Yevgeniya Amelina

Analysis and Update of the Academic Standard in Teaching User Experience in Response to the Digitalization Requirements

Master's thesis in the
International Master's Programme
Governance of Digitalization
Supervisors: Gunilla Widén and Anssi Öörni
Faculty of Social Sciences, Business and Economics
Åbo Akademi University
Åbo 2019

Abstract

ÅBO AKADEMI UNIVERSITY – Faculty of Social Sciences, Business and Economics

Abstract for master's thesis

Subject: Governance of digitalization	
Writer: Yevgeniya Amelina	
Title: Analysis and update of the academic standard in teaching user experience in response to the digitalization requirements	
Supervisor: Gunilla Widén	Supervisor: Anssi Öörni

Abstract:
The thesis addresses a gap in the literature, in which descriptions of the cases of updating university curricula in the fields of user experience (UX) and HCI are lacking, although user-centricity is a premise of digitalization, a trend that must be reflected in the curricula. The study uses the example of the project for revising and updating the content of the courses in UX at the Department of Future Technologies of the University of Turku as a case. The aim of the thesis is to consider the international best practices and the empirical data collected via in-depth interviews with the faculty of the University of Turku involved in teaching UX, to contribute a practical case of updating the curriculum in response to the digitalization requirements. First, a literature review is performed, in which international examples of advanced techniques in teaching UX and HCI and approaches to redesigning courses are presented and analysed. Next, a qualitative research methodology of in-depth structured interviews is discussed, based on an overview of qualitative research methods and interview as a means of collecting in-depth rich data about the studied subject. The thesis goes on to analyse the transcripts of 8 hour-long in-person interviews with the lecturers and researchers involved in teaching UX and HCI at the Department of Future Technologies to identify common themes as to the changes that are necessary to the content of the courses to adapt to the requirements of digitalization. The key findings are that UX should be more prominent in the course content, or should be the topic of a separate discipline. Further, fragments of the curricula in the fields of design and art are found to be indispensable to include in the augmented course content. The views as to incorporating business and marketing topics are found to be contrasting, with half of respondents seeing ways of including the content into the existing courses, and the other half dissenting. The opinions as to the integrative model combining technology, business, design and art within study programmes are also found to differ. Half of the participants accentuated the cluster of technology, design and art, while the other half saw potential in also including business topics. To conclude, based on the literature review highlighting the international best practices and the analysis of empirical data, recommendations as to updating UX curricula to foster active experiential learning are provided.

Keywords: user experience, human-computer interaction, interaction design, digitalization, curriculum, user-centricity, course redesign, innovation, in-depth interview, thematic analysis

Date: May 23, 2019	Number of pages: 127
The abstract is approved as a maturity test:	

Table of contents

List of figures

List of tables

1 Introduction. User-centricity as a premise of digitalization and a requirement for software developers and designers

This chapter discusses user-centricity as the cornerstone of digitalization. The aim of the research is introduced. The concepts of digitalization and the user-centred approach are defined and explored. Frameworks for teaching user experience and human-computer interaction courses are investigated as part of a brief literature overview, including the multi-disciplinary approach and innovative instruction methodologies. The structure of the thesis is presented in the final section.

1.1 Aim of the research

While user-centricity is a defining concept for the digital economy, relatively few studies address the topic of introducing new content to the university disciplines related to user experience (UX), human-computer interaction (HCI), and interaction design in response to the trend of digitalization. Its significance is emphasized by numerous researchers. There is a plethora of definitions for the terms "usability" and "user-centred approach," as well as ample research highlighting the need for restructuring and innovating the curricula in UX-related disciplines for software engineers, but a lack of systemic research and practical recommendations on introducing such changes to the course content. This poses challenges for instructors, researchers, and practitioners. The thesis aims to address these gaps by analysing international experience in teaching UX and a case of a Finnish university that underwent the process of developing and introducing a new basic course in UX and HCI.

