A Strategic Review of Technology Education in Virginia

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Background

Strategic Review initiated by State CTE Director

Methodology:

1. Weldon-Cooper Center, UVA
2. Philip Reed, Principal Investigator
3. Focus Groups from Industry & Education

Support by Virginia’s CTE Resource Center
http://www.cteresource.org
<table>
<thead>
<tr>
<th>Career Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Food &amp; Natural Resources</td>
</tr>
<tr>
<td><strong>Architecture &amp; Construction</strong></td>
</tr>
<tr>
<td><strong>Arts, A/V Technology &amp; Communications</strong></td>
</tr>
<tr>
<td>Business Management &amp; Administration</td>
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<tr>
<td>Education &amp; Training</td>
</tr>
<tr>
<td>Finance</td>
</tr>
<tr>
<td><strong>Government &amp; Public Administration</strong></td>
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<tr>
<td>Health Science</td>
</tr>
<tr>
<td><strong>Hospitality &amp; Tourism</strong></td>
</tr>
<tr>
<td><strong>Human Services</strong></td>
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<tr>
<td><strong>Information Technology</strong></td>
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<tr>
<td><strong>Law, Public Safety, Corrections &amp; Security</strong></td>
</tr>
<tr>
<td><strong>Manufacturing</strong></td>
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<tr>
<td>Marketing</td>
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<tr>
<td><strong>Science, Technology, Engineering &amp; Mathematics</strong></td>
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<tr>
<td><strong>Transportation, Distribution &amp; Logistics</strong></td>
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## Historical Context & Contemporary Trends & Issues

<table>
<thead>
<tr>
<th>Focus</th>
<th>Technology Education</th>
<th>Science Education</th>
<th>Instructional Technology</th>
<th>Technical Education</th>
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</table>

### Attributes

- **Technology Education**
  - Based on Standards for Technological Literacy (ITEA/ITEEA, 2000/2007).
  - Virginia’s program has a dual purpose of focusing on technological literacy and providing a foundation for technical education.
  - Referred to as Design and Technology in countries using the British educational model.

- **Science Education**
  - Based on Next Generation Science Standards (NGSS Lead States, 2013).

- **Instructional Technology**
  - Content neutral. All disciplines utilize technology to enhance the learning process.
  - Also known as Educational Technology.
  - Uses ISTE standards.

- **Technical Education**
  - Based on industry standards.
  - Commonly associated with community colleges, trade schools, and apprenticeship programs.
  - Virginia’s secondary program is Trade and Industry (T&I).
  - A significant factor in STEM education and employment (see Rothwell, 2013; Symonds, Schwartz, & Ferguson, 2011).
Business and Industry Stakeholders

- Virginia Manufacturers Association
- Dominion Resource Services, Inc.
- Newport News Ship Building
- Stihl, Incorporated
- Flexicell
- Rolls-Royce Crosspointe, LLC
- Virginia Beach Economic Development
- Micron Technology
- Lockheed Martin IS & GS
- Old Dominion University
- Thomas Nelson Community College
- Virginia Tech
Education Stakeholders

- VTEEA
- VCEC
- Teachers
- Supervisors
- Higher Education
- TSA
- PTA was also invited
Big Picture Questions

What do you believe are the most important technology and engineering career areas for Virginia’s economy now and in the future?

- What knowledge and skills will be needed in these careers?
- How do we prepare our students for these careers?

What will the major challenges be in ensuring our students are ready for the jobs of the future?

- What educational mechanisms are currently in place to prepare students with the knowledge and skills needed for the top 10 technology/engineering career areas?
- What trends indicate which technology/engineering career areas warrant the greatest attention over the next five or ten years?
Specific Programmatic Questions

After hearing the curriculum overviews this morning, to what extent does this curriculum address the content of the current/future careers and the level of rigor necessary to develop individuals prepared to enter those careers?

◦ Are there specific components that should be added now or in the future?
◦ What options might help to ensure that students in technology and engineering programs have equal opportunities and good choices to transition into college and careers?

What industry-based certifications are valued in technology and engineering jobs?

