Transforming our World Through Design, Diversity and Education
Proceedings of Universal Design and Higher Education in Transformation Congress 2018

Edited by
Gerald Craddock
Centre for Excellence in Universal Design, Dublin, Ireland

Cormac Doran
Institute of Technology Blanchardstown, Dublin, Ireland

Larry McNutt
Institute of Technology Blanchardstown, Dublin, Ireland

and

Dónal Rice
Centre for Excellence in Universal Design, Dublin, Ireland

IOS Press
Amsterdam • Berlin • Washington, DC
Preface

“Céad Míle Fáilte”
“A Hundred Thousand Welcomes”

UDHEIT2018, at its heart is a collective celebration of “Good Design”.

All our contributors, the users, designers, practitioners, educationalists, theorists and policy makers continue to demonstrate that good design enables and that each and every one of us is a designer.

The journey towards realising the UDHEIT2018 congress has been both an emotional and empowering journey bringing the two communities of higher education and universal design together. The themes and subject areas covered in these proceedings capture the wonderful diversity of our community of practitioners – building on a strong foundation in research, policy and practice. This publication marks a moment in time, with each contribution reflecting the shared values and beliefs, at the intersection of the fields of Higher Education and Universal Design. Harnessing this collective ambition is a potent resource with transformative potential.

The “whole systems” approach covering the macro (International/National), meso (Regional/Institutional) and micro (Coalface), the barriers and facilitators to full participation for all citizens will be discussed and debated at this international congress. Each of these elements is drawn from individual experiences, revealing a rich seam of transferable knowledge and skills that will empower a new generation of learners and designers.

The recent report by the OECD showing that people have become more pessimistic about their prospects of “social mobility” over the last two decades is a timely reminder of our need to view the required transformation from a “whole systems” perspective. The perceived risk of sliding down the social ladder is growing in nearly all OECD countries. Our focus must be on creating a more equitable and inclusive society where there is the prospect of social mobility, the alternative is bleak with the strong likelihood of further erosion of economic growth as well as a decrease in life satisfaction and wellbeing. According to the OECD this vista will have a further negative impact on social cohesion and democratic participation.

To support us in our journey, the United Nations Sustainable Development Goals advocates for equality, recognising that Universal Design is an important concept that should be incorporated in all person-centred policies. Moreover, the United Nations Convention on the rights of Persons with Disabilities (UNCRPD) clearly stipulates that the most effective way of delivering on the promise of an inclusive society is through a Universal Design approach.

The author of “The Fourth Industrial Revolution” – Klaus Schwab calls for leaders and citizens to “together shape a future that works for all by putting people first” empowering them and constantly reminding ourselves that all of these new technologies are first and foremost tools made by people for people. For this “Global Citizen” to live and thrive in an increasingly sophisticated technological world, education has a key role to play in requiring us all to take up our responsibilities now and into the future as active citizens in all facets of our lives whether we are customers, designers, creators,
voters or decision makers. It is for all of us to work in partnership with disadvantaged communities and marginalised sectors of society going on a “learning journey together” producing more active, participating citizens which in turn creates a more equitable and fairer society and in doing so enabling us to halt the persistent cycle of reproducing societal inequalities.

The large number of paper and workshop submissions for our congress from across the globe is a testament to the current state of Universal Design – exemplars which illustrate “what to do” and “how to do it”. The next phase of evolution in this field is to continue to articulate the “Why?” The Why question gets us to examine our beliefs and it is our beliefs that ultimately guide our behaviours and decisions. Therefore, what is now required is a transformational shift, which will move us beyond understanding Universal Design to experiencing and feeling it and make it central to our work. As David Rose (Director of CAST) said at our Universal Design conference in 2015 in Dublin, what is now needed is an “emotional response” as too many within our society have had negative experiences and feel disconnected from the mainstream. Universal Design and UDL (Universal Design for Learning) have expanded to look at exclusion from a social-emotional perspective (i.e., physical access is not enough; there must be belief that all students are able to learn, and all students must have access to learning). Our response now needs to be based on a creative and emotional response in how we design our environments, products and services.

Therefore, we humbly request and give you permission to leave your “Mask” behind and lead with your hearts and souls.

In all the social and public spaces, we inhabit including our Higher Education campuses, we meet individuals whose needs are as varied and complex as their personalities. In other words it is “Normal to be Different”. It has become clear that communities of siloed practices are limited and do not deliver for today’s complex and diverse world. A vision shaped by the needs of the communities we serve can transform exclusive environments to inclusive, connected and engaged experiences for all. Universal Design provides us with a framework and an opportunity to re-imagine our policies, facilities, services and curriculum, guided by a collective wisdom that declares “Diversity – Is the new normal”.

But, finally this work is an unfinished symphony – it needs your creative and emotional energy to bring this message to new audiences.

To all our reviewers, organisers and editors, the driving force behind UD-HEIT2018, we hold the vision that together we can achieve more. Each paper, presentation and conversation builds towards that goal of good design in all aspects of what we do. Let these papers (and our companion papers on Arrow@DIT) guide and inspire you, as you continue your journey, taking up the mantle by demonstrating that the emotional, philosophical and theoretical underpinnings of universal design can be realized in practice.

