Preface

Introduction: The Wh_ Questions

Why This Book?

Diversity is an omnipresent buzzword in academic circles in the continuing efforts to diversify curriculum. The term itself is hard to define, but everyone seems to understand it as plethora of varieties. We can define it as narrowly or as widely as needed in a given discourse, but the bottom line is that diversity is "being aware of what is there."

When thinking about my personal development in this very field, I am able to pinpoint the time I started thinking about diversity issues as such. In the 1980s there was a huge campaign for tolerance and against xenophobia in several European countries under the motto "All Different – All Equal!" Although the outcomes of that campaign are unknown to me, the developments in different parts of the region (SouthEast Europe) are perhaps witness that it was not too successful overall. Nevertheless, I learned that an awareness that we are surrounded with people different from ourselves in so many ways is perhaps the natural path that one could take when starting to explore the world of differences. Moreover, we all have our personal stories that motivate us on a daily basis to continue our diversity efforts.

Diversity awareness enriches a person. Being exposed to a variety of differences, a person's horizons broaden. Stereotypes and prejudices start to dis-

appear. Once initiated, the process is lengthy and gradual. The global advantages of diversity awareness are more than obvious, especially in the context of current world affairs.

We do not live in perfect academia. At the 2005 Yale Bouchet Conference of Diversity in Graduate Education (Yale School of Graduate Studies, Yale University, New Haven, Connecticut, April 1-2, 2005), a colleague and administrator of a large land grant institution in the Midwest was speaking about his personal experiences in convincing science and engineering faculty of the benefits of diversity as related to their research. He said that there are three groups, green, orange, and red, making a parallel to the colors of a traffic light. Those in the green zone had already understood the benefits of diversity and largely support the efforts of the institution; as such they were his supporters by default. Those in the orange zone were the "swing votes," and open to discussion. After some work, many of them "converted" into the green zone and became his greatest supporters. The red zone, however, composed of people that opposed diversity efforts, even openly, did not show signs of change in size.

Probably all of us have had experiences with colleagues from the red zone. I remember vividly a quite disturbing personal experience with a colleague that was a revelation of the ignorance and close-mindedness of the red zone academia. As we were closing up a meeting, I mentioned that I needed to wrap up quickly as I was getting late for a meeting of the University System of Maryland Faculty Diversity Network. The question I was asked was "What are you going to do there; is not diversity about women and African American only?"

As educators, we hold a great moral responsibility towards our students. We are shaping their minds, helping them grow, molding their lives and helping them to be exemplary members of society. That is a task, a responsibility and a challenge on one hand, but definitely an extraordinary opportunity, pleasure and honor on the other. Being aware of our differences makes us understand each other, solve differences more easily and even avoid them all together.

How This Book Kicked Off

In the beginning of my career in academia, I felt the need for guidance when striving to infuse diversity topics across the course curricula that I was teaching. In search of support, I came across a number of general titles, and especially literature on interventions in the lower segments of education (K-12).

Other books were clearly written for a Humanities audience on very specific topics.

Although there might not be a body of literature termed "studies on diversity issues in IT," that does not mean that there is a lack of it. One can find a body of work by prominent educators that refers to various aspects of the problems. There might not be a sufficient literature on what one would call the diversity theory as it relates to the field of IT, but there have been numerous articles where experiences from diverse Information Technology classrooms have been shared.

The idea for this volume came out of my personal need as educator for a tool of this kind. I used a few general education materials available and thought of transforming them to fit my teaching style and my students. I am glad that this book is being published, as it will save a lot of our successors many efforts that we had to go through when we needed a "one-stop service" volume such as this very one.

