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Computer Science is not Enough

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Abstract: *Despite huge investment, and the best of intentions, most development projects fail. This is particularly true of Information and Communication Technology for Development (ICTD) projects. We contend that a significant contributor to this failure is the lack of breadth in project design and implementation, and in the training of project implementers. Successful ICTD interventions, in addition to being based on the best computer science research has to offer, must be guided by the relevant social, cultural, political, economic and gender factors that underlie the interaction of the technology with the community into which it is being placed. We therefore argue that efforts to distance computer science from the broader context of ICTD scholarship and practice are misguided. ICTD should be recognized as a truly interdisciplinary area of research and practice. We further argue that ICTD as a discipline has a particular need for academic practitioners. We close with a compilation of current known ICTD academic efforts worldwide.*

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There are several active debates within the ICTD active community – is ICTD becoming a standalone subject? If it remains a sub-discipline, under what department(s) should it live? These arguments, however, are secondary to the more important question – are we doing ICT *for* Development, or ICT and Development? We push for the primacy of the former, as the intent of ICTD is actively to promote human and community development.

1. Computer Science and ICTD

1.1. The Digital Divide

The majority of the world's population does not have adequate access to information or communication. Roughly 2.5 billion people in the Global South live on less than two dollars a day (Collins, Morduch, Rutherfod and Ruthven, 2009). Among this group, several countries have less than 1% internet penetration (ITU, 2009). Illiteracy, lack of education and training, lack of power and communication infrastructure, and higher priority community development objectives combine to limit the effectiveness of efforts to introduce information and communication technology (ICT)-based development solutions. People in developing communities usually cannot benefit from the introduction of telemedicine, distance education, e-government, and other sophisticated Internet and technology-based strategies that are prevalent in the developed world.

1.2. The Need for Breadth

Despite billions of dollars invested with the best of intentions, there is a demonstrable lack of success in achieving global and local development objectives. This is particularly true of Information and Communication Technology for Development (ICTD) efforts. We contend that a significant contributor to this failure is the lack of breadth in both the implementation of development, and in the training of those who practice development. Those who work in development tend to communicate only with those most aligned with their field. For example, food security experts rarely attend community informatics conferences; health experts rarely attend ICTD conferences. Even re-

searchers and practitioners within the same community rarely cross paths (especially when there are significant geographical distances between them), and journals go unread by the communities who have contributed to the findings reported therein, who are therefore unable to put the recommended outcomes into action. It is little wonder that the needle barely moves in the overall progress of under-developed communities.

Many of these concerns have been articulated in the three ACM/IEEE ICTD conferences to date. However, while attendance at this conference is continues to grow, many of the presenters and attendees are the same from year to year – a predominantly computer science-oriented group of researchers and practitioners who themselves bemoan the disconnect in ICTD between the "ICT" and the "D." This separation is largely the result of both legacy and timing. Development studies has been an area of scholarship and practice for over 60 years; mass communications departments have been working in ICTD (although it is called development communications in this space) since the 1960s. Computer science is late to the game – yet often does not adequately acknowledge or build upon development's historical foundations. The underlying view that computer scientists will save the world because other development sectors have not yet been successful in doing so is naïve and overlooks the complexities of real-world development.

Information and Communication Technology *is* a critical component in global change strategies, but it needs to be considered as a component of development rather than as a stand-alone development sector. The eight UN Millennium Development Goals (none of which list ICTD access, use and capacity building as top goals) have encouraged numerous articles about the transformative role that ICT can and should play in attaining these goals (Gerster and Zimmerman, 2005; InfoDev, 2006). While the MDGs perhaps can be criticized for their normative approach to global iniquities, they have galvanized and coordinated efforts across industry, academia, practitioners, multilateral agencies and foundations, and NGOs. ICTD, especially the ICTD efforts grounded in computer Science, would do well to be as inclusive and cohesive.

1.3. ICT for Development vs. ICT and Development

Mainstream computer science research has the potential to drive ICTD innovation, while at the same time contributing to mainstream "First World" research and development efforts. There are few limits to the hardware and software systems that computer science can bring to bear upon the seemingly-limitless problems that result from sustained community and regional underdevelopment. The current approach – creating technologies based primarily upon our understanding and standpoint – perpetuates a model of ICT *and* Development, where we are technical experts whose talents can be used in development interventions. In contrast, creating technologies that have the potential to catalyze social change, and mapping human needs to technologies that directly respond to specific development problems represents ICT *for* Development.