“As water takes whatever shape it is in,
so free may you be about who you become”
(A Blessing for Equilibrium by John O’Donoghue)

Gerald Craddock, Conference Chair
Centre for Excellence in Universal Design

Larry McNutt, Conference Chair
Institute of Technology Blanchardstown
# Committees

## Conference Co-chairs

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gerald Craddock</td>
<td>Centre for Excellence in Universal Design</td>
</tr>
<tr>
<td>Larry McNutt</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
</tbody>
</table>

## Conference Organisation

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brian Campbell</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Yvonne Cooke</td>
<td>TU4Dublin Programme Team, Dublin Institute of Technology</td>
</tr>
<tr>
<td>Gerald Craddock</td>
<td>Centre for Excellence in Universal Design</td>
</tr>
<tr>
<td>Cormac Doran</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Bill Hunter</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Margaret Kinsella</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Larry McNutt</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Mairead Murphy</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Donal Rice</td>
<td>Centre for Excellence in Universal Design</td>
</tr>
</tbody>
</table>

## Scientific Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shahid Alvi</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Francesc Aragall</td>
<td>Design for All Institute Foundation</td>
</tr>
<tr>
<td>Declan Brady</td>
<td>Irish Computer Society</td>
</tr>
<tr>
<td>Catherine Bridge</td>
<td>University of New South Wales</td>
</tr>
<tr>
<td>Brian Campbell</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Jordanne Christie</td>
<td>Durham College</td>
</tr>
<tr>
<td>John Clarkson</td>
<td>University of Cambridge</td>
</tr>
<tr>
<td>Scott Clerk</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Brian Corcoran</td>
<td>School of Engineering, Dublin City University</td>
</tr>
<tr>
<td>Gerald Craddock</td>
<td>Centre for Excellence in Universal Design</td>
</tr>
<tr>
<td>Wesley Crichlow</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Peter Cudd</td>
<td>University of Sheffield</td>
</tr>
<tr>
<td>Catherine Deegan</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Cormac Doran</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Kevin Dougherty</td>
<td>Durham College</td>
</tr>
<tr>
<td>Richard Duncan</td>
<td>RL Mace Universal Design Institute</td>
</tr>
<tr>
<td>Shaun Ferns</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Enda Finn</td>
<td>Visual and Human-Centred Computing, Dundalk Institute of Technology</td>
</tr>
<tr>
<td>Valerie Fletcher</td>
<td>Institute for Human Centered Design</td>
</tr>
<tr>
<td>John Gilligan</td>
<td>School of Computing, Dublin Institute of Technology</td>
</tr>
<tr>
<td>Damian Gordon</td>
<td>School of Computing, Dublin Institute of Technology</td>
</tr>
<tr>
<td>Gary Granville</td>
<td>National College of Art and Design</td>
</tr>
<tr>
<td>Name</td>
<td>Institution</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Geraldine Gray</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Ali Grehan</td>
<td>City Architects, Dublin City Council</td>
</tr>
<tr>
<td>Tom Grey</td>
<td>TrinityHaus, Trinity College</td>
</tr>
<tr>
<td>Ruth Harris</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Jim Harrison</td>
<td>Cork Centre for Architectural Education</td>
</tr>
<tr>
<td>Assumpta Harvey</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Per-Olof Hedvall</td>
<td>Certec</td>
</tr>
<tr>
<td>Markus Hofmann</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Christian Horn</td>
<td>Department of Computing Science and Mathematics,</td>
</tr>
<tr>
<td></td>
<td>Dundalk Institute of Technology</td>
</tr>
<tr>
<td>James Hubbard</td>
<td>National Disability Authority</td>
</tr>
<tr>
<td>Bill Hunter</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Kevin Kelly</td>
<td>DIT</td>
</tr>
<tr>
<td>Alyson King</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Satoshi Kose</td>
<td>University of Tokyo</td>
</tr>
<tr>
<td>Mike Lafleur</td>
<td>Durham College</td>
</tr>
<tr>
<td>Kevin Lalor</td>
<td>DIT</td>
</tr>
<tr>
<td>Hugh McCabe</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Larry McNutt</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Tim McTiernan</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>John O’Connor</td>
<td>DIT</td>
</tr>
<tr>
<td>Pat O’Donnell</td>
<td>TU4Dublin</td>
</tr>
<tr>
<td>Ruth O’Reilly</td>
<td>National Disability Authority</td>
</tr>
<tr>
<td>Olivia Petrie</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Dónal Rice</td>
<td>National Disability Authority</td>
</tr>
<tr>
<td>Bitte Rydeman</td>
<td>Lund University</td>
</tr>
<tr>
<td>Robert Savelle</td>
<td>Durham College</td>
</tr>
<tr>
<td>Paul Stacey</td>
<td>Institute of Technology Blanchardstown</td>
</tr>
<tr>
<td>Ed Stienfeld</td>
<td>University of Buffalo</td>
</tr>
<tr>
<td>Joe Stokes</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Bernard Timmons</td>
<td>Applied Technology, Dublin Institute of Technology</td>
</tr>
<tr>
<td>Roland Van Oostveen</td>
<td>University of Ontario Institute of Technology</td>
</tr>
<tr>
<td>Trevor Vaugh</td>
<td>NUI Maynooth</td>
</tr>
<tr>
<td>PJ White</td>
<td>Institute of Technology Carlow</td>
</tr>
</tbody>
</table>
# Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>Gerald Craddock and Larry McNutt</td>
</tr>
<tr>
<td>Committees</td>
<td></td>
</tr>
<tr>
<td>Education – Putting Universal Design for Learning at the Heart of Education – Embedding Universal Design Content Across the Curriculum</td>
<td></td>
</tr>
<tr>
<td>The Training on Universal Design for All: A Case Study from the European Higher Education Area in Spain</td>
<td>Ma Carmen Martín Canoa, Alfonso Blesa Robles and Yolanda de la Fuente</td>
</tr>
<tr>
<td>Age-Focused Design – A Pedagogical Approach Integrating Empathy and Embodiment</td>
<td>Sarah Gunawan and Julia Jamrozik</td>
</tr>
<tr>
<td>Research-Based Educational Support of Undergraduate Students with Autism Spectrum Disorders</td>
<td>Kirsten Ribu</td>
</tr>
<tr>
<td>Universal Design as a Technical Norm and Juridical Term – A Factor of Development or Recession?</td>
<td>Olav Rand Bringa</td>
</tr>
<tr>
<td>Achieving Success of “Accessible India Campaign” Through Universal Design Education in India</td>
<td>Sandeep Sankat and Anne Britt Torkildsby</td>
</tr>
<tr>
<td>Integrating Universal Design and Accessibility into Computer Science Curricula – A Review of Literature and Practices in Europe</td>
<td>Anna Nishchyk and Weiqin Chen</td>
</tr>
<tr>
<td>Universal Access in Heritage Site: A Case Study on Jantar Mantar, Jaipur, India</td>
<td>Shweta Vardia, Ajay Khare and Rachna Khare</td>
</tr>
<tr>
<td>Using MOOCs to Promote Digital Accessibility and Universal Design, the MOOCAP Experience</td>
<td>John Gilligan, Weiqin Chen and Jenny Darzentas</td>
</tr>
<tr>
<td>Making Learning Materials Accessible in Higher Education—Attitudes Among Technology Faculty Members</td>
<td>Weiqin Chen, Norun C. Sanderson and Siri Kessel</td>
</tr>
<tr>
<td>Towards a More Inclusive University – Supporting Teachers Through Universal Design for Learning</td>
<td>Bitte Rydeman, Håkan Eftring and Per-Olof Hedvall</td>
</tr>
</tbody>
</table>
Three Decades of Universal Design – Defining Moments
Margaret Kinsella

