

A "Techy" Minor in Web Design and Development for Non-Technical Students

Ronald P. Vullo, Ph.D., and Catherine I. (Irving) Beaton, M.I.T.E.

Golisano College of Computing and Information Sciences
Rochester Institute of Technology
Rochester, New York 14623

Abstract - *It enthralls students fluent in Facebook and Foursquare, but eludes those outside computing majors. Students recognize the benefits of computing skills and that web technologies have become a universal infrastructure. Web development skills are increasingly vital to non-computing disciplines so we have created a minor in web design and development for non-technical students. In it they develop significant technical depth, despite their non-computing backgrounds. This presents challenges, but makes for a vibrant classroom. The minor is taught using Active Learning so students learn and experience both the theory and practice of web development. These students generally have no programming experience and are gently introduced to the process in their first course and gradually exposed to more in-depth development throughout the rest of the minor. The course order is deliberately flexible allowing students to choose their own path to success. The minor's rapid growth reflects its relevance.*

Keywords: Curriculum, Education, Non-Technical, Programming, Web

1 Introduction

"The power of the Web is in its universality."

– Tim Berners-Lee, W3C Director and inventor of the World Wide Web¹

Web development technologies are core to several computing degrees within the Golisano College of Computing and Information Sciences (GCCIS). Degree programs in Information Technology, Medical Informatics, New Media Interactive Development and Game Design and Development all have a significant web development component in their core courses. Students in degree programs often take a minor in web development. The authors support the belief that web development is integral to many computing disciplines, but also believe that it is increasingly vital to non-computing careers as well. For this reason, we have created a minor in web design and development that is both accessible to non-technical students, but also helps them develop significant technical depth of knowledge and skills. The minor attracts

students from such diverse programs on campus as Marketing (E. Philip Saunders College of Business), Psychology (College of Liberal Arts), Media Arts and Technology (School of Print Media), and Professional Photographic Illustration (School of Photographic Arts and Sciences).

Bringing together students from such diverse fields of study presents some challenges, but also makes for a vibrant and exciting classroom environment. The entire minor is taught "hands-on" in an Active Learning environment where didactic material is mixed in with a considerable amount of lab work. Students learn and experience both the theory and practice of web development.

Although these are non-computing majors and generally have no programming experience, they are gently introduced to the process in their first course. Students are gradually exposed to more in-depth content in the primary course, and those threads are woven into each subsequent course. When they reach their last course, students are modifying open source code and writing their own simple programs. Over the duration of their classes, they learn concepts such as client-side vs. server-side processing, templates, code libraries, and AJAX. In addition to these technical topics they also learn about design, aesthetics, accessibility, content creation, usability, and the history and evolution of the technologies they are using.

The minor is designed for non-computing majors and students outside the computing field who wish to learn more than just the basics of Web usage. Students enrolled in this minor have little or no knowledge of web development and related technologies. The minor features courses covering image creation, video production, communication, development, and integration technologies applied to the Web. Students completing this minor have the broad range of skills and understanding necessary to design and build a basic, but complete, web presence.

This minor is not available to students whose home programs are in GCCIS. This is by design; there is another web development minor available for GCCIS students which is tailored to their needs and background. This minor sequence is designed to teach students the programming and other computing skills that reflect the depth appropriate for a minor

in a degree program. These skills will not be a part of their major, but may support their chosen major as technology continues to grow as an important component in other degrees.

2 Program Structure and Sequence

The minor in Web Design and Development has a required first course (Web Foundations) three “middle courses” which can be taken in any order (Digital Image Creation, Digital Video Creation, and Rapid Online Presence) and a final course which serves to bring together and build upon the learning from the preceding four courses in an integrative manner (Web Integration & Application).

The program structure lays a common foundation for all of the students, allowing them to play equally on the same playing field. The various activities within the courses meet the needs of all four learning styles for students and provide components of stability and comfort for some students, and a sense of independence for others.

The sequence of the courses allows students to follow their own path, to some degree. After completing the foundation, students can elect from a selection of three courses. This option allows students to take control of their learning. They choose a course that matches their interests. Upon successful completion of the course, they now have increased motivation and desire, as well as confidence, to move on to the next course.

