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Experiences and Lessons Learned from an International Master's Program on Universal Design of ICT

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Experiences and Lessons Learned from an International Master's Program on Universal
Design of ICT

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Abstract

The development and widespread adoption of Information and Communication Technology (ICT) has brought great benefits to the society. However, it has also resulted in new inequalities as digital divides have emerged among groups of ICT users. We believe that education is the key to increase awareness and provide knowledge and competence to current and future ICT professionals in order to ensure universal design of ICT systems. The International Master's program in Universal Design of ICT (MAUU) at the Oslo and Akershus University College of Applied Sciences (HiOA) aims to meet the growing need of society for knowledge and expertise in universal design of ICT solutions. In this paper, we share our experiences and lessons learned from establishing, implementing, and managing the program, especially in recruitment, program structure, pedagogical methods, collaboration with other relevant organisations and educational institutions.

Keywords: universal design, ICT, education

Experiences and Lessons Learned from an International Master's Program on Universal Design of ICT

The rapid development and adoption of ICT has resulted in new inequalities among groups of ICT users due to the emergence of digital divides. This trend has produced social, political, and technical movements aimed at ensuring equal opportunities for everyone through the universal design of ICT. In Norway and many other countries, it is becoming a legal requirement that ICT systems and services should be accessible by anyone, anywhere, at anytime, and through any media and device, such as desktop, web and mobile applications, and self-service machines, so that all citizens can take an active part in social activities, education and employment. This poses great challenges for competent ICT professionals and society's ICT infrastructure and services.

Despite of the great effort in promoting universal design of ICT at different levels including legal, institutional and technical, there are still many ICT systems and services that are not accessible. We believe that education is the key to increase awareness and provide knowledge and competence to current and future ICT professionals in order to ensure universal design of ICT systems.

The International Master's program in Universal Design of ICT (MAUU) at the Oslo and Akershus University College of Applied Sciences (HiOA) aims to meet the growing need of society for knowledge and expertise in universal design of ICT solutions. Our effort is in accordance with the recent Teaching Accessibility Initiative (<http://teachingaccessibility.com/>), which gathers industry, academia and advocacy together to "create models for teaching and training students of technology to create accessible experiences".

In this paper, we will share our experiences and lessons learned from establishing, implementing, and managing the program, especially in recruitment, program structure,

pedagogical method, collaboration with other relevant organisations and educational institutions.

Related work

Integrating universal design principles into university curriculum is not a new idea and quite some efforts have been made in this area (e.g. Kurniawan, Arteaga, & Manduchi, 2010; Ludi, 2007; Waller, Hanson, & Sloan, 2009; Wang, 2012). In fact, as early as 2002, Jonathan Lazar discussed the needs for addressing accessibility and offered suggestions on how to integrate accessibility into courses that are commonly offered as a part of the information systems curriculum (Lazar, 2002). Gellenbeck (2005) reported their experience in developing educational materials to integrate accessibility knowledge units into the computer science curriculum. In the Accessing Higher Ground conference in 2013, a pre-conference session on Integrating Universal Design into the University Curriculum (<https://staff.washington.edu/tft/talks/ahg13/ud/>) took place where five facilitators from five different universities presented their views and shared their experiences in integrating universal design into different courses and programs. Youngblood (2013) discussed the pedagogical issues related to integrating accessibility principles into interactive media and communication curriculum. In 2013, we received a small funding from Universell* (<http://www.universell.no/>) to integrate the concept and principles of universal design into our undergraduate computer science curriculum. Such integration has been found to be able to increase students' awareness of the accessibility issues (Poor et al., 2012).

In addition to integrating into university curriculum, some universities developed dedicated courses and degree programs for universal design of ICT or accessibility. For example, The Dublin Institute of Technology in Ireland offers an MSc in Computing (Universal Design and Assistive Technology). The Université Paris 8-Vincennes-Saint-Denis in France offers a multidisciplinary Master's program on accessibility and development of

Assistive Technologies. The Technical University in Dresden in Germany offers a course on "Barrierefreie Dokumente" (accessible documents). The Master's course on Assistive Technologies and Universal Design at the University of Southampton in the UK teaches a broad range of accessibility topics, including iPhone accessibility. The University of the Aegean in Greece offers its Design students (undergraduate and Master's level) a course entitled 'Design for All'. In Canada, the OCAD University offers a Master of Design program in Inclusive Design. In the US, the University of Colorado Boulder offers an online course titled "Universal Design for Digital Media: Where Usability & Accessibility Meet".

The Master's program

The Master's program in Universal Design of ICT at HiOA started in 2012 after being approved by the Norwegian Agency for Quality Assurance in Education (NOKUT) in April the same year. HiOA decided to run a pilot of the program starting in August 2012. The first official start of the Master's program in Universal Design of ICT was in 2013.

Aimed towards producing ICT professionals with expertise in planning, developing, and evaluating universally designed ICT solutions, the program is structured around a set of mandatory courses and a 60 ECTS Master Thesis, lasting 3 semesters. In total, the Master's program amounts to 120 ECTS and has a duration of 4 semesters (full-time).