1.2 Digitalization: concept and business process changes

The focus of digitalization, as the phenomenon which places digital technology at the core of a business model, is user-centered approach. For software engineers, digitalization means that they are expected to assist the clients to create sophisticated digital services (see, e.g., Hienerth *et al.*, 2011, Yelmo *et al.*, 2011, Yazidi *et al.*, 2011, Cheng *et al.*, 2011).

Parida (2018) describes digitalization as a fundamental disruptive force triggered by the Fourth Industrial Revolution and the Internet of Things, which has changed the way business processes and activities are conceptualized. In the increasingly

digital age, relationships between organizations and customers are redesigned, and new business models are implemented. Calling for agility, speed, flexibility, and the ability to pivot rapidly to pursue new business opportunities and keep up with a highly volatile global business environment, digitalization places advanced technology at the heart of all processes, products, and services. According to Gartner, digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities, i.e., essentially a process of moving into a digital business.

Digitalization causes changes for businesses due to the adoption of digital technologies in the organization or in the operation environment (Parviainen *et al.*, 2017). Parida elaborates that under the influence of digitalization, business models transform to become service-based. Digitalization thus enables servitization, a transition from the traditional provision of products and basic services to the delivery of higher-value advanced services.

Porter and Heppelmann (2014) define the three elements of digitalization as 1) sensors, 2) devices that make the smart system, and 3) connectivity integration from the devices to the computer and digitalized platform. Combined, they enable predictive and prescriptive analytics for business solutions and value generation.

1.3 Definitions and applications of user-centricity

It is established in the literature that to produce software which would facilitate achievement of a user's goals, software engineers and web designers should comprehend the client and the details of their business model. Brenner et al. (2014) view the digital user as a new design perspective in business and information systems engineering (BISE). According to the authors, the ubiquity of information technology leads to a fundamental shift in the BISE, requiring the individual user and his or her needs to become the focus of all efforts.

However, user-centricity lacks a universal definition, and is understood differently by software developers and designers.

Hertzum and Clemmensen (2012) report on a study of usability professionals that solicited the constructs they apply when thinking about systems use. Adopting a broad approach to the definition, they do not distinguish between usability and user experience. The results of interviews with 24 Chinese, Danish, and Indian usability professionals indicate that goal-related performance is crucial for their thinking about usability and that they tend to view usability at an individual level, rather than at organizational and environmental levels, while considerations regarding users' cognitive activities appear to them more significant than human-factors knowledge about their sensorial abilities.

Alonso-Ríos et al. (2009) present a critical analysis and a taxonomy for usability, pointing out that the concept is derived from the term "user-friendliness," or "an expression used to describe computer systems which are designed to be simple to use by untrained users, by means of self-explanatory or self-evident interaction between user and computer" (Chandor, Graham, and Williamson, 1985, p. 472).

Gulliksen et al. (2003) offer a definition of user-centred systems design (UCSD), which is based on 12 key principles for a user-centred development process, deriving from the existing theory and practice of software development projects.

Hartson (1998) defines Human-Computer Interaction (HCI) as "a field of research and development, methodology, theory, and practice, with the objective of designing, constructing, and evaluating computer-based interactive systems, including hardware, software, input/output devices, displays, training and documentation, so that people can use them efficiently, effectively, safely, and with satisfaction." HCI is "cross-disciplinary in its implementation and multidisciplinary in its roots," drawing on fields that include human factors (e.g., task analysis and designing for human error in HCI), ergonomics (e.g., design of devices, workstations, and work environments), cognitive psychology (e.g., user modeling), behavioural psychology and psychometrics (e.g., user performance metrics), systems engineering (e.g., pre-design analysis), and computer science (e.g., graphical interfaces, software tools, and issues of software architecture) (Hartson, 1998).

For the purposes of this research, we adopt the explanation proposed by Patton (2007), who emphasizes that user-centricity goes beyond a systematic effort to understand the user's needs: instead, digitalization entails cooperating with the user to reach a joint informed decision regarding the software, or, rather, the digital service that they require.

