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REPOSITORY RECORD

Nicolle, C.A., and Jenny Darzentas. 2019. “What to Teach? A Taxonomy of Knowledge and Skills for 'design for All' Curricula Related to HCI”. figshare. https://hdl.handle.net/2134/1061.

What to teach? A taxonomy of Knowledge and Skills for 'Design for All' Curricula related to HCI

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Abstract

An EU project called IDCnet is focusing on educating the students and professionals who are learning and working in the area of information and communication technologies (ICT) to include the requirements of older and disabled people. The aim of the project is to integrate information and identify core knowledge sets and skills for model curricula in Design for All (DfA) specifically for information and communication products, systems and services.

Various categories of knowledge and skills have been identified as being important to include in modules and courses with Design for All content, e.g., awareness raising, reasons for promoting Design for All, and what legislation and guidelines are important to consider. Nine categories and some suggestion of the content of courses in inclusive design for ICT are discussed, suggesting what to teach and why it is important.

The paper concludes by stating that the work of IDCnet will be extended by carrying out teaching pilots, by communicating the results to Education Policy and Strategy bodies, and by inviting participation and contributions from interested and informed experts in this field.

1. Introduction

Fundamental to the topic of this workshop on *Including Accessibility and Inclusive Design in the Curriculum for Human Computer Interaction* is to understand what needs to be taught to students. Only then will they be able to claim that they have received instruction on Accessibility and Inclusive Design, especially when approaching prospective employers.

An EU project called IDCnet is focusing on educating the students and professionals who are learning and working in the area of information and communication technologies (ICT) to include the requirements of older and disabled people. The Inclusive Design Curriculum Network (IDCnet) is a Thematic Network financed by the Information Society Technologies Programme of the European Commission (http://www.idcnet.info/). The aim of the project is to integrate information and identify core knowledge sets and skills for model curricula in Design for All (DfA) specifically for information and communication products, systems and services. As a thematic network, a major aim of the project is also to support the creation of a European network to promote these interests, following the e-Europe objectives (http://europa.eu.int/information_society/eeurope/index_en.htm) and coordinating our efforts with the European Design for All e-Accessibility Network (EDeAN, http://www.e-accessibility.org) and its supportive infrastructure represented by the Design4All project (http://www.d4all.gr/).

ICT, ranging from, for example, computers to mobile telephones, are important in many sectors of society today. Such technologies enable participation not only in tele-working and tele-education, but also in e-health, leisure, e-shopping and other consumer activities. In many cases, older and disabled people may be the most likely to benefit from such new technologies, products and services. However, in reality they may have difficulties in taking advantage of the systems due to limitations in their physical, sensory or cognitive abilities. Thus, as advances are made in ICT, older and disabled people may lag behind—unless technologies are designed with their requirements in mind (Abascal and Nicolle, 2001). In principle, professionals may want to design more inclusively (and know in many cases that they may have to do so to comply with legislation), but they are likely to be struggling with exactly how to go about it. Education in the principles of inclusive design and the needs of older and disabled people is key to achieving this "how".

Many people think of accessibility as being firmly tied in with disability, and that accessibility is usability for people with disabilities, often using assistive technology. However, the relationship between HCI and Design for All in ICT is very close, with usability—one of the central rationales of HCI—seen as part of accessibility. This becomes clear if one thinks of using a mobile phone. If a particular user cannot access the functionality because the screen is too small, then it is neither accessible nor usable. In fact, ISO TS 16071 clearly defines accessibility in relation to usability as a measurable entity (ISO, 2000), defining accessibility as:

The usability of a product, service, environment or facility by people with the widest range of capabilities.

Design for All, or Inclusive Design is very much concerned with "a priori" design with a diverse range of users in mind. This concept of Design for All can, and should, be introduced as early as possible in a professional's career. In addition, training and competence in the use of appropriate user research methods and tools for inclusive design are needed. Ensuring that any materials, methods and tools for inclusive design are accessible and usable will also be crucial to their uptake. This all clearly emerged during discussions on obstacles and solutions for more inclusive design at the first Include 2001 Conference in London (April 2001, see http://www.hhrc.rca.ac.uk/events/include/), later to be emphasised at Include 2003 (http://www.hhrc.rca.ac.uk/events/include2003). However, in a survey with professional designers from the Design Business Association in the United Kingdom, there were few respondents from the communications industries who felt that inclusive design was particularly relevant to them, despite the implications of the Disability Discrimination Act (Lebbon, 2003).

