2007-08)

Source: NCES, IPEDS 2007-08 Completions Survey
Performance Relative to Funding: First-Year Retention Rate (2007-08)

Total Funding Per FTE

High Performance, Low Funding
- OSU
- FSU
- VCU

High Performance, High Funding
- UAB
- UMN
- UMB
- UIAB

Low Performance, High Funding
- UW
- UC
- UNR

Low Performance, Low Funding
- UC-D
- WSU
- WVU

Carnegie Avg
- Average
Performance Relative to Funding: Six-Year Graduation Rate (2007-08)

- **High Performance, High Funding**
  - OSU
  - FSU
  - UMO

- **High Performance, Low Funding**
  - WVU

- **Low Performance, High Funding**
  - UI
  - UI-C
  - UUT

- **Low Performance, Low Funding**
  - UC
  - UL
  - UNM

- **Carnegie Avg**
  - VCU

- **AVERAGE**
  - UC-D
  - WSU

- **Total Funding Per FTE**
  - Carnegie Avg: 30, 35, 40, 45, 50, 55, 60, 65, 70, 75
  - Total Funding: 7,500, 10,000, 12,500, 15,000, 17,500, 20,000, 22,500, 25,000, 27,500, 30,000
Performance Relative to Funding: Research Expenditures per FT Faculty (2007-08)

- High Performance, High Funding
- High Performance, Low Funding
- Low Performance, High Funding
- Low Performance, Low Funding

FSU

OSU

TU

UB

UAB

UA

UC

UC-D

VCU

FSU

UMO

UUT

UI

UI-C

UIA

UKS

UKY

UMN

UL

Average

Carnegie Avg

WSU

WVU

AVERAGE

7,500 10,000 12,500 15,000 17,500 20,000 22,500 25,000 27,500 30,000

40,000 55,000 70,000 85,000 100,000 115,000 130,000 145,000 160,000 175,000 190,000 205,000 220,000 235,000 250,000 265,000 280,000 295,000 310,000

Performance

Total Funding Per FTE
Preparation Levels of Incoming Students
Correlation = 0.50

Productivity: Ratio of Performance (Graduation Rate) to Total Revenues

Average Entering ACT Scores of First-Time Freshmen
Average Entering ACT Scores of First-Time Freshmen

Productivity: Ratio of Performance (Graduation Rate) to Total Revenues

Correlation = 0.21
Total Public Revenues per Degree

Weighted by STEM and Health
Revenues and Expenditures per Degree

Focus of this Work

- Production of Degrees – and Value to Students and the State
- Public Investment from State and Students

Costs of Producing Degrees

Postsecondary Education Institutions

Internal

External

Policy Focus
Calculation

State, Local, Tuition and Fee Revenues / Total Credentials Awarded (Weighted by Level of Award, and STEM and Health)
STEM and Health Credentials and Degrees

STEM = CIP (4, 11, 14, 15, 26, 27, 40, 41). Health Prof = CIP (51).