In a time of stagnant or declining enrolments matched with anxiety myths about the health of the technology sector, ICTD is a natural draw for students and faculty who aspire to greater impact. Yet, academic instruction and research in ICTD is limited to the extent that interdisciplinary lineages exist and support ICTD done "right." There is a critical need to develop institutional infrastructure and funding support models for the academician who is 50% computer science; 25% mass communication, information systems and sociology; and 25% development studies. This need is not unique to computer science departments; social science and humanities programs that have traditionally been the home of graduate development students cannot remain effective without the ability to leverage the power and near-ubiquity of modern ICT. The list of known academic ICTD efforts, listed in the Appendix, demonstrates the breadth of ICTD topics and home departments representative of this interrelated field. Master's program designed to offer a holistic education in the interrelated nature of development do exist – there are programs at the University of Manchester (UK), Universidad Rey Juan Carlos, University of Stockholm, University of Salzburg, and a joint academic program between the Hasso Plattner Institute and University of Capetown. However, the fear of the interdisciplinary disciplinary field pervades – how can we ensure sufficient

depth in the presence of breadth? This argument is not new – interdisciplinary research and education programs routinely face such questions, despite demonstrated funding and research success.

Universities tend to be conservative when it comes to organizational structure. Even as we argue against academic silos, we fight to preserve the purity and primacy of our historic intellectual turf. This contradiction is emblematic of the need cross-cutting academic programs that can focus the intellectual breadth of the entire campus upon ICTD education and research, and in which faculty (especially junior faculty) are rewarded for applying their domain proficiency in larger context of development.

2. The Need for Academic Practitioners

Universities have long enjoyed a reputation for advancing learning through service, although the reality is that many such efforts contribute to a schism between research and praxis. Given the potential for ICTD to support a rich assortment of development strategies, universities need to graduate experts who can help bridge the gap between the advantages of the networked information society, and those with the greatest potential to benefit if issues of access, social equity, sustainability, and appropriate design and distribution are addressed. However, the focus has to remain on people – if ICTD experts are not focused on actually serving human need, it's not development.

As a research area, ICTD is just now emerging as a clearly identifiable focus – there are perhaps a half dozen respected ICTD journals, and the premier conference in the field is less than four years old. A 2010 report shows that the field is growing, with several hundred academic researchers and several thousand graduate students working in some aspect of ICTD (Heeks, 2010). Although ICTD is emerging as a formal discipline at several of universities internationally, only a few programs related to ICTD exist in the United States. These programs primarily cater to the doctoral student, although there is a trend towards master's level programs, including ICTD certificate curricula and the announcement of two Master's degrees in ICTD to bring the total "practitioner" programs worldwide to six – of which five are in the European Union. Of the 100 ICTD courses taught at Universities worldwide, only 20% are taught in computer science departments.

If computer science is late to the game, American universities are also overdue in recognizing the value of the ICTD academic practitioner as a driving force for effective ICTD development and deployment, whose efforts will in turn sustain ICTD research and scholarship.

More than ever, we need to develop and support programs that represent a commitment to challenge both the academic silos and chasms in development that serve to perpetuate the inequities of underdevelopment. ICTD academic programs need to build on existing on-campus expertise and strength in many of the core areas that define the discipline, which will provide a focal point for both practice and research. The interdisciplinary nature of ICTD demands us to create interdisciplinary programs that make people more capable learners, more innovative teachers, more creative thinkers, more effective leaders and more engaged global citizens.

Instead of the focus on short-term research projects and discussions about tenure in ICTD, programs would be better served to train academic practitioners to strategically and efficiently utilize technology to help facilitate health, education, civil service and poverty alleviation initiatives all over the world, as well as to connect these efforts to amplify their impact. To this end, students will need to both specialize in the technical and social aspects of ICT while acquiring a broad foundation in development studies, public health, social sciences and assessment methods, in order to make a positive difference in the complex and interrelated systems of community and economic development. In order for ICT-based development interventions to succeed, technological considerations must be balanced with social, cultural, political, gender and other issues not related to the chosen technology. Only when students are channelling human needs into technical solutions, we can say that we are "doing" development.