◦ What other high-stakes, valid, nationally recognized credentials could be used to reinforce/confirm successful completion of Technology and Engineering Education programs?
◦ What are we currently doing to effectively prepare our students for these credentials?
Programmatic Questions (continued)

How would you define technology and engineering literacy?
  ◦ What knowledge and skills are needed to help students become technology and engineering literate?
  ◦ What activities and experiences should students encounter to build their technology and engineering literacy?

Let’s discuss industry-school partnerships---
  ◦ What are some characteristics that define a successful industry-school partnership in technology and engineering?
  ◦ Can you provide some examples you consider successful?
  ◦ What does industry/do educators expect from these partnerships?
Programmatic Questions (continued)

Let’s discuss pre-service and in-service experiences for teachers---

◦ What pre-service experiences would help prepare technology and engineering teachers?
◦ What in-service experiences would help prepare technology and engineering teachers?
◦ What should teachers zero in on in terms of design?
◦ What should elementary school teachers be thinking about in terms of technology?
Responses

Each stakeholder group contributed answers to the questions presented.

Compilation of information yielded:

- Advantages
- Content
- Skills
- Strategies
Conclusions

1. There is unprecedented support for technology and engineering education (i.e. NASA, NSF, the National Academies, and the National Assessment Governing Board).

2. The employment outlook for careers associated with technology and engineering education is very strong, both in the commonwealth and nationally.

3. Technology Education teachers are consistently listed on the critical shortage list in Virginia. This trend needs immediate attention, especially since it runs counter to conclusion 1.
Conclusions (continued)

4. Develop a comprehensive marketing plan for the Technology and Engineering Education program. The plan should identify key stakeholders, have multiple strategies, and have a clear timeline.

5. Outline a professional development plan for current teachers, teachers entering from industry, and career switchers. The plan should identify research-based practices, be grounded in the program offerings, and have a clear timeline.
Recommendations

1. Change the official program name to *Technology and Engineering Education*.

2. Update Virginia’s Technology Education Program around five levels: grades PK-5, grades 6-8, grades 9-12, adult education, and professional development for teachers and other school personnel.
   a) Develop formal support for elementary technology and engineering education
   b) Continue to support nationally recognized curriculums such as IB, PLTW, and Principles of Technology. *Expand the support of additional nationally recognized curriculum programs to aid with content consistency, student assessment, and the professional development of teachers.* Specifically, the Commonwealth should join the Engineering by Design (EbD) consortium.
   c) Investigate the efficacy of low-enrolled courses (i.e., Biotechnology Foundations, Bioengineering, Global Logistics and Enterprise Systems).
   d) Broaden from narrow technical content at the upper level (i.e. Electronics II and III) toward broader technological courses that utilize a systems approach (i.e. robotics, mechatronics).
Recommendations (continued)

2. Update Virginia’s Technology Education Program around five levels (cont’d).
   e) Focus on authentic approaches of design-based learning. Problems such as the NAE Grand Challenges for Engineering (National Academy of Engineering, 2015) should be used to provide real-world contexts for students.
   f) Strengthen work-based learning experiences for students in grades 9-12.
   g) Develop adult education for career switcher teachers and adults needing retraining in technology fields.

3. Increase teacher recruitment, preparation, and retention efforts.
   a) Provide scholarships for new teachers and grants for continuing professional development.
   b) Develop a pathway for school divisions to “grow-their-own” through division/community college/university partnerships that use Teachers for Tomorrow and distance learning.
   c) Strengthen the recruitment and training of career switchers, targeting those with degrees in architecture, engineering, engineering technology, industrial design, industrial technology, and physics.
Recommendations (continued)

4. Have technology and engineering education leaders work with the state Advisory Committee to provide continuous program guidance. Members should come from business and industry, the VTEEA, the Children’s Engineering Council, CTE directors, the TSA, and teacher educators.

5. Promote the importance of careers and opportunities available through Technology and Engineering Education to ensure all Virginians are technologically literate.
6. Increase program completion rates through the use of Virtual Virginia. For example, Technology Foundations is one of the highest-enrolled high school courses, and Technology Assessment and/or Technology Transfer both have appropriate content that should be developed for online delivery.

7. Ensure all K-12 students develop a degree of technological literacy.
Next Steps

Prepare a five year plan for implementation of recommendations
Request input from stakeholders for strategies to accomplish change
Implement strategies with assistance from stakeholders
For Further Information

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FROM HERE TO THERE

Lynn Basham, Ph.D., DTE
ITEEA
March 2017
Here we are in the present world. In this world, some incredible things are going on in Technology and Engineering classrooms.

