STEAM Camp 2015 @ Chelsea School

Release

Chelsea School

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Contents (In Progress):

CHAPTER

ONE

OVERVIEW

1.1 Summary

Through hands-on computing, Chelsea School's STEAM [1] Camp provides day-long, hands-on instruction in science, technology, engineering, mathematics, & the arts for students in 4th through 12th grades.

From July 17th through the 24th, 2015, our weekdays begin with learning fundamental programming concepts by programming tools with an innovative, visual programming language from MIT.

Following that joint session, participants may choose between game design & development or information security & forensics.

In the afternoon, participants will come together to study relationships between the culture, the arts, & innovative technologies.

1.2 Dates

Weekdays between July 17th and 24th, 2015

1.3 Location

Chelsea School in Hyattsville, MD:

> 2970 Belcrest Center Dr, Suite 300 [4th Floor]
>
> Hyattsville, MD 20782

1.4 Program Goals

- Promote literacy
- Practice project management strategies
- Encourage professional collaboration and consultation

[1] Science, Technology, Arts, Engineering, and Math
In the context of this program, STEM and STEAM are used interchangeably. We feel strongly that STEM education, as it is traditionally defined, must integrate critical reading, interpretation, and critique of the arts. We note, however, that Maryland State Department of Education gives this some consideration. STEM education programs, however, do not include humanities or the arts (livescience.com offers a fairly representative definition).

- Explore post-secondary programs, careers, and professional certification options
- Discover programmatic solutions to common problems
- Promote digital literacy
- Practice mind-mapping and other discovery techniques
- Introduce sound and valid logic
- Promote creative problem solving and critical thinking
- Provoke innovation and invention
- Encourage self-advocacy
- Encourage life-long learning

1.5 Features

1.5.1 State of the Art Facilities

Our new, state-of-the-art facility features interactive whiteboards; gigabit ethernet; & over 100 student workstations equipped for equitable access to appropriate assistive technology.

1.5.2 Research-based Instruction

Grounded in Chelsea School's philosophy, participants will receive individualized instruction; reading across the curriculum; & post-secondary exploration & preparation from highly experienced instructors & technologists.

1.6 Curriculum Overview

1.6.1 Programming Concepts

This game-based introduction to the logic underlying software engineering focuses on coding fundamentals using visual & text-based interpreted languages & their syntaxes & prepares participants for either our game design or cybersecurity & digital forensics sessions.

1.6.2 Game Design & Development

Participants will have hands-on experience building a game in professional game development engines. Using 3D models & code produced in C# & Javascript, they will assemble the terrain, objects & other elements of the game, capture input from users & script game physics & AI behavior.

1.6.3 Cybersecurity & Digital Forensics

Attendees will learn & apply basic concepts of programming, computer forensics, cryptography, steganography, system vulnerability assessment, & project management from a series of gaming & simulation activities & hands-on exercises.

1.6.4 Arts & Technology

Participants will explore the role of arts & creativity in technology — including the ways in which literature, visual arts, & music influence — & are influenced by — science & technology. Participants will engage in hands-on projects including writing workshops, crafts & more.

1.7 Daily Schedule

Weekdays

- Programming Fundamentals
- Break
- Breakout Session: Game Design **or** Infosec and Forensics
- Lunch
- Arts and Technology

1.8 Notes

CHAPTER

TWO

PHILOSOPHY

2.1 Chelsea School

Mission, Vision Statement, Values

2.2 STEAM Camp

2.2.1 Values

- Equality
- social and economic justice
- Differentiated Instruction
- Constructivist and Constructionist Pedagogy
- Connected Learning [1]
- Authentic Learning and Assessment
- Multi-Modal Learning and Instruction
- Rigorous relevant material
- independent practice
- risk-taking

2.2.2 Rational

- For every job posting for a bachelor's degree recipient in a non-STEM field there were 5 entry level postings for a bachelor's degree recipient in a STEM field. (STEMConnector)
- By 2018, the very significant bulk of STEM careers will be in the field of computing: 71% (traditional engineering is second at 16%. (STEMConnector)