In an experimental (and, I might add, highly risky) venture, Yvonne Hardy-Phillips (Director of the Towson University African American Cultural Center) and I (a "diversity enthusiast" and junior faculty at the same institution) chaired the Tenth Annual Multicultural Conference "Dimensions of Diversity" at Towson University in March 2004. We decided to focus on the diversity issues in the sciences. Actually, the working title of the conference was "The Diversity of Science, the Science of Diversity." The conference was nothing short of a success and assured me that there is an audience and researchers even within the natural, computer and mathematical sciences for diversity topics. There is a need for research, a need to know the state-of-the-art issues and share experiences in providing solutions for the problems identified in the process. This revelation was my single most important motivation for starting work on this book.

A serious survey of the literature would reveal that this book is a first of its kind to deal specifically with diversity issues in Information Technology education. In lengthy discussions on these topics with colleagues across disciplines, it seems to me that the common perception of the Information Technology field is that it is, for lack of a better term, "diversity-unfriendly."

At first glance, the Information Technology field does not appear to be a "natural" for infusing diversity topics. Granted, due to the nature of the field, we might not be teaching as many diversity-specific courses as our colleagues in the Humanities (e.g., Women's studies, History, etc.), but we are certainly able to infuse as much diversity into our classrooms by simple transformations of our tools. In a generic and low-level example, when teaching a skill, such as

creating table in Microsoft® Word, instead of using generic hiring data from an ACME Tomato Company, we could easily find data on the number of women in the senates (or equivalent governmental structures) in a few countries (especially Scandinavia) and substitute a diverse example for the sterile one the textbook provides. This will initiate a process that builds upon on itself, and is extremely beneficial to both the students and the instructors.

To attempt to satisfy what I assumed would be a widespread curiosity about the diversity issues in Information Technology education, I invited several colleagues to comment, in a brief and personal way, on what they consider to be the greatest challenges in the field. To a degree, my curiosity about the state-of-the-art of diversity in Information Technology education at large has been satisfied. But above all, it has been sharpened: and that must be the greater compliment to the authors. As one would expect with such an array of contributors, the chapters speak with authority and a willingness to venture challenging views.

What is This Book All About?

It is true that the definition of the term diversity varies, based on context. Normally, authors choose a working definition that suits their discourse. These chapters cover a wide range of diversity categories, its various aspects, dimensions and how diversity relates to Information Technology education.

By looking at relevant statistics, or at introspective testimonials given by the authors or those surveyed, the state of the diversity landscape in Information Technology crystallizes. It seems that at present, the predominant, severe issue is the numbers of female and African American students in the classrooms. Studies have investigated environmental and other parameters that might have been the cause of these problems, and propose ways of fixing them. Of special concern are the low numbers of women and minorities enrolled in the Information Technology majors. There *are* and *have been* statistics to document these numbers and analyses have been performed. The situation is not only grave for those most visible (for lack of a better term) “diversity slices.” Other “slices” are not as easily identifiable or surveyed. But even with the information we have at hand, we can say that the situation is serious, and that efforts need to be made, not only quickly, but also on a large scale.

In this book, not only gender and racial issues are being discussed. Disability and learning styles issues, for example, are also being raised in some chapters. Diversity (of a different kind) can also emerge in a classroom setting. Within

open-ended and autopoietic organizations with their multi-agent human environments, various social phenomena emerge and are observed.

Diversity in the classroom can be accommodated in a myriad of ways. Studies suggest that the way we teach IT, for example, might be better suited for our male students. Different teaching strategies can fix that. For the students with disability, there is a wealth of accessibility options available today. Open-ended projects seem to work better for both the students and faculty.

It would be a natural assumption, if going by the title itself, that this book would treat only issues that concern the student in the classroom. However, it is actually not so. The issues concerning the student and the classroom are dominant in the book, but faculty is not neglected. Tips for faculty development and self-development are given in several chapters. These tips aid instructors who may be confused on how to approach the diversity infusion, how to manage the diversity in his or her classroom and how to prepare to face the challenges of a diverse Information Technology classroom, where not only the technology but the people are diverse as well.

