iwac

integration of web accessibility courses

Collection of good practices for the integration of web accessibility in IT education

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Introduction

Web accessibility has in recent years started to gain more attention, especially among public organisations, largely because of the new EU-wide legislation on the subject.
As more and more professionals, both in IT-related roles and other roles, need to start practicing accessibility in their work, there is an increasing demand for education and training in the subject at all levels. However, in many higher education institutions across the EU, web accessibility does not regularly form part of the curriculum. Either the subject is completely lacking in the programme, or the education that does exist may be partial and sporadic rather than forming part of a consolidated course or programme. In either way, taking on web accessibility as an integrated part of IT programmes takes a bit of reflection, especially for teachers and trainers who may be new to the subject themselves.

This guide aims at lowering the threshold for getting started with web accessibility in IT-related courses and programmes in higher education. The goal is to provide practical examples on how web accessibility can be taught in practice, in different educational programmes. We hope that the collection will provide inspiration, both for novices but also for teachers that already teach web accessibility and are looking for new ways to vary or improve their courses.

Target audience

The guide has been primarily conceived for those who design and or deliver education and training in IT-related subjects at the higher education level. But, the examples of training activities and material included in the guide can also be transferred and applied in other educational contexts. The remits of education and training are here broadly defined in the sense that it includes both punctual lessons or even parts of lessons, as well as longer courses and programs. Although the examples in the good practice guide refer to university-level education, many of the examples can also be applied in vocational education and training (VET) courses and life-long learning processes.

The good practice guide seeks to present a variety of types of training, from traditional "classroom type" of courses to practical exercises and assignments. The principles behind the examples can be extended and applied in different settings
Also, the content of the good practice cases, and especially the list of reading material may also be of interest to many professionals that are affected by the new demands for accessibility and feel a need to refresh their knowledge.
The project partners therefore hope that the good practice guide will be of interest to anyone interested in IT training and education in the broad sense.

The structure of the guide

For a first time reader, we recommend reading this guide from beginning to the end. This is the best way to get an overview of the variety of ways in which the teaching of web accessibility can be designed, both in existing programmes and as separate courses. The cases are presented in two main categories, representing a progression from the general to the more specific.

The first category includes examples of web accessibility teaching mainstreamed into existing courses and general IT programmes, such as web development or interaction design. This integrated approach is usually the first step towards teaching web accessibility, as it allows for more experimentation when it comes to the level of ambition. It is easier to design a smaller module within a broader programme than to develop a more elaborate specialised course that still feeds into the overall programme.

The second category of cases deals with separate courses or modules focussing on web accessibility. In this category, the examples often use the same principles as those taught in the mainstreamed teaching, but they go deeper into the practice and/or apply the principles to a specific field. This part of the guide is of interest to those looking for inspiration on how to construct a whole course around web accessibility in the context of a specific field within IT education.

For impatient readers, there is a short conclusion by the end that summarises and analyses the common denominators between the cases in the guide. If you choose to start with this, please be sure to go back to the longer descriptions of the cases so that you can benefit from all the experiences of the universities contributing to the guide.

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Abbreviations

CSS	Cascading Style Sheets
ICT	Information Communication and Technology
JSON	JavaScript Object Notation
HCI	Human Computer Interaction
SGL	Scalable Vector Graphics
SMIL	Synchronized Multimedia Integration Language
WAD	Web Accessibility Directive
WCAG	Web Content Accessibility Guidelines
W3C	World Wide Web Consortium
XML	Extensible Markup Language

Accessibility mainstreamed into broader courses

Course: Emerging trends and critical topics in interaction design
Number of students attending: 30
Main field: Computer engineering and Information technic
Degree title: Master's degree year 1, advanced level
Duration of study: 5 weeks
Examination: Written and oral assignment and a design project that is submitted for grading at the end of the course.

Chalmers University of Technology

University Website - Sweden

Why the case has been chosen

The concept of norm-critical perspective is worth highlighting. This concept invites the students to reflect on current norms in society concerning users of different digital solutions. The use of personas is also a method with good potential for transferability.

Description of the course:

The course is elective and is split up in three modules:

- Inclusive design
- Creativity music interaction
- Value-based design & emergent technologies

Content related to accessibility and inclusion is mostly included in the module of inclusive design. For all three of the topics, the students discuss and explore various related trends and questions, and how they provide opportunities and present challenges to interaction designers, researchers, and other stakeholders. The modules are based on hands-on design activities.

Course included in the training:

Emerging trends and critical topics in interaction design

Purpose of the course:

After completing the course, the student should have a good understanding of the current trends and research areas. The purpose is for the student to be able to look ahead and keep themselves updated of ongoing research and current developments in the interaction design field.

Learning objectives of the course:

Knowledge and understanding:

- Describe current trends in interaction design.
- Account for current technology development in interaction design.

Skills and Abilities:

- Analyse and discuss design examples concerning a particular trend.
- Analyse and discuss the use of new technical solutions.
- Read, analyse and extract relevant content from scientific articles.

Evaluation ability and approach

- Discuss societal aspects of a particular trend, design or technological innovation.

Teaching methods:

One of the key methods used at this course is the use of norm-critical personas in the context of case studies. The students are presented with descriptions of user profiles with different needs and abilities. The personas can have one or several disabilities and are designed to challenge the student's perception of users and user needs, and to provide them with new insights and an understanding of the necessity for designers to accommodate to a variety of users with different expectations and needs. The students get a user case for reflection and have to solve a challenge by using the personas they have learned about.

Another method used is norm creative design. Norm creative methods are designed to challenge the common norms and perceptions of who are the typical users of a certain product or service, and what are their needs, expectations and behaviour. The students are given an assignment to analyse advanced apps for everyday tasks. The challenge is to explore how the apps align with inclusive design, and whether they support the needs of persons with specific user needs. The students also review whether the apps conform to Web Content Accessibility Guidelines (WCAG) 2.1. The students get to choose any app that they use every day.

