

The Garden of Earthly Delights: Constructing and Revising a Web Development Textbook

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ABSTRACT

Web development is widely considered to be a difficult topic to teach successfully within post-secondary computing programs. One reason for this difficulty is the large number of shifting technologies that need to be taught along with the conceptual complexity that needs to be mastered by both student and professor. Another challenge is helping students see the scope of web development, and their role in an era where the web is a part of everyday human affairs. This paper describes our 2014 textbook [2], its reception, and our plans for a second edition revision (which will be published in early 2017). Our hope is that a discussion of current teaching materials will provide opportunities to spark a dialogue not only about current technological topics, but perspectives on web development from other disciplines.

CCS Concepts

K.3.2 [Computers and Education]: Computer & Information Science Education – computer science education.

Keywords

Web development education; textbooks; pedagogy

1. INTRODUCTION

Determining what web development-related topics to teach within the constraints of one or maybe two courses in an undergraduate computing program is not easy. Indeed, it feels a bit analogous to gazing at Hieronymus Bosch's bizarre sixteenth-century masterpiece, *The Garden of Earthly Delights*. In this painting, an absurdist cacophony of images assaults the eyes: semi-transparent strawberries excrete people, giant birds join humans in a lake while playing with hairy blueberries, naked gymnasts ride horses, bears and pigs while carrying over-sized fish, and so on. With so much going on, it feels next to impossible to understand the ideas behind the painting ... or even to know if a single viewer is even intended to have broad comprehension about the painting. So too it might seem to anyone surveying the pandemonium of contemporary web development topics, tools, and techniques.

Teaching web development has been notoriously plagued by its expanding and shifting landscape of technologies (see, for instance, Lee [2003], Grove [2007], Liu and Phelps [2011], Miller et al [2013], and Hoar [2014]). This combination of teaching complexity and real-world change might be the reason why web development as a topic area seems to be shrinking within many computing programs. As noted by Miller and Connolly [2015]: "Of the 84 course exemplars in the in the ACM 2013 Computer Science Curriculum, not a single one contains any topics from the Web Platforms knowledge area!"

This slowdown of interest in web development topics within computer science seems especially odd given the growth and importance of web development in the world outside the

university. The reasons for this paradox have been examined elsewhere (Connolly 2011, Miller *et al* 2015). One of the main culprits is the rich panoply of technologies that need to be mastered by the student, and, more importantly, by the instructor teaching web development. Faculty teaching web development often did not specialize in this area within their graduate studies.

It is not that uncommon however for faculty to teach a course with which they are not experts. One key way to manage the teaching of an unfamiliar area is by relying on a suitable textbook. For many years, the lack of a single suitable textbook on web development was a common complaint by those teaching in the area (e.g., Grove 2007). Wang and McKim (2013) nicely sum up the problem: "Because one web program may cover multiple web technologies, it is difficult to find one or two textbooks with enough breadth and depth to cover all the technologies in the course."

This was the challenging lacuna that we tried to fill when we wrote our textbook, *Fundamentals of Web Development* (Pearson, 2014). The rest of this paper describes the book's general philosophy and approach, the organization and content within the first edition, its reception and feedback, and our changes for the second edition, which we are currently in the midst of writing. From this description, we hope to spark some dialogue about possible future directions for the teaching of web development.

2. TEXTBOOK OVERVIEW

In creating a textbook to cover the broad range of theory and tools used in web development, we had to be cognizant of our audience, which included not only traditional computer science students, but also those within IT and IS programs. We wanted to touch on a range of topics important to web practitioners, while also providing a theoretical context suitable for an upper-level undergraduate course. This final goal is worth reiterating. One of the main problems with existing books being used within the classroom is that they tended to be focused only on teaching one specific development technology or platform (e.g., ASP.NET, PHP, or JavaScript). We felt it was important for our book to also cover fundamental concepts which allow a learner to progress to a deeper understanding of the subject [1]. In addition, we used real world examples that draw on scenarios that are realistic and go beyond computing. For example an art store with real artwork and a travel site that manages photos both expand the scope of the book beyond computer science to help students see how others make use of the web.

To help us achieve this aim, the book was organized around the following key design principles. It had to cover both concepts and practice across the entire scope of web development. It had to focus on the reality of modern web development, which meant including common frameworks, content management systems and contemporary programming toolkits and APIs. To make the content more appealing to students, it had to integrate

sophisticated, realistic, and engaging case studies. Finally, since today's students are often reluctant readers, the book had to present its content in a manner suitable for visually-oriented learners (Figure 1 illustrates an example of the visual approach used within the book).