Greensboro College: A Model of UDL in the Curriculum
Georgieann Bodgan and Ilari Pass

Bringing Human Diversity into Design Processes Through Empathic Modelling
Lena Lorentzen and Per-Olof Hedvall

Strategies for Developing Students’ Empathy and Awareness for the Needs of People with Disabilities: Contributions to Design Education
Fausto Orsi Medola, Frode Eika Sandnes, Ana Lya Moya Ferrari and Ana Claudia Tavares Rodrigues

Engagement with Industry – Universal Design Practices in Real-World Industry

Using Design Thinking to Develop New Methods of Inclusive Exhibition Making
Katrine Hesseldahl, Chris McGinley and Georgia Monk

Ensuring Universal Design of ICT: Triggering the Triggers!
Miriam Eileen Nes Begnum

How Agile Teams Regard and Practice Universal Design During Software Development
Aleksander Bai, Heidi Mork and Viktoria Stray

Partnership and Community Engagement

Investigating and Applying Universal Design: A Partnership Between a University and an Art Museum
Joanne Gallagher Worthley, Linda S. Larrivee and Susanna E. Meyer

Regulatory Intermediaries: The Role of Interest Organizations in Supporting Web Accessibility Policy Implementation
G. Anthony Giannoumis

Universal Design in Architectural Education – Community Liaison on ‘Live Projects’
Kevin Busby and Jim Harrison

Co-Constructing Universal Design in Citizen Science Workshops
Per-Olof Hedvall, Bitte Rydeman, Sarah Granholm and Malin Andersson

Design and the Mind Engaging and Collaborative Workshops for the Neurodiverse
Natasha Trotman and Chris McGinley
Healthcare and Design of Healthcare Facilities – Facilitating Independent and Dignified Access to Healthcare for All

The Development of a Methodology for Contextual User Research in Healthcare Design Projects

  Donal Healion, Enda O’Dowd and Sam Russell

Employment – Universal Design to Eliminate Barriers and Promote Employment

Virtual Reality (VR) Technology: Empowering Managers to Reduce and Eliminate Accessibility Barriers for People with Autism Spectrum Disorders

  Miriam O’Sullivan and Gearoid Kearney

Tourism – Universal Design as a Business Improvement Tool to Expand Audience Reach

Tools to Upgrade Facilities for All: How to Improve Business Dealing with Tourism

  Barbara Chiarelli, Ilaria Garofolo and Valentina Novak

Transport – Opening up Transport Planning and Services by Embedding Universal Design

Re-Examining the Creativity of Universal Design Initiatives in Public Spaces in Japan

  Yoshito Dobashi and Nobuaki Ohmori

Housing and Homes – Planning, Designing and Building Homes That Work for All Ages, Sizes and Abilities

Universal Mosque/Masjid Design

  Nazem Fawzi Al-Mansoor

Universal Design in Housing in Australia: Getting to Yes

  Margaret Ward and Jane Bringolf

Housing Design for the Ageing: Struggle Toward Supporting Age-in-Place Instead of Special Housing for Seniors

  Satoshi Kose

Towards a Decision Support System for Improved Accessibility in Multi-Family Housing: Co-Design of an Application for Environmental Barrier Inventory

  Oskar Jonsson, Björn Slaug, Knut Mårtensson, Adrian Hansson, Steven M. Schmidt and Susanne Iwarsson

Home Coming? A Story of Reassurance, Opportunity and Hope for Universally Designed Housing in Australia

  Penny Galbraith
A Universal Design Perspective on Care Homes for Elderly People with and Without Dementia

*Nanet Mathiasen, Inge Mette Kirkeby and Lone Sigbrand*

The Relationship Between Housing Accessibility and Healthy Aging: The Case of Turkish Elderly Women

