Connecting VCCS Courses to a Project Based Dual-enrolled High School IT / CS Program

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NVCC Alexandria / Arlington Public Schools

Presented at the VCCS Information Systems Technologies & Computer Science Peer Group Conference
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This presentation describes planning for the IT / CS program at a new school:

Arlington Tech

Arlington Tech is a "choice program" within Arlington Public Schools focusing on project based learning (PBL).
Arlington Career Center

- Built in 1970s for APS CTE programs
- Approx. 1100 students each day
- Mixture of CTE, academic and special needs programs
- Arlington Tech launched this year
Arlington Tech is a rigorous, project-based learning, high school program that prepares students to succeed in college and in the workplace through collaborative problem solving.
Institutional Stakeholders
Historical Roots: GCTAA

Governor’s Career & Technical Academy

NOVA

Arlington Public Schools

NOVA-APS Academy (GCTAA) at the Career Center

Career & Technical Electives
- 9 Clusters
- 23 Programs
- 1,100 part-time students

Governor’s Career & Technical Academy Arlington (GCTAA)

Northern Virginia Community College

Academic Academy
150 students
Thinking Backwards: Goals

- Integrated project based learning (PBL)
- Career and Technical Education (CTE) pathway
- College connected through dual-enrollment
- Serving needs of diverse student community
IT or CS?

Information Technology

- Direct school to work pathway
- Low barrier to entry
- Industry certification
- Wide opportunities for integrative projects

Computer Science

- Solid pathway to 4 year college
- Attractive to high academic achievers
- Opportunities for high end projects
Why Not Both?

Combining web design and development with computer science opens endless possibilities for integrative web application projects.

<table>
<thead>
<tr>
<th>INFORMATION SYSTEMS TECHNOLOGY</th>
<th>Career Studies Certificate</th>
<th>Offered through AL, ELI, MA, WO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Design and Development</td>
<td>Code: 221-352-03</td>
<td>Catalog Year: 2016-2017</td>
</tr>
<tr>
<td>One Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITD 110 Web Design I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ITD 210 Web Page Design II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ITE 115 Introduction to Computer Applications and Concepts</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ITE 130 Introduction to Internet Services</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ITE 170 Multimedia Software</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ITN 100 Introduction to Telecommunications</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ITP 100 Software Design</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ITP 225 Web Scripting Languages</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Total credits for the Web Design and Development Career Studies Certificate</strong></td>
<td><strong>25</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMPUTER SCIENCE</th>
<th>Career Studies Certificate</th>
<th>Offered through AL, AN, LO, MA, WO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code: 2460</td>
<td></td>
<td>Catalog Year: 2016-2017</td>
</tr>
<tr>
<td>Two Years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSC 200 Introduction to Computer Science</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CSC 201 Computer Science I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CSC 202 Computer Science II</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CSC 205 Computer Organization</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
In this program you will learn:

- HTML5
- CSS3
- JavaScript
- Bash
- SQLite
- SVG
- Python
- Bottle

For more information contact:

Jeffrey Elkner
Web Development Instructor
703-228-5771
jeffrey.elkner@apsva.us

Arlington Career Center
816 S. Walter Reed Drive
Arlington, VA 22204
Phone: 703-228-5800

Web Development Certificate Program

- Learn to create websites
- Learn how the web works
- Learn HTML5, CSS3, JavaScript
- Learn SQL, SVG, and Python
- Get internship experience
- Earn college credits
- Earn GPA quality points
- Earn Industry Certification
- Earn NVCC Career Certificate

Taking Web Development was a Gateway to a new universe of Career Opportunities. I went from making websites to building software with the government. Web development was a key step in a marathon of success.