But in some, it tends to be business as usual.

In some, the idea of changing from drafting as it has been, or even CAD as it has been, is frightening.

There are career switchers who may sink without help.
HERE AND NEAR

Our students will deal with things like

- Autonomous cars
- Smart roads
- Electric cars that charge while being driven
- Nanotechnology in healthcare
- Drones delivering packages (or as one group of students suggested, dog walking)
- Brain control of realistic prosthetics with feedback for sense of touch.
- Wireless system change
- Immersive entertainment through virtual reality
- 3-D printing of organs

And on and on...
CHALLENGE

- To help career switchers become true technology education teachers who can teach using design
- To recruit more teachers through alternate routes
- To improve teaching practices for in-service teachers
- To unify the teachers we have
  - Are they the course they teach? (a CAD teacher?)
  - Are they STEM teachers?
  - Are they engineering teachers without technological literacy?
To market our profession
- Not as FIRST Robotics
- Not as TSA
- Not as the various course names (engineering

We need our students to speak for us

http://youtube.com/watch?v=Kwj8YpciaM0

To promote ourselves to counselors, administrators, academic teachers, parents and our own profession
To establish monetary incentives for new teachers

To develop a pathway for school divisions to grow their own through Teachers for Tomorrow program, community college and university collaboration
CHALLENGE

- To assist existing teachers with change and being on the cutting edge
  
  https://www.youtube.com/watch?v=7ZvYudJN5hU

- Aggressive Professional Development
Most of our technological literacy takes place in middle schools. We are having a 4 day Systems and Controls session at our summer conference.

We are having 3 days of Manufacturing Skills Institute MT1 training.

There will be 4 days of EbD, and half days of Design and Modeling.
A full day session will be offered on Maya and on SeaPerch

4 hour sessions will be offered on microcontrollers, electronics, mechatronics, and surveying

2 hour sessions on problem solving design briefs and engineering design notebooks, electronics, rocketry with a payload, and classroom management for career switchers

More is in the works, such as tours of industry
A spring offering of Backwards Design Process will be available to south side and southwestern Virginia.

A microcontroller workshop will be offered.

Principals of Technology carries a science credit, so we offer that training each summer.
TRAINING THE CHOIR?

- A State Superintendents’ Memo has gone out notifying school division personnel about the summer offerings.
- We will emphasize curriculum changes as the reason people need professional development.
- Making some training regional should attract more teachers.
- We want a special course (3-week?) for career switchers.
- EbD will be implemented.
REVISE SOME OLDIES BUT GOODIES

- Instructional Guides for Teachers developed a long time ago have outdated things and things that still hold true.
- An effort will be made to revitalize this material to be used by teachers new to the classroom.
- New easily used format could be of value.
Technical Drawing and Design had more design and physical modeling added to it the last time it was reviewed. Now we want to take it further.

We want to take teachers and students into designing for 3-D printing, and designing parts so that they fit together.

Middle school will have specific activities added for coding and microcontrollers.

A second year Cyber Security course is in the works.
Curriculum Change

- We will merge Electronic Systems I and II
- Electronic Systems III will turn into something related to mechatronics
- We will upgrade Manufacturing Systems I and II
- Some courses have low enrollment and will be looked at for sun-setting or improvement
- We will look at adding a course to Virtual Virginia
- We will put an emphasis on authentic approaches of design-based learning
They will tackle recommendations that deal with legislators, such as adding engineering to our name officially.

We would like to see all elementary preservice teachers take a class in Children’s Engineering.

Marketing must be done by all. We have to market to our teachers also.
We will be developing strategies to assist teachers with incorporating Work Based Learning. That will begin by researching successful practices.
A steering committee to assist with direction and curriculum will be created.

The committee will assist in keeping programs up to date so that five year plans are an ongoing thing.
Five years from now, we hope to have accomplished:

- More teachers
- Better prepared teachers
- Different courses
- Consortium membership
- Improved curriculum
- Curriculum guides easily updatable
- An steeringcommittee
- A virtual course
- A guide for assisting with work based learning
For Further Information:

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