Chapter 2.6
Balancing Tradeoffs in Designing, Deploying, and Authoring Interactive Web–Based Learn–By–Doing Environments

Lin Qiu
State University of New York at Oswego, USA

ABSTRACT

Computer-based learn-by-doing environments have been used to provide students supportive and authentic settings for challenge-based learning. This chapter describes the design tradeoffs involved in interactive learning environment design, deployment, and authoring. It presents a combination of design choices in INDIE, a software tool for authoring and delivering learn-by-doing environments. INDIE's design balances the tradeoffs and leverages Web technologies to improve the accessibility and deployability of learning environments as well as feedback generation and authorability. It explores a vision of learning environments that are more accessible and usable to students, more supportive and customizable to instructors, and more authorable to software developers.

INTRODUCTION

The constructivist theory of learning has shown that learning is a process where the learner actively constructs understanding rather than passively receiving knowledge (Bransford, Brown, & Cocking, 1999; Bransford, Goldman, & Vye, 1991; Brown, 1988; Chi, Leeuw, Chiu, & LaVancher, 1994). This learning theory has become one of the dominant theories in education. It provides us a strong theoretical base about the nature of learning and calls for changes to the traditional didactic-based methodology of instruction. Meanwhile, greater demands are being placed on education systems at all levels to teach students the ability to apply knowledge and skills learned in classrooms to solve real-world problems. In response to these emerging needs, challenge-based learning has become a popular

new paradigm of teaching. It centers learning on investigation and development of solutions to complex and ill-structured authentic problems (e.g., Boud, 1985; Bridges, 1992). Students acquire content knowledge and problem-solving skills through self-directed learning. Instructors work as facilitators providing resources and coaching to students. While challenge-based learning offers an effective approach to improve teaching and learning, a number of difficulties occur in implementing it in schools (Hoffman & Ritchie, 1997). For example, activities in solving realistic problems can be expensive, time-consuming, and even dangerous. Students need extra support to have successful learning experiences in complex real-life contexts.

Scenario-based learn-by-doing environments have been built to support challenge-based learning. They put students in fictional scenarios and provide tools such as simulations and data portfolios for solving challenges embedded in the scenarios. For example, Alien Rescue (Liu, Williams, & Pedersen, 2002) is a learning environment where students need to find a new home in the solar system for aliens to survive. BioWorld (Lajoie, Lavigne, Guerrera, & Munsie, 2001) is a learning environment where students need to diagnose patients in a simulated hospital setting. The goal-based scenario (GBS) (Schank & Neaman, 2001; Schank, Fano, Bell, & Jona, 1993) is a framework for scenario-based learn-by-doing environments. It engages students in a real-life role to solve some realistic problem in a simulated world. Students can carry out activities that are not feasible in classrooms and receive just-in-time individualized feedback. For example, Sickle Cell Counselor (Bell, Bareiss, & Beckwith, 1994) is a GBS where students work as reproductive counselors advising couples on the level of risk their children would have for sickle cell disease.

Recent advances in technology such as the Web and inexpensive and powerful computers have been particularly promising in making computer-based learning environments more accessible and deployable. This chapter describes INDIE, a software tool for authoring and delivering learn-by-doing environments. While INDIE is based on the GBS framework, it leverages the Web technology to improve its deployability, authorability, and usability. We begin with an overview of INDIE and description of Corrosion Investigator, a learning environment delivered by INDIE. We then focus on the design choices in INDIE to illustrate how to balance the design tradeoffs in deployment, authoring, and learning support.

INDIE

INDIE is a software tool for authoring and delivering Web-based learning environments where students can run simulated experiments, collect data, generate hypotheses, and construct arguments. INDIE includes an authoring tool and a content-independent runtime engine. The authoring tool provides a form-based Web interface (Figure 1) for constructing the content in an INDIE learning environment. The runtime engine reads in the content and delivers a Web-based learning environment.

Learning environments delivered by INDIE consist of a common set of Web interfaces: a *challenge* screen showing a statement describing the challenge scenario, a *reference* screen where students can browse materials describing the scenario and domain content, an *experiment* screen where students can order tests and collect results, a *feedback* screen where students can read and respond to comments from the instructor on their work, and a *report* screen where students can construct arguments for or against possible hypotheses. INDIE learning environments automatically generate lab test results based on requests from students and provide support for students to construct arguments.

15 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/balancing-tradeoffs-designing-deploying-authoring/41349

Related Content

Healthcare Automation System by Using Cloud-Based Telemonitoring Technique for Cardiovascular Disease Classification

Basudev Halder, Sucharita Mitraand Madhuchhanda Mitra (2020). *International Journal of Web-Based Learning and Teaching Technologies (pp. 46-63).*

www.irma-international.org/article/healthcare-automation-system-by-using-cloud-based-telemonitoring-technique-for-cardiovascular-disease-classification/246038

Developing Students' Self-Regulation Skills Within and Outside Academic Modules

Peng Cheng Wang, Eric C. P. Chua, Karin Avnitand Sok Mui Lim (2023). *Supporting Self-Regulated Learning and Student Success in Online Courses (pp. 304-320).*

www.irma-international.org/chapter/developing-students-self-regulation-skills-within-and-outside-academic-modules/320081

Leadership in Higher Education in Adopting a Telecommuting Program

P. J. Snodgrassand Ernest W. Brewer (2012). *Technology and Its Impact on Educational Leadership: Innovation and Change (pp. 90-103).*

www.irma-international.org/chapter/leadership-higher-education-adopting-telecommuting/62913

Teaching and Learning Information Technology through the Lens of Web 2.0

Mark Frydenberg (2011). *Web 2.0-Based E-Learning: Applying Social Informatics for Tertiary Teaching (pp. 128-148).*

www.irma-international.org/chapter/teaching-learning-information-technology-through/45020

The Challenges and Opportunities of Online Learning for Preservice Teachers During the COVID-19 Pandemic: Evidence From the U.S. and Turkey

ule Ylmaz Özden, Valerie Harlow Shinas, Chu N. Lyand Nazire Burçin Hamutolu (2022). *Handbook of Research on Managing and Designing Online Courses in Synchronous and Asynchronous Environments (pp. 455-476).*

www.irma-international.org/chapter/the-challenges-and-opportunities-of-online-learning-for-preservice-teachers-during-the-covid-19-pandemic/292378