Chris Hedrick, Web Developer and ACC Alumnus
<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Learning by Doing</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School Course</td>
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<td>Depending on available time and student interest, students who sign up for web development at the Arlington Career Center will be able to integrate the web development skills learned in their classes with Career Center projects in</td>
</tr>
<tr>
<td>Sign up for this 2 credit high school course at the Arlington Career Center:</td>
<td>Sign up for this 2 credit high school course at the Arlington Career Center:</td>
<td>• Cyber Security</td>
</tr>
<tr>
<td>• Advanced Topics in Information Technology (96648W)</td>
<td>• Advanced Topics in Computer Information Systems (96649W)</td>
<td>• Robotics</td>
</tr>
<tr>
<td>The class meets each day at the Career Center.</td>
<td>The class meets each day at the Career Center.</td>
<td>• Transportation Technology</td>
</tr>
<tr>
<td>College Course Credits</td>
<td>College Course Credits</td>
<td>• Solar Energy</td>
</tr>
<tr>
<td>Eligible students will earn college credit through NVCC for the following courses:</td>
<td>Eligible students can earn college credit through NVCC for the following courses:</td>
<td>• Horticulture</td>
</tr>
<tr>
<td>• ITD 110 – Web Page Design I (3 credits)</td>
<td>• ITP 100 – Software Design (3 credits)</td>
<td>• Insect Biology</td>
</tr>
<tr>
<td>• ITD 210 – Web Page Design II (3 credits)</td>
<td>• ITE 115 – Computer Applications and Concepts (3 credits)</td>
<td>and other areas of study based on student interest.</td>
</tr>
<tr>
<td>• ITE 130 – Introduction to Internet Services (3 credits)</td>
<td>• ITE 170 – Multimedia Software (3 credits)</td>
<td>The Arlington Career Center is committed to providing students with internship opportunities with industry partners. Students will have a chance to experience the real world of work first hand.</td>
</tr>
<tr>
<td></td>
<td>• ITN 100 – Introduction to Telecommunications (3 credits)</td>
<td>Arlington Tech, the new project-based learning program at the Career Center, offers students a full day opportunity to apply learning to real world projects in a variety of areas, including web development.</td>
</tr>
<tr>
<td></td>
<td>• ITP 225 – Web Scripting Languages (4 credits)</td>
<td></td>
</tr>
</tbody>
</table>
In this program you will learn:

- Welcome to MIT App Inventor
- BASH
- Python
- Java
- Oracle

For more information contact:
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Web Development Instructor
703-228-5771
jeffrey.elkner@apsva.us

Learning programming at the Career Center gave me the critical context and experience I needed to get my start in IT, and laid the foundation for my career. I can’t recommend the program highly enough to students who want to learn more about the field.

Henry Grever, Red Hat Programmer and ACC Alumnus

Computer Programming

- Learn App Inventor, Python, and Java programming
- Program mobile devices
- Program for the Web
- Learn in a project based, hands-on environment
- Earn transferable college credits in computer science
- Earn GPA quality points

Arlington Career Center
816 S. Walter Reed Drive
Arlington, VA 22204
Phone: 703-228-5800
Level 1

High School Course
Sign up for this 1 credit high school course at the Arlington Career center:

- Computer Programming (96638W)

The course meets on alternate days for a block period.

College Course Credits
You will earn college credit through NVCC for the following courses:

- CSC 200 - Intro to Computer Science (4 credits)
- CSC 130 - Scientific Programming (3 credits)
- CSC 185 - Programming Tools (1 credit)

* Note: Prior completion of or concurrent enrollment in Pre-calculus is a requirement for this course.

Level 2

High School Course
Sign up for this 1 credit high school course at the Arlington Career center:

- Advanced Programming (96643W)

The course meets on alternate days for a block period.

College Course Credits
You will earn college credit through NVCC for the following courses:

- CSC 201 - Computer Science I (4 credits)
- CSC 202 - Computer Science II (4 credits)

* Note: Prior completion of or concurrent enrollment in Calculus is a requirement for this course.

