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# INTUX PROJECT

## Mapping Report

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Project partners:



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## Table of Contents

1	Introduction .....	4
2	Mapping study courses .....	5
2.1	Turiba University outline .....	5
2.2	Universidad Politecnica de Madrid outline .....	5
2.3	University of Mariboro outline .....	8
2.4	Summary of INTUX project partner universities .....	9
2.5	Other universities .....	10
2.6	Summary of other European Universities .....	17
3	Analysis .....	19
3.1	Feedback from lecturers.....	19
3.2	Feedback from alumni and last year students .....	23
3.3	What should be added to the program? .....	27
4	Conclusions .....	30

# 1 Introduction

The present document describes the main result of activity 1 of work package 5 of the INTUX project: mapping study programs where usability testing with disabilities are involved in study courses.

To clearly identify HEI courses and programmes related to the field of UX design where there is an opportunity for training on inclusive and accessible user testing to be included in the curricula.

During the mapping of UX design and related courses, data was collected using the program mapping template within the INTUX project, involving partner universities: the University of Maribor (Slovenia), Turība University (Latvia), and Universidad Politécnica de Madrid (Spain). The following information was gathered:

- Details about each university
- A self-assessment report of specific study programs
- Information about UX design courses
- Feedback summaries from lecturers, including strengths, weaknesses, and an evaluation of the skills acquired
- Feedback summaries from alumni or final-year students, covering their evaluation of the knowledge gained, any gaps in knowledge and skills, and suggestions for program improvements

Desk research was also conducted to gather information about similar programs at other European universities.

Section 2 summarizes the mapping results from INTUX consortium universities and provides insights into UX design and related programs at other European institutions.

Section 3 presents feedback from lecturers and graduates or final-year students of UX design courses.

Section 4 offers the main conclusions based on the mapping and evaluation of the results.

The main result of this document will be is to provide an information for the recommendations on the inclusion of training on Inclusive and accessible user testing in curricula for higher education programmes (activity 3 of work package 5 of the INTUX project).

## 2 Mapping study courses

The main goal of this section is to gather study programs identified in the INTUX project partner universities and others European universities that are outside project consortium, which include UX design and related courses. Information was collected on 27 higher education institutions, including the three project partners—Turiba University, Universidad Politécnica de Madrid, and the University of Maribor—covering a total of 45 programs across nine European countries.

### 2.1 Turiba University outline

Turiba University (Latvia) in IT Field provides study course User interface (UI) and user experience (UX) in **Computer Systems** Bachelor's 4 years study program. Language English and it is delivered in the first year.

Course content description is as follows examines human-computer interaction in the context of graphical user interfaces and accessibility. The course covers human capabilities, design principles, prototyping techniques, evaluation techniques, and the implementation of graphical user interfaces. Deliverables include short programming assignments and a semester-long group project.

Course objectives, competences, and intended learning outcomes as follows: Knowledge on UX and UI; Understanding on human-computer interaction in the context of graphical user interfaces; Skills with prototyping techniques, evaluation techniques, and the implementation of graphical user interfaces; Able to deliverables include short programming assignments.

Study course provides practical knowledge and skillset, a balanced mixture of practical and theoretical knowledge and theoretical knowledge. And it is topics related to UX and are related to UX. Short description what UX-related topics are included in the course: Usability, Learnability, Visibility, Efficiency, Errors and user control, User-centered design, Generating designs, User interface (UI) software architecture, User testing, Information visualization, Color design and typography, Accessibility, Internationalization. Students get practical work and exercises related to UX. The teaching staff (professor, teaching assistant, etc.) that are responsible for the course has appropriate UX knowledge and skills needed for giving the lectures on UX-related topics.

Feedback and analyses are gathered in Analytics section.

### 2.2 Universidad Politecnica de Madrid outline

Universidad Politécnica de Madrid (Spain) in **Computer Engineering** Bachelor's 4 years study program is delivered study course Human-Computer Interaction and it is delivered in the first year. The program is implemented in Spanish Language.

Course content description the course covers the fundamental aspects of the design of interactive systems following the User-Centered Design process: Know and analyze the

types of users, their tasks, and the environment in which they will use the system;  
Designing the Interaction Build low- and high-fidelity prototypes; Evaluate the usability and accessibility of prototypes. The subject is based on continuous work throughout the course, through the completion of a project that It consists of several installments. In order to be able to follow the subject properly, it is therefore necessary to develop the project work throughout the semester.

Course objectives, competences, and intended learning outcomes as follows: Competences (from the bachelor's degree): Be able to solve problems by applying knowledge from mathematics, sciences and engineering. Be able to plan self-learning and update personal knowledge and demonstrate awareness of the need of lifelong learning as a professional in informatics technology. Be able to be creative and propose new ideas when working in situations with lack of information and under high stress. Be able to manage information Be able to gather, analyse and specify customers' needs. Be able to model and design the human-computer interaction of a system following a human-centric approach. Be able to understand social, ethics, professional and civil responsibilities of the computer engineers. Be able to design and develop computing projects. Learning outcomes: Be able to build low-cost prototypes to evaluate the design of the human-computer interaction. Be able to evaluate the usability and accessibility of interactive systems. Understand humans' information processing, and the limitations and diversity of human beings when they interact with systems. Understand the possibilities and limitations of different interaction devices and styles. Be able to apply the principles, methods, guidelines and standards of human-centred design and design for all, when designing the human-computer interaction.

Study course provides practical knowledge and skillset, a balanced mixture of practical and theoretical knowledge and theoretical knowledge. This course is all about UX (Human-Computer Interaction). It covers the fundamental aspects of the design of interactive systems following the User-Centered Design process.

Universidad Politécnica de Madrid in **Mathematics and Computer Engineering** Bachelor's 4 years study program is delivered study course Human-Computer Interaction and it is delivered in the first year. The program is implemented in Spanish Language.

Course content description the course covers the fundamental aspects of the design of interactive systems following the User-Centered Design process: Know and analyze the types of users, their tasks, and the environment in which they will use the system;  
Designing the Interaction Build low- and high-fidelity prototypes; Evaluate the usability and accessibility of prototypes. The subject is based on continuous work throughout the course, through the completion of a project that It consists of several instalments. In order to be able to follow the subject properly, it is therefore necessary to develop the project work throughout the semester.

Course objectives, competences, and intended learning outcomes as follows: Competences (from the bachelor's degree): Be able to solve problems by applying knowledge from mathematics, sciences and engineering. Be able to plan self-learning and update personal knowledge and demonstrate awareness of the need of lifelong learning as a professional in

informatics technology. Be able to be creative and propose new ideas when working in situations with lack of information and under high stress. Be able to manage information. Be able to gather, analyse and specify customers' needs. Be able to model and design the human-computer interaction of a system following a human-centric approach. Be able to understand social, ethics, professional and civil responsibilities of the computer engineers. Be able to design and develop computing projects. Learning outcomes: Be able to build low-cost prototypes to evaluate the design of the human-computer interaction. Be able to evaluate the usability and accessibility of interactive systems. Understand humans' information processing, and the limitations and diversity of human beings when they interact with systems. Understand the possibilities and limitations of different interaction devices and styles. Be able to apply the principles, methods, guidelines and standards of human-centred design and design for all, when designing the human-computer interaction.