*Yasemin Afacan*

**Urban Design and Planning**

Diversity of “Pedestrians on Wheels”, New Challenges for Cities in 21st Century

*Delfín Jiménez, Yolanda de la Fuente and Jesús Hernández-Galán*

Planning Accessibility Strategies and Connectivity for Malaysian Urban Built Environment

*Nur Amirah Abd Samad, Ismail Said and Asiah Abdul Rahim*

Emulating Perceptual Experience of Color Vision Deficiency with Virtual Reality

*Krzysztof Szczurowski and Matt Smith*

**Teaching and Learning in a Digital Context**

Exploring Maker Cultures and Pedagogies to Bridge the Gaps for Students with Special Needs

*Janette Hughes, Lauren Fridman and Jennifer Robb*

The Use of Social Robots for Supporting Language Training of Children

*Kristin S. Fuglerud and Ivar Solheim*

Embracing the Universal Design for Learning Framework in Digital Game Based Learning. A Set of Game Design Principles

*Larkin Cunningham and Orla Murphy*

Feedback from Digital Systems Used in Higher Education: An Inquiry into Triggered Emotions. Two Universal Design Oriented Solutions for a Better User Experience

*Diana Saplacan, Jo Herstad and Zada Pajalic*

The Semantic Student: Using Knowledge Modeling Activities to Enhance Enquiry-Based Group Learning in Engineering Education

*Paul Stacey*

Marrying Digital and Analog with Generation Z: Confronting the Moral Panic of Digital Learning in Late Modern Society

*Shahid Alvi*

**System and Institutional Design and Transformation**

From the Ground Up: Establishing a Centre for Universal Design in Australia

*Jane Bringolf*
Implementing Universal Design and the ICF in Higher Education: Towards a Model That Achieves Quality Higher Education for All
Giulia M.L. Bencini, Ilaria Garofolo and Alberto Arenghi

Developing a Theoretical Framework for Policy Development, Implementation and Evaluation
Marie Brennan

University for All: Embedding and Mainstreaming Equality of Access, Participation and Success in Higher Education
Anna M. Kelly and Lisa Padden

Transforming the Higher Education Experience of Students with Disabilities Through Innovative System Design and Accessible Data Visualisation
Bairbre Fleming and Julie Tonge

Design of Student Experience & Supports

Understanding the Influence of High School Preparation on the Success Strategies of Canadian University Students
Alyson E. King and Susan M. Brigham

Holistic Perspective to Individual Study Plan: Personal Development Project Plan
Ville Kivimäki and Saara Meriluoto

Empowering Students to Perform an Enhanced Role in the Assessment Process: Possibilities and Challenges
Paul Dervan

Career Services and Student Success in Canadian Postsecondary Institutions
Peter Dietsche

Curriculum Development and Transformation: Skills, Learning Outcomes and Universal Design

Universal Design Engineering
Keith Edyburn and Dave Edyburn

Curriculum Development Discourse and Practice
Fiona O’Riordan

Camilla Ryhl

Applying Learning: Student Experience of Research Skills Module
Sorca McDonnell

Teaching for Critical Thinking: A Study of Teaching Strategies Employed by Instructors in Ontario Colleges Through General Education Courses
Barry Thompson
Good Intentions in Universal Design: A Global Challenge for Higher Education
Jim Harrison, Kevin Busby and Tessa O’Shaughnessy
594

Re-Making Teacher Professional Development
Janette Hughes, Laura Morrison and Laura Dobos
602

Cultural and Personal Identities

Belonging at ITB: The Use of Photovoice Methodology (PVM) to Investigate Inclusion and Exclusion at ITB Based on Ethnicity and Nationality from a Student Perspective
Fionnuala Darby
611

Interculturalism in Higher Education in Ireland: An Analysis from a Strategy, Policy and Practice Perspective
Brid Ni Chonaill
624

Cultural Artefacts with Virtual Capabilities Enhance Self-Expression Possibilities for Children with Special Needs
Birgitta Cappelen and Anders-Petter Andersson
634

Civil War: A Board Game as Pedagogy and Critique
Hugh McCabe
643

Nature, Purpose and Practice of Higher Education Engagement

Ireland’s Higher Education Teachers Have a National Professional Development Framework, Now What?
Roisin Donnelly and Terry Maguire
655

Built Environment – Internal and External

Universal Design Building Standard for INDIA: A Critical Inquiry
Sushil Kumar Solanki and Rachna Khare
669

Universal Design, but at What Cost? A Case Study on Lifts in Norwegian School Competitions
Leif D. Houck
679

Evaluating Universal Design in Built Environments – A Scoping Project
Valerie Watchorn, Cathryn Grant, Richard Tucker, Danielle Hitch, Patsie Frawley, Susan Ang, Kathryn Aedy and Apeksha Gohil
689

A Status of Universal Design in Danish Architectural Policies
Sidse Grangaard
696

Clients’ Approach to Universal Design – A Slow Change?
Sidse Grangaard
706

A Review of Universal Design in Professional Architectural Education: Recommendations and Guidelines
Eoghan C. O’Shea, Megan Basnak, Merritt Bucholz and Edward Steinfeld
716
A Practitioner’s Universal Design Approach Making a Difference to Distressed Assets in Sri Lanka

Penny Galbraith

Beyond Resilience: Exploring a Concept of Place-Based Healing for Children in War

Sana Al-Azzawi and Göksenin İnalhan

Spatial (E)quality from a User Perspective

René Sørensen Overby

Lighting Design as a Universal Design Strategy to Support Functional Visual Environments