The program consists of three types of courses:

- *General courses* providing a general foundation for conducting a Master's project.
- *Specific mandatory courses* providing a thorough knowledge of essential topics within universal design of ICT.
- *Elective courses* providing in-depth knowledge within selected topics.

The general courses include **Academic Writing**, covering the structure and composition of academic texts, and **Research Methods and Research Ethics**, focusing on

qualitative and quantitative research methods essential to the universal design of ICT and ethical perspectives in universal design research.

The specific mandatory courses consists of **User Diversity and ICT Barriers** covering different user requirements based on diversity among users, equipment, and situations, as well as the identification and elimination of technical barriers. This course also covers national and international guidelines, regulations and legislation relevant for universal design of ICT; **Universal Design of Interactive Systems**, focusing on terminologies, methods and technical solutions in universal design of ICT; and **Interaction Styles and Technologies for Accessibility**, where accessibility issues and technical solutions related to the state of art human-computer interaction styles and technologies are covered.

The elective courses include **Programming and APIs for Interaction**, covering the technical aspects of the implementation of user interfaces; **Intelligent User Interfaces**, focusing on the use of artificial intelligence technology and images, video and sound analysis to meet the user's needs and to handle ambiguous interaction situations; and **Globalisation of Technology**, which focuses on how cultural factors influence the experience with user interfaces. In Globalisation of Technology, students have the option to do a (small) course project abroad at one of our partner institutions.

To ensure thorough and in-depth work on the chosen topic for the Master's project, the students start working with their Master's projects in the second semester, while still taking mandatory courses. In the third and fourth semesters, the students focus more on their Master's projects and writing their theses. At the end of their Master's projects each student is required to deliver a Master's Thesis for final assessment. Students also have the opportunity to conduct parts of their Master's projects abroad through a professor-to-professor agreement.

The structure of the Master's program as of August 2015 is shown in Table 1. The gradual increased focus on the Master's thesis is organised in phases with work requirements

that are assessed at the end of each semester. All work requirements for a phase have to be approved for the student to be allowed to continue to the next phase. This is another measure to ensure both progress and quality in the students' work with their Master's theses.

Consequently, students do not receive credits for the Master's Thesis until they have passed the final exam in the fourth semester.

Table 1

Structure of Master's Program in Universal Design of ICT (August 2015)

Semester	Courses		
1	Academic Writing, 10 ECTS	User Diversity and ICT Barriers, 10 ECTS	Universal Design of Interactive Systems, 10 ECTS
2	Research Methods and Research Ethics, 10 ECTS	Interaction Styles and Technologies for Accessibility, 10 ECTS	Master's Thesis Project phase I
3	Elective course, 10 ECTS	Master's Thesis Project phase II	
4	Master's Thesis Project phase III Final exam Master's Thesis (60 ECTS)		

The program is based on student-centred learning methods, with student-run seminars and project work that require active participation from students. This gives ample opportunity for feedback to each student as well as training students in presenting and discussing their work. Teaching methods used in courses include lectures, assignments, seminars, and project work, as well as using online learning resources. In addition, remote participation from students is supported by a video conferencing system. Lectures are also recorded and allow students to review the lecture videos after class.

Challenges and Lessons Learned

In summer 2015 the first group of Master's students admitted in autumn 2013 finished their study. At the time of writing, we have in total 45 students registered in the program, 5 admitted in 2013 (delayed), 20 admitted in 2014, and 20 admitted in 2015. Table 2 shows the distribution between students from Norway and EU and from other countries.

Table 2

Distribution of students 2013-2015

	2013	2014	2015
Norway and EU	3	7	12
International	10	13	8
Total	13	20	20

Recruitment

For the pilot study we had difficulties in recruiting students because of the limited time for recruiting. Later we established a Facebook page for the program where we publish information, activities, open positions, and career opportunities related to the program. We have also made brochures that we have sent to partner institutions and distributed at conferences. In addition we advertise the program in Google by providing relevant search keywords. We have also arranged information meetings for Bachelor students in related subject areas such as computer science, information science, etc.

We have realized that a recruitment strategy is essential for the program. An annual recruitment activity cycle together with the division of responsibility should be clearly defined. We have made an annual recruitment cycle including the time and activities as a first step. Administrative support is considered very important in effective recruitment.

The best recruitment is that our students become the ambassadors for the program. They participate actively in recruitment meetings and events. Half of the Master's students

admitted in 2013 have also published their research in international conferences. Their achievements have given the program a good reputation and made it attractive to potential students.

Program structure

The International students come from different areas of the world such as Asia, Africa and Europe, and have diverse background, including computer science, electrical engineering, etc. Their levels of English in understanding, speaking, and writing are also different. In the pilot study, we have already experienced that the language and background posed challenges. Some of the students were not able to follow the lectures in the beginning and had great difficulties with discussion and presentation in class as well as writing project reports. This has partially resulted in that some students were not able to follow the plan defined by the program.