This flexibility of the minor is deliberate. David Kolb, a renowned researcher in the area of learning styles, suggests that there are four specific categories for learners:

- Accommodators – preference for well-controlled, hands-on method
- Divergers – risk-taking, experimenting, seat-of-pants learners
- Assimilators- want to be guided to ‘right’ answer
- Convergers – big picture to personalization²

While these categorizations are broad, they do represent different learner needs. For a traditional student (19-25 years old) the lure seems to be a flashy, fast, real/virtual experience. It has to ‘mean’ something to them. These learners are Generation X learners, and they lean more towards a structured learning environment with a ‘wow’ appeal. Therefore it becomes important to quickly support the creation of a product or process, so that they feel successful. This can present a challenge for instructors, especially in early courses where students lack sufficient skills to build something substantial.

Computing for non-majors can be an intimidating area of study for students. It is essential that they feel they can approach and master the content without feeling

overwhelmed. The content of the courses is delivered in a variety of ways with a deliberate intent. For the first encounter with web/technologies, students are given an historical perspective on the internet and web page development. Some of this content is not new to all students. However, students do acknowledge that, while they are users of the internet and the web, they were unaware of much of its history – the how and why of the way it is now. The authors believe this historical context is important in establishing a solid foundation upon which to build knowledge.

Within the courses, there are a variety of activities to support different learning styles. Even in the first course, students hand-code HTML and CSS, create, edit, and manipulate digital images, create simple animations, and address web site accessibility issues. There are opportunities for collaboration with colleagues through in-class exercises, and out-of-class assignments to encourage them to research their topics outside of class time.

While technology has become pervasive in society, industry has noted a need for other skills within the technology field. Writing skills, communication skills, and presentation skills are all sought after, in the computing field. It is for this reason that the courses also incorporate these components. The specific structure and content of each of the courses is provided below.

GCCIS-ISTE-105: Web Foundations

Students required to take this course: Students in the Minor in Web Design and Development for Non-Computing Majors, Students in the following degree programs: Advertising and Public Relations, Journalism, New Media Publishing, Professional and Technical Communications, and Psychology.

Students who might elect to take the course: Non-computing students wishing to learn web basics. (This course is closed to computing majors and will not be accepted for credit toward college of computing degrees.)

Goals of the course: This course provides an introduction and hands-on practice in developing basic web sites. Emphasis is placed on standards compliance and cross-platform development. It also provides an introduction to the fundamentals of web-delivered media.

Course description: A hands-on introduction to Internet and web foundations for non-computing majors. Includes HTML (Hypertext Markup Language) and CSS (Cascading Stylesheets), web page design fundamentals, basic digital image manipulation, and web site implementation and maintenance. Students will design and build their own web sites using the latest technologies and deploy them to the web for world-wide access.

Topics: 1. Web Pages
1.1 Intro to Macintosh

- 1.2 History of Internet and Web
- 1.3 Basic Web Page Mechanics (HTML)
- 1.4 More HTML (Paths, Links & Images)
- 1.5 Advanced HTML and Validation
- 1.6 Adding Style with Basic CSS
- 1.7 CSS Layout
- 1.8 Copyright
- 1.9 Basic Navigation
- 1.10 Structure & Style (Menus & Lists)
- 1.11 Advanced CSS
- 1.12 Structure & Style (Swapping Stylesheets)
- 1.13 Color and Computers
- 1.14 Basic Design Principles for Web Sites
- 1.15 Fundamentals of Computer Graphics
- 2. Images
 - 2.1 Pixelmap Images
 - 2.2 Vector Graphics
 - 2.3 Preparing Images for the Web
 - 2.4 Editing Photographs)
 - 2.5 Creating Web Backgrounds
 - 2.6 Creating Images de Novo
- 3. Time-based Media (Animation and Video)
 - 3.1 Animation
 - 3.2 Video
- 4. Interaction (JavaScript)
 - 4.1 JavaScript & DOM
- 5. Putting it all together
 - 5.1 Designing a Larger Site
 - 5.2 Site Design Critique
 - 5.3 Prototyping a Site
 - 5.4 Site Prototype Critique

Learning Outcomes: At the end of the course, the student will be able to:

- Create web pages using hand-coded HTML including CSS text formatting, images, tables, and CSS layout/positioning.
- Edit, create, and use digital images effectively by choosing and implementing correct image formats.
- Create and use small animated gifs to enhance web pages.
- Use SFTP software to upload and maintain web pages, including setting proper Unix permissions. in-class exercises and out-of-class projects

GCCIS-ISTE-205: Digital Image Creation

Students required to take this course: Students in the Minor in Web Design and Development.