Nanet Mathiasen and Anne Kathrine Frandsen

Empathy Enabled by Critical Design – A New Tool in the Universal Design Toolbox

Anne Britt Torkildsby

Towards a Universal Design Evaluation for Assessing the Performance of the Built Environment

Erica Isa Mosca and Stefano Capolongo

Designing and Building the Visual Pathway as Public Art: Some Pros and Cons of Design-Build Pedagogy for Higher Education

Galen Cranz

Information and Communications Technology

When Trustworthy Information Becomes Inaccessible: The Search Behaviour of Users with Dyslexia in an Online Encyclopedia

Birgit Kvikne and Gerd Berget

Studying Older People with Visual Impairments Using Mainstream Smartphones with the Aid of the EziSmart Keypad and Apps

Kristin S. Fuglerud, Richard Chan and Hilde T. Sørli

Method for Semi-Automated Evaluation of User Experience Using Brain Activity

Aleksander Bai and Kristin S. Fuglerud

Categorization and Comparison of Accessibility Testing Methods for Software Development

Aleksander Bai, Kristin Fuglerud, Rannveig A. Skjerve and Till Halbach

Should Colour Vision Deficiency Be a Recognized Special Education Need (SEN)?

Anne Kristin Kvitle

A Mobile Application for Supporting Dementia Relatives: A Case Study

Till Halbach, Ivar Solheim, Siri Ytrehus and Trenton Schulz
Universal Balance? 847
  Charlotte Magnusson, Héctor Caltenco, Kirsten Rassmus-Gröhn
  and Bitte Rydeman

Stroke and Universal Design 854
  Charlotte Magnusson, Margarita Anastassova, Sabrina Paneels,
  Kirsten Rassmus-Gröhn, Bitte Rydeman, Gary Randall,
  Leire Ortiz Fernandez, Stephand Bouilland, Julien Pager
  and Per-Olof Hedvall

Legibility in Print Text for People with Impaired Vision 862
  Jonny Nersveen, Anne Kristin Kvitle and Eivind Arnstein Johansen

Applying a Universal Design Approach to Empower Children with Multiple
Impairments in Assistive Technology Assessment 870
  Trish MacKeogh, Karola Dillenburg and John Donovan

Subject Index 881

Author Index 885
Implementing Universal Design and the ICF in Higher Education: Towards a Model That Achieves Quality Higher Education for All

Giulia M. L. BENCINI a, 1, Ilaria GAROFOLO b, Alberto ARENGHI c

a Ca Foscari University of Venice, Department of Linguistics and Comparative Cultural Studies
b University of Trieste, Department of Engineering and Architecture
c University of Brescia, Department of Civil Engineering, Architecture, Land, Environment and of Mathematics

Abstract. The landmark UN 2030 Agenda for Sustainable Development Goals (SDGs) for the first time explicitly makes reference to the inclusion of the needs and capacities of all persons, on equal grounds, in the planning of our built environment and services (Goal 11) and in our quality educational systems (Goal 4). Accessibility and inclusion of all people in vulnerable situations, including people with disabilities, provides a strong benchmark for sustainability. Accessibility and Inclusion in higher education are the topic of an increasing number of studies, however, there is no existing common set of multidomain indicators for Inclusion available to the multiple stakeholders involved in higher education. The purpose of this paper is to fill this gap. With a Universal Design approach and the common language of the ICF we aim to provide a multi-dimensional assessment and planning tool to quantitatively and qualitatively measure Inclusion of environments and services in Higher Education.

Keywords. ICF and Universal Design in Higher Education, Inclusion in Higher Education, Inclusion Index.

1. Introduction

Universities world-wide have increasingly embraced the values of Accessibility and Inclusion for diverse student populations. This is in line with several supra-national policies and agendas at the European and global level which recognize that being able to be educated is an essential human function (UN 2030 Sustainable Development Goal Number 4: Access to quality education for all). Choosing to be educated and having access to Higher Education enhances personal freedoms and capabilities, and at a societal
level, higher education plays a pivotal role in eliminating disparities among citizens based on gender, disability, minority-status, or any other form of socially-based exclusion and inequality [1]. There is, however, still a great need to mainstream disability along the lines advocated by many international organizations [2].

Implementing inclusive higher education requires a number of conceptual and operational shifts on multiple dimensions. First, inclusion requires designing learning environments (in the broadest sense) that take student diversity as a starting point, second it requires embracing inclusion as a dynamic interaction between people (i.e. students) and their physical, social, technological and social environments [3]. Third, for a university system to be inclusive, its governance and policies, its physical, administrative, instructional, technical, and communicative environments and policies need to be systematically described and assessed in order to either plan their initial development or transformation. Interventions to foster Inclusion in higher education are increasing in number in many countries, as is the number of studies that offer detailed analyses of one domain such as: reasonable accommodations and accessibility to higher education; career guidance; universal design for learning; assistive technologies and ICT; job placement services; peer-tutoring (see, for example, the contributions in the edited volume by Pace, Pavone and Petrini, 2018 and references therein [4]. We argue that for inclusion to be effective at a systems level, initiatives in one domain (e.g., accessibility to the built environment) must be linked to inclusion in other domains (e.g., accessible teaching and learning). There is, to our knowledge, no existing set of multidomain indicators to assist the multiple stakeholders involved in higher education.