Like digitalization, the user-centered method has numerous manifestations and is applied in areas as diverse as user data protection (e.g., Bestavros *et al.*, 2017), online shopping (Dabrowski and Acton, 2013), digital marketing (Corrigan and Miller, 2011), 5G networks (Monserrat *et al.,* 2016), media research (Costa, 2014), mobile cloud computing (Dijiang *et al.*, 2013), and e-learning (Huang and Shiu, 2012).

1.4 Frameworks of teaching user experience and HCI

When it comes to teaching user-centered approach to software engineers at universities with technological profile, the term "human-computer interaction" is used. However, as Churchill *et al.* (2013) point out, the meaning of "usability" is broader, as applications and information systems should have an appealing design and provide emotional satisfaction to the user.

As the ever-changing technological landscape reflects psychological, sociological, and cultural characteristics of the users, universities and professional bodies like the Association for Computing Machinery (ACM) are challenged to keep their curricula up-to-date. A multi-disciplinary approach is applied, since the field of user experience draws upon ergonomics, psychology, design, managerial science, and business, among others. In a global survey with 339 participants by Churchill *et al*. (2013), respondents agreed that cognitive science, design, and philosophy are crucial subjects for the content of user experience courses, while accessibility, teamwork, social computing, social media, and ubiquitous computing are the most significant topics in HCI, and Agile/iterative design is the indispensable method to be taught. On the other hand, the interviewees mentioned that although a uniform curriculum or degree would be beneficiary for both students and industry professionals who employ them, "a common language seems to be lacking" (Churchill *et al.*, 2013, p. 49).

In the 2015 doctoral thesis, Nieminen emphasizes that achieving user involvement and construction of design teams calls for an in-depth knowledge of the participants' competencies, and validates a user-centered design competency model, in which 12 skills and abilities that are suggested as the most pertinent are grouped into the categories of "User Strengths, Soft Skills, Designer Strengths, and Hard Skills."

Koutsabasis and Vosinakis (2012) propose an HCI design studio course that unites constructivist pedagogies and virtual worlds and combines HCI methods, design practice, and technology between a real and virtual design studio. Sundblad *et al.* (2006) introduce a project course on User Oriented Interaction Design, in which guest lectures by specialists in areas like industrial design, psychology, anthropology, ethnology, human-computer interaction, computer science, and cinema studies are followed up by practical exercises, with the focus shifted from observation of the users to the cooperative design perspective. In an earlier study, Mackay and Fayard (1997) propose a still different framework, encompassing HCI, natural science, and design.

Faiola and Matei (2010) suggest augmenting human-computer interaction design education with teaching affordance design for mobile devices. According to them, the advancement of HCID during the last 20 years implies that researchers in the field of education should take into account the emerging theoretical models of interactive product design, particularly to empower the students with knowledge of the social context of technology design and development. A fundamental component of the pedagogical model offered by Faiola and Matei is the notion of affordance, which suggests to the user a particular kind of the product functionality. The authors elaborate that in line with cognitive theory, users interact with mobile devices by constructing mental models of their functions, starting with physical appearance, and analyse a case study of an HCID teaching strategy which focuses on the significance of affordance.

Altay (2014) presents a course on human factors that applies learner-centered methods to user-centered design teaching, drawing upon the parallels between the two approaches, while Getto and Beecher (2016) point out that the growing

demand for user experience designers calls for novel approaches to teaching and training would-be professionals, and introduce a model for creating the corresponding educational programs at universities, which includes a working knowledge of the UX process and application of sound principles in the process of design of digital products and services and encourages the students to solve real problems. The tip for educational institutions identified by Getto and Beecher (2016) is that lack of access to suitable training in UX best practices can be overcome by understanding core UX competencies and by developing partnerships with UX experts when implementing courses and programmes in UX.

Cooke and Mings (2005) consider the gap between academic research and workplace practices and cite the outcomes of 12 interviews conducted at Microsoft to find out the specialists' views on usability education and research, indicating that UX teaching needs to be extended to include additional usability evaluation methods and that students need critical and communication skills when they enter the workplace.