<table>
<thead>
<tr>
<th>CIP Codes</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>agriculture, agriculture operations, and related sciences.</td>
</tr>
<tr>
<td>3</td>
<td>natural resources and conservation</td>
</tr>
<tr>
<td>4</td>
<td>architecture and related services</td>
</tr>
<tr>
<td>5</td>
<td>area, ethnic, cultural, and gender studies</td>
</tr>
<tr>
<td>9</td>
<td>communication, journalism, and related programs</td>
</tr>
<tr>
<td>10</td>
<td>communications technologies/technicians and support services</td>
</tr>
<tr>
<td>11</td>
<td>computer and information sciences and support services.</td>
</tr>
<tr>
<td>12</td>
<td>personal and culinary services</td>
</tr>
<tr>
<td>13</td>
<td>education</td>
</tr>
<tr>
<td>14</td>
<td>engineering.</td>
</tr>
<tr>
<td>15</td>
<td>engineering technologies/technicians</td>
</tr>
<tr>
<td>16</td>
<td>foreign languages, literatures, and linguistics</td>
</tr>
<tr>
<td>19</td>
<td>family and consumer sciences/human sciences</td>
</tr>
<tr>
<td>22</td>
<td>legal professions and studies</td>
</tr>
<tr>
<td>23</td>
<td>english language and literature/letters</td>
</tr>
<tr>
<td>24</td>
<td>liberal arts and sciences, general studies and humanities</td>
</tr>
<tr>
<td>25</td>
<td>library science</td>
</tr>
<tr>
<td>26</td>
<td>biological and biomedical sciences</td>
</tr>
<tr>
<td>27</td>
<td>mathematics and statistics</td>
</tr>
<tr>
<td>29</td>
<td>military technologies</td>
</tr>
<tr>
<td>30</td>
<td>multi/interdisciplinary studies</td>
</tr>
<tr>
<td>31</td>
<td>parks, recreation, leisure, and fitness studies</td>
</tr>
<tr>
<td>38</td>
<td>philosophy and religious studies</td>
</tr>
<tr>
<td>39</td>
<td>theology and religious vocations</td>
</tr>
<tr>
<td>40</td>
<td>physical sciences</td>
</tr>
<tr>
<td>41</td>
<td>science technologies/technicians</td>
</tr>
<tr>
<td>42</td>
<td>psychology</td>
</tr>
<tr>
<td>43</td>
<td>security and protective services</td>
</tr>
<tr>
<td>44</td>
<td>public administration and social service professions</td>
</tr>
<tr>
<td>45</td>
<td>social sciences</td>
</tr>
<tr>
<td>46</td>
<td>construction trades</td>
</tr>
<tr>
<td>47</td>
<td>mechanic and repair technologies/technicians</td>
</tr>
<tr>
<td>48</td>
<td>precision production</td>
</tr>
<tr>
<td>49</td>
<td>transportation and materials moving</td>
</tr>
<tr>
<td>50</td>
<td>visual and performing arts</td>
</tr>
<tr>
<td>51</td>
<td>health professions and related clinical sciences</td>
</tr>
<tr>
<td>52</td>
<td>business, management, marketing, and related support services</td>
</tr>
<tr>
<td>54</td>
<td>history</td>
</tr>
</tbody>
</table>

Sources: NCES, IPEDS
Median Earnings in Virginia by Level, STEM and Health

Sources: U.S. Census Bureau, 2009 American Community Survey (Public Use Microdata Samples)
### Virginia Commonwealth University: Degrees Weighted by Value to the State and Individuals: Median Earnings in the State Employment Market

<table>
<thead>
<tr>
<th>Degree-Level</th>
<th>Median Earnings</th>
<th>Indexed to Bachelor's Degrees</th>
<th>Awards</th>
<th>Weighted Awards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certificates</td>
<td>22,777</td>
<td>0.54</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Certificates STEM</td>
<td>57,016</td>
<td>1.36</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Certificates Health</td>
<td>28,508</td>
<td>0.68</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Associates</td>
<td>31,454</td>
<td>0.75</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Associates STEM</td>
<td>61,103</td>
<td>1.46</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Associates Health</td>
<td>43,385</td>
<td>1.03</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bachelors</td>
<td>41,975</td>
<td><strong>1.00</strong></td>
<td>2,699</td>
<td>2,699</td>
</tr>
<tr>
<td>Bachelors STEM</td>
<td>75,924</td>
<td>1.81</td>
<td>461</td>
<td>834</td>
</tr>
<tr>
<td>Bachelors Health</td>
<td>53,975</td>
<td>1.29</td>
<td>384</td>
<td>494</td>
</tr>
<tr>
<td>Masters</td>
<td>59,067</td>
<td>1.41</td>
<td>1,133</td>
<td>1,594</td>
</tr>
<tr>
<td>Masters STEM</td>
<td>92,915</td>
<td>2.21</td>
<td>172</td>
<td>381</td>
</tr>
<tr>
<td>Masters Health</td>
<td>63,351</td>
<td>1.51</td>
<td>236</td>
<td>356</td>
</tr>
<tr>
<td>Doctorates</td>
<td>75,924</td>
<td>1.81</td>
<td>62</td>
<td>112</td>
</tr>
<tr>
<td>Doctorates STEM</td>
<td>97,765</td>
<td>2.33</td>
<td>57</td>
<td>133</td>
</tr>
<tr>
<td>Doctorates Health</td>
<td>95,027</td>
<td>2.26</td>
<td>133</td>
<td>301</td>
</tr>
<tr>
<td>First-Professionals</td>
<td>85,524</td>
<td>2.04</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>First-Professionals STEM</td>
<td>75,924</td>
<td>1.81</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>First-Professionals Health</td>
<td>97,616</td>
<td>2.33</td>
<td>397</td>
<td>923</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>5,736</strong></td>
<td></td>
<td><strong>7,828</strong></td>
<td></td>
</tr>
</tbody>
</table>