In this paper we propose that the framework and coding system offered by the International Classification of Functioning Disability and Health or ICF [3] can be combined with a Universal Design approach for the built environment [5][6][7][8] and Universal Design for Learning for the educational environment see [9][10][11][12][13][14] to assist all actors involved in planning for higher education build inclusive learning spaces and services. The goal of the paper is twofold: 1) to increase awareness of the usefulness of the ICF in higher education as conceptual framework and assessment tool to be implemented both at the level of individual learners entering higher education and at a the level of the learning environments 2) to provide a multi-domain measurable set of environmental indicators for inclusion in higher education to be shared by local and national educational policy makers, administrators, educators, designers and the entire community of users. It is essential to plan and build for inclusion in higher education with a multidisciplinary approach and domain specific expertise – but all actors must share a common language. For this we propose the use of the common framework of the ICF.

We start with a brief introduction and overview of the ICF framework in section 2 and then present our proposal of a core set of ICF domains specifically relevant to the design process of Higher Education environments, taking a student oriented perspective as our reference point.
2. Introduction to the ICF

The ICF is a classification system that belongs to World Health Organization (WHO) family of international classifications [3]. Whereas the more widely know International Classification of Diseases (ICD) gives users an etiological framework to classify diseases by diagnosis through the use of an alphanumeric coding system (e.g.: F81.0, Specific reading disorder; F81.81, disorder of written expression), the ICF offers a complementary and broader classification system to the ICD. Like the ICD the ICF is grounded in the body with a list of body functions and structures (e.g., The structures and functions of the nervous system), but, unlike the ICD, the ICF also includes lists of domains of activity and domains of participation.

In the ICF, the term functioning is a neutral term and it refers to all body functions, activities and participation. Similarly, the term disability is a neutral cover term that applies to impairments, activity limitations and participation restrictions. Central to the ICF is also the recognition of the role of environmental variables on human functions, activities and participation, so the ICF also includes lists of environments. Because the ICF adopts a person-centered view, environments are broadly defined as consisting not just of the physical environment but also including the social, relational and cultural environments.

Like the ICD, the ICF uses an alphanumeric coding system with letter codes to identify the major domains describing human functions (b = body functions; s = body structures), activities (d) and environments (e). In addition to the major codes the ICF uses Qualifiers following the codes: numbers 0-4 indicate level of impairment (0=none, 4=complete problem). Further qualifiers have different meanings: In Activity/Participation: there is a distinction between a person’s ability to perform a skill in in his/her natural environment (performance qualifier) vs. performing the skill in a standard setting, such as a clinic (capacity qualifier). The capacity qualifier in turn consists of 2 digits, indicating capacity without assistance and capacity with assistance.

As an example, consider the case of a person who may, for whatever reason – it could be hearing loss, language deficit or speaking in a non-native language – have severe difficulties in carrying out a conversation in a natural environment. The relevant ICF macro-chapter is d3 (Communication), the subchapter is d3501: “sustaining a conversation” which is defined as “Continuing and shaping a dialogue or interchange by taking turns in vocalizing, speaking or signing, by adding ideas, introducing a new topic or retrieving a topic that has been previously mentioned” [3]. She/he would therefore receive a 3 (indicating severe impairment) on the corresponding activity, followed by a 2 code for the first capacity qualifier without assistance (indicating moderate impairment) in a standardized environment (such as a speech-language therapy clinic) and a 1 score for the capacity qualifier in a standardized environment with assistance. To summarize, the corresponding ICF code would be: d350.3.2.1. The code reads: severe impairment in conducting a conversation in a natural environment, moderate impairment in a standardized environment without assistance, mild impairment in a standardized setting with assistance (Example adapted from [16]).
2.1 The ICF in higher education

We propose that the ICF is a useful common framework to adopt and share across stakeholders in higher education because it offers a person centered classification system which is useful to flexibly describe who the learners entering higher education are, the extent to which they can and cannot perform functions and activities in different contexts through the useful distinction between “performance” and “capacity” illustrated in the example provided in introduction section above and the more fine-grained set of descriptors for learner profiles above and beyond standard ICD diagnostic codes. ICF codes also include useful information relative to the kinds of accommodations needed to support student’s best performance, be it quiet testing environments, smaller class-room settings and flexible seating arrangements, communication support services in the form of translators, captioning, to name a few.

Another strength of the ICF is the importance of the role of the environment. It is within this domain that we focused on in developing our set of indicators, because this where stakeholders can intervene with a systems wide approach in higher education. In choosing the indicators to include in the Environment Chapters relevant for Higher Education in a student-centered approach, we situated our selection of indicators first by narrowing the definition of “environments” to those that are typical of higher education, from the built environment (classrooms, student halls, libraries, labs, facilities) to the online or virtual environment (e.g., website, e-learning or virtual-reality-platforms) to the human environment (teaching staff, administrative staff, peers).

2.2 The ICF, Universal Design and Universal Design for Learning

Common to the ICF, Universal Design and Universal Design for Learning approaches is the focus on the interaction between person and environment – in this extended sense [7][8]. With respect to the built environment in which learning takes place, Universal Design is the highest expression of person-centered planning philosophy. UD is addressed “to the greatest extent possible” of all users (hence introducing a limit) which cannot literally mean each and every single person, otherwise designing ‘for all’ risks hiding behind a single abstract definition losing both sight of the complexity of the real world and giving the illusion that Universally Designed spaces are the final solution. UD is best viewed as an ongoing process, in the awareness that there is no one easy fix. There will always be unique situations which require customized solutions [17].