Learning by Doing
Depending on available time and student interest, students who sign up for computer programming at the Arlington Career Center will be able to integrate the computer programming skills learned in their classes with Career Center projects in:

- Cyber Security
- Robotics
- Transportation Technology
- Solar Energy
- Horticulture
- Insect Biology

and other areas of study based on student interest.

The Arlington Career Center is committed to providing students with internship opportunities with industry partners. Students will have a chance to experience the real world of work first hand.

Arlington Tech, the new project-based learning program at the Career Center, offers students a full day opportunity to apply learning to real world projects in a variety of areas, including computer programming.
Project Based Learning

Arlington Tech's PBL focus allows (indeed demands):

- Global consideration of learning goals across all courses
- Integration of learning concepts with applications (projects)
- Integration beyond IT/CS disciplines
Thinking Backwards Again

Which software stack will address the overlapping content requirements of all our IT / CS courses? (Additional personal requirement: must use *free* software!)
Brief Detour: Why Free Software?

- PBL requires freedom to explore and invent
- Free software comes with pre-approved licenses
- Free software projects permit open participation (authentic projects)
- Free software projects permit open collaboration
Back to the Stack

- GNU/Linux + tools and utilities
- HTML5 / CSS3 / JavaScript
- App Inventor
- Java
- Python, *especially Python!*
Why Python?

- Great language for teaching (low floor, high ceiling)
- Executable pseudo-code
- Language of choice for scientists needing to program
- Well suited to "server-side scripting" (Flask and Django)
- Becoming language of choice at colleges and universities
- Open, engaging community
**Level 1**

**High School Course**

Sign up for this 1 credit high school course at the Arlington Career center:

- **Computer Programming (96638W)** *

The course meets on alternate days for a block period.

**College Course Credits**

You will earn college credit through NVCC for the following courses:

- **CSC 200 - Intro to Computer Science** (4 credits)
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- **CSC 185 - Programming Tools** (1 credit)

*Note: Prior completion of or concurrent enrollment in Pre-calculus is a requirement for this course.*

---

**Level 2**

**High School Course**

Sign up for this 1 credit high school course at the Arlington Career center:

- **Advanced Programming (96643W)** *

The course meets on alternate days for a block period.

**College Course Credits**

You will earn college credit through NVCC for the following courses:

- **CSC 201 - Computer Science I** (4 credits)
- **CSC 202 - Computer Science II** (4 credits)

*Note: Prior completion of or concurrent enrollment in Calculus is a requirement for this course.*
<table>
<thead>
<tr>
<th>Features</th>
<th>The Beauty and Joy of Computing</th>
<th>Thriving in Our Digital World</th>
<th>Mobile CSP</th>
<th>Code.org CSP</th>
<th>Project Lead the Way CSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Delivery</td>
<td>Advanced, rigorous programming, mobile apps, Internet API's</td>
<td>Project based learning and blended delivery using online materials</td>
<td>Project based learning harnessing app development</td>
<td>Daily lesson plans, App Lab widgets, Code Studio, discovery based instruction</td>
<td>Exposure to a wide range of professional tools and programming languages</td>
</tr>
<tr>
<td>Programming Environment</td>
<td>Snap/Python</td>
<td>Scratch Processing</td>
<td>App Inventor</td>
<td>Block OR JavaScript Internet Simulator App Lab</td>
<td>Scratch App Inventor Python PHP SQL HTML CSS JavaScript Linux &amp; NetLogo</td>
</tr>
<tr>
<td>Course Development &amp; Availability</td>
<td>8 units available, with continued development planned</td>
<td>Seven AP units available</td>
<td>Complete and available through website registration</td>
<td>Units 1 &amp; 2 available; additional units to be rolled out in 2015-2016</td>
<td>Available to PLTW teachers and districts only</td>
</tr>
<tr>
<td>Support</td>
<td>Free online support through wiki and Piazza; crowd-funded 6-week PD to be available in 2016</td>
<td>PD for AP CSP with teacher stipend to be offered beginning Summer 2016</td>
<td>Free 6-week online PD for all teachers</td>
<td>15-month in-person/online PD with teacher stipend in partner districts (matching funds required)</td>
<td>Intensive 2-week in person training for teachers in PLTW districts (fee required for districts)</td>
</tr>
<tr>
<td>Websites</td>
<td>bjc.berkeley.edu uteachcs.org</td>
<td><a href="http://www.mobile-csp.org/">www.mobile-csp.org/</a></td>
<td>code.org/educate/csp</td>
<td>pltw.org/pltw-computer-science-curriculum</td>
<td></td>
</tr>
</tbody>
</table>