Breuch *et al.* (2001) draw a connection between technical communication and usability teaching, suggesting that there are ample opportunities for incorporating usability testing and research into technical communication curricula, because both emphasize audience analysis, technology, and information design. The authors analyse methodologies of implementing usability courses at three universities and provide recommendations as to the necessary changes in the curriculum, equipment, and facilities.

Preece and Keller (1991) consider the aspect of teaching HCI to practitioners on a post-graduate level applying a distance learning methodology. The intended audience are practicing engineers, scientists and managers, who use their industrial base as a classroom and a laboratory.

Ludi (2005) analyses approaches to teaching software testing and its multiple facets, including the presentation of the various types of testing and the use of tools, describing the usability testing process and project used in an elective

seminar for software engineering undergraduates. The activities in the seminar are hands-on, an approach that enables students to plan the methodology, recruit participants, perform the testing, and analyse the results.

1.5 Research questions and structure of the thesis

As the above brief review of the literature in the fields of user-centricity and human-computer interaction testifies that there is no accepted academic standard or universal framework in producing or updating content for such courses, particularly when it comes to disciplines tailored for software engineering students, this thesis introduces a case of a higher education institution with technological profile, University of Turku, that seeks to update the introductory course offering in the fields of user experience, interaction design, and human-computer interaction.

The thesis considers the following set of research questions:

1. What topics are indispensable to be included in user experience courses?

2. What approaches to teaching UX programmes can be borrowed from the experience of the universities worldwide?

3. How can different elements of the curricula in the fields of business and marketing, design, information and knowledge management, information behavior, psychology, and communication studies be incorporated to support the development of UX programmes?

4. What recommendations can be made for developing content of the courses in UX/HCI for the universities with technological profile, based on the experience of the Department of Future Technologies at the University of Turku?

The study begins with an introductory chapter on user-centricity as a premise of digitalization, which includes definitions of the key concepts and a brief literature review on the extant approaches to teaching courses in user experience, human-computer interaction, and interaction design.

The thesis continues with an in-depth literature review, considering the international best practices in teaching user experience, human-computer

interaction, and interaction design. Examples of the advanced international models of teaching user experience and interaction design are explored. Approaches to updating and redesigning the content of the courses in UX and HCI described in the literature are analysed.

The third chapter is devoted to the data collection method. It overviews qualitative research methodology, provides a motivation for choosing a qualitative methodology as the study design, considers interviews as a method of collecting data in qualitative research, and elaborates on the process of conducting in-depth structured interviews with the faculty of the University of Turku as the method for collecting empirical data.

Chapter 4 covers the analysis of the interview data. The empirical data was collected via interviews with lecturers and researchers involved in teaching the corresponding disciplines, as well as software engineering. The interviews sought to identify the directions in which the existing courses could be innovated, or a strategy for developing a new basic course. Answers to the interview questions are systematized. Thematic analysis is employed to identify common themes as to developing basic curriculum in UX and HCI that emerged from the interviews.

The thesis concludes with a discussion of the interview findings and answers to the research questions. Based on the interviews with the faculty, recommendations for updating the university curricula are provided. Finally, directions for further research are identified.

2 Literature review

This chapter consists of two parts. In the first section, international models of teaching user experience, human-computer interaction, and interaction design are presented. The second is devoted to approaches to redesign of various courses implemented by the universities worldwide. This analysis is performed in order to identify the international best practices in teaching user experience to answer the corresponding research question. The examples of course redesign are meant to serve as models of approaches to reformatting the content of the courses at the University of Turku. Both sections of the study, in conjunction with the interview analysis data presented in the following chapter, serve as the source for a set of recommendations for updating the UX, HCI, and interaction design curricula at the universities with technological profile similar to the case institution.