A third method is the use of disability simulators where the students get to try out different challenges in accessing Information communication and technology (ICT) with alternative means. For example, the students are given tasks to complete using only the keyboard, or where the mouse does not follow command, or the display is blurred or moving around. The idea is to challenge pre-conceptions of the students and change their mindset to become more aware of the variety of user needs and experiences. This method is somewhat controversial as it does not fully reflect the actual experience of persons with disabilities. However, it does still have some value for raising awareness of what type of challenges a person with disabilities can be faced with.

Teaching material:

Microsoft inclusive design
Link to Microsoft inclusive design

Inclusive design toolkit from University of Cambridge.
Link to Inclusive design by University of Cambridge

Designkit.org includes case studies and other methods to open up the mindset of designers of inclusive design.
Link to Designkit

Karlstad University

University Website - Sweden

Course: Accessibility is permeated through several courses regarding web accessibility
Number of students attending: Varies
Main field: Information systems
Degree title: Undergraduate level, Bachelor's degree.
Duration of study: 2-3 years
Examination: Various types

Why the case has been chosen

This is an example of a mainstreaming approach across several different courses. It means that undergraduates are exposed to the subject in small doses from different angles, regardless of their individual choice of courses. Mainstreaming is a good way to start the introduction of web accessibility, but it also carries the risk of the topic being overshadowed by other parts of the courses.

Description of the course:

The study program is designed for students who want to develop their technical knowledge to work with the web as an interactive medium.

Course included in the training:

Accessibility is to some extent part of the following courses for web developers:

- Business by web and web analytics, 7,5 credits
- Portable format, 5 credits
- HTML and CSS for Web development, 5 credits
- Future Web Standards, 7,5 credits

Purpose of the course:

Business by web and web analytics:
In this course, the students practice professional writing through producing a number of short reports on the topics discussed in the seminars: one on web usability, one on web analysis based on traffic data from a sample web site, and one on marketing concerning digital media.
Assessment is based on written individual assignments presented and discussed in seminars.

HTML and CSS for Web development:
The course deals with how to structure a webpage with HTML5 and how to present the content of the HTML5 page with Cascading Style Sheets (CSS) regarding formatting and layout, and how to use CSS to adapt the content of the HTML5 page on portable units.
Assessment is based on group hand-in assignments and an individual written exam.

Portable format
The course alternates between theory and practice. Students conduct tests based on web standards and evaluate the compatibility of web pages in different web browsers. Extensible Markup Language (XML) and JavaScript Object Notation (JSON), two standards for data transfer between different web services and/or information systems are introduced. By applying the two formats in combination with already acquired web development knowledge, students are expected to solve implementation assignments in a course project.

Future Web Standards
Introductory lectures provide an overview of current work on web standards. Students seek information independently on ongoing standardisation efforts in World Wide Web Consortium (W3C), for example, and write a report on such a project including a comparison of the existing standards that W3C provides. The theme of the study must be approved by the tutor. The account is documented in an individual report. Supervision is provided in the course of the report writing. Each student is also required to review the report of at least one fellow-student. The report is presented in mandatory seminars.

Learning objectives of the course:

See paragraph of each separate course.

Teaching methods:

Some examples of teaching accessibility are:
Lecture on:

- universal design,
- design for all as an introduction to the universal design in the concept of accessibility.
- the concepts of barrier-free (about barriers)

Students test their code with validators.
Students that are writing short essays can then choose to write about web accessibility.

Teaching material:

Web Accessible company Funka website

Book:
Krug, S. *Don´t make me think! : a common sense approach to web usability*.

Course: Information Society and Internet of Things
Number of students attending: Varies
Main field: Informatics
Degree title: Master´s level
Duration of study: 20 weeks
Examination: 50% written report, 10% written reflection on the process and cooperation included in the project report and 40% oral examination

Linnæus University

University Website - Sweden

Why the case has been chosen

The course includes a mix of theory and practice, where the students get to apply their knowledge from the course, including accessibility, in concrete situations. The evaluation is also an assignment that has a direct bearing on how to practice accessibility at work.

Description of the course:

The course consists of lectures, seminars, and project work. In the project work, the students have to account for their individual contribution

Purpose of the course:

The focus of the course is on the impact of information technology in relation to society, organisations and the individual level. Organisation, participation, and interaction as well as the vision of an information society for everyone will be analysed through the theories and methods of user-oriented IT design. The course aims to give an overall understanding of the relationship between social change, organisational change and design as well as the use of digital services.

Learning objectives of the course:

After completing the course students will be able to:

- describe, analyse and reflect on how information technology in general and, more specifically, the Internet of Things affect people's lives on a societal, organizational and individual level
- describe, analyse and reflect on user participation in the design of interactive products and have knowledge of theories and methods for participatory design
- identify and analyse a range of applications with a focus on interactive products and services. And how they facilitate and support people's interactions with other people, its surroundings and interactive products
- use and adapt methods and techniques for the design of interactive products or services with and for users. Work in groups in the design process
- describe, analyse and reflect on how the Internet of Things can create value and help in organizing and participating in the creation of an information society for all
- describe, analyse and reflect on user participation and how it will help to facilitate and support people with experiences and activities and their involvement with and through interactive products or services in the creation of digital environments

Teaching methods:

Lecturing and reading about accessibility. Seminar discussions.
Lecture: Broad aspect on the why of web accessibility, and more specific information on three research areas, for example concerning accessibility for people with visual disabilities.
Seminar: The students receive theoretical material to read and analyse.