Differences in attitude towards inclusive design are also evident between the U.S. and the U.K. In the U.S. legislation is considered the most important factor which results in consideration of the needs of people with disabilities. However, in the U.K. legislation is mainly seen as providing a basic platform on which to build, and knowledge is considered the key factor (Dong, Keates, & Clarkson, 2003). The study by Dong et al also identified a number of strategies to facilitate the adoption and successful practice of inclusive design, for example, better awareness of inclusive design and better design tools, including more comprehensive statistical and market data. Likewise, these same strategies have also been identified and further extended by IDCnet.

2. IDCnet's Strategy

IDCnet wished to have a better idea of industry's perception of inclusive design, their strategies for promoting inclusive design, and how much industry knows about disability legislation. In addition, in order to develop successful curricula in Design for All, it is necessary to know what industry want from graduates with inclusive design knowledge, and what they actually end up getting.

One of the first major activities of IDCnet was a workshop held in Helsinki in February 2003 called 'Design for All Curriculum: Towards a synergy of the needs of ICT industry and education.' The workshop brought together experts from industry (e.g. software and hardware designers) to discuss what they would expect from graduates who claim a proficiency in Design for All. In addition, experts from the academic world, with teaching or research interests in DfA, presented their own experiences in the field to suggest key knowledge sets and skills that they feel are necessary for curricula in this area.

As well as attempting to answer these questions, the workshop was also to focus on one of the key points of the eEurope 2002 action plan, in particular, to “Ensure the establishment and networking of national centres of excellence in design-for-all and create recommendations for a European curriculum for designers and engineers."

3. Some Results

The workshop noted that there is a great deal of information around on inclusive design (including, e.g., research projects, websites, networks, etc.), but it was felt that these receive minimal interest from industry (Engelen, Strobbe and Darzentas, 2003). Various categories of knowledge and skills were identified as being important to include in modules and courses with DfA content, e.g., how to raise awareness, what legislation and guidelines are important to consider, and what useful resources can be made available to ICT students.

These categories and some suggestion of the content of courses in inclusive design for ICT are discussed below, suggesting what to teach and why it is important. The first four categories would be relevant to a wide range of application areas, whereas the remaining ones would apply mainly to the ICT sector. The hope would be that as the philosophy of inclusive design becomes more well established as a part of design, the first two categories (awareness raising and why Design for All) may be able to receive less emphasis. On the other hand, other categories may grow in importance, e.g. as there are new advances in networked and wireless technology (Darzentas, 2003a and 2003b).

Each set is capable of having several topics in it. The sets could be taken as a whole making a complete course, although, as they do not include topics like design processes, they would not be able to be stand alone. The more flexible approach would be to take topics in a ‘mix and match’ style to blend into ongoing courses. This could be done at a module level, or even at a unit level, topics could be inserted and blended into ongoing courses. In the subsections that follow, each category/area is described briefly, and indicative learning outcomes are associated with each.

3.1 Awareness of Design for All

This knowledge category serves most often as an introduction to Design for All. By various means students are encouraged to think of users in a wider category than just mirror images of themselves, to understand how barriers are unintentionally put up when user needs are not sufficiently understood. Practical exercises can be used here, like empathic modelling (Nicolle and Maguire, 2003) or encouraging students to seek out examples of bad design (Story, 2003).

Learning outcomes:
Students are made aware of problems faced by users in various contexts, e.g. access to built environment, products and services, and to information sources especially the Web. Students understand that Design for All does not mean one universal solution, but the

inclusion of accommodations that serve all situations and users, i.e. both those with disabilities and those in handicapping situations.

3.2 Why Design for All? Ethical, legal and commercial considerations

Under this knowledge category students are introduced to three complementary rationales for Design for All, as under the considerations in the subtitle above.

Learning outcomes:

- As part of ethical considerations, students learn about the history of Design for All, the move from segregation to integration, from specialised solutions to inclusive solutions and equal opportunities for all.
- As part of legal considerations, students learn about various pieces of legislation, how they have come about, their impact, and what is set to happen in the future.
- As part of commercial considerations, students are introduced to the commercial benefit of Design for All and various supporting arguments, such as the problem of retro-fitting design. Other requirements, such as the importance of making sure that products appeal to all and do not carry stigma are re-iterated since the "specialised solution" design that is non-aesthetic is often rejected, even though it may fulfil its functional requirements.

3.3 Recommendations

This knowledge category is a 'catch all' for work such as Principles, Guidelines, Standards, Recommendations, and Specifications that have a bearing on Design for All.

