Guest Editorial

Open-Source Software for Engineering Education: Pedagogical Strategies That Leverage Open-Source Tools

VAST numbers of students and other people interested in learning resources can now exploit learning infrastructures and learning designs on the Web. Even larger learning resources reside in universities’ and organizations’ intranets and Web-accessible e-learning systems. As the amount of learning content available on the Web continues to grow rapidly, it is increasingly important to define effective methods and strategies that will exploit this content for the promotion of sound pedagogy. Especially in computer engineering education, this requirement relates to the critical need to enhance and promote the development of student skills and competencies.

The open-source software (OSS) paradigm encompasses a new philosophy for the enhancement of collaborative efforts and also provides a wide range of solutions to real-world problems. The technical approaches underlying such solutions usually come from communities of researchers and reflect their consensus on the social character of IT artifacts. Just as OSS is beginning to empower and energize learning solutions, the underlying principles and technologies can enhance a new era of pedagogical strategies. In this special issue of IEEE TRANSACTIONS ON EDUCATION, we focus on the new possibilities the OSS paradigm affords for improved computer engineering education and technology-enhanced learning.

I. FREE AND OPEN-SOURCE SOFTWARE

Free and open-source software (FOSS) has received growing attention in recent years from various perspectives. The dramatic increase in OSS adoption and contribution has galvanized the engineering education researchers who, in recent years, have been trying to decipher the phenomenon of OSS, its relation to already-conducted research, and its implications for new research opportunities that affect classroom instruction.

The current OSS landscape presents a very interesting picture. Although the idea behind OSS dates back to the 1960s and the Unix era in the 1980s, the term OSS was not coined until 1998. Since then, the OSS movement has evolved at a very fast pace. Prime examples of successful OSS projects include operating systems (Linux, FreeBSD, OpenBSD, NetBSD), Web browsers (Firefox, Konqueror), graphical environments (KDE, Gnome), productivity applications (OpenOffice), programming languages and infrastructure (Apache, MySQL), and development tools (GNU toolchain, Eclipse). These widely-accepted OSS endeavors demonstrate that a wide range of OSS applications are available and that they present a viable and robust alternative to proprietary software solutions. Many applications of FOSS for education are also available. Worldwide initiatives, such as Sakai, and a great number of the so-called open-learning management systems, challenge engineering education. The objective of this special issue is to communicate and disseminate recent engineering education research in this area, as well as the success stories that demonstrate the power of OSS to improve traditional engineering education and e-learning approaches. This issue will demonstrate state-of-the-art approaches in OSS systems that have been successfully applied in the classroom, and will show how new, advanced, pedagogical models and teaching strategies can expand the learning frontiers in engineering education. We hope this will initiate a dialog between the pedagogical, human, and technical views of this field that affect engineering education. Novel pedagogical approaches and sound technological FOSS solutions are presented which will create a context for this dialogue and exploration.

II. IN THIS ISSUE

The articles selected for this special issue lay out a path for the strategic exploitation of FOSS for more effective pedagogical strategies in real-world engineering education, and cover the following topics:

- use of FOSS for learning management systems;
- use of FOSS for learning objects and learning design approaches;
- pedagogical strategies for the deployment of FOSS tools;
- use of case studies;
- open-learning management systems;
- communities of learners in engineering courses through the deployment of FOSS tools;
- collaborative/constructive content authoring for engineering courses.

The latest FOSS developments contribute significantly to pedagogical performance, providing:

- new technological building blocks for solutions that support pedagogical scenarios;
- portfolio- or Wiki-based collaborative approaches to learning content creation and use;
- exploitation of social networks, including social activities and context;
- new insights into the formation of online-learning communities;
- technologies for semantic-based e-learning.
As always, a new era requires champions. The promotion of FOSS for engineering education requires a deeper understanding of pedagogical issues and challenges. This special issue both contributes to the literature and also sets new challenges for further research in this area. A key finding relates to the limited focus of pedagogical strategies in real world settings. The engineering education community can reap many benefits from the research presented in this special issue. Ultimately, this special issue highlights the need to look beyond the various trees of the FOSS era to see the forest, by defining strategic new pedagogical models, along with new knowledge and learning management models.

We invite the engineering education, management, computer science, and FOSS communities to develop synergies that will promote FOSS-based pedagogical strategies as a key enabler for a new era of more meaningful learning and education.

ACKNOWLEDGMENT

We thank D. A. Conner (former Editor-in-Chief of IEEE TRANSACTIONS ON EDUCATION) for giving us the opportunity to serve our community, and for his continuous commitment and contribution to a mutual vision. We also thank the academics and practitioners who contributed excellent research work to this special issue. We are grateful to the more than 60 reviewers who, with their comments and guidance, helped us reach the level of quality the articles in this issue represent. Finally, we thank our colleagues in the Association for Information Systems special interest group on Reusable Learning Objects and Learning Designs (http://www.sigrl.org) for the joint effort to promote the Open Source Vision in Education in computer science and information systems communities.

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