State, Local, Tuition and Fee Revenues / 7,828
Total Public Revenues per Degree (2007-08)
Weighted by STEM and Health

University of Colorado Denver
Florida State University
University of Utah
University of Cincinnati-Main Campus
University of Missouri-Columbia
Wayne State University
University of Illinois at Chicago
Virginia Commonwealth University
West Virginia University
University of Louisville
Peer Average
Ohio State University-Main Campus
University of Kansas
University of New Mexico-Main Campus
Temple University
University of Iowa
University of Arizona
University of Kentucky
University at Buffalo
University of Minnesota-Twin Cities
University of Nevada-Reno
University of Alabama at Birmingham

Peer Average: 57,168

- 20,000 40,000 60,000 80,000 100,000
Revenues per Degree (Weighted by Level, STEM, and Health)
Virginia Institutions Relative to Peer Averages (2007-08)

Sources: NCES, IPEDS Finance Survey; U.S. Census Bureau, 2009 American Community Survey (Public Use Microdata Samples)
Productivity Measures Adopted by the National Governor’s Association
Credentials Awarded (One Year and More) per 100,000 of State, Local, and Tuition and Fee Revenues - Public Sector, 2008-09
(Weighted by Median Earnings of Graduates - by Degree-Level and STEM and Health)

Sources: NCES, IPEDS Completions Survey; U.S. Census Bureau, American Community Survey (Public Use Microdata Samples)
Credentials Awarded (One Year and More) per $100,000 of State & Local Appropriations and Tuition & Fees Revenues - Public Research & Medical, 2008-09
(Weighted by Median Earnings of Graduates - by Degree-Level and STEM and Health)

Sources: NCES, IPEDS Completions Survey; U.S. Census Bureau, American Community Survey (Public Use Microdata Samples)
Credentials Awarded (One Year and More) per $100,000 of State & Local Appropriations and Tuition & Fees Revenues - Public Masters, Bachelors, and Other 4-Year, 2008-09
(Weighted by Median Earnings of Graduates - by Degree-Level and STEM and Health)

Sources: NCES, IPEDS Completions Survey; U.S. Census Bureau, American Community Survey (Public Use Microdata Samples)
Credentials Awarded (One Year and More) per $100,000 of State & Local Appropriations and Tuition & Fees Revenues - Public Associates & Other 2-Year, 2008-09
(Weighted by Median Earnings of Graduates - by Degree-Level and STEM and Health)

Sources: NCES, IPEDS Completions Survey; U.S. Census Bureau, American Community Survey (Public Use Microdata Samples)
Credentials Awarded (One Year and More) per 100,000 of Education and Related Expenditures - Public Sector, 2008-09
(Weighted by Median Earnings of Graduates - by Degree-Level and STEM and Health)

Sources: NCES, IPEDS Completions Survey; U.S. Census Bureau, American Community Survey (Public Use Microdata Samples)
### Credentials Awarded (One Year and More) per 100,000 of Education and Related Expenditures - Public Research, 2008-09

(Weighted by Median Earnings of Graduates - by Degree-Level and STEM and Health)