Therefore, the basic idea of the book is to serve as a teacher's tool. When needed, an instructor may not only find relevant information, but be able to use the strategies overviewed in the book, to grow as a diversity-aware and -transfusing educator. The students will love it and so will the instructor. This process, however, does not happen in a one-way fashion. Students enrich teachers as much as the teachers enrich the students. I speak from personal experience.

What are the Issues and Challenges that the Chapters Focus On?

The spectacular specialization of research in Information Technology areas, coupled with a corresponding proliferation of journals, has meant that in many cases it is virtually impossible to keep up with what is happening in research areas adjacent to one's own, let alone those that are far removed. Other areas, however, are just emerging. Interdisciplinary research, coupling the Information Technology disciplines and the social studies, for example, is quickly emerging, producing significant insight into the problems and social phenomena that Information Technology inherently introduced and has continued to produce.

It is a cliché of book reviews that edited volumes are often a curious and idiosyncratic collection of chapters. Note that essential to the personal char-

acter of this volume was the need to avoid constraining contributors with rigid guidelines. We ended up with a rich selection of chapters, as diverse in focus as the topic of the book itself, but complementary to each other nonetheless. A brief description of each of the chapters follows. The chapters offer one of the many possible logical orderings that I have considered, and significantly complement each other. The book starts with chapters that may be termed theoretical, as they focus more on the *identification* of diversity dimensions relating to Information Technology education, and identify the present issues. Via chapters that are more *introspective*, contributors share their own and their students' experiences, we stress again, more personally on the gravity of the problem. The last few chapters offer solutions and are presented in the form of best practices—experiments that have worked for our colleagues and thus contribute to piecing together the *solution* mosaic. Therefore, to reiterate, the underlying idea of this book is to state the theory first and, by identifying the issues, provide possible solutions.

In the chapter, "Dimensions of Diversity in the IT Classroom Onground and Online," Bhattacharya and Jorgensen introduce us to the dimensions of diversity in a cultural context with special reference to the development of Information Technology in general, and make a special reference to Information Technology education. They justify that globalization of education in a true sense cannot be achieved only by establishing accessibility and developing cost-effective technologies. The authors debate the influence of Information Technology on diversity and global culture issues via the modes by which technology is currently being used. The authors argue that the ideal is not possible within present Information Technology usage unless the underpinning culture of the Information Technology curriculum is acknowledged, openly discussed and adjusted for. They develop a model in phases to discuss the difficulties in engaging with technology and thus find ways of increasing its usage particularly in the education sector.

As educators, we need to work towards creating a culture and providing an environment in which students are able to express themselves without risk or fear of retribution. In order to promote higher order thinking skills, we must move from the single expert view to a more collaborative and engaging classroom. In Information Technology, there are controversies and different solutions to problems. For example, students need to be helped to understand arguments for different points of view and to see how they relate to each other. The development of technological literacy, as well as life skills, would be accelerated using argumentation skills such as debating, justifying an opinion, weighing up conflicting points of view and analyzing disagreements. These skills are intrinsically linked to problem solving skills, and may be assessed in

dynamic and exciting ways, such as observation, interaction, group work and challenge. Arguments can be grounded on common knowledge, personal knowledge, testimony, plausibility and necessary truth. That is the essential message of John R. Daker's chapter titled, "Dialectic Argumentation for Promoting Dialogue in IT Education: An Epistemological Framework for Considering the Social Impacts of IT." These philosophies are essential to understanding both the made world and the new electronic age.