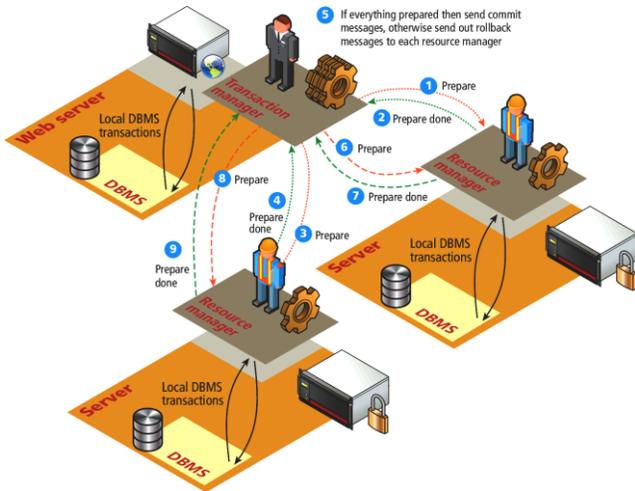


Figure 1 - Example illustration from book

The first edition contains 21 chapters divided into the following areas: the technological infrastructure of web development (1 chapter), HTML, CSS, and web media (5 chapters), JavaScript (2 chapters), server-side development using PHP (6 chapters), security and server administration (2 chapters), and advanced topics such as software design, web services, search engines, content management systems, and social network administration (5 chapters).

3. FUTURE WORK

The rate of innovation and change within the web development field is of course quite notorious. Our next edition plans to expand coverage in the following areas

3.1 Broader Coverage of Web Infrastructure

One of the key threshold concepts [1] within web development is a clear understanding of how the web works. The next edition will likely expand on this coverage to cover many of the key changes in the web environment in the past five years.

3.2 CSS3

When the first edition was being written, CSS3 browser support was still quite narrow. Since that time, CSS3 support has strengthened significantly, and is now part of the normal repertoire of many practicing web developers.

3.3 Expanded JavaScript Coverage

JavaScript programming today is not just an important adjunct to web development. For this reason, our plans for the next edition will expand our coverage of JavaScript from two to four chapters.

3.4 Changes to PHP

With the recent release of PHP 7.0, new features of the language will improve the academic discussion around typing, casting, testing and the contrast between strong and weakly typed languages.

3.5 Web Server Administration

Given the explosion of cloud services, virtualization and SOS methodologies, coverage of some key theoretical and practical aspects of these ideas will be added. There are plans to expand analytics, and discuss configuration management systems and containers.

3.6 Search Engines

Search engines will be expanded in the technical areas, by adding measures of similarity and spell checking algorithms. Integration of analytics and search as a service will be added as well as updated discussions of search engine optimization techniques.

3.7 Experts' Views

One of the most inspiring aspects of web development are the large number of professionals in the field. The technical, social and ethical issues raised in such large scale enterprises are not easily covered in an academic course or textbook, but do lend themselves well to short narratives on a topic. The second edition plans to include many expert opinions, that is, a page or less of content in which leaders from industry describe in detail an aspect of their operation.

4. CONCLUSION

We hope this paper will provide benefits not only to us as we write the next edition of our textbook, but also to other instructors and web practitioners in the workshop.

5. REFERENCES

- [1] Alston, P. *et al.* Uncovering Threshold Concepts in Web Development: An Instructor Perspective. *ACM Transactions on Computing Education (TOCE)* 15.1 (2015).
- [2] Connolly, R. & Hoar, R. 2014. *Fundamentals of Web Development*, Pearson.
- [3] Connolly, R.W. 2011. Awakening Rip Van Winkle: modernizing the computer science web curriculum. In *Proceedings of the 16th annual joint conference on Innovation and technology in computer science education (ITiCSE '11)*. ACM, New York, NY, USA, 18-22.
- [4] Grove, R.F. 2007, "Trends in Teaching Web-Based Development: A Survey of Pedagogy in Web Development Courses", *Proceedings of the 3rd International Conference on Web Information Systems and Technologies*.
- [5] Hoar, Ricardo. "The Real World Web: How Institutional IT Affects The Delivery Of A Capstone Web Development Course." *Proceedings of the Western Canadian Conference on Computing Education*. ACM, 2014.
- [6] Lee, A.H. 2003, "A manageable web software architecture: searching for simplicity", *ACM SIGCSE Bulletin*, vol. 35, no. 1, pp. 229-233.
- [7] Liu, Y. & Phelps, G. 2011, "Challenges and professional tools used when teaching web programming", *Journal of Computing Sciences in Colleges*, vol. 26, no. 5, pp. 116-121.
- [8] Miller, Craig S., and Randy Connolly. "Introduction to the Special Issue on Web Development." *ACM Transactions on Computing Education (TOCE)* 15.1 (2015): 1.
- [9] Wang, X. and McKim, James C. 2013. The opportunities and challenges to teach web programming in computer science curriculum CS2013. *J. Comput. Sci. Coll.* 29, 2 (December 2013), 67-78.