Study course provides practical knowledge and skillset, a balanced mixture of practical and theoretical knowledge and theoretical knowledge. This course is all about UX (Human-Computer Interaction). It covers the fundamental aspects of the design of interactive systems following the User-Centered Design process.

Universidad Politécnica de Madrid in **Digital Innovation – Specializations in Human Computer Interaction and Design** Master's 2 years study program is delivered study course Evaluation of Interactive Systems and it is delivered in the first year. The program is implemented in English Language.

Course content description the course covers the teaches methods to perform usability evaluation, experimental design and to statistically analyse the results. Different evaluation methods will be introduced for different tasks, user groups, and performed in a lab environment as well as in field. Additionally, this course places the user in the centre of the evaluation, including vulnerable groups as participants with disabilities. The course covers the following topics: Introduction to evaluation of interactive systems; Inspection methods; Interrogation techniques; Usability testing; Empirical research and experiments: design, implementation, analysis and reporting.

Course objectives, competences, and intended learning outcomes as follows: Competences (from the bachelor's degree): Be able to apply the acquired knowledge and their problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study. Be able to evaluate the human-computer interaction of products and services of high innovative value. Learning outcomes: Understand and carry experiments to evaluate interactive systems Be able to plan and perform evaluation of prototypes with different fidelity levels. Be able to evaluate the usability of prototypes.

Study course provides practical knowledge and skillset, a balanced mixture of practical and theoretical knowledge and theoretical knowledge. This course is all about UX (Human-Computer Interaction). It covers the fundamental aspects of the design of interactive systems following the User-Centered Design process.

Feedback and analyses are gathered in Analytics section.

## 2.3 University of Mariboro outline

University of Maribor (Slovenia) in **Computer Science and Information Technologies** Bachelor's 3 years study program has 3 study courses that has UX related topics as follows: WEB FUNDAMENTALS. The objective of this course is to teach students how to use basic services on the internet and how to implement and test simple Web pages, written in HTML, CSS, Javascript and PHP. WEB PROGRAMMING. The objective of this course is to teach students to implement Web applications with the latest technologies, programming tools, scripting and programming languages suitable for Web application development. HUMAN-COMPUTER INTERACTION. The objective of this course is to for students to understand and be able to analyse of human-computer interaction technologies, as well to be able to design and implement advanced user interfaces.

University of Maribor in **Informatics and Data Technologies** Bachelor's 3 years study program has 2 study courses that has UX related topics as follows: Basics of Web Technologies. Among others, the topics covered here are the concept of the World Wide Web - HTML5 - Web page design with CSS - Web page programming with JavaScript - Responsive web page design. The developed solutions, which rely mostly on a graphic interface, could additionally be tested by real users. Quality assurance. Quality theory in information systems development, Quality metrics for IT solutions. Extending quality metrics with user testing activities.

University of Maribor in **Informatics and Technologies of Communication** Bachelor's 3 years study program has 3 study courses that has UX related topics as follows: WEB technologies and annotation languages. Among others, the topics covered here are the concept of the: (1) World Wide Web protocols, HTTP, (2) HTML markup language. (3) Web forms, data transfer between browser and server (4) Separation of view and content, CSS styles. (5) Web page development tools. (6) Web page validation and optimization. (7) Web page accessibility (8) Standards for the development of web solutions. Dynamic WEB solutions. (1) Dynamic forms and their link to HTML forms, validation. (2) Management of graphical elements of dynamic web site. (3) Dynamic website development using MVC pattern. (4) Display and editing of database data using dynamic web pages. (5) Dynamic web pages testing. Application development tools. (1) Cloud-based application development tools. (2) Tools evaluation. (3) Products evaluation. (4) Acceptance and use of application development tools. (5) Testing of different application types. (6) Test automation tools. (7) Graphical user interface testing tools. Getting acquainted and actually working with some up-today software applications development tools.

University of Maribor in **MEDIA COMMUNICATIONS (MEDIA PRODUCTION)** Bachelor's 3 years study program has 2 study courses that has UX related topics as follows: FUNDAMENTALS OF WEB PROGRAMMING. The objective of this course is for students to demonstrate an understanding of the concept of development and implementation of computer programmes, emphasising programming for the web. WEB DEVELOPMENT. The objective of this course is for students to learn and understand technologies and processes for modern web systems development, to implement web systems by using modern web



technologies, programming languages and multimedia content, and to use them in practice.

University of Maribor in **MEDIA COMMUNICATIONS (MEDIA PRODUCTION)** Master's 2 years study program has 1 study course that has UX related topics as follows: HUMAN-COMPUTER INTERACTION. The objective of this course is to teach student how to analyse, implement, develop and evaluate user-friendly interfaces and other software products of all kinds to efficiently use human factors and abilities.

University of Maribor in **Informatics and Data Technologies** Master's 2 years study program has 3 study courses that has UX related topics as follows: DEVELOPMENT OF INFORMATION SYSTEMS AND SERVICES. The objective of the course is for students to be able to demonstrate understanding of the characteristics of advanced approaches to development of information systems and services in order to analyze, select, adapt and apply appropriate process models and corresponding graphical notations and diagramming techniques. WEB TECHNOLOGIES. The objective of this course is for students to demonstrate understanding of theoretical basis of web technologies, to demonstrate knowledge about challenges and best practices in modern web solutions development, to analyze, evaluate and use the most up-to-date web technologies for the developing innovative web solutions. USER EXPERIENCE EVALUATION. The objective of the course is for students to be able to demonstrate understanding of theoretical foundations of evaluating the quality of user experience while using information solutions and services, to be able to use the appropriate models in the design of user experience evaluation process, and to be able to use appropriate methods to analyze and evaluate user experience of information solutions and services.

University of Maribor in **Computer science and informatics** PhD's 3 years study program has 1 study course that has UX related topics as follows: USER-CENTRED SOFTWARE ENGINEERING The objective of this course is to teach students how to carry out research work on the field of planning, development and implementation of modern user-centred information solutions with an emphasis on methods and metrics for evaluating usability and user experience.

Lecturers and alumni or final year student feedback and analyses are gathered in Analytics section.

## 2.4 Summary of INTUX project partner universities

- The programs are offered in Latvia, Spain, and Slovenia, each tailored to local academic structures and languages (English, Spanish, and Slovenian).
- Turiba University (TU) and Universidad Politécnica de Madrid (UPM) offer structured, project-based learning from the first year, while University of Maribor (UM) integrates UX topics across various courses in both bachelor's and master's programs.
- Language of instruction: English at TU and for the Master's at UPM ; Spanish for Bachelor's at UPM ; Slovenian at UM.

- **UX/UI Focus:** TU and UPM focus heavily on human-computer interaction and design principles, while UM provides a broader IT education with UX elements integrated into web development and HCI courses.

Each university offers a unique blend of theoretical and practical UX/UI education, adapted to their respective academic environments.

## 2.5 Other universities

This section gathers information about programs implemented by 24 higher education institutions in six European countries.