[1] Connected learning is an approach to addressing inequity in education in ways geared to a networked society. It seeks to leverage the potential of digital media to expand access to learning that is socially embedded, interest-driven, and oriented toward educational, economic, or political opportunity. Connected learning is realized when a young person is able to pursue a personal interest or passion with the support of friends and caring adults, and is in turn able to link this learning and interest to academic achievement, career success or civic engagement. This model is based on evidence that the most resilient, adaptive, and effective learning involves individual interest as well as social support to overcome adversity and provide recognition (Ito). The approach knits together three crucial contexts for learning: interest-powered; peer-supported; academically oriented. In addition, it embraces these key design principles: production-centered; open networks; shared purpose.

- Only 10% of students in the United States receive credits for computing related courses in elementary, primary, or secondary school courses. (Code.org)
- Computing careers offer very broad variety of entry-level position requirements, allowing for significant personal preference when commiting to a post-secondary path.

2.2.3 Critical Considerations

- Underrepresentation of women in STEM fields
- Equitable Access to resources
- Participants include reluctant readers and writers
- Participants benefit from indivualized instruction well-suited to their learning styles and preferences.

CHAPTER

THREE

PROGRAMMING FUNDAMENTALS...PROGRAM

3.1 Time

3.2 Summary

3.3 Goal

3.4 Learning Outcomes

3.5 Schedule

CHAPTER

FOUR

ARTS AND TECHNOLOGY

CHAPTER

FIVE

CYBERSECURITY AND DIGITAL FORENSICS PROGRAM

5.1 Description

The *Cybersecurity and Digital Forensics* course is a component of a two-week summer program at Chelsea School in Hyattsville, Maryland, for middle and secondary-school students who are interested in the growing field of cybersecurity [1].

This ten-day experience provides hands-on activities focused on computing and cybersecurity topics. Attendees will learn and apply basic concepts of programming, computer forensics, cryptography, steganography, system vulnerabilities and program management from a series of gaming and simulation activities and hands-on exercises.

5.2 Goal

To allow secondary students to explore and apply various topics within cybersecurity fields by linking research to practice through hands-on experience.

5.3 Learning Outcomes

5.4 Hours

5.5 Topics [2]

5.5.1 Cyberthreats and Motivations

- From Hacktivists to Cybercriminals, to Scriptkiddies and *lulz*

5.5.2 Cybersafety

- Password best practices
- Personal disclosure

[1] In the context of this course, cybersecurity, infosec, security, network security, and information security are used interchangeably. Note too that the scope of study is limited to PC-based Microsoft and Linux-linux based systems. We do not attempt to cram mobile forensics or Macintosh server security into the program.

[2] A realistic plan is in place to address these topics to an appropriate degree, with time left for red-teaming and hands-on learning. As we get a snapshot of enrollment, the emphases with shift, and the delivery of content will be adjusted to meet the individual needs of participants.

- cyberbullying
- Getting help or support
- Reporting abuse
- Generating strong passwords or passphrases
- Password Management

5.5.3 Cyberethics

- Ethical Hacking
- The Ethical Hacker (Levy)
- Critical Engineering Manifesto
- System Administrator Code of Conduct & discussion of case studies/vignettes

5.5.4 Penetration Testing for Security Auditors

- Obtaining authorization from the client
- Definition of Scope with the client
- Cleaning up after yourself
- Producing a Summative Report: executive summaries and elaborated findings and recommendations
- Confidentiality and non-disclosure agreements
- Legal contraints

5.5.5 Digital Forensics

- Toolkits
- Chain of Custody
- Case Management & Reporting

5.5.6 Project Management and Professional Collaboration

- Agile Framework: Emphasis on Scrum with components of Extreme Programming
- Source code management with git (Github, Gitlab, Bitbucket)