3. Development of Key Indicators for Inclusion in Higher Education

Universities must be directed to adopt diversity and inclusion as core values within their mission and strategic planning, to be required to provide university-wide inclusion plans that take into account people, environments and their interactions and monitor progress through periodic status reports. All of the stakeholders involved in design for education, be it designers of the built environment (e.g., architects and engineers) or curriculum and learning designers (program or department directors, academic and instructional staff) must be involved in the design and planning stage with a view that takes student diversity into account, in a dynamic transformative process informed by advances in technology and learning science (e.g. Universal Design for Learning).
To plan, develop and monitor inclusion, key indicators must be available and shared across stakeholders. For this we propose using the common language of the ICF to contextualize the domain of the indicator. We find that the ICF offers a person-centered approach that can be useful both as a general framework and a flexible descriptive matrix to encode individual and personal student characteristics. The advantage of the ICF is that it is applicable to ALL students, irrespective of their physical, cognitive, psychological, cultural, or linguistic backgrounds. The ICF also allows us to describe the physical, instructional, social and cultural environments in which learning takes place, highlighting the central role played by contextual variables on learning outcomes. Our multi-domain instrument is aimed at aiding institutions of higher education in systematizing their manyfold actions and approaches to inclusion within a more holistic framework.

3.1. ICF Chapters relevant to describing personal learner characteristics

Inclusive education models require learner-centered approaches to education and environments that maximally support learners with diverse physical, linguistic, cognitive and learning styles, while at the same time meeting national higher education standards. In the current WHO conceptualization, the ICF shifts the emphasis from disease and disability to the broader concept of functioning, activity and participation, which apply to all human beings. As we saw in section 2, the ICF includes both a description of a person’s body structures and functions (e.g., motor and sensory functions, special mental functions such as language, activities such as communicating) to the impact that limitation in one domain may have on a person’s ability to participate in domains of life such as education and educational related activities (e.g., participating in: an archeological trip, a chemistry lab, a foreign language discussion group, etc.). This is moderated by contextual and personal factors, from individual circumstances and attitudes to larger societal factors (e.g., anything from belief systems about the role of higher education with respect to paid employment, to beliefs about the value of learning foreign languages).

University planners, governance bodies, instructional and technical staff need to be familiar with the conceptual framework and basic coding system of the ICF to consider the design impact of: differing characteristics of students from various backgrounds and ages; students navigating the built environment and the virtual environment without sight or hearing, or even with neither sight nor hearing; varying language backgrounds and competencies in accessing and understanding information presented in print media, audio, video, communication and websites; the consequences of disease or trauma; the challenges for students with limited mobility or agility as they seek to participate in academic life (lectures, events, international mobility and study abroad). Fortunately, the ICF is increasingly being adopted internationally to define functional learner profiles to accompany learners throughout their educational careers from primary to secondary school and in a growing number of cases ICF functional profiles are making their way into higher educational systems – a trend we strongly support, because functional profiles obtained during a student’s primary and secondary schooling career offer precious information as to the adaptations required.
3.2. Chapters relevant to describing the learning environment

The ICF contains a large number of environmental chapters - physical, social, and relational in nature. When choosing the relevant environmental chapters we deliberately adopted a learner-centered perspective, that is, we placed the learner at the center of the ICF framework and then used the ICF coding system to describe everything in the learning environment from a student’s perspective. From a student’s perspective environment includes everything from the physical and virtual learning environments, to the way learning is facilitated via learning curricula, to the providers of instruction and services, to the individual interactions with different faculty, staff and peers.

In our work we aimed at selecting the most relevant ICF Environmental Chapters drawing on our own perspectives and experiences as researchers, educators and university appointed delegates for disability support services in medium-sized Italian Universities with undergraduate and programs that span across the liberal-arts and humanities, physical, biological and social sciences, medicine, architecture and engineering. We therefore identified the following environmental ICF chapters and situated them in a university context, from a student-centered perspective:

- E1 Chapters covering products and technology
- E3 Chapters covering support and relationships
- E4 Chapters covering attitudes
- E 5 Chapters covering services, systems and policies.

4. Towards a multidomain set of indicators for inclusion

Inclusion in higher education requires planning physical, virtual and social environments that maximally support learners with diverse physical, linguistic, cognitive and learning preferences and styles. In order to allow stakeholders in higher education plan and monitor inclusion we provide a multi-domain checklist using the ICF along with quantitatively and qualitatively measurable indicators across different ICF environmental chapters which stakeholders in higher education have agency on. The checklist is summarized in Table 1. The checklist aims at the right balance between qualitative, quantitative indicators or a mixture of the two, following the dictact that indicators should try to be SMART (specific, measurable, attainable, relevant and time bound) and SPICED (subjective, participatory, interpreted, cross-checked, empowering and diverse).

Future work will test the use of these indicators in different universities. This will allow us to select benchmarks with the goal of developing shared best practices at a national and international level.

4.1. Summary and concluding remarks

Inclusion in higher education requires planning physical, virtual and social environments that maximally support learners with diverse physical, linguistic, cognitive and learning preferences and styles. In this work we have outlined a multi-domain instrument aimed at aiding institutions of higher education assess, plan and monitor Inclusion practices and actions. We recognize that many institutions may be well along their way in the domains described by the indicators, however, there is no existing instrument that captures the
need for a holistic approach to Inclusion, nor metrics that can help institutions assess or benchmark their actions for inclusion. This instrument can therefore be used by universities in their strategic plans for Inclusion, allowing for a greater synergy across traditionally different actors (e.g., persons in charge of planning the built environment, persons involved in curriculum development, ICT, etc.)

Table 1. Multidomain Instrument for Inclusion in Higher Education using the ICF with Quantitative (SM) and Qualitative (SP) Indicators and related Metrics (N = Number; SM = SMART Indicator; SP = Spiced Indicator).