Appendix: Known ICTD Courses

Institution	Course Title	Level	Home Department
Agder University & Mzumbe University	ICT in Development	G(grad)	
American University	Nations, Policy & Information Technology	G	Kogod School of Business
BRAC University	Development Informatics	G	Development Studies
Butler University	International Communications Systems	U (under-grad)	Journalism
CalTech	Product Design for the Developing World	U	
Carnegie Mellon University	Human-Computer Interaction in the Developing World	G	School of Computer Science
Carnegie Mellon University	Technology and Global Development		School of Computer Science
Carnegie Mellon University	iSTEP: Technology Field Research in Developing Communities		School of Computer Science
Carnegie Mellon University	Technology for Developing Communities		School of Computer Science
Carnegie Mellon University	Technology and Global Development	U	School of Computer Science
Carnegie Mellon University	Technology and Policy for Disaster and Humanitarian Response	G	School of Computer Science
Colorado State University	Technology in Community-Based Development	G	Intl Institute for Sustainable Development
Copenhagen Business School	IT, Institutions and Development		
Dominican University	Community Informatics	G	Library and Information Science
Finnish Virutal University	ICT for Development		
George Mason University	Managing the Digital Divide	G	School of Public Policy
Georgia Tech	Computing for Social Good/Computing for Good (C4G)	U/G	International Affairs and Computer Science
Georgia Tech	Science, Technology & International Affairs	U	International Affairs and Computer Science
Georgia Tech	Computers, Communication & International Development	G	International Affairs and Computer Science
Global Virtual University	ICT in Development		
Indiana University	Globalization and Information	G	School of Informatics
IIT Bombay	ICT, Gender and Development		Psychology
IIT Bombay	Information and Communication Technologies For Socio-Economic Development		
Indian Institute of Technology Delhi	Electronic Governance	U	Sociology
KTH Sweden	Introduction to ICT for Development		
Loyola College (MD)	Community Informatics/Community Tele-centers	G	Computer Science
MIT	ICT4D: Information and Communication Technologies for Development		Health Sciences, Computer Science

MIT	Launching Mobile Ventures for the Next Billion Consumers		Health Sciences, Computer Science
MIT	Dlab II - ICT4D		Center for Developmental Comm.
Michigan State University	ICT for Development	U	Department of Telecommunication
Michigan State University	ICT Global Corps Field Study	U	Department of Telecommunication
Monash University	Social informatics	G	Faculty of Information Technology
MOP Vaishnav College for Women	Information & Communication Technologies	G	Communications
National University Of Singapore	State & Civil Society In The Information Age		Communications and New Media Programme
National University Of Singapore	ICTs & Development		Communications and New Media Programme
NYU	Information and Communication Technologies (ICT) for Developing Regions		Computer Science
NYU	New Approaches to Digital Learning (Educational Technologies in Global Context)		Educational Communications
Örebro University	Egovernment Systems in Developing Countries	G	School of Business
Queen's University	Advanced Studies in Information and Communication Technology	U	Sociology
Royal Holloway, University of London	Information and Communication Technologies for Development	U	Geography
Royal Holloway, University of London	ICT4D Short Courses		
Royal Institute of Technology in Stockholm	Doctoral seminar on Social and community informatics	G	
SUNY - Albany	Social and Community Informatics	U	Department of Information Studies
Syracuse	Technology as Public Good	G	Community and Information Technology Institute
Teri University (India)	Science, technology and sustainable development	G	MDP Program
Texas State University	International Communication Issues	G	Journalism
Tulane University	Information Technology and International Development	U	Payson Center for International Dev.
Tulane University	Information and Communication Technologies for International Development: Global Digital Divide	G	Payson Center for International Dev.
U Capetown	ICT4D	U	Computer Science
U Indiana	Globalization and Information	G	School of Informatics
U Michigan	Digital Government I: Information Technology and Democratic Politics	G	School of Information
U Michigan	Digital Government II: Information Technology and Democratic Administration	G	School of Information
U Michigan	Community Information Corps Seminar	G	School of Information
U Michigan	Information Use in Communities	G	School of Information
University of Missouri St. Louis	Development Communication		