Students who might elect to take the course: Students interested in learning digital image creation and manipulation for the web. This course is open to college of computing majors and may be taken as a free elective.

Goals of the course: Students will develop a deeper understanding of, and skill level working with digital imaging targeted for the web.

Course description: This course explores the creation and manipulation of digital images intended for use on the Web. Topics include basic digital photography, acquisition of images, and intermediate image manipulation. Students will do projects creating images suitable for the internet. Prerequisite: GCCIS-ISTE-105 or GCCIS-ISTE-140 (Web I for IT Majors)

Topics: 1. Digital Image Principles

- 1.1 Pixels
- 1.2 Additive and Subtractive Color
- 1.3 Bit Depth
- 1.4 Gamut and Color Spaces
- 2. Basic Digital Photography
 - 2.1 Image Sensor technologies
 - 2.2 Aperture
 - 2.3 Exposure Time
 - 2.4 Composition
 - 2.5 Lighting
 - 2.6 Planning a Shoot
 - 2.7 Releases and Copyright
- 3. Scanning Images
- 4. Image Manipulation
 - 4.1 RAW vs. JPEG
 - 4.2 Color Correction and White Balance
 - 4.3 Masks
 - 4.4 Compositing Images
 - 4.5 Removing Defects
- 5. Compression
- 6. Presenting images on the web

Learning Outcomes: At the end of the course, the student will be able to:

- Demonstrate knowledge of principles of Digital Image generation and display.
- Demonstrate knowledge of digital photography technologies and basic photographic optical principles.
- Take good quality digital photographs.
- Manipulate digital images.
- Appropriately present images on the web.

GCCIS-ISTE-206 Digital Video Creation

Students required to take this course: Students completing the Minor in Web Design and Development

Students who might elect to take the course: Students will develop a deeper understanding of, and skill level working with digital video targeted for the web. This course is open to college of computing majors and may be taken as a free elective.

Goals of the course: Students will acquire a basic competency in creating digital audio and video and its use on the Web.

Course description: This course explores the creation of digital video intended for use on the Web. Topics include basics of digital videography, acquisition of audio, editing,

streaming, compression, as well as storytelling with video and integration into web sites and applications. Students will be provided with digital cameras for use in the course. Prerequisite: GCCIS-ISTE-105 or GCCIS-ISTE-140 (Web I for IT Majors)

Topics: 1. Storytelling with Video in a Digital World

- 1.1 Structure of a Story
 - 1.2 Scripts & Storyboards
 - 1.3 Fiction, News, Commentary, Comedy, etc.
 - 1.4 Live vs. Edited Video
2. Technique
- 2.1 Lighting
 - 2.2 Camerawork
 - 2.3 Microphones and Audio Mixing
 - 2.4 Animation, Stop-Action, Time Lapse
3. Digital Video Technologies and Techniques
- 3.1 Capturing
 - 3.2 Editing
 - 3.3 Captioning
 - 3.4 Encoding
 - 3.5 Streaming
 - 3.6 Podcasting
 - 3.7 Teleconferencing
 - 3.8 Special Effects
4. User Interaction
- 4.1 Web Technologies for User Control
 - 4.2 Integrating Audio and Video into Web Sites and Apps

Learning Outcomes: At the end of the course, the student will be able to:

- Create a Narrative
- Develop web-based audio and video productions
- Perform competent lighting technique
- Perform competent Videography technique
- Perform competent Editing technique
- Provide constructive peer critique and feedback
- Create an integrated web-video user experience

For this course students are provided with video cameras, and lighting equipment. This course is scheduled to meet once per week for a contiguous 3 hour block, usually in the evening and/or a lab which can be darkened for viewing video.

GCCIS-ISTE-305: Rapid Online Presence

Students required to take this course: Students in the Minor in Web Design and Development for Non-Computing Majors, Students in the New Media Publishing degree program.