Learning outcomes:
Students are made aware that such bodies of knowledge exist. They should be encouraged to search for such work and consult them as a first step. At the same time, it is acknowledged and explained/illustrated that these are not always easy to find, and rarely will be in a format that is easy for them to use and implement in specific contexts. The 'jargon' of each type of recommendation is also a consideration.

3.4 Interpersonal Skills for Teamwork

This category is slightly different from the preceding ones because it centres on skills rather than on knowledge. However, it can be stressed to students that behavioural skills such as team work, communication skills, information representation, information retrieval, etc., are very important to design work practice in general (see Career Space: Curriculum Development Guidelines. Available at: http://www.careerspace.com/) and to Design for All in particular. This is because Design for All is not widely understood or accepted as yet. Designers with Design for All knowledge may find themselves the only person in the team. They will have to work to convince their co-workers at many different areas within the organisation of the importance of Design for All.

For this area, the actual teaching strategies are the most useful way to give students the opportunity to learn these skills, by organising team work, presentations and critical evaluations/critiques. In particular students who are to work as agents of change or 'evangelists' for Design for All should be able to demonstrate their skills of convincing the unwilling/disbelieving/unaware with sound argument and efficient persuasion.

Learning outcomes:
Students are made aware of the existence of these skills, their importance to the workplace, and to Design for All, and that they should practise them.

3.5 Accessible content: knowledge about documents and multimedia

As its label implies, this category refers to making sure that 'content' (mostly information and interactive Web sites) are accessible. The content can be all types of media, and one of the first rules of accessibility is that alternate forms of media be available. Topics can include: making content accessible in the sense of structuring documents, or making Web content accessible in the sense of what content goes in, or even in the sense of Web content management. The learning outcome is generalised. Depending upon the type of students, whether they are Web designers with training in information design or computer programmers, the topics and their related objectives can become more specific, for instance, understanding how to code for accessibility, etc.

Learning outcomes:
Students develop the ability to understand when content is problematic and why. They learn about current methods and techniques to produce accessible content or to convert content. Depending upon the type of student or course, they develop the ability to produce accessible content or to convert content.

3.6 Accessible interaction: input and output

This label is subtitled 'input and output' to delineate the category from accessible content. This category is for the hardware and software enablement of interaction, but abstracted from the users.
Topics here would include:

- Knowledge about assistive and adaptive devices that enable alternative input and output, e.g. speech synthesizers, screen reader software, screen magnifiers, alternative keyboards, etc., as well as different types of browsers and operating systems that allow different manipulation of the content, etc.
- Knowledge about different types of modalities: speech, haptics, gesture, sketch, scanning, bio-sensors, etc.
- Knowledge about different bandwidths, device capabilities, etc.

Learning outcomes:
Students are introduced to a range of different input and output modalities and considerations. As with other categories, depending upon the specific course objectives

and the background of the students, the material can range from ‘knowledgeable about’ to ‘knowing how to’—that is, competent to talk about these topics and understanding at a general level how they function, to being able to actually develop them and to work on developments with them.

3.7 New paradigms of interaction

This category was created for the work that is mostly in the research state currently, but within the next five years—the typical time span of an undergraduate+master’s university education—could breakthrough into mainstream development. Topics that could currently be included here are affective and social computing, a range of smart computing applications, smart homes, clothes, cars, ambient intelligence, etc.

Learning outcomes:
Students become familiar with the emerging paradigms, understanding how they have evolved from current paradigms. Further specialisation depends upon both the background of the students and degree of emergence of the paradigm. In each case, students must be encouraged to view these developments through the ‘lens’ of Design for All.

3.8 User centred design

This category is the one into which go all the human, user, usability/accessibility philosophies, methodologies and techniques that apply to requirements and evaluation phases of design, etc. Many of these are routinely taught as part of HCI courses, but note that as currently used they do not always include diversity in users and situations.

Learning outcomes:
Students are made aware of the work in this area, the methods and tools available, and the way these can be used to capture requirements and to evaluate designs for e-inclusion. Students are also required to actively use these techniques, etc.

3.9 Application domains and research

This label can refer to ‘application domains’, and separately to research issues and challenges that go with them, or it can view these two activities as related, dependent upon the case.
This category has a wealth of areas, such as public access to information, authoring environments, health monitoring, etc. One of the most important for the contribution it is bringing to the field as a whole, is that of technology enhanced learning, and for this reason is it described in more detail below

Learning outcomes:
As with paradigms of interaction, application domains within the ICT sector need to be followed by students, and they need to bring to them the Design for All perspective, perhaps carrying over lessons from one application into another.

