

Experiences from a Master's Degree in Assistive Technology for Independent Living

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Abstract—This paper presents a Master's Degree in Assistive Technology for Independent Living taught by the University of the Basque Country (UPV/EHU). The main objective of this master's degree is to train professionals to be able to prescribe, adapt, maintain and monitor the use of Assistive Technology to enable the social integration of people with disabilities and elderly people. In this way, graduates are given suitable training in order to be able to propose a range of original solutions with which to overcome barriers caused by disabilities and aging, and to help people with restrictions to achieve more independent living. It is hoped that graduates will be contracted by industries wanting to employ people with disabilities, institutions providing support to people with restrictions, or administrations fighting against social exclusion. Students come from technological, social and health areas. One of the conclusions of this experience was that we found that the mixture of backgrounds provides valuable experience for working in multidisciplinary teams and that practical work with users and professionals is fundamental for the professional training of the graduates.

Keywords—Master's degree; social applications of engineering; Assistive Technology; Independent living

I. CONTEXT AND PRECEDENTS

The Basque Country has a long record in the provision of support and care to people with disabilities and elderly people, in conjunction with a number of industries devoted to provide employment to people with disabilities. In recent decades Research and Development activity in Accessibility, Assistive Technology, Smart Homes, Technology for Health Care, etc., has increased notably in the Basque Country, frequently due to the availability of regional and European funding.

A number of industries, research institutes and institutions with a mutual interest in social applications of Information and Communication Technologies (TIC) created the "Association of Industries Interested in Social Computing" (APTES)[1], with the objective of studying, enabling, and leading R&D activities in that field. One of its first findings was that most engineers working in socially supportive R&D had not received specific training in key topics such as disability, aging, accessibility, ergonomics, etc. Therefore, APTES contacted the University of the Basque Country to co-organize a Master's Degree principally oriented to people that were already working in the area, who required some theoretical

and practical training to complete their professional experience.

The resulting Master's Degree was not official. The qualification was given by the UPV/EHU. This master was only taught in 2005-2006, and twenty people graduated from it.

This experience was the starting point for the proposal of a new Master's degree officially recognized by the Spanish Academic Administration that would start in 2009. The period from 2007 to 2009 was devoted to analyzing the accumulated experience and to refine several key issues for the new proposal, such as objectives, methodology, teaching materials, collaboration with care and research institutions, etc.

II. SIMILAR DEGREES IN THIS FIELD

Diverse degrees in Web Accessibility and Accessibility to the Physical Space are being taught by different universities. They cannot be compared with the MSc described in this paper because most of them follow an on-line teaching style and lack any practical contact with the users and their environment.

Since 2007 King's College London has offered an MA on Inclusive Education & Technology [2]. It is composed of 90 ECTS credits, to be taken in one or two years. The impartation modality is face-to-face. Its aim is to develop participants' knowledge, understanding and capacity to critically appraise and systematically reflect on learning difficulties and disabilities, e-Inclusion, and the use of technology within educational settings. Even if it focuses on the learning objective, some of the applied methodologies and the achieved skills are similar to our MSs.

More similar to our proposal is the MSc in Assistive Technology taught from 1999 to 2007 also by King's College London. Its aim was to develop the students' capacity for critical thinking and complex problem solving, and also to help them to gain practical skills, through short placements, and research skills through a dissertation project. The course was run in a traditional format, rather than via distance learning. It was defined as multidisciplinary, flexible, user-centred academic and practical, and vocational. Most of its focus and subject matter are also covered in our proposal: "Disability, technology and Enablement", "Mobility",

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“Assistive Technology Access”, “Augmentative and Alternative Communication”, “Daily living Technologies”, “Assistive Technology Provision” and Statistics and Research Methods”. In line with our proposal the access requirements are multidisciplinary: a certificate in Rehabilitation Engineering, Physical Science/Engineering (plus three years of relevant work experience) or a diploma in a clinical subject (Occupational Therapy, Physiotherapy (plus two years of relevant work experience)).