Lecture: A brief on the principles of universal design.
Seminar: Journals and conferences, the students choose one to work with and analyse.

Teaching material:

Informatics Compendium and digital material, Linnaeus University
WCAG accessibility guidelines

Malmö University

University Website - Sweden

Course: Accessibility is permeated through several courses regarding web accessibility
Number of students attending: 30-100
Main field: Accessibility
Degree title: Bachelor and master
Duration of study: 5-10 weeks
Examination: It varies from a series of assignments, bigger projects, reports, group projects, oral exam and examination

Why the case has been chosen

This is an example of how a basic mainstreaming approach can be implemented. In the chosen approach, there are no specific courses on accessibility, but the topic is introduced in small doses throughout a series of courses. This could be positive in the way that all courses are touched by accessibility in some way. A potential backside is that the subject is not given enough attention and gets lost among the other issues taught in the courses. This is a delicate balance to be aware of.

Description of the course:

Web development: The students will develop practical skills in the development of websites, and also a theoretical background about both limits and opportunities in development according to current standards.
Web publishing: The students learn about current standards in web publishing and they learn to develop and maintain web productions that are correct both from a technical and usability standpoint.
Introduction to web development: The course purpose is to introduce fundamental concepts and techniques that are part of modern web development.
Crossmedia: The student will develop their ability and skills to develop for several different media . They will reason about and take into account technology, economy and customer value when choosing a media channel.
Information beyond the screen: The course examines how new user interfaces can improve the user experience

It´s important that all assignments completed during the different courses hold a high level of accessibility through all the work. It´s a natural part of the courses. The courses also emphasise that the services developed should work in different media, for instance both on a computer and the phone.

Course included in the training:

Web development (7.5 cr), Web publishing (15 cr), Introduction to web development (7.5 cr), Crossmedia (15 cr), Information beyond the screen (7.5 cr)

Purpose of the course:

Different purposes for each course but all include accessibility in each segment or moment of the courses.

Learning objectives of the course:

Every course has objectives that are adapted to the context. These are some of the most relevant learning objectives with respect to web accessibility:

- Describe how different human-computer interaction modalities affect the information architecture
- Learn how to construct web pages based on current standards, with consideration for accessibility and compatibility
- Be able to account for current applicable standards for web development
- Be able to explain principles for creating useful and accessible websites
- Show an understanding of the limitations and opportunities in different distribution channels

Teaching methods:

The methods used varies depending on the different courses. Accessibility is mainstreamed as a fundamental principle throughout the courses.

Teaching material:

Sundström.T (2005) “Användbarhetsboken: bästa sätten att göra fungerande webb” Lund: Studentliteratur AB.
The book covers web accessibility fundamentals such as the WCAG guidelines and objectives and how to do user testing for accessibility.

Davidson D (2010) “Cross-Media Communications: An Introduction to the Art of Creating Integrated Media Experiences” ETC Press
This text is an introduction to the future of mass media and mass communications – cross-media communications. It helps the students to understand fundamental terms and concepts and provides a solid overview of cross-media communications.

Krug S (2014) “Don't make me think, revisited: a common sense approach to web usability” New Riders Publishing.
The book teaches web designers about the principles of intuitive navigation and information design and accessibility.

Nunnally, Brad & Farkas, David (2016). UX research: practical techniques for designing better products. First edition Sebastopol, Calif.: O'Reilly
This is a quick reference guide, the students will learn a common language and set of tools to help them carry out research in an informed and productive manner.

Mittuniversitetet
MID SWEDEN UNIVERSITY

Mid Sweden University

University Website - Sweden

Course: Human-Computer Interaction
Number of students attending: 40-50
Main field: Computer engineering
Degree title: Master's degree year 3, c-level
Duration of study: 10 weeks
Examination: Laboratory work, seminars and project

Why the case has been chosen

The course provides an example of how to integrate universal design principles as a basis for all, which includes showing that accessibility is useful for everyone in different circumstances. Also, the course includes a focus on the student's own reflection on their design choices, which helps to integrate the universal design thinking into the working habits and practices of each future professional.

Description of the course:

Good usability and a positive user experience are of great importance for a successful interactive system. Through this course, the students will gain skills in different methods and tools for design, development and evaluation of interactive systems.

Purpose of the course:

Usability has become an increasingly important criterion for the evaluation of interactive systems. Good usability and positive user experience are paramount for a successful interactive system. Through this course, the students will gain skills in a variety of methods and tools for design, development and evaluation of interactive systems.

Learning objectives of the course:

After finishing the course, the student should be able to

- define fundamental terms in the area of interaction design,
- describe and use user-centred methods for developing and evaluating interactive systems,
- analyse methods using different theories and models,
- combine different methods or parts thereof to reach his or her own goals,
- evaluate his or her choice of method and make suggestions for improvements, and regarding ethical aspects of research.

Teaching methods:

The course consists of approximately 10% lectures, 10% laboratory exercises, 5% exercise sessions, 5% seminars. The remaining 70% is devoted to studying without supervision, preparation for the laboratory exercises and seminars, and the project assignment which is carried out in a group with other students. The course starts off with lectures and is closely followed by laboratory exercises in which existing interactive systems are evaluated. The project assignment which is carried out in a group with other students is thereafter started, supported by the exercise sessions which simultaneously acts as tutoring sessions while also presenting practical examples for different methods related to the design process. Seminars are also held where current interactive systems and

their design principles are discussed. The course finishes with an oral and written presentation of the project assignment.

Accessibility is not examined in the course, but the following are part of the teaching:

- Lecture about permanent, temporary, and situational disabilities. By designing for someone with a permanent disability, someone with a situational limitation can also benefit.
- Students are asked to evaluate their interaction design according to Jakob Nielsen's ten general principles for interaction design.
- Students are asked to manually review their interaction design according to some selected WCAG principles, by following a self-assessment online guide.

