Fabrication Laboratory

Facilities Committee Meeting
January 10, 2018
Technology Education 6-12
CURRICULUM REVIEW CYCLE & BOARD UPDATES

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>MAR 17, 2016</td>
<td>BCTC Meeting</td>
</tr>
<tr>
<td></td>
<td>• Concept of MakerSpaces Shared in Technology Presentation</td>
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<tr>
<td>DEC 6, 2016</td>
<td>Board Facilities Meeting</td>
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<tr>
<td></td>
<td>• Concept of FabLab Presented to Facilities Committee</td>
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<tr>
<td>FEB 16, 2017</td>
<td>BCTC Meeting</td>
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<tr>
<td></td>
<td>• Technology Education Stage 1 Curriculum Review Report to Board</td>
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<td>AUG 14, 2017</td>
<td>Board Facilities Meeting</td>
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<tr>
<td></td>
<td>• Facilities Committee w/Interest to Secure Architect</td>
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<tr>
<td>NOV 13, 2017</td>
<td>Board of Directors Meeting</td>
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<td></td>
<td>• Technology Education Curriculum Review Update to Board</td>
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<td>• Secondary Course Update in Technology Education</td>
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21st Century Schools

- In 21st century schools, students become makers and learners, teachers become facilitators and activators, and physical spaces become learning studios and learning commons.

- The future of education cannot be about giving students the skills to fill jobs; it must be about fostering in them the skills to create and sustain jobs. One of the most essential skills in today’s world: the ability to innovate.
  - Great innovators create useful solutions facilitated by a variety of design skills: needs assessments, user research, interviewing, data analysis, and experimentation.

“Makerspaces are popping up in libraries, schools, shipping containers and buses as part of a revolution that has people returning to their workshops and building with their hands.” (L. Falck, Beyond the Maker Movement: How the Change Makers are the Future of Education, Forbes, July 2014)

“The global community of inventors, designers, engineers, artists, programmers, hackers, tinkerers, craftsmen and DIY’ers—the kind of people who share a quality that leads to learning [and]... to innovation, a perennial curiosity about how they could do it better the next time.” (S. Swaaley, Maker Movement Reinvents Education, Newsweek, Sept. 2014)
21st Century Schools

Wissahickon School District K-12 Vision:

“*In a Twenty-First Century learning environment, it is the intention of the Wissahickon School District to promote a culture in which students construct meaning through doing. Students will be given the opportunity to engage in purposeful and authentic real world challenges that require them to apply their learning in cross-disciplinary and innovative ways. In our efforts to prepare students to be both career and college ready, we will provide problem-based learning opportunities in flexible learning environments that require them to think creatively and critically, and collaborate with others from the school community and well beyond.*”
21st Century Teaching and Learning

• K-12 opportunities for WSD students to engage in hands-on activities that support academic learning and promote experimentation, collaboration, and a can-do mindset.
  • Elementary – Role of the librarian restructured to support collaborative, cross-curricular projects (pilot commenced in 2015-16, with full implementation in Fall 2017)
  • Middle School – Maker Space, implemented in Fall 2015, is a place to extend learning through exploration of interdisciplinary applications, digital fabrication (3D printer), assembling simple structures, and technical challenges
  • Integration of computer science activities and programs (e.g. Hour of Code, Boys and Girls Who Code, Secondary Robotics teams)

• The district’s goal is to continue to create meaningful experiences for our students that make learning so powerful and memorable that they’ll continue to seek out these types of experiences through high school and post-graduation.
Engineering Program

• Engineers find solutions to pressing problems by turning their ideas into a reality.

• Our goal is to foster a program offering transformative learning experiences in an engaging, hands-on environment that empowers students to develop high demand knowledge and skills needed to thrive in the global economy.
  • Adopt a problem-solving mindset
  • Real-world applications and challenges
  • Develop collaborators and thinkers
  • Learn from mistakes and through reflection
  • Pertinent to all learners regardless of their career path
Engineering Program

What it will be…

• Learning happening mostly through making, doing, building, shaping and inventing
• Emphasizes the notion of learning to design through the process of making
• Dream up, design and make almost anything imaginable using cutting-edge software and equipment to bring digital ideas to a physical reality
• Projects and problems provide a venue for students to invent, prototype, design, innovate, collaborate, and make mistakes

What it will not be…

• A prescribed series of steps from start to completion
• Limiting cookie-cutter products
• Traditional ‘shop’ class
The Engineering Design Process anchors the redesigned Engineering program within the Technology Education program. Students will learn to solve real problems by applying both academic knowledge and innovative thinking to design solutions, by conducting research, creating and testing prototypes, sharing results, and reflecting on those results.

The design cycle is all about reiteration, trying something again and again until it works, and then, once it works, making it better.
Engineering Program

How will our program shift?