Based on these experiences, we have moved the Academic Writing course from the second semester to the first semester and moved Research Methods from the first semester to the second for students who started in autumn 2014. By doing so, we hope that the Academic Writing course will give students the necessary competence in English, so that they can better participate in the activities defined by the program.

Pedagogical methods

Some of the International students also experience culture shock in terms of study methods and form of exams in the Master's program. In the program, we emphasise self-study, active group work and discussion, and encourage independent and critical thinking. The exam questions also reflect on these points. We experienced that many international

students were used to sit in a big classroom and listen passively to the lecturers rather than actively participating in the classroom discussions.

In order to prepare students with their study, we set up sessions to introduce the study methods in the first week of the semester. In addition, lecturers arrange special individual and group supervision sessions during the courses, so that students receive adaptive and individualised support from the lecturers in relation to their progress and projects. In addition, we utilize student-centred and peer learning approaches where students take responsibility for running seminars and practical exercises and providing feedback to each other on projects and reports.

Collaboration

One of the challenges for students in the program is to understand the ICT barriers experienced by different user groups. In most cases, the students have never thought about the user diversity before. In order to address this challenge, we have established collaboration with different public and private institutions and non-governmental organisations (e.g. organisation for people with disabilities, elderly, and immigrants). We take our students on excursions to these institutions/organisations and invite people from these institutions/organisations to give guest lectures and encourage students to collaborate with these organisations in their Master's projects. Through these activities we have seen the increased understanding among students of the user diversity and ICT barriers, which gives them motivation to gain more knowledge and skills in universal design of ICT.

In addition, students are encouraged to stay abroad in our partner institutions for 3-6 months in one of the elective courses. We also invite international researchers in the field to give guest lectures in our courses. The experience in partner institutions and guest lectures

provide students with global perspective and new ideas. The personal experiences of these researchers also help students to understand and reflect on their goals and career paths.

Discussion

Integrating Universal Design as a topic and focus area for ICT education has promoted knowledge and awareness of practical ICT solutions designed for the diversity of the human experience, fostered changes in pedagogical approaches to teaching and learning, and encouraged new forms of commercialization and innovation.

The MAUU program at HiOA has promoted new knowledge and increased awareness of universally designed ICT solutions. Students are involved extensively in planning, developing, and evaluating universally designed ICT solutions through their coursework and the in-depth study involved in their Master's project. The MAUU program is designed to internalize knowledge, skills and abilities in the universal design of ICT by utilizing student-centred learning methods, student-run seminars and practice-based exercises that require the active involvement and participation of students. This internalization ensures that the students graduating from the MAUU have the capacity to advocate for and create universally designed ICT solutions. In addition, the international experiences that MAUU graduates may gain by studying abroad and conducting presentations at international conferences provides an opportunity to further disseminate and exchange knowledge on universal design of ICT between different institutions and cultures. Through these experiences the MAUU students become ambassadors and advocates for the universal design of ICT and contribute to increasing awareness globally. Thus, the MAUU program takes a bottom-up approach to achieving social change and technological innovation by empowering individuals at the start of their careers to promote equality through the universal design of ICT.

The MAUU program has also stimulated new and multimodal approaches to teaching and learning. The program has developed a problem-based, solutions-oriented approach that integrates teaching and learning efforts with relevant stakeholders from the public and private sectors. This approach aims to create new models for teaching and learning universal design of ICT by connecting course lectures, assignments, seminars, and project work with on-going efforts in government and industry. The program has additionally partnered with non-governmental organisations representing people with disabilities, elderly, and immigrants. The program also utilizes a wide variety of digital learning resources and formats to promote student-centred and peer-to-peer learning opportunities.

Finally, the MAUU program has the capacity to begin delivering commercially viable universally designed ICT products and services as spin-offs of on-going research, development and education. While the program has yet to produce a startup from these efforts, one of the implicit aims of the program is to encourage entrepreneurship by using universal design to enhance the value of new and existing ICT products and services. The potential for developing universally designed commercial products and services as an output of the program, through student entrepreneurship and research and development efforts, promotes new opportunities for innovation. Thus, the program provides a unique opportunity to contribute to local, national and international markets by using universal design of ICT as a platform for promoting innovation.

Conclusion

In this paper we have shared our experience in establishing, implementing, and managing the international Master's program in universal design of ICT. The challenges in program plan, recruitment, pedagogical methods, and collaboration with academic and industry and how we addressed the challenges have been discussed.

The program plan and pedagogical methods are under constant evaluation and revision. Feedback from students, lecturers, and employers for our graduate students and our own reflections are taken into considerations in the revisions. We have recently changed the admission requirement to include Human-Computer Interaction background, so that the students have a common starting point for the program. We are currently working on extending the program from full-time to providing full-time, single-course, and part-time programs in order to accommodate students who are not able to participate in the full-time program. In addition, we work closely with the administration to improve recruitment for the program. Since July 2015, the program is advertised at Study Portals (<http://www.studyportals.com/>), which provides information for helping people finding international Masters in Europe. In September 2015 the international office at HiOA published a joint brochure for all international Master's programs at HiOA. It is already taken into use in the recruitment processes for fall 2016.

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