In the third chapter, "Bridging the Digital Divide: A Feminist Perspective on the Project," Mary Kirk examines the problem of power and access gaps in relation to both users and developers of Information Technology and proposes solutions from a feminist perspective. The chapter begins by explaining the importance of cross-disciplinary dialog between the so-called "hard" sciences (such as Computer Science and Information Technology) and the "soft" sciences (such as Psychology and Women's Studies). Next, Kirk attempts to demystify the "F Word" (as in Feminism) by providing a primer on the feminist approach and explaining how social institutions operate to teach values, attitudes and beliefs. The remainder of the chapter examines the impact of three social institutions (mass media, language and education) in relation to science and technology. Kirk explores the influence of mass media by providing examples of how stereotypes are used to teach limited and limiting beliefs that influence perceptions of science and technology. She demonstrates how language operates as a social institution in the male-oriented technology culture to privilege one gender over the other. Lastly, Kirk explores education as a social institution by sharing a brief history of women in science in the United States and explaining how methods of teaching and learning privilege certain groups over others. The chapter concludes by sharing the vision of feminist science-studies scholars for a science and technology for all and encourages us to pledge ourselves to birth a new social revolution on a global scale by bridging the digital divide.

In the chapter that follows, "Gender and Programming: Mixing the Abstract and the Concrete," Peter McKeena provides us with an examination of a theory of gendered styles in (computer) programming. The theory is predicated on the differences between male and female students in using the concepts of abstraction and black boxes. It critically explores the theoretical questions and issues raised and summarized in the design of an empirical, quantitative means of testing gender-based attitudes to black boxes, alongside and triangulated with ethnographic research into the experiences and attitudes of female students in relation to programming. This might be critical in identifying the low enrollment of female students in the Information Technology-related

fields and the problems of their retention within related majors once they have decided to pursue a degree in these fields. The paradigm shift represented by object-oriented programming is given particular consideration because of the claims made on its behalf within this debate, and as a special case of abstraction. The chapter concludes that there is no gendered difference in attitudes to black boxes in programming, and that the reasons for female under-representation in computing lie elsewhere, which gives another perspective on the assumed gender stereotypes of the male and female abilities and attitudes towards abstraction.

The fifth chapter, "Dimensions of Sustainable Diversity in IT: Applications to the Information Technology College Major and Career Aspirations Among Underrepresented High School Students of Color" by Stockard, Akbari and Damooei, acknowledges that diversity issues in the Information Technology field go beyond racial and ethnic dimensions to include many more. A finer resolution of the problem is presented in this chapter. Diversity aspects here include disability, age and other factors. While the chapter examines the different forces that affect the career aspirations and opportunities of individuals of color, women, the disabled and the young as they make decisions about relating to the Information Technology field, this chapter is inspired, but not fundamentally driven, by data rather than the need to expand the traditionally investigated aspects of the diversity complex. The authors assert that diversity should be viewed globally with the understanding that the globalization process has begun to change the dynamics of the phenomenon of diversification. In an effort to show the impact of career aspirations and the influences on the development of such aspirations among minority and nontraditional students, they show results from a recent study. This study looks at the career experiences, opportunities, attitudes and aspirations with respect to Mathematics, Science, Computer Science and Information Technology of underrepresented students in the federally funded Upward Bound and Math/Science Upward Bound programs. The chapter concludes with a brief discussion of the role of social and cultural creativity and innovation, arguing that these are essential components of a notion of *sustainable* diversity.

Alfreda Dudley-Sponaugle presents the sixth chapter of the book, "Under-Representation of African American Women Pursuing Higher-Level Degrees in the Computer Science/Technology Fields," with plentiful introspective on the problems of the missing student in the Information Technology classroom—the female African American. Statistical data show the disparity in representation of female students in general and African American women in particular in the Information Technology fields. There are relatively few African-American

women represented in the Computer Sciences/Technology areas. The number of African-American women pursuing a higher degree in these areas is almost non-existent. There are many factors, which may contribute to this trend. This chapter focuses on some of the complexities involved in this problem. Using statistical data, the author covers the socioeconomic, educational and cultural barriers, which have an effect on this under-represented populace. In conjunction with this information, Dudley-Sponaugle elaborates on some of her own experiences as a former student and an educator, as well as selected experiences of some of her students.