The methodology and teaching style is also similar. “The reduced number of students favoured well integrated groups, but supplementary income to keep the course going was needed. Fifty five percent of the graduates went on to jobs in the AT field with higher levels of responsibility, following completion of the MSc” [3]. The main difference is in the ratio of credits devoted to practical experience in real assistive premises working with users and professionals.

III. A MASTER’S DEGREE IN ASSISTIVE TECHNOLOGY FOR INDEPENDENT LIVING

A Master’s degree in “Assistive Technology for Independent Living” was designed by a committee composed of UPV/EHU lecturers, members of APTES, and experts from diverse research, care and employment institutions. Its main objective was to train professionals to be able to prescribe, adapt, maintain and monitor the use of Assistive Technology to allow the social integration of people with disabilities and elderly people.

A. Fundamentals

As a starting point the commission agreed on some organizational issues that conditioned the structure and schedule of the proposed master’s:

- To accept students from very diverse backgrounds (technological, health and social), in order to provide a multidisciplinary working environment. In this way, students with a background in health or social affairs would gain experience with technology applications for independent living, and students with a technological background would learn about the actual characteristics and needs of people with disabilities and elderly people. Therefore the objective was that each graduate would be able to progress in her or his own specialization and additionally, have a good command of the multidisciplinary aspects.
- To orient the degree to people currently working in the field as APTES was aware of a significant demand for specialization from people working in this area. This decision very much conditioned the schedule (the lectures were concentrated in one day a week) and the teaching period (at least two years were necessary to take the master’s).

B. Design Process

The committee created *ad-hoc* for the design of the master’s was composed of UPV/EHU lecturers and APTES members. The latter included experts from member companies, research institutes, sheltered employment and health care providers, all of whom were working in the area of

disability and aging. They met regularly between 2007 and 2008.

Apart from designing content and deciding the general structure of the Master’s degree, the committee sought suitable lecturers for the new degree (as required by the UPV/EHU to process the proposal).

The degree proposal was completed at the end of year 2008, and was submitted to the Regional and National Quality Evaluation Agencies. After fixing and fulfilling a number of amendments pointed out by these Agencies, official permission to start the master’s was obtained at the beginning of year 2009. Therefore, the UPV/EHU started teaching this Master’s degree in the course 2009/2010.

IV. MASTER’S DEGREE CHARACTERISTICS

The teaching and learning activities of the master’s were structured in three categories:

- Face-to-face master’s sessions (30%).
- Practical seminars where students develop specific assignments, usually working in groups (40%).
- Visits to care, employment, or research institutions guided by local professionals to observe activities implying real users (20%).
- Evaluation sessions, including oral presentation of some assignments and exams (10%).

In addition, students have to stay in centres out of the UPV/EHU:

- A 150-hour practicum developed in the first year. The practicum usually serves as an initial approach to their Master’s theses to be completed during the second year.
- A 15-ETCS Master’s thesis (requiring a minimum of 375 hours of personal work) in the second year.

The thesis is usually developed in a care-giving institution, employment providing organization, or research institute, member of APTES. In addition other industries, associations and institutions offer the possibility of hosting and supervising students to develop their Master’s Theses. For instance, *Grupo Gureak* [4] is an industrial group that provides employment for more than 4,000 people with diverse types of disabilities. ELKARTU is the Coordinator of the Federations of People with Physical Disabilities in Gipuzkoa [5]. *Matia Fundazioa* [6] is a non-profit making organization with over 130 years' experience looking after the elderly, employing around 1000 highly qualified professionals. It has a unit, called *Matia Gerontology Institute* [7], dedicated to creating applicable knowledge and disseminating it to society. In addition diverse research institutions collaborate on the master’s (such as VICOMTech-IK4 [8] and Tecnalia [9]) integrating several Master’s Theses into their research projects in Health-care, Ambient Assisted Living, Accessibility, etc.