• Individual and collaborative team activities, projects, and problems

• Develop planning, documentation, communication, and other professional skills, including project management, peer review, and an understanding ethical issues related to professional practice and product development

• Digital and manufacturing equipment/tools support creation of physical models of design elements and product building using varied materials, including wood, plastics, and metal

• Reverse engineering to disassemble/analyze products and manufacturing systems

• Mathematical concepts and statistical analysis essential to potential solutions to meet physical constraints, alternate design solutions, and estimating associated costs

• Understand site development for residential and commercial facilities, meet applicable building codes, and analyze the implications of various construction materials and utilities, systems, and services
Engineering Program

How will our program continue to grow?

• Extends to problems that engage a broader range of engineering, further developing strategies that enable students to direct their own learning

EXPLORE AND SOLVE PROBLEMS INVOLVING:

- Strength of Structures...
- Solar Energy...
- Thermal Energy...
- Aerospace Flight...
- Wind Energy...
- Automation, Kinematics, Manufacturing...

HOW WILL WE BEST SUPPORT THESE TYPES OF COURSES?

WHS FAB LAB!
What is the Fab Lab?

• The fabrication laboratory (Fab Lab) is a place where students can collaborate, design, prototype, test, and build innovative solutions using cutting-edge technology and manufacturing tools. The labs are meant to stimulate creativity and spark innovation.

• A fab lab is not solely a tinker lab, a woodshop, a metal shop, or a computer lab, but it contains elements found in all of these spaces – it is designed to accommodate a wide range of activities, tools, materials, and equipment.

• A physical, intellectual, and collaborative space where students can come together to develop new ideas and test new ideas.
What is the Fab Lab?

- Computer Design Software
- Collaborative Work Stations
- Wood Manufacturing Equipment
- Metal Manufacturing Equipment
- Routing, Cutting, Etching
- Table-Top Milling
- 3D Printing
- Prototype Testing
Influential Factors Supporting our Program

Opportunities for cross-curricular collaboration
  • Marketing and Entrepreneurship, Interior Design, Artistic Design, STEM

Career and College Readiness
  • Interdisciplinary activities designed to develop life-long skills such as problem-solving, critical and creative thinking, communication, collaboration, and perseverance
  • Support students in the exploration of career opportunities in a variety of areas such as engineering, technology, design, and manufacturing.
  • Post High School Excellence Plan

Changes in the PA Certification
  • Industrial Arts → Technology Education
Influential Factors Supporting our Program

Higher Education Fabrication Laboratories:

• Harvard University Fabrication Laboratory – Graduate School of Design (https://fablab.gsd.harvard.edu/)
• University of Pennsylvania PennDesign Fabrication Lab – School of Design (https://www.design.upenn.edu/fab-lab/about)
• Columbia University Fabrication Lab – Graduate School of Architecture, Planning, and Preservation (https://www.arch.columbia.edu/research/labs/4-fabrication-lab)
• University of Maryland Fabrication Lab – School of Architecture, Planning, and Preservation (http://arch.umd.edu/mapp/fabrication-lab)
• University of Washington Fabrication Lab – College of Built Environments (http://be.washington.edu/spaces/digital-hand-fabrication/)
• Purdue University Fabrication Lab – School of Engineering (https://design.gatech.edu/digital-fabrication-lab)
• Georgia Tech Digital Fabrication Lab – College of Design (https://design.gatech.edu/digital-fabrication-lab)
• Cal Poly Digital Fabrication Lab – College of Architecture and Environmental Design (https://dfab.calpoly.edu/)
Fabrication Lab Project

Concept Rendering and Cost Proposal
Current Classroom Spaces
Fab Lab Location
# Project Costs

## Summary of Construction Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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<tbody>
<tr>
<td>a. Construction (Primarily renovation costs 4800 SF x $185)</td>
<td>$987,100</td>
</tr>
<tr>
<td>b. Architectural and Engineering Fees (10%)</td>
<td>$83,904</td>
</tr>
<tr>
<td>c. Schematic Design Credit</td>
<td>$(16,000)</td>
</tr>
<tr>
<td>c. Land Development Fees</td>
<td>$0</td>
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**Sub-Total** $1,055,004

## Additional Construction Related Costs

<table>
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<th>Description</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Additional Construction Related Costs (includes reports, agency approval fees, printing, contingency, miscellaneous expenses @ 15%)</td>
<td>$158,251</td>
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<tr>
<td>Furnishings &amp; Equipment</td>
<td>$100,000</td>
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<tr>
<td>Technology</td>
<td>$100,000</td>
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**Sub-Total** $358,251

## Estimated Project Cost

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<td>$1,413,255</td>
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Project Costs

• Expansion beyond the current Technology Education classroom space necessary to allow space for engineering workstations and manufacturing equipment while meeting safety requirements

• Potential cost savings within Computer lab space

• Computer lab will be supported by the 1:1 student laptops and repurposed monitors

• Searching for grant opportunities to support funding of equipment, tools, and materials