The situation in the enrollment and retention of students in the Information Technology fields is not different from the corresponding situation in the fields of Mathematics and the other "hard" sciences. In Chapter VII, "Working with Students in Math, Technology, and Sciences for Better Success: One Faculty Member's Experiences," Shah and Miller elaborate on an extensive effort to improve retention rates via specific advising strategies. These efforts span over a long period and have been successful. As a measure of success, the authors have used their own courses in chemistry as case studies. Therefore, with this chapter we present a successful case from another discipline that is completely transferable to the Information Technology field. By strong mentoring and devotion, students can make it. The interventions are done via—amongst other methods—devoted tutoring in basic Mathematics. Once the strong basics are built, the student's understanding of the core is strengthened and they manage to progress more easily through the more challenging upper-level courses. The authors present their efforts and experience in interventions in a vast range of courses for a diverse audience—traditional and nontraditional students in a university setting, as well as students in courses tailored to meet the needs of a specific private sector company.

In the eighth chapter, "Assessing Diversity Issues in Instructional Technology: Strategies that Enhance Student Learning and Generate Outcomes Assessment Data," Virginia Johnson Anderson stresses that the primary focus in higher education today is the assessment of student learning. IT faculties and departments are being asked to document quantitatively what students have learned in relation to goal-oriented expectations. Although that "students will value diversity in the academy and the workplace" is a common course, General Education or institutional goal, we often know little about how well students achieve this goal because we do *not* assess it. This chapter describes how to construct Student Learning Outcomes consistent with valuing diversity, how to design tests/assignments to see if students have achieved those outcomes and how to use that information to inform and enhance student learning in their IT courses, departments or institutions.

Holding up diversity as something that has to be learned as if it is part of the curriculum may sometimes be counterproductive. It is perhaps much more natural and sensitive to allow diversity to become part of the curriculum by the way it is integrated into student learning. The projects that Chapter IX, "The Open Ended Group Project: A Way of Including Diversity in the IT Curriculum," is devoted to, are one such method that can allow educators to tackle the issues surrounding diversity without making it a separate part of the curriculum. In this way, students are able to discover the many issues that a heterogeneous society has as part of its makeup. They see how differences between people operate in the real world and experience for themselves that these differences are a source of much strength and excitement. The OEGP seeks to foster cooperation amongst students by providing a common goal for them to work to and encouraging them to pool their skills. Educators can work definite diversity issues that need to be addressed into the OEGP idea or they may leave it more fluid and tackle issues as and when they arise. By simply putting people together, their differences are bound to surface, and students will necessarily have to face those differences and learn how they might be used to best advantage. In this way, the OEGP provides a natural method of confronting diversity and learning how rich people's differences make social and working life.

Many in Information Technology education—following more than 20 years of multicultural critique and theory—have integrated "diversity" into their curricula. Nevertheless, while this is certainly laudable, there is an irony to the course "multiculturalism" has taken in the sciences generally. By submitting to a canon originating in the humanities and social sciences—no matter how progressive or well-intentioned—much of the transgressive and revolutionary character of multicultural pedagogies is lost in translation, and the insights of radical theorists become, simply, one more module to graft onto existing curricula or, at the very least, another source of authority joining or supplanting existing canons. In this essay, we feel that introducing diversity into Information Technology means generating a body of creative criticism from within Information Technology itself, in the same way multiculturalism originated in the critical, transgressive spaces between literature, cultural studies, anthropology and pedagogy. In Chapter X, "Attack of the Rainbow Bots: Generating Diversity through Multi-Agent Systems," Collins and Trajkovski trace their own efforts to develop isomorphic critiques from recent insights into multi-agent systems using a JAVA-based software agent they have developed called "Izbushka." With Izbushka the authors not only study the diverse learning processes in human subjects, especially learning in context, but in this environment, diversity emerges and is generated.