2.1 International best practices in teaching user experience, human-computer interaction, and interaction design

2.1.1 Emphasis on teamwork

A common feature of the international models of teaching user experience and interaction design is the accent on teamwork. The premise is that the goals of the courses can only be reached if the students complete assignments divided into groups that incorporate different skills and backgrounds. In all of the examined models, teamwork skills are practiced alongside finding solutions to the technical problems that the groups face.

Teamwork was the cornerstone, for example, during implementation of an introductory course on human-computer interaction taught at the University of Aveiro to the electrical and computer engineering students presented by Sousa Santos (2006). The focus of the course was on tasks completed as part of groups. The emphasis on teamwork was present during two stages of the implementation of the course, with and without practical classes offered.

During the first years, no practical sessions were part of the course. However, teamwork was already highlighted, with groups of 6-8 graduate students

completing team assignments, which consisted in designing a user interface and implementing and evaluating a prototype.

Later, when practical classes were introduced, the accent again was on teamwork, this time in smaller groups that completed a series of assignments. During the first tasks, the students, working in groups of two, evaluated a user interface, applying assessment methods like observer techniques, controlled experiments, and heuristic evaluation. The students acted as both experimenters and users. Through teamwork and practical experience, a goal was to showcase that users may struggle with software that is supposed to be easy to use, to achieve a change of the students' attitude to the process of software design and testing with the users. Another point illustrated by the assignments as part of the teams was that designs offering the same functionality and information could support user tasks in different ways.

A number of group tasks were used for the course to reach its goals. The group work during the first one consisted in carrying out simple tasks on an e-shopping web site, while the counterpart student observed and registered usability indicators and assessed user satisfaction. Afterwards, the students changed roles, and the same tasks needed to be performed using a different web site.

In the second practical assignment involving groups, the students participated as users in a controlled experiment, usually in the scope of the research work.

Carrying out the third practical task as part of a group, they performed a heuristic evaluation of an application or a web site. They started out with evaluating the selected targets on a general level to understand their functionality and organisation and moved on to a more in-depth analysis, in which usability heuristics were employed, and the severity of the usability problems was categorised. The findings were organised into a report and a presentation.

The fourth group assignment was devoted to designing a simple mobile phone usability test. The students used a mobile phone model unknown to them, while the colleagues observed and registered usability measures. Each group had to put forth the types of users, the tasks, and the measures, followed by a general discussion.

The final assignment implemented as part of a group was a comprehensive one. It involved performing requirements analysis, proposing a conceptual model, implementing a prototype, and evaluating a user interface. The emphasis in all the tasks was on practicing a user-centred design methodology, specifically, on implementing the usability engineering life cycle.

An emphasis on groupwork is also evident in the course in interaction design at Indiana University of Pennsylvania, described in Shumba (2006). Activities in the following formats were performed: group projects, group reports, and presenting the findings to the groups or the whole class. The course was highly interactive and collaborative. The students were expected to complete a usability testing lab-based project that lasted a semester.

The discipline concentrated on using group assignments to explore psychological aspects of using products, methods of evaluating user interfaces, cognitive models of users, simple interactive design methods and tools, and the future of user interfaces. The presented course did not encompass the technical aspects of using interface building software. Instead, the issues addressed via group work were what interactive products should look like, what one should expect from them, how they can be used efficiently, and when an interactive product should be accepted, rejected, or modified (Shumba, 2006).

Interdisciplinary team work is at the core of a course in human-computer interaction at the University of the Pacific presented in Cliburn (2017), which centres on a process for developing interactive products that are useful (providing functionality that is of value to the users) and usable (making the functionality accessible to the users). Team-based learning was the principal method of the course. Interdisciplinary teams of students performed a series of assignments collaborating to design and subsequently evaluate the usability of interactive applications.

The students read the textbook and took short quizzes online. In class, a brief lecture by the instructor was followed by an interactive team-based assignment that facilitated further exploration of a topic from the reading.

The essence of the course was for the interdisciplinary teams to offer, design, implement, and evaluate the usability of an interactive application. The students worked in groups to complete a sequence of assignments as follows.