A. Profiles

As previously mentioned, the accepted students have diverse Bachelor degrees in technological studies (such as

Informatics, Engineering, Electronics, etc.); social studies (such as Pedagogy, Psychology, Social Working, etc.); health area (such as Nursery and Medicine). The profiles of the lecturers are also multidisciplinary, in order to be able to teach the matters included in the master's degree. A significant number of the lecturers are professionals from industries, institutions and associations dedicated to the support of people with disabilities and the elderly.

B. Competences

The graduates are expected to work for industries wanting to employ people with disabilities, institutions providing support to people with restrictions, or administrations fighting social exclusion. To this end, graduates should acquire these general competences:

- Ability to identify and analyze the needs of people with disability, the elderly, dependents and/or with a social exclusion risk.
- Ability to select, assess and adapt assistive equipment to people with disability, the elderly, dependents and/or with social exclusion risk.
- Knowledge about Legal and ethical issues related to disability and ageing.
- Ability to enhance the autonomy and quality of life of people with disability, including their personal and social inclusion in the working environment.

C. Subjects

This master's has been taught by the University of the Basque Country (UPV/EHU) since 2009. It is composed of 6 mandatory subjects (from 6 to 9 ECTS each), a Practicum and a 15 ECTS Master Thesis. All of them are oriented to acquire competences fully related to Design for All.

In the first year cross curricular competences related to human factors are studied, principally concerning Disabilities and Ageing. In addition they take a 150-hour *practicum*. In the second year they study Legislation, standards, policies and initiatives, Augmentative and Alternative user interfaces, and Mobility and technology for Independent Living subjects. They also develop a 375-hour Master's thesis.

D. Management

Several members of the designing committee became members of the Academic Committee set up to manage this master's degree. In addition coordinators were appointed for each module. The academic committee meets periodically to supervise the Master's and to solve possible incidences.

Taking into account the interest of APTEs to orientate the master's to people currently working in the area, the schedule was organized so that eight hours were taught on Fridays. For this reason two years are necessary to take the 60 European Credit Transfer and Accumulation System (ECTS).

E. Achieved Results

So far, after six years of experience, the achieved results are satisfactory. Ten students graduated in the first promotion. In the second promotion eight students graduated. Currently,

the five students of the third promotion are working on their Master's theses.

V. MASTER'S THESIS PROJECTS

One of the aspects that most attract future students to this master's is the possibility of developing their Master's Thesis in the facilities and conditions provided by collaborating industries, research institutions and care centres, working in fields related to disability, aging, accessibility, assistive technology, care provision, etc.

Even if engineers are usually allocated technology oriented projects, they are asked to devote a considerable part of the project to the study of human factors, in order to detect user needs, to perform evaluations with users, to apply user-centred design, etc. In this way they develop new skills related to the human side of the interaction.

To obtain an idea of the diversity of the topic under study, these are some of the projects that have been defended by master's graduates;

- Contributions to public transport accessibility based on collaborative design.
- Contributions to Accessible Web Design.
- Routing and personalized guidance for people with visual impairments.
- Creating e-pokayoke for Promoting Employment of People with Intellectual Disabilities.
- Usable eReaders. Market Analysis and Design.
- Design of a System for the Development of plans for Independent Life.
- Customizing User Interfaces in Telemetry by means of the ISO / IEC-24752 and ANSI / CEA-2018 standards.
- Neurorehabilitation System Based on Virtual Reality and Remote Evaluation.
- A survey on the implementation of Augmentative and Alternative Communication systems.
- Affective computing in the field of autism spectrum disorders
- New technologies applied to task learning for people with intellectual disabilities
- Postural patterns detection system for wheelchair users
- Nutritional study of older people at home for the design of a diet support system
- ELKARLAGUN: accessible spaces management system
- DISAAC: Augmentative and alternative communication in the hospital setting
- Values of the Socio-Technological Spaces in co-Education

VI. A NEW VERSION OF THE MASTER'S IN ASSISTIVE TECHNOLOGY FOR INDEPENDENT LIVING

A. Drawbacks of the current format of the degree

While most students in the previous promotions were working while taking their Master's, the students in the current promotion are fully devoted to it. That means that the population of people with working experience in this field that wanted to complete their training and theoretical background has very much decreased. Current target students are recently graduates, who prefer to take the master's in one year, having classes throughout the week. Nevertheless, students who are working during the course will be able to take specific subjects required for their work, without engaging for the whole degree.