Teaching material:

Book: Jennifer Preece, Yvonne Rogers, Helen Sharp: Interaction Design: beyond human-computer interaction. Wiley, 2015.

Online material:
Microsoft inclusive design
Self-evaluation of selected WCAG principles
Jacob Nielsen's "10 Usability Heuristics for User Interface Design", 1994, updated 15 November 2020.

HOCHSCHULE DER MEDIEN

Stuttgart Media University

University Website - Germany

Course: Human-Computer Interaction
Number of students attending: 90
Main field: Media informatics
Degree title: Bachelor Medieninformatik
Duration of study: 15 weeks
Examination: Computer-based examination (using an e-learning system)

Why the case has been chosen:

A good example of how the education is enhanced by including empathic exercises ("day-in-a-life" storytelling).

Description of the course:

This course focuses on media informatics

Course included in the training:

Media informatics

Purpose of the course:

In this course, the students will learn about theory mixed with assignments with empathic angle where the students need to put themselves in the place of a person with disabilities.

Learning objectives of the course:

The students know the basics of human information processing, the main types of human-computer interaction, the basics of accessibility and relevant standards and guidelines. The students can evaluate the accessibility of a web page and make suggestions for improvement. The students can collaborate in teams and present the results of their work to a larger audience.
The individual sessions cover the following topics: software ergonomics, human perception, human memory, experience and processes, input and output devices, information representation and types of interaction, basics of accessibility web accessibility (focusing in the Web Content Accessibility Guidelines and the BITV Test), introduction to usability engineering.

Teaching methods:

The course consists of one half lectures and one half exercises. The lectures are a mixture of ex-cathedra teaching Human Computer Interaction (HCI) and flipped-classroom. There is usually also a guest lecture by a software developer with a disability. For the exercises, the students are split up into three groups, each with their own tutor. The exercises usually apply methods discussed during the lecture. The students are allowed to do the exercises (as a kind of homework) in small teams. The students' results are discussed during the face-to-face sessions. The exercises include one unit in which the students prepare a presentation about a "day-in-the-life story" about a fictional person with a disability (based on the MOOCAP project's day-in-the-life stories). Both the lectures and the exercise sessions can be enlivened with quick online polls.
An important part of both the lectures and the exercises, i.e. for weeks, focuses on familiarity with WCAG 2.1 levels A and AA and using the corresponding checks from the German BITV evaluation methodology to evaluate the accessibility of a web page.

Teaching material:

The day-in-the-life stories from the MOOCAP project:

The online documentation for the BITV Test, an evaluation method for WCAG 2.1 developed in Germany:
Markus Dahm: Grundlagen der Mensch-Computer-Interaktion. Pearson, 2006. ISBN 978-3-8632-6621-9 (now only available as e-book)
Andreas M. Heinecke: Mensch-Computer-Interaktion: Basiswissen für Entwickler und Gestalter. Springer 2011.
Michael Herczeg: Software-Ergonomie. Theorien, Modelle und Kriterien für gebrauchstaugliche interaktive Computersysteme. De Gruyter Oldenbourg, 2018.

Course: Human Computer Interaction
Number of students attending: Varies
Main field: Computer Science
Degree title: Bachelor's degree in computer science and Digital Communication
Duration of study: 12 weeks
Examination: The exam of the entire HCI course consists of a test with open and closed questions. At each session, two or three questions are related to accessibility topics.

University of Bari Aldo Moro

University Website - Italy

Why the case has been chosen

This is an example of how accessibility can be introduced at a small scale in a more extensive course, and still be a subject of examination (which is not always the case at other universities). Including the topic specifically in examinations is important for the students' motivation to learn.

Description of the course:

Focus is on human computer interaction but there are elements of web-accessibility during the course itself. The course will educate experts that will be able to construct solutions to societal problems whit the help of accessible computer science.

Purpose of the course:

The purpose is to learn about how Human Computer Interactions work.

Teaching methods:

Traditional teaching, in class lectures and individual study.

Teaching material:

Lessons are based on the content published in the W3C web sites. The program concerns methods for the design and the evaluation of the accessibility of websites. WCAG 2.0 are introduced for the correct design of websites, and other methods for evaluating the accessibility of applications by involving persons with disabilities are also presented.

Accessibility is only part of the course, and there is not enough room to expand on the topic. With more time, students would be encouraged to use assistive technologies and involve in real accessibility tests. With such a short time, the important message of this 3-hours class is to provide students with the main concepts and make them sensitive to accessibility issues.

UNIVERSITÀ DEGLI STUDI
DI GENOVA

University of Genova

University Website - Italy

Course: Several different courses
Number of students attending: Varies
Main field: Varies
Degree title: Varies
Duration of study: Varies
Examination: Varies

Why the case has been chosen

UniGe is an example of a university starting out with including accessibility in small doses in several courses. The laboratory for web accessibility is worth highlighting since this provides a resource not only for the IT courses, but for the university as a whole. In particular, the laboratory establishes a connection between the study environment and the working life environment, through the encouragement of and support to practical student projects.

Description of the course:

Several courses have been identified as having aspects of Web Accessibility at UniGe.
For example:

1. Web Application Development, 6 ECTS, for bachelor's degrees in computer science and Computer Engineering;
2. Web Design, 12 ECTS, for bachelor degree in Digital Humanities (in the area of Computer Engineering);
3. Web Design, 6 ECTS, for master degree in Product and Event Design (in the area of Architecture);
4. Cognitive Ergonomics, 6 ECTS, for master degree in Digital Humanities (in the area of Psychology);
5. Interaction Design, 6 ECTS, for master degree in Digital Humanities (in the area of Architecture).

