New Directions for Computing Education

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Editors

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Embedding Computing Across Disciplines

Springer

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Preface

In recent years, the conversation regarding interdisciplinary computing has moved beyond the boundaries of Computer Science and its related fields, such as Information Technology, Information Systems, and Software Engineering. It now ranges across all fields in academia, from the arts and humanities to the social and natural sciences. This volume has grown out of collaborative work with colleagues across this broad spectrum of disciplines. It originates in conversations hosted by professional organizations related to computing and education (including most notably SIGSCE, the special interest group for computer science education within the Association for Computing Machinery), in multi-disciplinary workshops on the topic, on advisory boards for academic programs and editorial boards on various publications, and in NSF activities and other projects. Simply put, in many activities of our professional lives, we found the conversation regarding interdisciplinary computing education to be expansive, inclusive, and thriving.

These conversations were highly energizing for our work as colleagues at Washington & Jefferson College. Our department is committed to thinking seriously and creatively about the most effective ways to integrate computing education at an institution founded on the principles of a liberal education. At W&J, we want to help our students solve problems with computing, not just to prepare them for careers in technology. We also seek to build a model for computing education that facilitates campus-wide research and collaboration. During our own local conversations, we developed a new curriculum based upon a constructivist epistemology designed to guide students toward an interdisciplinary exploration of computing and problem solving. We felt equipped to do this work by our collective disciplinary diversity, as our backgrounds include Computer Science, Data Science, Educational Technology, Archeology, and the Humanities. And so the discourse regarding interdisciplinary computing education became a part of our daily instructional work.

This volume captures some of the exciting trends in computing education that we believe will have a broad influence in the coming years. In our explorations of alternative models for delivering computing education, we encountered more and more educators at both large institutions and small institutions like ours who were

developing their own models for addressing the new demands on computing education. We observed that many diverse institutions were responding to new trends in education toward incorporating computing education into the broader curriculum. Since rapid technical change often heralds commensurate adjustments to educational philosophy and pedagogy, we recognized recent changes as opportunities to look broadly at computing education to identify new directions for its development.

Looking at these emerging trends and models is timely, as this conversation is also taking place in the context of a growing national focus on how to expand computer science education. The Computer Science for All initiative is advocating for computer science courses for all K-12 students and leads us to grapple with the problem of ensuring we have sufficiently educated and resourced K-12 teachers to meet this vision. We have seen both the recent launch of the AP Computer Science Principles course, as a less programming-focused alternative to the AP Computer Science A course; at the same time we see the rise of projects like Hour of Code, Girls who Code, and similar projects to get students started with basic programming skills. At the higher education level, coding bootcamps are being positioned as an alternative to a traditional degree for those wanting job training to enter the tech industry. Woven through all of this is a concern for how we ensure that these initiatives help us solve the problem of broadening participation in computing for all groups. The conversation on interdisciplinary computing has much to add to this discussion.

This book would not have been possible without the help and support of our colleagues, family, and friends. We are especially thankful to our contributing authors who cheerfully responded to numerous requests for information and ongoing communication regarding administrative minutiae, deadlines, and editing. These colleagues have been a pleasure to work with, and the quality of this volume is largely a testament to the effectiveness of their work in their respective fields; we are very proud to have the opportunity to associate our work with theirs. We are also appreciative of our colleagues at W&J who have participated in many conversations with us regarding our views on computing education and how it impacts their fields as well as our own. And we are especially thankful to family and friends who understood and supported us through our preoccupation as we compiled and collaborated on this book. We remain appreciative and humbled by such generous support.

Washington, PA, USA

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About the Editors

Samuel B. Fee (sam@washjeff.edu) is Professor and Chair of Computing and Information Studies at Washington & Jefferson College. His research interests extend into the realms of computing, education, and digital media production. His inquiries within these areas are aimed at better answering a few specific questions, including how do we best learn and conduct research within the broader realm of computing? How does technology change the way we interact with one another? How do visuals and interfaces impact our abilities to communicate and learn? He previously co-edited the volume *The Role of Criticism in Understanding Problem Solving*. He publishes regularly on the topics of computing pedagogies and educational research as well as software development and digital media.

Amanda M. Holland-Minkley (amh@washjeff.edu) is Associate Professor of Computing & Information Studies at Washington & Jefferson College. Her research explores novel applications of problem-based and hands-on pedagogies to computer science education, both at the course and the curricular level. These applications strive to take computer science content and render it in forms useful and accessible to students from a diversity of disciplines. She is also highly engaged in undergraduate research, with recent projects falling at the intersection of information security, data management, and machine learning.

Thomas E. Lombardi (telombardi@gmail.com) is Assistant Professor of Computer Information Systems in the School of Business at the University of the Virgin Islands. His research focuses on the application of data science and interdisciplinary computing to a wide range of subjects such as digital humanities, networking and bioinformatics. He is particularly interested in developing pedagogies for teaching data-oriented concepts to a broad audience for the purpose of improving civic education. Most recently his theoretical research addresses the potential role of computation in the analysis of iconography. Specifically, his project applies data mining and machine learning techniques to large repositories of artwork. Prior to his academic appointments, Lombardi worked as an application developer and consultant at data warehousing companies specializing in business and educational data.

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