The Academic Commission decided to make some modifications to the curriculum that have been recently approved by the National Quality Evaluation Agency of the Universities. Therefore the master's will adopt this new format for next course (2015/2016).

B. Characteristics of the new version

Due to evolution of the relevant technology, some topics have been updated and others have been allocated more time, such as Web Accessibility and Ambient Intelligence for Smart Homes.

The new master's degree maintains a 60 ECTS design, but the subjects are split into thirteen 3-ECTS mandatory subjects, a 6-ECTS Practicum, and a 15-ECTS Master thesis. The face-to-face master's sessions will be taken in 4 hour sessions from Monday to Friday afternoon.

C. Subjects

Basically, the subjects cover the same topics taught in the previous design, but a number of updates have been included, and topics have been reorganized in 3-ECTS modules:

- **Legislation, ethics and standards.** Legal and ethical issues. Applicable guidelines and standards.
- **Research methods:** Design, data analysis and oral and written communication. Organizing ideas, discourse building, writing and oral expression for interpersonal and public communication.
- **Team work and entrepreneurship.** Work in multidisciplinary teams in professional environments. Planning, developing ideas, decision making.
- **Current conception of disability:** Independent Living, social and labour participation, inclusion, civil rights.
- **Supporting models for social and labour integration.** Diagnosis, evaluation, and assessment of assistive models and tools for social and technological support applied to social and labour integration.
- **Active and healthy ageing.** Enhancement of the ageing process and independent life.

- **Dependent elderly.** Theoretic-practical methodologies and tools for socio-educative working with mature, elderly and dependent people.
- **Chronic stage and teleassistance.** Chronic patients' characteristics and needs. Self care and active health.
- **User-adapted human-computer interaction.** Principles of user interface design and evaluation for people with permanent or temporary disability. Usability and accessibility. User-centred approach.
- **Augmentative and Alternative Communication.** Oral communication disorders. Characteristics, support, resources.
- **Web accessibility.** Methods, standards and techniques to design and evaluate Web accessibility.
- **Assisted Mobility.** Autonomous mobility, adapted transportation, environment control, manipulation.
- **Intelligent environments to support independent daily-life.** Assistive robotics, intelligent environment and ambient supported living.

VII. ADVANTAGES FOR ENGINEERS

A. Transdisciplinarity

The majority of master's degrees available to Engineers in the Spanish academic system are oriented to specialization in technologically specific matters. However, the master's presented in this paper has a transdisciplinary approach that, in our opinion, contributes to the comprehensive training of engineers who will go on to work for humankind in diverse environments. Even if the engineers graduating in this master's are expected to work principally in technological areas, they will be able to take into account all the aspects implicated in the application of technology to support humans.

B. Practical approach

The high ratio of practical classes developed in real environments, in contact with people with disabilities or elderly people, provides practical experience that cannot be obtained with only theoretical lessons. In fact, the graduates stated that this is one of the most appreciated characteristics of this degree.

The Academic Committee of this master's have received invitations to convert it into an on-line master's course, in order to increase the number of students, to reduce costs, and to extend it to a broader audience, principally in Spanish speaking countries. These invitations have been always declined because the Academic Committee is of the opinion that physical contact with users and professionals from the area of Disability and Aging cannot be substituted by any other format of knowledge transmission.

VIII. CONCLUSIONS

The experience obtained by the conception, management, teaching and evaluation of a Master's degree on Assistive Technology for Independent Living suggests that the integration of students with a background in engineering with students coming from health and social areas has proved to be

very positive. Engineers had better opportunities to learn how to treat human issues in designing and testing supportive technology. In addition, it enhanced their ability to work in multidisciplinary teams.

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