Sweden:

- Malmö University program Interaction design with bachelor 3 years. This three-year interaction design programme has a strong focus on user-centred design of digital artefacts. The education is rooted in the strong Scandinavian design tradition of involving users in the design process. This particular approach is sought-after by design and technology companies worldwide. Students are trained to think critically and to challenge existing technology as a way to creatively reflect on the possibilities for new types of interaction. Interaction Design: Methods I, Interaction Design: Graphical User Interfaces, Interaction Design in Society. Course objectives serves as an introduction to human-centred design as commonly conducted in interaction design. Interaction designers are designers of interaction, and this is the expertise and focus they bring to a design team. As such, this course introduces notions of interactivity and begins to sensitise students to the concerns of interaction design. Course contents are introduced to and engage in a typical human-centred design process of research, identifying insights, setting the problem, ideating and evaluating. Theoretical perspectives of design and interactivity are introduced to support and contextualise practical activities. Learning outcomes: After completing the course students will be able to: Communicate the outcomes of a short human-centred interaction design project. Describe and critique design project experience with design process models and terminology. Critique and analyse an interactive artifact, drawing from course literature.
- Lund University program Information Systems Master's 1 year programme you will learn how Information Technologies (IT), Business Intelligence (BI) and Artificial Intelligence (AI) can be used to achieve strategic goals, and how to understand and work with modern information systems which are flexible to the goals and needs of the organisation. You will gain a deeper understanding of the wider business context of information systems, how digitalisation affects organisations and the relationship between IT, innovation and sustainability. Informatics: Human-Computer-Interaction - Design. Learning outcomes: The overall aim of the course is for the students to achieve knowledge and skills within the area of interaction design, and to give a picture of the current state of the research field and area of application. Students achieve the course objectives through a combination of

a design approach to learning and a component that allows for reflection, where individual work is presented and evaluated.

To pass the course, the student must demonstrate knowledge of and understanding of how different types of computer and interactive media can be integrated into daily life, work and leisure time how interaction problems are handled within the context of system development work. Student must demonstrate individually or in groups skills in methods for analysis, design and evaluation of interaction and interaction situations the ability to use methods for analysis, design and evaluation of intera.

- Stockholm University Master's Programme in Design for Creative and Immersive Technology (MSc) Master's 1 year program will train you to invent, design and build new technology, while heeding users' practices in context as well as taking potential societal transformations into consideration.
- Stockholm University Bachelor's program in computer science bachelor 3 years Human-Computer Interaction course gives you basic knowledge of basic concepts in the field of human-computer interaction and the psychology of the usage process. You get tools to identify factors that affect human-computer communication positively or negatively and show design methods that improve human-computer communication. This course is only offered within programs or Computer and Systems Science II, 30 credits and cannot be applied for as an independent course.
- Södertörn University International Master's Programme in User Experience and Interactive Media Design Master's 2 years programme provides students with the opportunity to qualify for work in media technology, with a particular focus on interaction design, user experience design, and the design of interactive media. The programme focuses on the design and critical analysis of interactive media and digital artefacts and services in different contexts based on varying perspectives and values. Graduates have gained broad competence, meaning that they qualify for work in most stages of the design and development process. The programme is also a good foundation for a doctoral degree. The extensive theoretical and research preparatory parts of the programme give a good preparation for analytical work tasks and project-management roles. Knowledge - apply advanced theoretical knowledge of interactive media, user experience, interaction design, user-centred development, and design theory in analyses of complex problems related to media technology. Judgement and approach - evaluate the properties and qualities of design solutions and digital artefacts from different theoretical perspectives, and with respect to benefits to society, usability and use qualities.
- Jönköping University User Experience Design Master's 1 year programme provides advanced knowledge and skills in the use of emergent digital technologies, providing a more intuitive user experience and increased user satisfaction and productivity.
- Jönköping University New Media Design. This programme combines graphic design, programming and web design, with training in both digital marketing and project management. Get skills to design and encode interactive web applications for different devices and platforms with a clear focus on the user

experience. Develop your theoretical and practical knowledge for designing graphic material for both printed and digital media. User Experience Design The course will give the students an overview of fundamental concepts within user experience design with particular focus on information architecture and interaction design.

The course includes the following elements:

- Treat information as a material for the creation of shared digital environments;
- Apply information architecture and interaction design concepts and methods to real-world; situations
- Create blueprints for interactive systems through sketching, storyboarding, and prototyping;
- Design interactions that make use of digital, ambient, or behavioral interfaces;
- Consider emotion and persuasiveness as core elements of the design process; Apply cognitive and behavioral models to design for accessibility and inclusion;
- Apply skills and knowledge in the context of team-work and collaborative projects.

Norway:

- University of Oslo Informatics: Design, Use, Interaction Master's 2 years. In this master's program, you will learn to understand how today's computer systems work in practice, and you learn to use the knowledge to create tomorrow's IT solutions. Skills - You can analyse an information system using relevant theories and can evaluate IT-solutions in a social context and related to other systems and infrastructure analyse the needs of the users and consider them in light of technical possibilities and limitations consider social and ethical consequences of IT Competences - You examine and use the needs of users and society as the basis for professional assessments and choices.
- University of Bergen Media and Interaction Design Bachelor's 3 years in media and interaction design, you learn to understand the media field, so that we can design solutions that provide efficient media production and user-friendly media use. Interaction design is about creating solutions that make the product and system easier for the user. The course provides an introduction to prototyping and design of interactive technologies. The students learn about various methods and techniques for prototyping that are relevant for the design of interfaces for web and mobile units. The course also deals with design principles and guidelines for creating good, useful and user-friendly interfaces. In addition, students learn about different forms of user participation in design activities. The student knows key terms within interactive user interfaces and interactive applications has knowledge of prototyping and various forms of prototyping activities has knowledge of design principles and guidelines for good design knows the advantages and disadvantages of various prototyping techniques

have knowledge of and insight into various theories and concepts one uses to understand user participation and how one can involve users in design activities.

- University of Bergen Media and Interaction Design Master's 2 years Media and interaction design is about designing and developing engaging solutions for new media. You will gain a highly industry-relevant educational qualification that enables you to design prototypes on new media, and evaluate the user experience of both media producers and media users. The student can analyze media technology with a focus on how design impacts interaction and user experience. identify and discuss issues and challenges for the design of media technology today, with a focus on interaction. discover appropriate tools and techniques for software development assess the socio-cultural implications of interactive media and user-generated content.
- Norwegian University of Science and Technology (NTNU) Interaction Design Master's 2 years in NTNU's master's programme in Industrial Design and work with real life problems while acquiring knowledge, insight and working methods from aesthetics, industrial design and engineering. The candidate will know the steps in a web design process: Information architecture, writing for web, paper prototyping, wireframes and usability testing, GDPR, WCAG, image types ad uses, layout, composition and grids and animatin. Trustworthiness, dark patterns, and ethics will be discussed. Students will understand principles for good design for each step in the process. The candidate should be able to organize information, explore and choosing the right UI patterns, conveying a clear identity, and create an engaging user experience.
- Norwegian University of Science and Technology (NTNU) Interaction Design Bachelor's 3 years UX designer and learn to put the user's needs first. On the course, you work with the design and prototyping of websites, mobile services, design systems and physical interactive solutions. The student Has basic knowledge of what user-centred design is and which phases, methods and principles lie at the core of user-centred design Has basic knowledge of the terms User-Centered Design (UCD), User experience (UX), and User Interface (UI) Has basic knowledge of ethical research guidelines and GDPR which are linked to research and the handling of personally sensitive data.