5.5.7 Post-secondary Preparation

- Resume Development
- Career Profiles
- Post-secondary academic options
- Relevant certification options

5.5.8 Server Configuration and Administration

- Server Hardening
- log management
- Intrusion Detection Systems
- Network and system management

5.5.9 Threat Mitgation

- Social Engineering (exploiting human aspects of computing systems)
- Network Scanning and enumeration
- Privilege escalation
- Physical access to machines
- Malware typology
- Brute-force and dictionary attacks
- Cross site scripting
- Phishing
- Session Fixation
- Session Hijacking
- SQL Injection
- Denial of Service attacks
- Exploits and Zero-day exploits

5.5.10 Cryptography and Cryptography

- Steganalysis
- Cryptoanalysis

5.5.11 Topics Notes

- Network fundamentals, protocols, handshakes
- Ethical Hacking, cyberethics, code of conduct
- Infosec Defined
- Pentration Testing - Scope, Authorization, summative reporting of findings/recommendations
- Cyberlaw
- Chain of Custody
- Forensics Toolkits, forensic reporting/case management
- Filesystem navigation and management
- **Threats and Mitigation**

  - Phishing
  - Malware
  - Web security - session attacks, cross site scripting, SQL Injection
  - Exploits, Zero-day exploits
  - Brute Force and Dictionary attacks
  - Privilege Escalation
  - traffic sniffing (eavesdropping on network communications for sensitive information)
  - social engineering
  - Passive and Active scanning
- Server Hardening
- Maintaining systems: patches, updates, security announcements, log management, AV databases
- Intrusion Detection Systems
- Log Management
- Threats and motivations
- encryption

5.6 Primary References

This session is grounded in significant research in contemporary theory, methods, and best practice as well as professional, ethical, legal conduct.

While material is drawn from myriad resources, seminal resources help inform the structure of this class:

1. *Basic Penetration Testing* (Syngress)
2. *Computer Security Literacy: Staying Safe in a Digital World* <http://www.crcpress.com/product/isbn/9781439856185> (CRC Press)
3. *Basic Forensics* (Syngress)
4. *Kali Linux CTF Blueprints* (Packt Pub.)
5. *Applied Network Security Monitoring* (Syngress)
6. *The Basics of Information Security, 2nd Edition* (Syngress)

5.7 Technologies

- Microsoft Windows 7
- Linux
- Apache (web server)
- MySQL (database)
- Python, Perl, PHP (interpreted scripting languages, as needed)
- Metasploit

- Backbox Linux
- Kali Linux
- Virtualization (Oracle Virtualbox, Vagrant, VMWare Player, Proxmox (hypervisor)
- Hardware firewalls
- Routers
- TCP/IP (syn, awk /)
- SSL
- NMAP
- Nessus
- Mozilla Firefox security extensions
- Google Chrome security extensions
- plain text code editors (vim, gedit, emacs, notepad++)
- high level interpreted scripting languages (Python, Perl, shell scripting)
- ZendStudio
- Jira and Jira Agile (Atlassian)
- Git and Github
- metasploitable
- WPA, WEP, WPA2, WPS wireless technologies
- DD-WRT
- Linksys WRT54G Wireless Router
- Shell scripting (bash and zsh)

5.8 Post-Secondary Paths

5.8.1 Relevant Certifications

- Security+ (CompTIA)
- Network+ (CompTIA)
- Linux+ (CompTIA)
- Certified Ethical Hacker (CEH)
- ECSA: Certified Security Analyst (IACRB)
- CPT: Certified Pentetration Tester (IACRB)
- Certified ScrumMaster (CSM)
- GIAC Security Essentials
- CISSP: Certified Information Systems Security Professional
- CISM: Certified Information Security Manager
- CSD: Certified Scrum Developer

5.8.2 Representative Undergrad Academic Programs

- Software Studies (UMBC)
- Network Security (Fairmont State University)
- Software Engineering (WVU)
- Digital Humanties (GMU)