**Mobile CS Principles**

This course is supported by the Mobile Computer Science Principles Project (Mobile CSP), an NSF-funded effort to provide a broad and rigorous introduction to computer science based on App Inventor, a mobile programming language for Android devices. The course is based on the College Board’s emerging Advanced Placement (AP) Computer Science Principles curriculum framework for introductory computer science.
Beginning Python Programming

for Aspiring Web Developers

Using Python 3

by Jeffrey Elkner (with liberal borrowings from the work of Allen B. Downey and Peter Wentworth)

Last updated: 25 January 2017

- Copyright Notice
- Contributor List
- Chapter 1 The way of the program
- Chapter 2 Values, expressions, and statements
- Chapter 3 Strings, lists, and tuples
- Chapter 4 Conditionals and loops
- Chapter 5 Functions
- Chapter 6 Dictionaries, sets, files, and modules
- Chapter 7 Classes and objects
- Chapter 8 Inheritance
- Chapter 9 Server-side scripting
- Appendix A Configuring Ubuntu for Python web development
- Appendix B Making Graphs with matplotlib
- GNU Free Document License
- Search Page
Table of Contents

» Introduction
» Java Basics
» Object-oriented Programming
» Algorithms
» Practice Free-Response Questions
» Interlude
» Advanced Topics
» Making Android Apps: A Tutorial
» Epilogue
3. Basic Data Structures

- 3.1. Objectives
- 3.2. What Are Linear Structures?
- 3.3. What is a Stack?
- 3.4. The Stack Abstract Data Type
- 3.5. Implementing a Stack in Python
- 3.6. Simple Balanced Parentheses
- 3.7. Balanced Symbols (A General Case)
- 3.8. Converting Decimal Numbers to Binary Numbers
- 3.9. Infix, Prefix and Postfix Expressions
  - 3.9.1. Conversion of Infix Expressions to Prefix and Postfix
  - 3.9.2. General Infix-to-Postfix Conversion
  - 3.9.3. Postfix Evaluation
- 3.10. What is a Queue?
- 3.11. The Queue Abstract Data Type
- 3.12. Implementing a Queue in Python
- 3.13. Simulation: Hot Potato
  - 3.14.1. Main Simulation Steps
  - 3.14.2. Python Implementation
  - 3.14.3. Discussion
- 3.15. What is a Deque?
- 3.16. The Deque Abstract Data Type
- 3.17. Implementing a Deque in Python
- 3.18. Palindrome Checker
- 3.19. Lists
- 3.20. The Unordered List Abstract Data Type
- 3.21. Implementing an Unordered List Linked Lists
  - 3.21.1. The Node Class
  - 3.21.2. The Unordered List Class
- 3.22. The Ordered List Abstract Data Type
- 3.23. Implementing an Ordered List
  - 3.23.1. Analysis of Linked Lists
- 3.24. Summary
- 3.25. Key Terms
- 3.26. Discussion Questions
- 3.27. Programming Exercises
Where Is This Going?

In the next few years, I plan to:

- Connect with the OER community
- Reconnect with the Python community
- Develop integrated PBL IT / CS OER curriculum
- Reach out to and network with VCCS colleagues
- Develop partnerships for student career pathways
- Help change the world!
Contact Me!

Please email me at jeff@elkner.net or call me at 703-228-5771 if you would like to connect with me.