The first assignment was the project proposal presentation. In pairs, which included students with and without prior programming experience, the participants pitched ideas of an interactive application to the class, that voted on the pitches to determine the final projects to be implemented. The selected project names were posted online, and applications to participate in them were made when completing the second assignment.

As assignment 2, the students prepared a cover letter and a resume to apply for positions of project manager, programming lead, evaluation lead, and programmer in the final projects determined at the previous stage. The focus was again on ensuring interdisciplinarity within teams: the instructor assigned project roles based on the cover letters and resumes so that the teams had the necessary skillset. The groups used Scrum to manage teamwork for the rest of the term.

For the third assignment, an interview script, the students developed questions for an interview with potential users to identify the features that needed to be implemented in their interactive applications. Following the script, interviews with classmates were held, during which students practiced collection of data to establish the requirements for the project.

Assignment 4 was use cases. The participants analysed the data collected via interviews, chose 3 features for their applications on which they were going to focus during the rest of the term, and prepared use case descriptions for the selected features.

Completing assignment 5, the teams created low-fidelity prototypes for the two different potential designs of their final project user interface. The prototypes had to support all 3 product features identified during the previous assignment. Then, students interacted with each other's prototypes and gave feedback on their experience. Based on the evaluation by the fellow students, one of the prototypes was chosen for the final implementation.

Assignment 6 involved completing an online training course required of all researchers prior to submitting protocols to the Institutional Review Boards.

Assignment 7 was an evaluation plan. Each team created a usability test for the 3 features selected during the previous stages to be implemented in the high-fidelity prototype. A user satisfaction questionnaire was also put together. The teams' project manager and evaluation lead then completed the paperwork necessary to have their proposed procedure reviewed by the Institutional Review Board.

Assignment 8 was the final project written report. At this stage, usability tests of the high-fidelity prototypes were conducted. Each student participated as a subject in the testing of three other teams' prototypes. Evaluation leads then analysed the data and, aided by the project managers, prepared the final project reports, which took the form of research articles. It was not a prerequisite that the projects were found to be usable. In the reports, the students had to explain clearly how they arrived at their findings, and make suggestions as to improving the usability of the prototypes.

The combination of exercises was meant to apply teamwork at each stage to accomplish the project goals.

Teamwork was used to facilitate carrying out project assignments also in a capstone design course at the University of Washington, described in detail in Borriello (2000). Three objectives were pursued by the discipline. First, the course tied together the curriculum, as the students applied the knowledge received through prior coursework to complete a prototype of a device. The second objective was to implement teamwork: the participants engaged in an open-ended team design, during which the initial concept was refined into an implementation, as they constructed, debugged, and demonstrated a prototype. Third, the course had themes that connected the students to research activities at the department and facilitated interaction with graduate students.

The course comprised two halves. In the first portion, the students worked as part of groups to perform laboratory assignments, select and refine their projects, and identify the components and development environments that they would use, as

well as potential users. During the second half of the course, they developed the prototype of the project concept and prepared documentation and presentations.

Another example of employing teamwork to reach the goals of the course is a model for innovating HCI education at Delft University of Technology proposed in Mulder (2015). The essence of the described pedagogical framework and transdisciplinary design approach called “Applab” is applying technology to the work of the student groups with the urban stakeholders on solving a societal problem.

Applab is based on the concept of a chaordic teaching and research environment, combining rigour and structure of the activities (order) with creativity and active experimentation (chaos). The lab emerged in response to the desire of the students to work as part of interdisciplinary teams to contribute to solving the design challenges in their city.

In this approach, the sessions are held at a laboratory for applied creativity, extended with an emphasis on electronic and sensor devices, the Internet of Things, and open data. Applab represents a technical workshop, where students learn about the latest digital technologies. The lab also connects with the research programme that investigates the role of design in transforming society. It studies the design process on the urban interaction level and trains students in digital communication, interactive media design, and computer science.