Denmark:

- IT University of Copenhagen Digital Design and Interactive Technologies Master's 2 years programme in Digital Design and Interactive Technologies provides you with in-depth knowledge of how to design digital technologies. You will develop a critical and analytical mindset and gain hands-on design skills to rethink and shape new interactive technologies.
- IT University of Copenhagen Digital Design and Interactive Technologies Bachelor's 3 years programme is designed for those eager to shape the future of digital technology through an exploratory and critical lens. The programme combines technology, design, and societal insights, empowering you to craft meaningful solutions.

- Business Academy Aarhus, School of Applied Sciences Multimedia Design Bachelor's 2 years higher education for people who would like to get knowledge and skills within user interface design (UI), user experience design (UX), digital content, programming and business understanding. You'll get a high academic level and hands-on work consisting of sketches and exams. In the degree programme, you will work with planning, management and completion of multimedia projects. You will learn to apply communication theories, narrative techniques and means of communication and you will acquire practical experience with programming and improve your skills in concept development and design. Starting the semester by focusing on UX/UI in an entertaining context, with a study trip included. Then we continue to focus more on design, working with design systems and finally, we work on real cases in collaboration with companies. There will also be masterclasses in this semester.

#### Finland:

- Aalto University Human-Computer Interaction - Computer Master's 2 years In the Human-Computer Interaction major, you acquire the necessary skills to innovate new ways to interact with computing systems and information technologies for the benefit of people. The major has an internationally unique engineering and computational (CS/EE) focus with a strong contribution from psychology and design. Students learn how, e.g., computational methods are applied in a human-oriented way.
- Aalto University Digital Systems and Design Bachelor's 3 years. The major covers interdisciplinary topics from electrical engineering and automation, computer science, communication science, information science, and electronics. Through these studies, you will gain expertise in a range of techniques covering mathematics, modeling and analysis of signals and systems, and electronics.
- Laurea University of Applied Sciences Service Innovation and Design Master's study program In this Service Innovation and Design programme, you will acquire multidisciplinary knowledge of service innovation and design through advanced studies of different service theories and their implications for service innovation and design practice. SID programme combines service business and service design competences, and brings you to the forefront of recent developments in the field.
- Laurea University of Applied Sciences Business Information Technology, Developing Digital Services Bachelor's 3,5 years Business Information Technology (BIT) programme gives you the chance to develop skills in IT and business management. Along with the digital service business, you will learn the basics of requirement analysis, application design, -implementation and -testing. As work is becoming more digital, companies need skilled application developers who are familiar with all the phases of software development life cycle. This programme is designed to fill those needs.
- University of Turku Information and Communication Technology Bachelor's 3 years study program Digitalisation and artificial intelligence are reshaping the way organisations and societies work. The Bachelor's Degree Programme in

Information and Communication Technology prepares you to use both current and future technologies in a variety of ways as part of diverse work communities.

- University of Turku Digital Design Master's 2 years. The students will learn designing, modeling, analysis, and optimization of products, machines, structures and systems. In addition to theoretical knowledge and practical skills of design in mechanical engineering, the Digital Design specialisation track supports the students with the development of suitable personal and social competencies.

Czech Republic:

- Masaryk University Programming and development Bachelor's 3 years. The focus of the Programming and development bachelor program is design, creation, implementation and program maintenance technology and in lesser amount also technical equipment of modern computer systems and digitally controlled systems. Graduates of the program will have fundamental understanding of the whole computer systems life cycle, starting with computer architectures, programming and software engineering, through computer networks and operating systems and ending with development of embedded systems. This technological view is supported by the necessary mathematical foundations and by introduction to design principles of secure computer systems. Important feature of the program is the focus on continuous practical verification of attained knowledge, including semestral project and semester-long internship. The goal of this program is to focus the graduates to the solving the technological (real world) problems.
- Masaryk University Informatics Bachelor's 3 years study programme is recommended to students who intend to get fundamental knowledge in informatics and get acquainted with the general principals of making and using information technology. Besides, the basic orientation in the field students will get enough knowledge and practical training to be able to find employment in the field immediately after graduation. The programme offers some options to aim the profile of the education towards selected basic areas of computer science, such as computer graphics, data processing, information security, networking, artificial intelligence, and computer science.
- Masaryk University Visual informatics - Image analysis and processing Master's 2 years the Visual Informatics degree program prepares students to work with image information and models of spatial scenes, which includes or touches on areas such as computer graphics, image processing, visualization, computer vision, virtual and augmented reality, video processing, pattern recognition, human-computer communication , 3D modeling, animation, graphic design and machine learning.

Germany:

- IU International University UX Design (User Experience Design) Bachelor's 3 years In the UX Design distance learning course, you will receive in-depth training in the areas of interaction and experience design. You also have the opportunity to focus on highly sought-after career fields with the courses User Research & Testing, UX Conception and Usability Engineering.

- SRH Fernhochschule – The Distance Learning University UX Design Bachelor's 3 years UX designer, you enjoy questioning human needs and behavior and developing digital tools that are easy and intuitive to use. In addition to design, you are also interested in analyzing complex relationships. In the Bachelor's distance learning course in UX Design, you will acquire expertise in all questions relating to the usability of digital applications. Another focus is on human-machine interaction. This will enable you to develop a strong understanding of the interaction between users and technology. The skills you learn will enable you to plan, manage and evaluate UX design projects independently. In detail, the following content forms the core of your degree program: UX design: methods and tools; information architecture and systems Prototyping and usability evaluation: UX/UI principles; prototypes; usability testing methods User research: selecting, conducting and analyzing research methods Human-machine interaction: application principles such as usability engineering, interaction design and ubiquitous computing & ambient intelligence Data analysis : Analysis of data from user feedback and usage statistics; derived recommendations for the design and improvement of technologies.
- SRH Fernhochschule – The Distance Learning University UX & Service Design Master's 2 years distance learning Master's degree in UX & Service Design (MA) qualifies you to design the user experience. You are enthusiastic about the management and design of user experience and want to develop first-class services.
- FOM University of Applied Sciences for Economics & Management UX Design & Digital Solutions Bachelor's 3,5 years In seven semesters, you will learn how to create optimal user experiences by designing digital products that are intuitive, appealing and user-friendly. The course combines UX design fundamentals with specialist areas such as computer science, design and psychology. You will gain knowledge in user research, interaction design and prototyping. After graduating, you will have the technical understanding and skills to develop inclusive and accessible digital products. This will give you a holistic perspective on designing digital experiences
- MU Media University of Applied Sciences Communication Design and Creative Strategies Master's 2 years the Communication Design and Creative Strategies is a future-proof program. It provides key competencies expected from creative heads in management positions, focusing on aesthetic production in advertising, marketing and visual communication. The aim is to master the entire design-oriented process of value creation both in theory and practice.
- Furtwangen University Design of Interactive Media Master's 1,5 years courses are about interaction and user experience design, the staging of interactive media in real and virtual spaces, cognition and perception of multimodal interactive media, game design and gamification and much more.
- Brand University of Applied Sciences Design Innovation Master's 1,5 years With a focus on design innovation , you will learn how to design exciting digital products and services. You will deepen your knowledge of storytelling and UX strategy in order to work in the international brand industry.
- Reutlingen University Digital Business Bachelor's 3 years Business information systems, digital business models and processes, digital transformation in



business and society, digitization, computer science, artificial intelligence (AI), practice-oriented studies, project management, user experience (UX), business informatics.