5.9 Notes

CHAPTER

SIX

GAME DESIGN AND DEVELOPMENT PROGRAM

CHAPTER

SEVEN

CAMP FACULTY

7.1 Rik Goldman

7.1.1 Sessions

- Programming Fundamentals
- Infosec and Forensics

7.1.2 Vita

7.1.3 Learn More

7.2 Sabre Goldman

7.2.1 Course

- Arts and Technology

7.2.2 Vita

7.3 David Vest

7.3.1 Courses

- Programming Fundamentals
- Game Design and Development

7.3.2 Vita

7.3.3 Learn More

CHAPTER

EIGHT

FREQUENTLY ASKED QUESTIONS

8.1 What is Chelsea School?

8.2 What is STEM Education? What then is STEAM education?

This curriculum seeks to merge the boundaries of science, technology engineering and math (STEM), while explicitly integrating these subjects with arts and the humanities.

Maryland State Department of Education gives this some consideration in its *Maryland State STEM Standards of Practice Framework* [1].

However, we feel strongly that

1. Computing is a core literacy
2. The ability to read, interpret, and critique cultural productions is a necessary condition of digital literacy and computing.

Therefore, we have worked toward adopting the acronym *STEAM* and the phrases *STEAM Education* and *STEAM Camp*.

[1] From Maryland State STEM Standards of Practice Framework (2012):

STEM education is an approach to teaching and learning that integrates the content and skills of science, technology, engineering, and mathematics. STEM Standards of Practice guide STEM instruction by defining the combination of behaviors, integrated with STEM content, which are expected of a proficient STEM student. These behaviors include engagement in inquiry, logical reasoning, collaboration, and investigation. The goal of STEM education is to prepare students for post-secondary study and the 21st century workforce.

STEM education removes the artificial barriers that isolate content and allows for an integrated instructional approach. The curriculum should allow students to develop life skills and apply content knowledge within a real world context. STEM education is active and focuses on a student-centered learning environment. Students engage in questioning, problem solving,collaboration, and hands-on activities while they address real life issues. In STEM education, teachers function as classroom facilitators. They guide students through the problem-solving process and plan projects that lead to mastery of content and STEM proficiency. STEM proficient students are able to answer complex questions, investigate global issues, and develop solutions for challenges and real world problems while applying the rigor of science, technology, engineering, and mathematics content in a seamless fashion. STEM proficient students are logical thinkers, effective communicators and are technologically,scientifically, and mathematically literate. (4)

There are two goals for STEM education in *high school*. The first goal is on the development of STEM proficient students. All students will continue to grow in their STEM proficiency as they progress from grades 9-12. Students demonstrate independence and become more focused and sophisticated in their approach to answering complex questions, investigating global issues, and developing solutions for challenges and real world problems. STEM proficient students graduate with the basic skills and knowledge required to pursue post-secondary study or work in any field.

The second goal for STEM education in high school is on the advanced preparation of students for post-secondary study and careers in science, technology, engineering, or mathematics. High school provides a unique opportunity for students to explore different career paths and college majors through advanced coursework, career academies, magnet programs, STEM academies, specialized STEM programs, internships, and dual enrollment opportunities. Specific programs to address the needs for advanced preparation of students shall be determine by individual schools systems. (5)

8.3 What is the location of the summer camp?

8.4 What are the camp hours?

8.5 What is the break and lunch plan?

8.6 How can a parent best support a participant?

8.7 What is the daily schedule?

8.8 What resources do participants need?

8.9 What additional resources are encouraged for participants?

8.10 Is homework assigned?

8.11 How can a participant prepare before camp starts?

8.12 Are there prerequisites for prospective participants?

8.13 Notes

CHAPTER

NINE

REGISTRATION

9.1 Registration Options

9.2 Open Registration

9.3 Registration How-To

CHAPTER

TEN

REFERENCE TOOLS

- *genindex*
- *search*

P

R

S

U

V

W