Course included in the training:

Computer Engineering, Architecture and Phycology

Purpose of the course:

There are several different purposes but what they have in common is that all of them have an aspect of teaching about web accessibility in some way.

Learning objectives of the course:

The students will learn about web accessibility in different ways, depending on the individual courses.

Teaching methods:

All the courses in UniGe are face-to-face or blended, offering a mix of lectures and labs, and use the e-learning platform to share learning materials. Accessibility is taught only in a few of the courses above, as a single topic of 2-4 hours max. In most courses, accessibility is approached from a technical point of view and taught by staff from the engineering or computer science domain.

There is a wish to include more specific courses on accessibility, especially for those students doing courses where accessibility is not an objective for the courses, but a prerequisite (Semantic Web and Linked Data, Virtual/Augmented Reality and Gamification).

In addition to possible courses in which web accessibility is taught, some other experiences exist in UniGE, e.g. final projects and stages for students. Currently, one student of Informatica (bachelor's degree) is evaluating the accessibility of some university webpages, using the most recent checkpoints. A second student is studying the software/API available for the automatic generation of images descriptions to compare their results and to understand whether they can be used for automatic alt-text generation.

Finally, since 2018 the Service and Training Centre SimAv has started working on a new lab dedicated to web accessibility. Some activities introduce interested students to the technical skills needed to build accessible websites according to EU and national legislation through internships, final thesis, and practical exercises. In addition, SimAv also organises seminars on this topic for the university staff and other stakeholders.

Course: Mobile App Development
Number of students attending: Varies
Main field: Computer Science
Degree title: Master course in Computer Science
Duration of study: 12 weeks
Examination: Varies, written and oral exam

University of Milan

University Website - Italy

Why the case has been chosen

Mobile apps are an accessibility area that has been less in focus than the web. Therefore, this is an interesting example of a course that is focussing on a specific aspect.

Description of the course:

The course presents advanced information processing techniques in the context of applications for mobile devices. The main topics addressed in the course are calculation of indoor position, activity recognition techniques, and Augmented Reality.

Purpose of the course:

To learn about app development and also how it can be made accessible.

Learning objectives of the course:

Students will strengthen their skills in the analysis of complex problems and in the development of solutions with scientific methodology. Students will also acquire knowledge on three topics of particular relevance in the technological panorama (indoor positioning, Augmented Reality, activity recognition). Since these topics are still subject of research, students will also strengthen their understanding of scientific papers. They will also increase their development skills since they will create a prototype application exploiting innovative aspects/technologies.

Within this Mobile App Development course, 1 CFU module is dedicated to mobile app accessibility.

Teaching methods:

The topic is taught focusing on the HCI aspects (e.g., user-centered design, evaluation with users, etc. and gives a brief introduction to the technological aspects (mobile screen readers, etc. Recent research results in the field are presented to the students who are invited to read research papers.

University of Milan

University Website - Italy

Course: Human-Computer Interaction
Number of students attending: Varies
Main field: Computer Science
Degree title: Bachelor degree program in Computer Science for New Media Communication
Duration of study: 12 weeks
Examination: Written test and a project

Why the case has been chosen

The hackability group collaboration mentioned under "Teaching methods" is an innovative approach that focuses on practicing knowledge of usability and accessibility in a different way.

Description of the course:

The course aims at providing students with the knowledge and tools to design and perform strategies for usability and accessibility assessment of interactive systems. These aspects are at the base of the design techniques of a satisfying, pleasant and efficient digital experience.

Purpose of the course:

The students will acquire abilities to evaluate the advantages and disadvantages of the different design choices in support of effective digital communication, as well as to draw adequate conclusions from user tests and other forms of usability and accessibility assessment based on scientific methods of investigation.

Learning objectives of the course:

In a part of the course, the students acquire abilities to draw adequate conclusions from user tests and other forms of usability and accessibility assessment based on scientific methods of investigation. The part of the program on accessibility covers the following topics:

- Design for All
- Methods for accessibility analysis
- Colour issues and colour perception deficiency

Other topics related to accessibility could be presented but this is part of a broader course where accessibility is only one of the issues to be covered.

Teaching methods:

The students will learn about accessibility issues in projects. They will learn about how to perform a complete accessibility analysis by using a combination of automatic and manual evaluation methods. Alternatively, they can carry out a prototype to favour the inclusion of users with disabilities in collaboration with the Hackability group of Milano.

Courses with a focus on accessibility and/or universal design

Course: Universal Design & Assistive ICT
Number of students attending: 20-60
Main field: Computer Science
Degree title: BSc. in Computer Science
Duration of study: 13 weeks, three hours per week
Examination: Marks are based 30% on work during the semester and 70% on a written exam

Dublin Institute of Technology

University website - Ireland

Why the case has been chosen

This example is using both theory and practice at first hand. It involves learning about the web accessibility directive (WAD) and Web Content Accessibility Guidelines (WCAG), letting the students discuss the standards and laws, and understand how to use the regulations. This approach gives plenty of room for students to reflect and practice how they can use their knowledge about WAD and WCAG.

Description of the course:

This course teaches universal design, with a focus on letting students discuss how they can use WAD and WCAG in practice.

Course included in the training:

Computer Science

Purpose of the course:

The course covers the following topics: The principles of universal design, their relevance to computer science, e.g. making language simpler (see for example the language used by insurance companies; automatic readability tests); their relevance for SEO. Widening the audience and considering diversity.

This sold on the basis of three principles:

(1) it makes business sense;
(2) there is a legal mandate (which for a long time did not exist; the EU WAD is very recent, but the US ADA was relevant due to US companies such as IBM that had offices in Ireland);
(3) it is the good thing to do, it makes social sense (it is easy to show lots of examples that are close enough to students, e.g. issues experienced by their grandparents or online banking).