- Ansbach University of Applied Sciences Media Systems Engineering Bachelor's 3 years the Digital communication, media systems for events and studios, media systems in vehicles, media systems in buildings, systems engineering, user interfaces, UX design.
- SRH Berlin University of Applied Sciences Web-Development Bachelor's 3 years In the English-language B.Sc. Web Development course, you will learn how to conceive, design and develop real, digital products and services. Interaction design, UX design, usability engineering, scripting languages, business informatics and social media are on the curriculum, as are hardware programming, communication strategy and agile project management. Building on this, you will develop digital experiences, online platforms, hardware projects, virtual spaces and games.
- PFH - Private University of Göttingen User Experience Management & Design Master's 2 years the goals of the "User Experience Management & Design" program is to ensure that your program or app makes it into the group of satisfied customers. You will also learn how to develop a business model that is sustainable in the digital world, as well as other topics that will help you create a successful business model. You will be learning all of this and more by putting theory into practice and working on your own projects.

## 2.6 Summary of other European Universities

Swedish universities emphasize a strong user-centered design approach rooted in Scandinavian design traditions, particularly at Malmö University. Programs in Lund and Stockholm also integrate business, AI, and broader societal impacts into interaction design. The curricula are often interdisciplinary, combining technical, theoretical, and practical elements with a focus on critical thinking and user involvement.

Norwegian programs, such as those at the University of Oslo and NTNU, focus heavily on practical application and real-life problem-solving within interaction design. These programs emphasize understanding the social and ethical implications of IT solutions, with an added focus on industry relevance and creating solutions that meet user needs in practical contexts.

Denmark's IT University of Copenhagen offers programs that stress critical and analytical approaches to digital design, blending societal insights with hands-on skills. The Business Academy Aarhus, with its focus on multimedia and UI/UX design, incorporates practical projects and industry collaboration, reflecting Denmark's emphasis on a balance between creativity and technical skills.

Finnish universities like Aalto and Laurea focus on integrating engineering and computational methods with human-centered design, stressing innovation in human-computer interaction. The programs tend to have a strong research and theoretical orientation alongside practical skill-building, preparing students for cutting-edge roles in digital technology.

Czech institutions like Masaryk University offer more technically oriented programs with a focus on programming, development, and visual informatics. The approach here is grounded in a thorough understanding of computer systems and their lifecycle, with an emphasis on practical, real-world applications of design principles within a technological framework.

German universities present a diverse range of programs, from UX Design to Media Systems Engineering. They combine technical expertise with a strong focus on user experience and digital solutions. Programs often integrate business, design, and psychology, emphasizing interdisciplinary knowledge and real-world application. German curricula are generally designed to equip students with the skills needed to manage and develop digital products that are both user-friendly and innovative.

The next chapter includes analysis and lecturers and alumni or final year student feedback.

## 3 Analysis

All study programs reviewed in the previous chapter include an introductory course in UX and provide well-structured curricula. These programs are well-aligned from the Bachelor's level to the PhD level. First, the study programs from various universities, including partner institutions within the INTUX project, are comprehensive. They cover Bachelor's and Master's levels effectively, though there is a notable gap in PhD-level programs. Additionally, the results of the INTUX project could be utilized to develop and enhance PhD-level courses.

Second, while most universities offer a solid theoretical foundation, they often lack practical examples and best practices that could be integrated from the INTUX project. There is a notable deficiency in case studies and real-life scenarios.

Third, the technical approach includes basic programming courses relevant to web development and design methods. However, there is a gap in programming courses for non-IT students, who need to learn design tools, methods, and approaches.

The following differences were noted in the research:

- **Latvia and Spain** offer programs that combine strong foundational courses in UX and HCI within computer science degrees, emphasizing practical projects and user-centered design.
- **Slovenia** provides diverse IT programs with a focus on web technologies and UX evaluation.
- **Nordic countries** (Sweden, Norway, Denmark, Finland) offer robust programs integrating user-centered design with societal and technological impacts.
- **Germany** features a wide range of specialized UX programs, from practical Bachelor's degrees to strategic Master's programs, covering everything from UX design to digital business transformation.

These differences reflect each country's educational priorities, industry needs, and cultural approaches to design and technology.

### 3.1 Feedback from lecturers

During the program mapping, lecturers' opinions on the strengths and weaknesses of the programs being evaluated were also gathered.

Strengths:

- Educate, analyse and specify the needs of the clients, deadlines, available means and possible conditioning factors that could affect the system to be developed.
- Model and design human-computer interaction adopting a user-centric approach, and being able to design, develop, evaluate and ensure accessibility, ergonomics, usability and security of the same.
- Understand the concept of life cycle, which encompasses the meaning of its phases (planning, development, installation, and evolution), the consequences for the

development of all aspects of computer systems (software, hardware, and human-machine interface), and the relationship between quality and lifecycle management.

- Create prototypes, simulations or models that allow the validation of the system with the customer.
- Take into consideration the social, ethical and legal conditions desired in the profession and practice of computer science.
- Ability to learn autonomously and update knowledge, and recognition of their need in the area of computer science.
- With respect to my former students to whom I have taught in my 1st and 3rd grade subjects, of their strengths I highlight their ability to work in a team, their knowledge of inclusive design, and incorporation of techniques/tools/principles that they discover throughout the elaboration of their group work.
- To exemplify it, in the 3 generations of students to whom I have taught as a first-year teacher in Human-Computer Interaction and in the first generation of students in the third year in the subject of Video Game Fundamentals, students have been able to satisfactorily audit their work (both high-fidelity prototypes and vertical slices) from an accessibility perspective following different guidelines, updated principles and manuals provided by the teaching staff (WCAG and the white paper on accessibility in video games). In addition, more than half of the work at IPO and all at FdV have gone further and have managed to correct and implement the corrections they considered most critical to improve the accessibility of their products and expand the base of their potential users from an inclusive design perspective.
- Given that these are first-year students, the knowledge and skills that they are expected to acquire in the subject of Human-Computer Interaction are quite general. In my opinion, they become aware of the need to involve users throughout the development process through a user-centered design process. They also acquire knowledge about the objectives and how to carry out different stages of the process, such as the analysis of the context of use, the design of low- and high-fidelity prototypes, and the performance of usability tests. They become aware of the need to address the diversity of capacities in users, and the importance of accessibility.
- Students acquire many skills and knowledge in relation to IPO and UX. For example, they learn what the main concepts are and what is the terminology that should be used to refer to it or what methodologies exist. However, I think the most important thing they learn is to understand that they must think about users when it comes to saving a system, and that those users are very diverse. In general, GMI students are students accustomed to a very computer and technological vision of software solution design, which tends to focus a lot on technology and very little on the human being. Therefore, this subject is very disruptive for them, and makes them understand that it is essential to take users into account throughout the design and development process.
- Students develop many skills in the field of mathematics and computer science, especially when it comes to data analysis.
- Students receive introductory and practical teaching about human-computer interaction.