<table>
<thead>
<tr>
<th>State</th>
<th>Credentials Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>3.04</td>
</tr>
<tr>
<td>Florida</td>
<td>2.52</td>
</tr>
<tr>
<td>Utah</td>
<td>2.49</td>
</tr>
<tr>
<td>Georgia</td>
<td>2.47</td>
</tr>
<tr>
<td>Montana</td>
<td>2.46</td>
</tr>
<tr>
<td>Arizona</td>
<td>2.36</td>
</tr>
<tr>
<td>South Dakota</td>
<td>2.30</td>
</tr>
<tr>
<td>Missouri</td>
<td>2.19</td>
</tr>
<tr>
<td>Georgia</td>
<td>2.19</td>
</tr>
<tr>
<td>South Carolina</td>
<td>2.16</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>2.10</td>
</tr>
<tr>
<td>Montana</td>
<td>2.04</td>
</tr>
<tr>
<td>Arizona</td>
<td>1.87</td>
</tr>
<tr>
<td>Maine</td>
<td>1.82</td>
</tr>
<tr>
<td>Iowa</td>
<td>1.86</td>
</tr>
<tr>
<td>Illinois</td>
<td>1.82</td>
</tr>
<tr>
<td>Missouri</td>
<td>1.80</td>
</tr>
<tr>
<td>Kentucky</td>
<td>1.80</td>
</tr>
<tr>
<td>Nevada</td>
<td>1.72</td>
</tr>
<tr>
<td>New Mexico</td>
<td>1.71</td>
</tr>
<tr>
<td>Virginia</td>
<td>1.71</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>1.67</td>
</tr>
<tr>
<td>South Dakota</td>
<td>1.67</td>
</tr>
<tr>
<td>South Carolina</td>
<td>1.62</td>
</tr>
<tr>
<td>Alabama</td>
<td>1.62</td>
</tr>
<tr>
<td>North Carolina</td>
<td>1.61</td>
</tr>
<tr>
<td>Indiana</td>
<td>1.61</td>
</tr>
<tr>
<td>Delaware</td>
<td>1.61</td>
</tr>
<tr>
<td>North Dakota</td>
<td>1.61</td>
</tr>
<tr>
<td>Texas</td>
<td>1.56</td>
</tr>
<tr>
<td>Tennessee</td>
<td>1.56</td>
</tr>
<tr>
<td>Mississippi</td>
<td>1.49</td>
</tr>
<tr>
<td>South Carolina</td>
<td>1.47</td>
</tr>
<tr>
<td>Oregon</td>
<td>1.47</td>
</tr>
<tr>
<td>Minnesota</td>
<td>1.45</td>
</tr>
<tr>
<td>New York</td>
<td>1.45</td>
</tr>
<tr>
<td>Hawaii</td>
<td>1.41</td>
</tr>
<tr>
<td>Nevada</td>
<td>1.39</td>
</tr>
<tr>
<td>New Mexico</td>
<td>1.38</td>
</tr>
<tr>
<td>Virginia</td>
<td>1.37</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>1.37</td>
</tr>
<tr>
<td>Alaska</td>
<td>1.27</td>
</tr>
<tr>
<td>Hawaii</td>
<td>0.81</td>
</tr>
</tbody>
</table>

Sources: NCES, IPEDS Completions Survey; U.S. Census Bureau, American Community Survey (Public Use Microdata Samples)
Credentials Awarded (One Year and More) per 100,000 of Education and Related Expenditures - Public Bachelor’s and Masters, 2008-09
(Weighted by Median Earnings of Graduates - by Degree-Level and STEM and Health)

Sources: NCES, IPEDS Completions Survey; U.S. Census Bureau, American Community Survey (Public Use Microdata Samples)
Credentials Awarded (One Year and More) per 100,000 of Education and Related Expenditures - Public Two-Year, 2008-09
(Weighted by Median Earnings of Graduates - by Degree-Level and STEM and Health)

Sources: NCES, IPEDS Completions Survey; U.S. Census Bureau, American Community Survey (Public Use Microdata Samples)
What’s Missing?

1. Measures of quality
2. Measures of actual “costs” per degree – by program, degree-level, etc.
3. Additional desired outcomes – e.g. measures of performance associated with public service, engagement with business and employers, research/technology transfer, etc.
At the Institutional Level – Why Peers are so Important

Comparison to similar institutions

- Mission
- Size
- Program Mix
- Selectivity
- Etc.
Approaches to Achieving Greater Productivity

• Building Cost Effective Systems

• Change the Academic Production Function

• Reduce Leaks in the Pipeline

• Reduce Demand Each Student Places on the System
Building Cost-Effective Systems

• More Appropriate Mix of Institutions

• Create New Types of Providers

• Effective Collaboration Among Institutions

• Support Year-Round Operations
Changing the Academic Production Function

• Create Programs of Cost-Effective Size (Elimination in Some Cases, Collaboration in Others)

• Reengineer Curricula

• Reengineer Course Delivery
Reducing Leaks in the Pipeline

• Preparation of Traditional and Non-Traditional Students

• Transfer and articulation

• Incentives for Degree Completion

• Curricula Alignment

• Financial Aid Incentives

• Early-Warning Systems

• Improve Consumer Information
Reducing Demands Each Student Places on the System

- Students Come to College More Prepared (Less Remediation)
- Accelerated Learning
- Minimize “Rework”
- Improve Rates of Course Completion
- Reduce Credit Hours to Degree
- Encourage Use of Assessment/“Test-Out” Options
- Learning in the Workplace/Credit for Experience
If you had the data, how might you measure productivity differently?

What measures and methods would you use?
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