Students who might elect to take the course: Non-computing students wishing to learn how to set up web sites that go beyond a few static pages. (This course is closed to computing majors and will not be accepted for credit toward college of computing degrees.)

Goals of the course: This course provides a practical overview of web development using rapid site development tools such

as Blogs, Wikis, Content Management Systems, and Web Site Toolkits.

Course description: Although large-scale web sites still require considerable development effort, there are today several options for establishing a web presence using tools designed for non-programmers. This course gives students understanding of and experience with installing and customizing web sites using tools such as Blogs, Wikis, Content Management Systems, and Web Site Toolkits. Prerequisite:GCCIS-ISTE-105

Topics: 1. Blogs

- 1.1 What is a blog?
 - 1.2 History of blogs
 - 1.3 Blogging sites
 - 1.4 Blog software installation and customization
2. Web Site Generators
- 2.1 Using software that creates web sites (i.e. iPhoto)
 - 2.2 Customizing generated pages
3. Wikis
- 3.1 What is a wiki?
 - 3.2 History of Wikis
 - 3.3 Wikis vs. Blogs
 - 3.4 Wiki software installation and customization
4. Web Site Toolkits
- 4.1 Types of Toolkits
 - 4.2 Installing and using toolkits
5. Content Management Systems
- 5.1 What is a content management system?
 - 5.2 Content management systems vs. toolkits, wikis and blogs
6. DIY: Integrating open source pieces
- 6.1 Mixing and matching toolkits, content management systems, wikis, blogs generated pages

Learning Outcomes: At the end of the course, the student will be able to:

- Evaluate and select appropriate tools and methods of rapidly creating web sites.
- Apply the basic principles of information architecture and navigation design to the development of a web site.
- Install and configure a selection of open source web applications such as wikis, blogs, etc.
- Modify the design/layout/navigation of the above systems to create customized web presence.
- Add and manipulate content in the above systems.

GCCIS-IST-405: Web Integration & Application

Students required to take this course: Students completing the Minor in Web Design and Development. (This course is closed to students not enrolled in the minor.)

Goals of the course: This course brings together and builds upon the learning from the preceding four courses in the Minor in Web Design and Development in an integrative manner.

Course description: The final course in the minor in Web Design and Development (for non-GCCIS majors). Students will develop a deeper understanding of technologies underlying the web and how to combine them. This course builds upon the work from the preceding four courses in the minor and emphasizes integrating multiple technologies and content sources to create sophisticated web sites and web applications for desktop and mobile devices. This course is not available to GCCIS majors. Prerequisites: GCCIS-ISTE-105, GCCIS-ISTE-205, GCCIS-ISTE-206, and GCCIS-ISTE-305

Topics: 1. Server-Side Programming

- 1.1 constructs
- 1.2 functions
- 1.3 data structures
- 1.4 includes and code organization
- 2. Maintaining State
 - 2.1 cookies
 - 2.2 session variables
- 3. Structured Content
 - 3.1 normalization
 - 3.2 structured files (CSV, INI, XML)
 - 3.3 databases
- 4. Site Architectures and Approaches
 - 4.1 Pages and Directories
 - 4.2 Model-View-Controller
 - 4.3 two- and three-tiered architectures
 - 4.4 Integrating Web Services & Data Sources
 - 4.5 Security Issues
- 5. Web Applications
 - 5.1 AJAX
 - 5.2 Mobile Apps

Learning Outcomes: At the end of the course, the student will be able to:

- Evaluate and select appropriate methods and technologies for creating multi-tiered web sites.
- Integrate multiple data sources into a web site or web application.
- Maintain user state and provide an individualized user experience.
- Take measures to address security issues of a data-backed web system.

For this course students are provided with accounts on a Unix web server supporting PHP and MySQL. Mobile computing devices (i.e. iPads and iPod touches) are also provided for development and testing of web apps.

3 References

- [1] Berners-Lee, Tim. Retrieved April 10, 2012 from <http://www.w3.org/WAI/>.
- [2] Smith, M. K. (2001). 'David A. Kolb on experiential learning', the encyclopedia of informal education. Retrieved April 10, 2012 from <http://www.infed.org/biblio/b-explrn.htm>.