Engineering Education: Past, Present and Future
“.. The [Students] They Are a Changin...”

Come gather 'round people Wherever you roam
And admit that the waters Around you have grown
And accept it that soon You'll be drenched to the bone
If your time to you Is worth savin'
Then you better start swimmin’ Or you'll sink like a stone

For the times they are a-changin'.

Bob Dylan, "The Times They Are A-Changin’, 1964"

The Conference for Industry and Education Collaboration (CIEC)
Palm Springs, California
Feb. 4-6, 2015

Dr. Mitchell Springer; Prof. Mark Schuver
Overview

- Longer and healthier life spans
- Who are the new students?
- Why are college costs so high?
- Increasing debt loads
- Moving back home
  - Postponing marriage
  - Homes, cars, material possessions
  - Having children later in life
- Expectations of Millennials
- Making program/cost changes to remain competitive
Longer and Healthier Life-Spans

- Seniors are working longer today
  - 34% say they never plan to retire
- Passing of the torch is being postponed
  - changes in life expectancy (78m; 82f)
  - living longer and staying healthier
  - work is knowledge based; promoting staying in the workplace longer than in previous periods
  - technology can be learned by young and old alike
Who Are the Students

- **Veterans (Traditionalist) 1922-1945;** 52 million people - those born prior to WW II

- **Baby Boomers 1946-1964;** 78.3 million people - those born during or after WW II and raised during a period of extreme optimism, opportunity and progress.
  - Began turning 65 in January 1, 2011;
    - At a rate of 10,000/day; ~4M/yr for next 18 years

- **Generation Xers 1965-1980;** 44 million people - came of age in the shadow of the boomers; children of Veterans or older Boomers or younger siblings

- **Generation Y (Millennials) 1981-2000;** 69.7 million people - children of younger boomers; most loved

Although US Census Bureau provides the basic information on live births and birth rates, aside from the Veteran and Boomer cohorts, it is not wholly agreed which years should be counted in post-Boomer groups.
Student Debt - 511% Since 2009

The Crazy Growth of Student Loans

Sources: New York Fed, Bureau of Economic Analysis
Increasing Debt Loads

- $29,400 average student debt (2013)
- Student Debt almost tripled between 2004 and 2012 and stands over $1.3 trillion as of 2014:Q2
  - 71% of 2012 students borrowed money
  - 70% Increase in the number of borrowers
  - 70% increase average balance per person

- Reasons for the growth in borrowers and per-person debt: More people attend college and graduate school
  - Parents take out student loans for their children
  - Students stay longer in college and more often attend graduate school
  - Lower repayment rates as borrowers delay payments through deferments and forbearances
  - Discharging student debt is very difficult and the balance stays with the borrower
Why Are College Costs So High?

- No shortage of accusations
  - Too many buildings
  - State funding has been reduced; causing increases in student tuition
  - Too many administrators
  - Spending too much on sports/football fields/arenas
  - Food is of too high of quality and costs too much to provide
Implications of Student Debt and Slow Job Growth

- Moving back home
- Postponing marriage
- Postponing material purchases (homes, cars...)
- Postponing having children
- Significant impact to U.S. economy
Moving Back Home

- Difficult job market
- Slowly recovering economy
- 34% reported moving back home after graduation in 2011;
- 60% reported moving back home after graduation in 2013
From 1960 to 2010 - Median Age at First Marriage increased by Nearly 6 Years
Postponing Family

- Total fertility rate
- Education and fertility
- Income and fertility
- Biological implications
Total Fertility Rate

- The number of babies the average woman would bear over the course of her life if she were to survive until the end of her reproductive years and age-specific birth rate were to remain constant.
- The American fertility rate currently sits at 1.93.
- In order for a country to maintain a steady population, it needs a fertility rate of 2.1.
- Which means that the Japanese and Italians (with fertility rates of about 1.4) are on the verge of downsizing their countries. Their cities are dwindling; some small towns are on the cusp of simply closing.
- 1979 world’s fertility rate was 6.0, today it’s 2.52.
Education and Fertility

- The more educated women become, the less children they have
  - U.S. average 1.93
  - College graduate = 1.78
  - Women with a graduate degree = 1.61

<table>
<thead>
<tr>
<th>Education level</th>
<th>Total Fertility Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not a high school graduate</td>
<td>2.447</td>
</tr>
<tr>
<td>High school, 4 years</td>
<td>1.947</td>
</tr>
<tr>
<td>College, 1 or more year</td>
<td>1.719</td>
</tr>
<tr>
<td>Associate’s degree</td>
<td>1.820</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>1.632</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>1.596</td>
</tr>
</tbody>
</table>

Education and Delayed Family Formation

- The drop in fertility among women with college and advanced degrees, then, is in large part a function of delayed family formation.