3.9.1. eLearning

The education sector, and in particular the higher education eLearning sector is well advanced in its considerations of what it means to have accessible e-learning. It is in this domain that one finds courses built around Web technologies, making content accessible and making interaction accessible. Typically the development of accessible instructional materials is a distributed process, where course materials are a combination of instructor created materials, including assessment/evaluation materials (tests and quizzes); existing materials that an instructor links to; and the organisational and evaluation capabilities of some course management tool. In addition, classroom collaborative activity is simulated by some kind of synchronous or asynchronous conferencing system.

Learning outcomes:

Two possible scenarios follow.

1. An application domain as rich as that described above can be used as a guiding framework for students following a series of modules on Design for All. Thus, the seemingly disparate categories can be shown to be facets of a whole problem. Thus the application domain can be introduced into other categories.

2. Another approach is to use the background of the eLearning domain to help to narrow down specific parts of the overall problem, such as making content accessible, including the content that students link to, or assuring equivalence by removing bias and accommodating all types of students needs, as far as is reasonable in assessment/evaluation exercises. In such a case students will seek research results such as those from user modelling, user and device profiles, customisation, personalisation, adaptivity, emotions, adaptable interfaces and accessible metadata, etc.

4. Conclusions and next steps?

The work of IDCnet is to identify core knowledge and skill sets, in discussion with industry and academia, by carrying out teaching pilots, and by communicating the results to Education Policy and Strategy bodies.

Insofar as teaching inclusive design, this tackles some of the fundamentals of the issue, but leaves out questions of accreditation, how to train the trainers etc.
We also need to discover how we can best promote industry-academia co-operation on Design for All curricula in ICT. What is certain is that inclusive design is here to stay. Although industry may not be featuring it in its advertisements, this should not deter us. After all, after so many years of HCI, industry, in its documents addressing the ICT skills gap, did not mention HCI! (www.career-space.com)

Thus IDCnet is still discussing whether everything we want to teach is covered in the categories mentioned above, and we are looking for those involved in teaching to contribute with their experiences. We invite you to participate in the project's discussion list at helsinki@listserv.cc.kuleuven.ac.be, and if interested to participate in future network activities—more information at www.idcnet.info.

Acknowledgements

This work is being undertaken in the framework of the project IDCnet – IST–2001–38786, partly funded by the IST Programme of the European Commission. The Authors would like to acknowledge the contributions of their colleagues from the Fraunhofer Institute for Applied Information Technology; DocArch, Katholieke Universiteit Leuven Research & Development; the Universitat de València Estudi General (Research Unit ACCESO); STAKES (National Research and Development Centre for Welfare and Health); Royal National Institute for the Blind; and ISdAC International Association.

References

Abascal, J. and Nicolle, C. (2001). Why Inclusive Design Guidelines?. In *Inclusive Design Guidelines for HCI*, Nicolle, C. and Abascal, J. (eds), Taylor and Francis, London.

Darzentas, J.S. (ed.), (2003a). Identifying core knowledge and skill sets for model curricula. IDCnet Deliverable 3.2.

Darzentas, J. S. (2003b). Design for All:Designing for Diversity in *Tales of the Disappearing Computer. In print* Kameas, A. and Streitz, N. (Eds). CTI Press Patras, Greece.

Dong, H., Keates, S. and Clarkson, J. (2003), UK and US industrial perspectives on inclusive design. In proceedings of Include 2003, Inclusive Design for Society and Business, 26-28 March 2003, London: Helen Hamlyn Research Centre, Royal College of Art.

Engelen, J., Strobbe, C. and Darzentas, J. (2003), Teaching design for all: the needs and expectations of industry from a DfA curriculum. Paper to be presented at HCI International, Crete, June 2003. International Proceedings to be published by Lawrence Erlbaum Associates.

International Organisation for Standardisation, 2000, *ISO 16071 Ergonomics of Human–System Interaction—Guidance on Software Accessibility. Technical specification* (Switzerland: International Organisation for Standardisation).

Lebbon, C. (2003). I-design – building a toolkit for inclusive designers. In Proceedings of Include 2003, 26-28 March 2003, London: Royal College of Art.

Nicolle, C. and Maguire, M. (2003). Empathic Modelling in Teaching Design for All. Paper to be presented at HCI International, Crete, June 2003. International Proceedings to be published by Lawrence Erlbaum Associates.

Story, M.F. Special Topics on Universal Design: retrievable from http://www.udeducation.org/teach/course_outlines/courses_focus/story.asp