- They apply that knowledge to the interaction design of a computing system, and the perform usability testing of the prototypes they develop.
- The strong side of this teaching is that they put into practice what they learn, and that they get in touch with realistic users.
- Systematic design of the user experience of products, processes or services.
- Problem-solving with a user-centered design approach.
- The students have adequately acquired the skills and knowledge, with an average grade of remarkably high. They have become aware of the needs of people with functional diversity and have learned that developers must make extra efforts to take them into account, so that the user experience is complete and without discrimination. Students have been very involved and motivated in learning and applying accessibility (something that has usually been new to most of them).

Evaluating the listed can be concluded:

- Students are well-trained in understanding client needs, setting deadlines, and creating prototypes for validation.
- They excel in designing user-centric interfaces, ensuring accessibility, ergonomics, usability, and security.
- Students understand the software development lifecycle and its impact on quality management.
- They are mindful of social, ethical, and legal considerations in computer science.
- Students learn independently, continuously updating their knowledge.
- Strong teamwork skills and inclusive design practices are evident, with a focus on accessibility and usability.
- Students grasp user-centered design, gaining skills in context analysis, prototyping, and usability testing.
- The course shifts students' focus to the human aspect of design, emphasizing user diversity.
- Practical experience with real-world users enhances their skills in interaction design and usability testing.
- They are trained in systematic UX design and problem-solving from a user-centered perspective.
- Students are highly aware of functional diversity, ensuring inclusive and non-discriminatory user experiences.

The following weaknesses were mentioned:

- Know how to work in situations lacking information and under pressure, having new ideas, being creative. As the FdV subject is optional in the bachelor's degree in computer engineering and the IPO subject is not sufficient to cover all aspects of Computer Engineering in terms of accessibility, many students lack the skills to realistically apply an inclusive design of their software projects. That is why most students in the degree know "the principles and theory" that we explain in the first year as it is a compulsory subject, but later in their development no one guides them on how to really translate them into their software process (requirements,

development, testing, maintenance, etc...). In fact, based on my experience as a teacher participating in the Practicum and TFG in the last year of the course, all this knowledge acquired by not being reinforced/extended in subjects of subsequent years has been practically forgotten and is completely ignored. My impression is that there is a very strong lack of the aspect of inclusive design and accessibility in developments proposed by those students who have ignored the importance of the content of these subjects. Although they put into practice different activities of the user-centered design process, their maturity as people is still low, and they lack knowledge about Software Engineering, so I think that their vision of the software development process is limited and superficial. In the analysis of the context of use, they do not manage to carry out interviews capable of extracting really relevant information for the future design of the system, they do not know how to abstract user models (such as People) from the information collected, and then they do not know how to adapt their designs well to what they learned during the analysis of the context of use.

- Although they are slightly seen in the subject, I think it would be necessary for students to have more training in aspects more related to the acquisition of social skills, such as effective communication with real users to understand the context of use. It would also be very important to be able to delve deeper into the importance of knowing and considering the diversity (cognitive, physical, social...) of the potential users of the system. There is also a need for a little more training in relation to the ethical aspects of the profession, including concepts such as non-discrimination and data protection.
- In my opinion there is little training in the design of applications and technological solutions and in SW development with new frameworks such as REACT, WordPress, ELIXIR; etc. They have very little knowledge in accessibility and UX.
- In my opinion, the teaching on accessibility issues is not as deep as it should be. They learn about the basics of disability and accessibility, but they don't apply that knowledge in any of the prototypes.
- In some cases, the knowledge acquired remains on a theoretical or academic level due to the difficulty of putting it into practice in a realistic and extensive way.
- In other situations, some knowledge and techniques are not in-depth or some areas of the profession, such as content strategy or information architecture, are left uncovered.
- I don't think that the graduates had shortcomings in their training. To mention some weakness, is that some students had certain difficulties in applying the conclusions to people with disabilities when making a report on an innovative technology.
- Although they are slightly seen in the subject, I think it would be necessary for students to have more training in aspects more related to the acquisition of social skills, such as effective communication with real users to understand the context of use. It would also be very important to be able to delve deeper into the importance of knowing and considering the diversity (cognitive, physical, social...) of the potential users of the system. There is also a need for a little more training in

relation to the ethical aspects of the profession, including concepts such as non-discrimination and data protection.

- They should work better know how to work in situations lacking information and under pressure, having new ideas, being creative.
- As the FdV subject is optional in the bachelor's degree in computer engineering and the IPO subject is not sufficient to cover all aspects of Computer Engineering in terms of accessibility, many students lack the skills to realistically apply an inclusive design of their software projects.
- That is why most students in the degree know "the principles and theory" that we explain in the first year as it is a compulsory subject, but later in their development no one guides them on how to really translate them into their software process (requirements, development, testing, maintenance, etc...).
- In fact, based on my experience as a teacher participating in the Practicum and TFG in the last year of the course, all this knowledge acquired by not being reinforced/extended in subjects of subsequent years has been practically forgotten and is completely ignored. My impression is that there is a very strong lack of the aspect of inclusive design and accessibility in developments proposed by those students who have ignored the importance of the content of these subjects.
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It can be concluded that, students face challenges in applying inclusive design and accessibility principles practically, as these are not reinforced beyond initial courses. There is a lack of training in social skills, particularly in user communication and understanding diversity, as well as ethical aspects like non-discrimination. They have limited exposure to modern development frameworks and lack depth in UX. Knowledge often stays theoretical due to difficulties in practical implementation, and key areas like content strategy and information architecture are insufficiently covered. Students also struggle with working under pressure, creativity, and conducting effective user research.

### 3.2 Feedback from alumni and last year students

During the program mapping, alumni and last year students opinions on the strengths and weaknesses of the programs being evaluated were also gathered.

Strengths:

- It is true that many students develop basic skills such as not putting white texts on light backgrounds.
- As for the field of user experience design, this only occurs in the subject of Human-Computer Interaction, and I think it teaches you to understand what a usability test is and how to do it, as well as how to create flow diagrams of the application and designs that allow you to interact with the prototype.
- Its strengths would be the development of teamwork and laying the foundations on programming in java, specifically through the subject of AED in the second year.
- You acquire a good foundation in many areas of computer science and some technical skills, such as how to function or be able to face new situations.
- I think that the most solid knowledge is the technical/programming knowledge.
- The strength and the greatest skill learned is the ability to solve problems, during the degree a way of thinking, analyzing, and looking for solutions is developed that is applicable in any aspect, beyond the computer field. I think that's the skill that is developed the most without a doubt. Linked to this skill is also the ability to learn autonomously. All this allows graduates to have the ability to generate solutions that respond to the problems that are presented to us.
- To most of the students, UX design was something new, and many of the methodologies which we learned were new to us. I would say the most valuable part of what we learned are the steps needed to design, create and evaluate a design. Even if most of the techniques will not be used all the time, knowing at least some beforehand could be useful in the future.
- They have learned the importance of user-driven design. You have learned how to create navigation flows, layout schemes, etc. to enable consistent and consistent application. They have also learned how to evaluate a low-fidelity prototype and how to do a context analysis.
- We have developed teamwork skills while improving our technical abilities in areas such as user interface, IT project management, and broader fields like economics.
- We have a very good level of programming which allows us to learn new languages without much difficulty. We have a very good level of logical reasoning which helps us to deal with problems that we have never seen before easily. In general, we have a very varied and complete profile.
- As for the degree "Mathematics and Computer Science", students satisfactorily develop the ability to structure quickly and well the data of the problems they face. A good ability to work in a team is also developed.
- In terms of mathematical knowledge, the degree focuses its mathematical teaching on instilling a broad base in all fields, but without delving into any of them; and it teaches, on the part of computer science, Java and C languages as a priority, languages that, due to their low level, are the cause of the ability to structure data that I mentioned earlier.
- "Collective" subjects are also taught in which the class, pretending to be a company divided into teams, must develop a computer system through technologies that they had not used before. This results in each student acquiring one or other skills depending on the team to which they belong, although we can group them into frontend (they study Angular or React), backend (they study Node or Spring) and database (they study SQL and a specific development environment for databases such as PgAdmin).



- How to perform usability tests and collect useful information from users. Without a doubt it has been the most important thing and something that I have been able to do correctly.
- How to analyze and use usability heuristics.
- How to perform usability tests and collect useful information from users. Without a doubt it has been the most important thing and something that I have been able to do correctly.
- How to analyze and use usability heuristics.

From the collected opinions, we can note that:

- Students learn essential design skills, like avoiding poor color contrasts.
- The Human-Computer Interaction course teaches usability testing, flow diagrams, and prototype design.
- Strong teamwork and solid programming foundations, especially in Java, are developed.
- Problem-solving skills and independent learning are significant strengths.
- Students gain insights into UX design methodologies, focusing on design steps, evaluation, and user-centered design.
- They learn to create consistent navigation flows and evaluate low-fidelity prototypes.
- Strong programming skills, logical reasoning, and quick adaptability to new languages are demonstrated.
- A broad mathematical foundation with a focus on Java and C enhances data structuring abilities.
- Real-world project simulations in "collective" courses boost both front-end and back-end skills.
- Students effectively conduct usability tests, analyze heuristics, and gather user insights.

The following weaknesses were mentioned:

- In general, one subject in the entire degree seems insufficient to me, many of them do not even know that they should follow a structure in the GUIs to be able to be used as they should.
- The missing knowledge is how to structure the information in the prototype, so that, while remaining aesthetic, it can be accessible. Accessibility is one of the topics that I feel is not addressed in the subject.
- There is a lack of knowledge about the most up-to-date and currently used programming languages, as the current plan is outdated. There are no subjects that teach you about application design and how to relate subjects explained in previous years.
- The use of more current technologies and topics.
- One of the most important aspects that could be emphasized more is the organization and estimation of project work hours.
- One of the biggest weaknesses is the ability to work in a group in a coordinated, fluid and effective way, something that I have been able to verify in my subsequent studies. I think that, despite how common it is to have to do group work during the

degree, it is not taught at any time how to work in a group, what tools are useful for it and how this process should be carried out.

- Even if for UX it's not required, not having studied UI design experience alongside it hinders it a bit. The main problem was the lack of time to explore each area in detail, leaving us to do it quickly and forget why it was important. Maybe reducing the scope, a bit to focus more on some areas would have been useful. I feel the area which was a bit lacking was the development of the high-fidelity prototype, due to a lack of time and inexperience using Figma in our case.
- They have not been efficiently learned to apply design heuristics and WCAG.
- In general, the lack of real-world projects leaves small gaps that need to be filled when starting a professional career, or that could be improved with the simulation of real-life situations.
- We are pursuing a degree focused mainly on technical profiles related to data science and artificial intelligence. However, we only have one subject for each of these fields, one of them optional, which is insufficient to acquire adequate knowledge.
- We are going to divide the deficiencies into two parts: Computer Science and Mathematics.
- Computer Science: Very Low Level, Low High Level. Java and C are mainly taught, but Haskell, C++, Maple and Matlab are occasionally touched, in addition to those languages and technologies that are studied for collective subjects (see answer to question 3).
- As a result, students are proficient in low-level languages, but none of them are high-level. When you go out into the job market, there are many more offers (the difference in numbers is brutal) that require modern languages such as Python and not languages such as C, not to mention frameworks such as Angular, React, Node..., which are not explicitly taught in the degree either.
- In addition, it does not teach how to handle any type of version controller (GitHub, for example) or organization model (kanban).
- Thus, the UPM teaches tools that, although they are very necessary to understand how technology works, are not useful at a practical level for much and the vast majority of us are only going to use them to get by in our first two or three years as professionals (since, basically, they are the only thing we have at that moment to offer the market).
- Mathematics: ignored. All fields of mathematics are touched upon without delving into any of them. Taking into account the degree we are in, it seems to me that there are no notable deficiencies in this part. The problem is that there are subjects that are too dense in both Mathematics and Computer Science. This, together with the fact that Mathematics forces you to think, makes the average student ignore the mathematical syllabus, limiting themselves to memorizing exams from past years and spitting out the procedures in the exam they must take that year. Result: zero mathematical learning and, consequently, zero acquired logical thinking, but very good grade. Those who try to learn well are overwhelmed by the burden and end up sacrificing a subject.
- I'm not saying that the latter is everyone's pattern, but it's the most general (and it's very noticeable by the questions students ask, as well as the answers they often give you to basic things).

- User interface design, I think nothing is taught, I understand that it is because they assume that we know it from before, but when they ask for application and website designs there are no guidelines.

The main conclusions about the weaknesses identified in the program are:

- There is insufficient coverage of key topics like structuring GUIs, accessibility, and design heuristics, leaving students underprepared for real-world application.
- The curriculum is outdated, lacking instruction in modern programming languages, current technologies, and practical tools like version control and project management techniques.
- Students receive inadequate training in UI design, with limited focus on high-fidelity prototypes and time constraints hindering deeper exploration of UX/UI integration.
- The program fails to provide enough practical, real-world project experience, which creates gaps in students' readiness for professional work.
- Mathematics is taught broadly but not in depth, leading to poor retention of mathematical concepts and logical thinking skills.
- Group work skills are underdeveloped, as the program does not provide adequate guidance on effective teamwork practices.

### 3.3 What should be added to the program?

Alumni and last year students are also invited to answer the question about what should be added to the program. The following responses were collected:

- More compulsory subjects on UX, but when they are more trained, making known the problems that people with disabilities may have.
- A design section should be added to the degree that focuses on the explanation of certain concepts such as content structuring and the correct placement of elements to make it aesthetically pleasing.
- For example, you know how to make a database, you know how to design an API, we should know a frontend base (which is not explained in the race either), but not integration. It is something that is learned externally but it would not be a bad idea to explain yourself in the career since it is something common in the work environment.
- In addition, there are electives such as Cloud that offer another side of computer science and that can help Devops-oriented students since it is difficult to gain experience in this field.
- More updated content.
- A subject that emphasized the importance of working in a group and taught what it is to work in a group efficiently and how it can be achieved.
- Maybe an introduction course to UI design first to learn the basics at least of good UI design and accessibility, and then tackle UX design, or the other way around.
- Nothing
- I think a software architecture course could be interesting.