One of the questions for students to reflect on is: How many people will you exclude by your design decisions? For example, students design a teapot as an exercise and come up with features such as voice recognition to open the lid etc. We then run the Exclusion Calculator from the Cambridge Inclusive Design Toolkit. This leads to questions such as “How much vision do you need?” and “How much audio capability do you need?”. These questions are linked to a British census study which contained six questions about abilities (i.e. about lifting, hearing, etc.).

Once you have buy-in from students, you can then introduce the technology and talk about WCAG (including conformance levels). You can then get them to do an automated audit (which is the quickest way to see issues, but does not find all of them) and then do a manual one (see e.g. MeAC,

which also does automated test before the manual audit and which has a scoring system based on "fail", "pass" and "marginal fail").
The course module contains two assignments, one related to universal design and one that involves the audit of two websites. The rest of the course is about alternative technologies.

Learning objectives of the course:

- Be able to audit a website;
- Be familiar with WCAG;
- Know about the impact of design decisions.

Teaching methods:

The face-to-face classes involve a lot of round-table discussions and debate. Sometimes the students are given a video to watch in advance and this is discussed face-to-face in class. When the Covid-19 lockdown happened, it was initially not clear whether people with disabilities would be able to use the video conferencing systems etc., but it turned out they already had virtual book clubs etc.

Teaching material:

There aren't any good textbooks on universal design, except for architecture. Assistive technology textbooks focus more on other technologies than IT. For this reason, it is necessary to find other resources, especially many online resources such as:

- Resources by the Centre of Excellence in Universal Design in Ireland.
- Many web accessibilities resources by the Web Accessibility Initiative and Web AIM.
- The Cambridge Inclusive Design Toolkit.
- Resources from the MOOCAP project, especially the mobile week in the introductory course. The videos are good. Many videos show examples of bad design. (One nice example is footage from a camera next to ferry port that show people getting into the wrong lane etc. Also, a road sign in Galway that says, "In order to turn left, keep right".) It would be helpful to have more such resources. (See for example, "Meet the Normals – Adventures in Universal Design" video, e.g. about accessing the bus.)

Mittuniversitetet
MID SWEDEN UNIVERSITY

Mid Sweden University

University Website - Sweden

Course: Universal Design of Digital Accessibility
Number of students attending: Varies
Main field: Graphic Design
Degree title: First year (A-level)
Duration of study: 10 weeks
Examination: Creative work with design solutions and written reports. Practical work, workshops and written exam.

Why the case has been chosen

The course involves students conducting usability and accessibility testing together with persons with disabilities. This method deepens the understanding of the subject and combines theory and practice in an interesting way. It is an interactive course where the students work close to the target group.

Description of the course:

The course is provided online, at entry-level.

Purpose of the course:

The course is about web design and apps with the aim of designing content so that it becomes accessible and useful for everyone.

Learning objectives of the course:

After finishing the course, the student should be able to:

- Apply the basics of user interfaces design.
- Describe and apply the basics of design methodology.
- Perform simple usability tests.
- Process texts into a more readable language.
- Describe relevant disabilities and explain their impact on content and design.
- Implement an inclusive design process.
- Use relevant parts of Swedish legislation, EU directives, Web Accessibility Initiative.
- Apply the Digital Authority's guidance.

Teaching methods:

This is an online course, where students are required to both learn from online content and also read additional material (see teaching material below). The content includes the following topics:

- Usability and accessibility for web apps.
- The basics of design methodology.
- Plain language (easy to read)
- External monitoring of usability and accessibility.
- Laws, rules and guidelines for universal design.
- Implement an inclusive design process (“Design for all”projects).

Teaching material:

Required literature

- Author: Sundin Maria, Englund Helena. Title: Tillgängliga webbplatser i praktiken.
- Author: Krug, Steve. Title: Don´t make me think. Third edition. New Riders, 2014.

- Author: Krug, Steve. Title: Rocket Surgery Made Easy. New Riders, 2009.
- Author: Forsberg, Jenny. Title: Skriv för din målgrupp: tips för träffsäkra texter.
- Author: Everett N. McKay. Title: UI is Communication. Morgan Kaufmann, 2013.
- Examples from the book ”Evil by design”.
- Scandic’s Accessibility Standards
- WCAG in Swedish
- Material from Swedish Agency for Accessible Media, MTM.
- Adobe XD and Adobe Acrobat Professional or equivalent are required for this course.
- Universal Pictograms

Stockholm University

University Website - Sweden

Course: Inclusive design in interactive environments
Number of students attending: 30-50
Main field: Independent course
Degree title: Bachelor
Duration of study: 5 weeks
Examination: Assignment

Why the case has been chosen

The course provides a good example of the use of participatory design methods to increase understanding among students and also provide the students with practical skills for user-centred design. In addition, the course has a focus on gaming, which provides an example of how accessibility can be integrated into niche areas.

Description of the course:

This course explores inclusive design of interactive environments from different perspectives regarding abilities and norms. It is an independent course with a focus on computer/mobile games. Interactive environments can be digital environments or a mix between physical/digital environments, with both interpersonal communication and human-machine interaction. The course discusses different types and degrees of abilities, and how these relate to digital divides.

In order to learn about inclusive design in practice, the students work together with persons with disabilities throughout the course on assignments to solve practical problems. The students get to design an executable prototype system, using a participatory design method where the prototypes are evaluated by the users.

Course included in the training:

Elective course

Purpose of the course:

The students will be able to understand what inclusive design involves in practice and get the experience of working together with users of different abilities to solve a practical problem. The interactive environments are focused on gaming.