The eleventh chapter, "Adaptive Technology in a Computing Curriculum," describes how adaptive technology for the disabled can enhance a computing curriculum. Blaise Liffick argues that computer professionals will naturally have an increasing role in the support of adaptive technology because of economic, legal and social pressures, and that consequently, adaptive technology topics should be covered within a standard computing curriculum. Ideas for integrating adaptive technology topics into computing courses are presented, along with an outline of an advanced course on adaptive technology from an Information Technology perspective. A model adaptive technology laboratory for supporting these efforts is described in detail. Liffick hopes that this chapter will encourage Information Technology educators to use adaptive technology topics as examples within their courses, ultimately leading to a computing workforce that is ready, willing and able to provide fundamental adaptive technology services to those with disabilities as well as a workforce that is aware and knowledgeable of the issues of their colleagues with various disabilities, and knows how to accommodate their needs.

Introducing diversity topics in the natural, mathematical and computer sciences is a hard task, since these disciplines are traditionally labeled as "diversity-unfriendly," due to the primary foci of their study. In Chapter XII, "Tessellations: A Tool for Diversity Infusions in the Curriculum," Sarhangi, Meiselwitz and Trajkovski illustrate how tessellations can be used as a tool for the infusion of multicultural topics. The authors give a framework, designed after the Towson University (Towson, Maryland, USA) course "Computers and Creativity," where these concepts have been successfully implemented.

With the last chapter, "Training Faculty for Diversity Infusion in the IT Curriculum," Trajkovski offers a flexible training environment and strategies for diversity infusion in the Information Technology curriculum. The chapter overviews the so-called "My First Diversity Workbook," and how the author uses it in his diversity trainings for faculty. The major part of the workshops consists of four parts. In the first part, the trainer talks abut his or her positive experiences of diversity infusion in the curriculum, and serves as a motivational component of the training. The second and third components provide inspiration for the micro and macro infusion of topics into the curriculum from the outside and the inside. By using external examples and facts, or internal experiences and introspections, the instructors can successfully diversify a unit lesson or the whole curriculum. In the fourth component, the trainer talks about continuing to share classroom experiences after the workshop is done—usually online—within the framework of an e-group. Trajkovski offers a de-

scription of how to fit these four components in two different contexts, and describes in detail the schedule and the experiences of the participants from those two workshops, custom-tailored to the needs of the institution that the trainings had been designed for. These workshop patterns are fully replicable. The chapter not only describes the author's strategies in covering the topics, but also provides a selection of sources that the trainer and the participants may use when replicating or modifying this training pattern.

How to Use This Book

This book presents an organized reading on the state of diversity affairs today in the field of Information Technology education. With convincing facts, we now see the actual problems more clearly and are able to identify the critical points that need mending. As for the readers that are professional educators in IT, they will see that they are infusing diversity in their teaching on a daily basis, without realizing it or labeling it so, which will give them a personal motivation to do it even more and better.

This book attempts to shed light on the status of diversity in the field of Information Technology education. As a first book on this very topic (to the best of our knowledge), it identifies a wide range of problems that educators face on daily basis and proposes practical, applicable solutions, mainly by showcasing successful and replicable examples. Chapters present research and introspection on racial, gender, national origin, disability and other diversity categories. The course and training examples, success stories from retention efforts and the strategies in assessment that account for diversity all supplement the topics with practical examples on how to identify, face, act and intervene when an instructor is thinking of infusing diversity topic(s) in the curriculum, whether on a small, unit level, or course-wide or even curriculum-wide level in general.

This book represents a pioneering work in a field that is slowly shaping itself. Despite the other Information Technology fields, this branch is in its very inception. It is a significant repository of relevant statistics teaching strategies and case studies that are easy to replicate.

The foreword of the book calls for education for all. That basically is the motivation of all chapters of the book. We want to be effective, equal opportunity instructors and do the best we can to accommodate all of our students in our classrooms. We as educators—especially in higher education—are not in a position to do miracles when trying to remedy problems that have rooted

deep in, say, the socio-economic background of a student. However, we can do something, and that is important. We can work on helping our students broaden their horizons, know diversity and enter a more comfortable and accommodating workforce (and world in general), one that suits them better.