- A compulsory subject, even if it is 3 credits, where python is learned, especially the use of essential libraries such as pandas, numpy, seaborn, sklearn, pyspark, tensorflow.
- Separate the subjects of data science and artificial intelligence into two parts (to be able to delve deeper into them and not have to see the whole syllabus in a hurry).
- The degree needs three very important things:
  - Version Control. Nothing is taught at any time about version controllers like GitHub despite being something strictly demanded in any job offer. You can pass the race perfectly without using a version controller.
  - Modern technology. As already mentioned, something more modern than C and Java and of a high level needs to be taught. By popularity, the clear candidate is Python: modern, simple, effective, in high demand and, in addition, it is requested punctually in one or two mathematical subjects (although not necessarily and not every year) to do some very small practice (come on, as if it were not requested). Personally, I use Python a lot for small personal projects that serve me very well in my day-to-day life: mathematical operations, automating simple but repetitive tasks...
  - User Perspective. In the last year you find IPO, GPI and Fundamentals. These three teach (rather try to teach) software development from the perspective of the user, the developer, and the entrepreneur, respectively. But Fundamentals is the same as 3rd year ESO ADE: remove it. As for GPI, it teaches how to manage a project, but in the third year we had to do a project for a chair in Software Engineering (IS). Why do and then teach instead of teaching and then doing? They are in reverse order: first there should be GPI with 6 credits in third and then IS with 3 credits in fourth (I am not going to stop to explain the reasons, but these two subjects, in their current situation, are wasted). IPO is the only one that is on your site.
- The following changes should therefore be made:
  - A subject that teaches Github, Figma, Python, and Jupyter. With all these elements you have a subject that teaches varied, modern and highly demanded tools and that we can apply in a global project of the subject, that is, develop software throughout the subject using only those tools. By the way, it should be a modern topic like AI, Machine-Learning, NLP... (topics that are not touched on in the degree, except for AI that is touched on very passing).
  - Change GPI and IS places: GPI in third with 6 credits and IS in fourth with 3 credits.
  - Let's remove Fundamentals, that is, 3 credits. Thus, IPO would put it in the first quarter of the fourth quarter with 6 credits. The other 3 remaining credits can (and should) be used in a subject dedicated to the frontend development of a web application, taking what was seen in IPO to practice in software development: let's call it "Frontend Development". The IPO teacher can teach this subject and his job would consist of evaluating, at the user level, the app that the students develop (a development divided into phases: first having the draft, then the

design in Figma, then a black and white design on the web... go little by little, well) thus being able to evaluate elements that are not tangible in IPO, such as the alternative texts of the images, that the app allows colour changes based on the user's visual impairment, that it is legible by a reader for the blind... I don't know exactly how it would be approached, but there is a lot to play with and we combine Software Engineering with IPO.

- Real elective subjects, which allow you to specialize and choose what you like and what you would like to work on.

Both lecturers and alumni were asked to answer the question - Do you agree that the graduates have learned the mentioned program to a sufficient extent during their studies? The assessment had to be made according to the following scale, where 1 – No, 2 – More no than yes, 3 – More yes than no, 4 – Students can assess UX and 5 – Students have excellent UX skills.

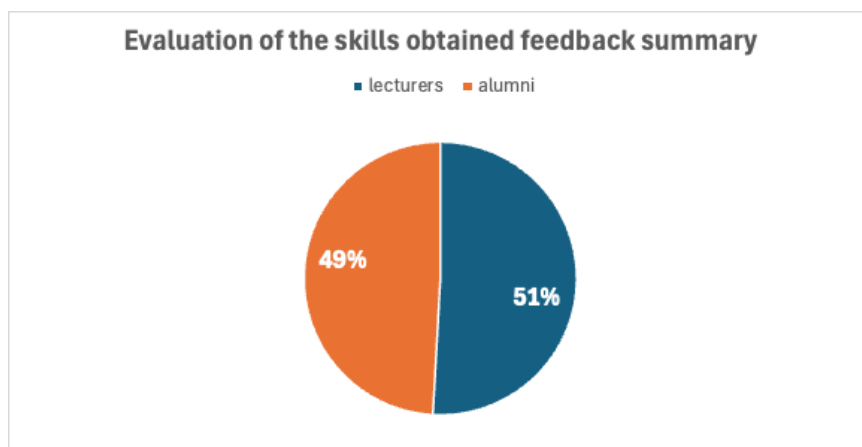


Figure 1. Evaluation of the skills obtained feedback summary

A total of 10 lecturers' feedback and 15 students' or graduates' response evaluations were obtained, which can be seen in Fig. 1. It can be concluded that there is room for improvement, even though 51% of lecturers and 49% of alumni gave the highest rating of 5, indicating that students have excellent UX skills. However, the average ratings (on a scale of 1 to 5) of 2.9 from instructors and 2.8 from students or graduates suggest that while the results are better than average, they are not a convincing advantage. This indicates that knowledge has been acquired, but there is still significant room for growth and improvement.

## 4 Conclusions

The main conclusions from the review of study programs are:

- **Structured Curricula Across Levels.** All reviewed programs include an introductory UX course and have well-structured curricula, effectively aligned from Bachelor's to PhD levels.
- **Comprehensive Coverage.** Programs at various universities, including INTUX project partners, are comprehensive at the Bachelor's and Master's levels. However, there is a gap in PhD-level courses, which could be addressed by leveraging the INTUX project's results.
- **Balance Between Theory and Practice.** While most universities offer strong theoretical foundations, there is a deficiency in practical examples, case studies, and real-life scenarios that could be supplemented by the INTUX project.
- **Programming and Design Tools.** Basic programming courses relevant to web development are included, but there is a gap in programming education for non-IT students, who need more exposure to design tools, methods, and approaches.
- **Regional Differences.** Study programs vary by region:
  - Latvia and Spain emphasize practical projects and user-centered design within computer science degrees.
  - Slovenia focuses on web technologies and UX evaluation.
  - Nordic countries integrate user-centered design with societal and technological impacts.
  - Germany offers a range of specialized UX programs, from practical Bachelor's to strategic Master's programs.

These differences reflect the varying educational priorities, industry needs, and cultural approaches across countries.

Looking at the strengths, it can be concluded that UX is interesting for both teachers and students, as well as graduates who are able to apply knowledge, competences and skills even after graduation. The instructors recognize that the material is useful and has improved their knowledge of UX, and the available materials can provide an opportunity to work in groups as well as individually.

Looking at the weaknesses, it can be concluded that many people are confused and difficult to understand when hearing and learning about the UX study course for the first time, but it is one of the fundamentals to become familiar with the UX approach and be able to start applying it, and when the basics have already settled, you can continue to go deeper and apply UX approaches already in nature and at work.

Answering the question and concluding what can be improved, it is clear that more such study courses, which are based on UX approaches, which means that a horizontal approach in the entire study program, where the UX approach is involved, so as to live through all study courses, where a UX approach can be applied.