U Toronto	Community Informatics	G	School of Information
U Toronto	Digital Divides	G	School of Information
U Wisconsin	Linking Information Technology and Community Organization Information Practices	U	Sociology
UC Berkeley	Social Entrepreneurs in ICTD		School of Information
UC Berkeley	ICT for Development: Context, Strategies and Impacts		School of Information
UC Berkeley	Graduate Reading Seminar on ICT and Development	G	School of Information
UC Berkeley	Information and Communications Technology for Development		School of Information
UC Berkeley	User Interface Design and Development	G	School of Information
UC Berkeley	Governanace of the E-conomy	U	Political Science
UC Berkeley	Designing Rural Computing Applications	G	School of Information
UC Berkeley and CMU	An Information and Communications Technology (ICT) Framework for Developing Regions	U	
UC Santa Cruz	Technology Targeted at Social Issues		Computer Science
UC Santa Cruz	Information and Computing Technology for Development		Computer Science
Universidad Católica Boliviana	ICT for Development		
Universidad Complutense de Madrid	Las Tecnologías de Información y Comunicaciones como herramientas de Desarrollo Humano: Brechas y oportunidades digitales		
Universidad Politécnica de Madrid	TIC y Desarrollo Humano		
University of Brighton	Information and Communications Policy		
University of Brighton	Communications and Development		
University of Brighton	Community Informatics		
University of Brighton	The Network Society		
University of California at Los Angeles	Information Services in Diverse Cultural Communities	U	Dept of Information Studies
University of Colorado, Boulder	Graduate Seminar on ICTD	G	ATLAS Institute
University of Colorado, Boulder	ICTD Projects Course	G	ATLAS Institute
University of Colorado, Boulder	Fieldwork Methods for ICTD Practitioners	G	ATLAS Institute
University of Exeter	Building Sustainable Communities: Regeneration and Development	G	Geography
University of Illinois (UIUC)	Digital Divide: Policy Research and Community Empowerment	G	Library and Information Science
University of Illinois (UIUC)	Community Informatics Concepts	G	Library and Information Science
University of Illinois (UIUC)	Community Informatics Research and Theory 1	G	Library and Information Science

University of Illinois (UIUC)	Social informatics	G	Library and Information Science
University of Kuopio	Information and Communication Technology for Development		
University of Manchester	ICTs for Development	G	IDPM
University of Manchester	ICTs and Social Economic Development	G	IDPM
University of Manchester	E-Government	G	IDPM
University of Manchester	ICTs in Practice	G	IDPM
University of Maryland - Baltimore County	Women, Gender and Information Technology		
University of Missouri	Digital Divide: Race, Class, Education and Technology	G	Law
University of Oslo, Norway	Implementing Health Information Systems Programme from Anthropological Perspective	G	Department of Informatics
University of Oxford	ICT for Development	G	Oxford Internet Institute
University of Salzburg	Technologies and Humanities I		CASRICTS
University of Salzburg	Technologies and Humanities II		CASRICTS
University of Salzburg	Politics & ICTs		CASRICTS
University of San Francisco	International Telecomm Technology		School of Business and Management
University of San Francisco	Telecommunication Policy and Strategy		School of Business and Management
University of San Francisco	Special Topics		School of Business and Management
University of Southern California	Research Seminar on Mobile phones, On-Line Community, and Social Change	G	
University of the Philippines	Special Topics - ICTD	U	Public Administration and Governance
University of Toledo	Community Informatics	U	Sociology
University of Trento	CT4SD: Information and Communication Technologies for Sustainable Development	G	School of Information and Telecommunicaiton
University of Washington	Digital Games Research for ICTD		Technical Communication (Engineering)
University of Washington	Capstone Projects for ICTD	U	Computer Science & Engineering
University of Washington	Technology for Low-Income Regions	U	Computer Science & Engineering
University of Washington	Information in Social Context	G	School of Information
University of Washington	ICTD Seminar	G	Computer Science & Engineering
University of Washington	Mobile/Cloud Applications for Emerging Regions	U/G	Computer Science & Engineering
University of Washington	ICTD Design Experience	U	Computer Science & Engineering
University of Washington	Computing for the Developing World	G	Computer Science & Engineering
University of Washington	International Communication and National Development		

Wageningen University	Technography, Researching Technology and Development		

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