- For instance, it’s not just the length of education that diminishes fertility, or the careers the education makes possible, but the debt load the education incurs. Since 1987, when the Nellie Mae Corporation began keeping statistical track of student loans, the average student-loan burden on college graduates has almost quadrupled, from $7,500 to $29,400.
As income rises, fertility rate declines

<table>
<thead>
<tr>
<th>Household Income Level</th>
<th>Total Fertility Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under $20,000</td>
<td>2.038</td>
</tr>
<tr>
<td>$20,000 to $29,000</td>
<td>1.988</td>
</tr>
<tr>
<td>$35,000 to $49,999</td>
<td>2.052</td>
</tr>
<tr>
<td>$50,000 to $74,999</td>
<td>1.734</td>
</tr>
<tr>
<td>$75,000 to $99,000</td>
<td>1.752</td>
</tr>
<tr>
<td>$100,000 and over</td>
<td>1.832</td>
</tr>
</tbody>
</table>

It’s Also Biological

- Between the ages of 24 and 34, a woman’s chance of becoming infertile increases from 3 percent to 8 percent. By 35, half of women trying to get pregnant over the course of 8 months will not succeed. After 35 it gets even more difficult. By age 39, a woman has a 15 percent chance of being unable to conceive at all. And by a woman’s 43 birthday, her chances of getting pregnant are nearly zero.

- All of which is why today, 1 out of every 100 babies born in the United States is created via In Vitro Fertilization
**Median Age of First Time Parents**

**Recasting Motherhood, 1990 to 2008**

(% of births by characteristics of mother)

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>2008</th>
<th>Percentage Point Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mother’s Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20</td>
<td>13</td>
<td>10</td>
<td>-3</td>
</tr>
<tr>
<td>20-34</td>
<td>78</td>
<td>75</td>
<td>-3</td>
</tr>
<tr>
<td>35+</td>
<td>9</td>
<td>14</td>
<td>+5</td>
</tr>
<tr>
<td><strong>Mother’s Race</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>65</td>
<td>53</td>
<td>-12</td>
</tr>
<tr>
<td>Black</td>
<td>16</td>
<td>15</td>
<td>-1</td>
</tr>
<tr>
<td>Hispanic</td>
<td>14</td>
<td>24</td>
<td>+10</td>
</tr>
<tr>
<td>Asian</td>
<td>3</td>
<td>6</td>
<td>+3</td>
</tr>
<tr>
<td><strong>Mother’s Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>72</td>
<td>59</td>
<td>-13</td>
</tr>
<tr>
<td>Unmarried</td>
<td>28</td>
<td>41</td>
<td>+13</td>
</tr>
</tbody>
</table>

*Note: 2008 data are preliminary. Percentages may not total to 100% due to missing data or rounding.
Source: Statistics calculated using National Center for Health Statistics data (see Methodology)*
Average Age of First Time Mothers – Climbing Over 30
Postponing Material Purchases -- Life Phases


Median U.S. Age and It’s Implications

- 1950 – median age was 30
- 2000 – median age was 35
- 2050 – median age will be 40; which is the median age in Florida today
- Labor shortages appear to be a reality
  - older people consume at lower rates
  - Tax base declines as demands on government increase
- “Significant innovations and big discoveries tend to be made between the ages of 30 and 50, with the peak of creativity coming somewhere between 35 and 40 years of age.” p. 101
Ratio of Workers to Retirees

The Social Security Administration predicts that by 2034, the ratio of workers-to-retirees will fall to just 2.1 workers for every retiree as a result of (1) roughly 809 million Baby Boomers retiring and (2) the declining fertility rates having failed to produce a proportionate number of new workers.

<table>
<thead>
<tr>
<th>Year</th>
<th>Workers (in millions)</th>
<th>Beneficiaries (in millions)</th>
<th>Ratio (number of workers supporting each retiree)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940</td>
<td>35.390</td>
<td>0.222</td>
<td>159.4</td>
</tr>
<tr>
<td>1950</td>
<td>48.2850</td>
<td>2.930</td>
<td>16.5</td>
</tr>
<tr>
<td>1960</td>
<td>72.530</td>
<td>14.262</td>
<td>5.1</td>
</tr>
<tr>
<td>1970</td>
<td>93.090</td>
<td>25.186</td>
<td>3.7</td>
</tr>
<tr>
<td>1980</td>
<td>113.656</td>
<td>35.118</td>
<td>3.2</td>
</tr>
<tr>
<td>1990</td>
<td>133.672</td>
<td>39.470</td>
<td>3.4</td>
</tr>
<tr>
<td>2000</td>
<td>155.295</td>
<td>45.166</td>
<td>3.4</td>
</tr>
<tr>
<td>2010</td>
<td>156.725</td>
<td>53.398</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Source: Social Security administration (http://www.ssa.gov/history/ratios.html).
Expectations of Millennials

- Work-Life Balance
- Reward
- Self-Expression
- Attention
- Achievement
- Informality
- Simplicity
- Multitasking
- Meaning

Challenges
(Making the Connections)

- Slowly recovering economy
- Difficult job market
- High student debt
- Moving back home
- Delaying marriage, family and material possessions
- Paying for graduate school ???
  - What do we have to do differently?