Learning objectives of the course:

- Understand basic concepts in inclusive design of interactive environments (IE)
- Know the needs of people with disabilities in IE
- Know the extent of issues of exclusion in IE
- Get a notion of what it means to interact with IE with different types of disabilities
- Be able to apply methods for inclusive design of IE
- Have knowledge about solutions to issues of exclusion in IE

Teaching methods:

Participatory design is a key method used in the course. Participatory design is a product and services design method focusing on the user. It involves stakeholders, end-users, and the student are divided into teams working together in the design process in order to help ensure that the end-product meets the needs of users. The University collaborates with different disability organisations to

involve the end users in the design process. As a complement, or when it is not possible to involve the users, the course also uses accessibility guidelines like WCAG or personas to visualise user needs.

The course also uses experience-based methods where the student gets to try on a computer game with controls used by persons with disabilities. For example, the games are played using only one hand to control the game or using voice control or a mouth-operated mouse. The idea is that the students will learn how to develop inclusive and accessible games themselves.

The course also involves an assignment for the students to create their own very simple game with a focus on accessibility. The students create their own components, and all of the aspects of the game have to include accessibility. This is usually something that is done towards the end of the course where they will use their new knowledge about accessibility for games.

Teaching material:

Designing with people is a website where you can find different personas that can be used in order to illustrate user needs show different cases of disabilities, if you can't find a real person with a disability to collaborate with in the different design projects. The course focuses at first hand on finding real persons to involve and uses personas as a second-hand choice.
Link to Designing with people material

Since there is a focus on creating games and inclusive design, a key aspect of the course concerns game accessibility. Therefore, the course material also includes guidelines that can help them develop games to a broader audience.
Link to Gaming accessibility guidelines

Part of the course also includes guidelines around subtitling and accessible language.
Link to Subtitle Guidelines
Link to ACM Accessible Writing Guide

HOCHSCHULE DER MEDIEN

Stuttgart Media University

University Website - Germany

Course: Accessible Design in ICT
Number of students attending: 20
Main field: Mobile Media
Degree title: The module is part of the Master Mobile Media
Duration of study: 3 semesters
Examination: Marks are based on homework, presentations and contributions to the discussion forum

Why the case has been chosen

This case is an example with a large variety of learning objectives that could be inspirational for many.

Description of the course:

The Accessible Design in ICT course provides expert and hands-on knowledge in the area of design for users with disabilities and older users. This includes a basic understanding of disability types, barriers and pertaining assistive technologies. A special focus is on accessible web design, serving as a model for the design of other software types. The course follows a “flipped classroom” approach, i.e. the students should study literature on their own, according to a list of “mandatory” and “optional” readings, and do some assignments, to prepare for the weekly face-to-face session. In the face-to-face session, they discuss literature and assignments for a deeper understanding.

Purpose of the course:

The course is mainly based on the European standard EN 301 549 and consists of the following units in order to cover the various parts of that standard.

1. Human-computer interaction and variety of user needs
2. Accessible documents & multimedia
3. Accessible PDF documents & eBooks
4. Accessible Web – Introduction
5. Accessible Web – WCAG 2.1 Part I (Guidelines 1.1 – 1.3)
6. Accessible web – WCAG 2.1 Part II (Guidelines 1.4 – 2.2)
7. Accessible web – WCAG 2.1 Part III (Guidelines 2.3 – 2.5)
8. Accessible web – WCAG 2.1 Part IV (Guidelines 3.1 – 4.1)
9. Accessible web – Automatic checking tools
10. Accessible software, mobile apps, self-service terminals, etc.
11. Accessible design & inclusive design processes
12. Demographic data and regulations on accessibility

There may be some synergy with usability engineering, since the course puts the students in a better position to involve people with disabilities in user testing.

Learning objectives of the course:

- Students know the basic user needs in the context of human-computer interaction and the functional needs for digital interaction systems.
- Students know the most common types of disabilities. They know assistive technologies and adaptation strategies and are able to evaluate their effectiveness for specific disabilities.

- Students know the most important demographics for people with disabilities – worldwide, for Europe and for Germany – and understand the impact of demographic changes.
- Students understand the principles for the creation of accessible documents and forms and can apply these to a few types of documents (word processing, presentations and PDF).
- Students understand the barriers that can arise in multimedia systems (video, communication systems), know the relevant guidelines and tools, and can apply them.
- Students know the potential of e-books (specifically the ePUB-3 format) for accessibility.
- Students know the barriers that can arise on the Web, know the WCAG 2.1 guidelines and can apply them to web pages.
- Students understand the process for evaluating the accessibility of a web site and know a few automated evaluation tools.
- Students understand the principles of accessibility for hardware, software, mobile apps, terminals, closed systems, product documentation, support services, relay services and emergency alert systems.
- Students understand the principles of accessible design and can apply them in the context of user-centred development processes.
- Students know the benefits of accessible design on a personal, social and business ("business case") level.
- Students know which processes are important for an accessible organisation.
- Students know the laws relevant to accessibility on various levels (i.e. geographic and area of application) and can apply standard EN 301 549 to practical projects.

Teaching methods:

Flipped classroom approach, online quizzes, contributions to the forum in Moodle (e-learning system), teamwork, presentations, discussions about the homework, peer review. The course aims to be interactive instead of relying on ex-cathedra teaching. There is also an excursion to the Nikolauspflege, a foundation that provides training to with a range of visual impairments and that sells various assistive technologies. This excursion is well received by the students.

Teaching material:

Videos (both existing ones and videos created by the lecturers), various external web pages, content created by the lecturers, the MOOCAP day-in-the-life stories, WCAG 2.1 and its documentation, standard EN 301 549, relevant laws and regulations (EU Web Accessibility Directive, EU Accessibility Act, BITV evaluation method for WCAG 2.1, UN Convention on the Rights of Persons with Disabilities (CRPD), crossword puzzles.