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Indicator</th>
<th>Type</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>E125</td>
<td>Fix hardware equipped with dedicated accessibility programs</td>
<td>SM</td>
<td>N devices</td>
</tr>
<tr>
<td></td>
<td>Portable hardware equipped with dedicated accessibility programs</td>
<td>SM</td>
<td>N devices</td>
</tr>
<tr>
<td></td>
<td>Applications and software (text to speech, captioning...)</td>
<td>SM &amp; SP</td>
<td>N licences</td>
</tr>
<tr>
<td></td>
<td>Research and development initiatives with focus on UD, UDL and inclusion</td>
<td>SM &amp; SP</td>
<td>N initiatives</td>
</tr>
<tr>
<td></td>
<td>Texts composed following plain and bases language principles and guidelines</td>
<td>SM</td>
<td>existence</td>
</tr>
<tr>
<td>E130</td>
<td>Educational technology and software, learning labs and platforms, video and audio hardware and software</td>
<td>SM &amp; SP</td>
<td>N products</td>
</tr>
<tr>
<td></td>
<td>Courses providing multiple means of engagement, representation, action and expression</td>
<td>SM &amp; SP</td>
<td>N courses; N credits hours</td>
</tr>
<tr>
<td></td>
<td>Continuing education and training opportunities on ICF and UDL for administrative, technical, instructional and support staff</td>
<td>SM &amp; SP</td>
<td>N participants; N hours</td>
</tr>
<tr>
<td></td>
<td>Research and development in inclusive education</td>
<td>SM &amp; SP</td>
<td>N projects</td>
</tr>
<tr>
<td>E140</td>
<td>Flexible or specially designed equipment</td>
<td>SM</td>
<td>N products</td>
</tr>
<tr>
<td></td>
<td>Applications and software (text to speech, captioning...)</td>
<td>SM</td>
<td>N products</td>
</tr>
<tr>
<td></td>
<td>Events providing multiple means of participation, engagement, representation, action and expression</td>
<td>SM &amp; SP</td>
<td>N events</td>
</tr>
</tbody>
</table>

G.M.L. Bencini et al. / Implementing Universal Design and the ICF in Higher Education
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Indicator</th>
<th>Type</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1 - Products and Technology</td>
<td>Accessible locations compliant with current standards</td>
<td>SM &amp; SP</td>
<td>% classrooms % facilities % lecture, meeting and conference halls</td>
</tr>
<tr>
<td></td>
<td>Orientation and navigation facilitators (tactile paths and maps, wayfinding)</td>
<td>SM &amp; SP</td>
<td>N devices/facilitators</td>
</tr>
<tr>
<td></td>
<td>Proximity and navigation software</td>
<td>SM</td>
<td>N devices</td>
</tr>
<tr>
<td></td>
<td>Clear, flexible and multimedia /multi format information and signage</td>
<td>SM &amp; SP</td>
<td>% signage out of total % safety, evacuation, hazards signage</td>
</tr>
<tr>
<td></td>
<td>Flexible or specially designed furniture and equipment</td>
<td>SM &amp; SP</td>
<td>% furniture % equipment</td>
</tr>
<tr>
<td></td>
<td>Spaces designed for easy and flexible use</td>
<td>SM &amp; SP</td>
<td>% of classrooms with movable seatings and furniture</td>
</tr>
<tr>
<td></td>
<td>Domotics</td>
<td>SM</td>
<td>N devices</td>
</tr>
<tr>
<td>E3 - Support and Relationships</td>
<td>Instructional staff competent in UDL</td>
<td>SM &amp; SP</td>
<td>N persons N initiatives</td>
</tr>
<tr>
<td>E4 - Attitudes</td>
<td>Continuing education and training opportunities on ICF and UDL for administrative, technical, instructional and support staff</td>
<td>SM &amp; SP</td>
<td>N initiatives N participants</td>
</tr>
<tr>
<td></td>
<td>Public engagement initiatives respecting UD</td>
<td>SM &amp; SP</td>
<td>N initiatives N participants</td>
</tr>
<tr>
<td></td>
<td>Public engagement initiatives respecting UDL</td>
<td>SM &amp; SP</td>
<td>N initiatives N participants</td>
</tr>
<tr>
<td>E5 - Services, Systems and Policies</td>
<td>Transportation services to and from university facilities and off-site locations</td>
<td>SM &amp; SP</td>
<td>existence of service</td>
</tr>
<tr>
<td></td>
<td>Safety and evacuation plans for persons with disabilities</td>
<td>SM &amp; SP</td>
<td>existence of plans</td>
</tr>
<tr>
<td></td>
<td>Inclusion and UD endorsed by all university statutes, acts and strategic documents</td>
<td>SM &amp; SP</td>
<td>existence of plans</td>
</tr>
<tr>
<td></td>
<td>Availability of documents and guidelines, how to's, best practices, checklists</td>
<td>SM</td>
<td>existence</td>
</tr>
<tr>
<td></td>
<td>Communication, information and documents comply with accessibility standards (e.g. W3C), texts are flexible, multimodal and in alternative formats</td>
<td>SM &amp; SP</td>
<td>existence</td>
</tr>
<tr>
<td></td>
<td>Texts composed following plain and base language principles and guidelines</td>
<td>SP</td>
<td>existence</td>
</tr>
</tbody>
</table>
In our selection of the student relevant ICF Environmental Chapters we also draw on our own perspectives and experiences as researchers, educators and university appointed delegates for disability support services in medium-sized Italian Universities with undergraduate and programs that span across the liberal-arts and humanities, physical, biological and social sciences, medicine, architecture and engineering.

Future work will test the use of these indicators in different universities. This will allow us to select benchmarks with the goal of developing shared best practices at a national and international level.

References