Course: Accessible documents
Number of students attending: 30
Main field:
Degree title: Bachelor Media Computer Science
Duration of study: One semester
Examination: Oral exam

TU Dresden

University Website - Germany

Why the case has been chosen

An example of how a course could focus on one particular field of accessibility. In this case accessible documents.

Description of the course:

The course Accessible Documents addresses students of the computer science programmes as well as students that deal with the design of IT systems for people with special needs or who are interested in access with less or without barriers. Blind, visually impaired, hearing impaired and deaf people, people with physical impairments, people with dyslexia as well as elderly people require specific media and presentation forms/modalities and partially use special interaction techniques to access graphical user interfaces and the Web.

The first part of this course presents these special needs and the architecture of assistive technology such as screen readers. Current guidelines for HTML (WCAG and the German BITV) are dealt with during the second part of the course. Various test methods and tools for XHTML in this regard apply an automatic procedure. The third part of the course shows specific document types and techniques to reduce barriers: Synchronized multimedia integration language (SMIL) documents, PDF for books with less barriers, Scalable Vector Graphics (SVG) for graphics and MathML for mathematical expressions. Recent developments regarding the processing of documents between authors, publishers, libraries and readers frame the last part of this course.

Purpose of the course:

The purpose of the course is to provide students with an introduction to accessible documents for persons with sensory disabilities. It does not cover learning or cognitive disabilities.

Teaching material:

- McCall, K. (2005) Accessible and Usable PDF Document: Techniques for Document Authors, ISBN 0-9738246-1
- Clark, J. (2003) Building Accessible Websites, New Riders. (Also available on Joe Clark's website and on Archive.org.)
- Edwards, A.D.N. (1995) Extraordinary Human-Computer Interaction - Interfaces for Users with Disabilities, Cambridge University Press: New York.
- Eisenberg, D. J. (2002) SVG Essentials: Producing Scalable Vector Graphics with XML, O'Reilly. Hellbusch, J.E. (2005) Barrierefreies Webdesign, dpunkt. Ivory, M. (2003) Automated Web Site Evaluation, Kluwer.
- Sandhu, P (2003) The MathML Handbook, Charles River Media
- Link to the Web Accessibility Initiative of W3C

Conclusions

The collection of good practices displays a range of ways in which universities have included web accessibility courses in IT education, either as stand-alone courses or as modules integrated into broader courses and programs. The courses all take place in their local and national context and within the remits of the specific context of the different subjects. However, looking through the cases, there are many common contents and approaches that seem to be working across educational and geographical borders.

As a conclusion, below is a short summary of some of the lessons drawn from the good practice collection. We hope that the examples can act as an inspiration for more teachers to get involved with web accessibility courses. At the end of the document you will also find a table where you can search for examples describing specific learning methods.

The main take-away that the partners of the project would like to convey is that it is possible to include education on web accessibility to at least some degree in any IT-related course on any level. All of the universities involved in the project have started with low-scale initiatives that have been further built upon and improved successively. There is a lot of free materials to build on, so today is the day to get started!

What are some common elements of success?

1. Start with the appropriate level of ambition.
   If web accessibility is a completely new subject, it can be easier to start introducing some stand-alone lectures and readings on web accessibility integrated in other courses, rather than developing a separate module.

2. Combine theoretical study with hands-on activities.
   It is difficult to understand and apply web accessibility unless you get a sense of what accessibility means in practice. Ideally, the course should include practical exercises where the students get to experience what it is like to access the web in a way they are not used to.

3. Treat web accessibility as a core part of the educational programme.
   For students to both understand the importance of web accessibility and also to be able to apply the learnings in practice, it is important that the module on web accessibility is not presented as a separate “specialist” subject, but rather as core knowledge that is connected to other professional skills in their field.

How can you attract students to the courses?

1. To raise interest in the subject, all students in a particular programme should become familiar with at least some aspects of web accessibility regardless of their individual choice of courses. This can attract more students to further elective courses where they will have the opportunity to dig deeper into the topic.

2. Web accessibility is about people. Courses that invite students to engage in practical assignments and collaborate with users with different experiences will both deepen the understanding of the topic and also attract more interest.

3. Engage in partnerships with disability organisations and also with organisations and companies that implement web accessibility as part of their day to day organisation. This will both make the course better related to workplace reality, and also help students to broaden their network of contacts that can be useful for them in the future.

What are some key requirements for transferring the good practices?

1. As a start, be sure to take some time as a teacher to learn both about web accessibility and about accessible learning and education. There is a lot of free materials to get inspired from. A good start can be the Handbook and MOOCs provided by the IWAC project.

2. Make sure to anchor the approach and the courses both among colleagues and at university management level. This is important both to ensure that the courses you start are sustainable in the longer term, and also to spread awareness around the topic of web accessibility.

3. A key requirement is a willingness to learn as you are doing, and to reach out to partners for collaboration and mutual learning. Many of the most successful courses in the good practice guide involve collaborations with disabled persons' organisations or with employers.

Table summarising the characteristics of each of the examples

	Contacts with users	Use of personas/ cases	Challenging norms	Non-academic material	Practical assignments
Chalmers University of Technology		X	X		
Karlstad University				X	X
Linnæus University					X
Malmö University			X		X
Mid Sweden University			X		X
Stuttgart Media University	X	X	X		X
University of Bari Aldo Moro	X		X	X	
University of Genova					X
University of Milan					X
University of Milan	X				X
Dublin Institute of Technology			X	X	X
Mid Sweden University	X			X	
Stockholm University	X	X	X	X	X
Stuttgart Media University			X	X	
TU Dresden			X		X