Teamwork is at the heart of the course, as the students work with multiple stakeholders in a consortium consisting of the representatives of educational and research institutions, creative industries, business, governmental organizations, interest groups, and local residents. The essence of the model is co-creation as part of multidisciplinary teams. The aim of the collaboration is to leverage teamwork to better frame the problems to deal with societal challenges. The approach applied by the participants of Applab can be described as a citizen-centred collaborative design process.

The pedagogical purpose of Applab is three-fold: to teach meaningful design via group work, to train in developing breakthrough applications in co-production with local stakeholders, and to bring design thinking into HCI education. Design

thinking is adopted as an approach to leverage a cross-disciplinary collaboration between research, government, creative industry, and HCI education. Besides, the latest digital techniques like laser cutting, 3D printing, and the Internet of Things are provided.

Participating in Applab provides a meaningful design challenge that comes with the groupwork experience with the co-creative partners. Therefore, Applab is a learning and development environment for the training of higher order skills like teamwork, creativity, data and ICT literacy, communication, problem solving, critical thinking, and social and cultural skills. An essential skill that is honed is accounting for the multiple values while dealing with the different partners and stakeholders involved in framing the problem space as part of the groups.

2.1.2 Experiential learning techniques

Another theme that links together various advanced models of teaching UX and HCI is experiential learning. The present section overviews some examples.

Brown and Pastel (2009) write about a combined undergraduate and graduate human-computer interaction course at Michigan Technological University. The essence of a combined course is that students enrolled in distinct courses gather in the same room and share insights on the relevant topics. The undergraduate course focused on group projects, which involved designing and implementing a high-fidelity prototype application. The corresponding graduate HCI course was experiential. The essence of experiential learning is to perform hands-on tasks to solve real-world problems. Thus, the students performed the role of usability experts, tested the final prototype with users, and analysed the results. The graduates also completed a short assignment exploring current research in HCI and presenting on the findings.

The course was organised as an intricate exchange between the undergraduate and graduate participants aimed at fostering experiential learning.

In the initial phases of the course, supported by the lectures on the fundamentals of HCI, each group and grad student were required to create a proposal and a web site. The undergraduate groups were oriented to think about the primary users and their tasks, in order to bear in mind and apply the user-centred design

approach for the rest of the course. The graduate students read one group proposal and met with that group to discuss the project. The graduates contributed to the proposal by determining the primary, secondary, and tertiary users, their goals, and the tasks necessary to achieve them.

During the intermediary course phases, the graduate students and undergraduate groups engaged in independent work. Only a few lectures by the instructor were offered. The task for the undergraduate students was to create a low-fidelity prototype and to present it as a cognitive walkthrough to the class. As experiential learning was applied, each graduate student worked with two undergrad groups to evaluate the prototypes via basic heuristics. The undergraduate groups used the assessments by the graduate students to develop their prototypes outside of class. The graduate students also prepared presentations covering their research topics.

In the final phases of the course, lectures on advanced topics were delivered. Outside of class, the undergraduates developed their high-fidelity prototypes, while the graduates prepared for the usability testing. Because the work was performed concurrently, the graduates could get updates on the status of the high-fidelity prototype and suggest how to provide more depth in certain aspects of the prototype for testing. Eventually, graduate students engaged in experiential learning by facilitating user testing, while the undergrad group members recorded data and monitored the prototypes for errors.

Another example of a successful implementation of an experiential learning methodology is given in Talone *et al.* (2017), who introduce the concept of a hybrid experiential learning approach via creating a user experience Lab at the University of Central Florida. The model of the course serves as the link between project-based courses and full-time industry internships.

Experiential learning is at the core of activities at the UX Lab. Students apply their user experience skills working for the local companies as part-time consultants, while receiving mentoring from a faculty member and a graduate student proficient in HCI and UX. Students who apply to work at the Lab are matched to projects based on their experience and interests. They are paid hourly and complete projects for the industry partners, while benefitting from the supervision

of faculty members. The undergraduates receive additional support through direct supervision by a graduate student.

This arrangement allows local businesses to thrive on an opportunity to partner with the university to receive high-quality low-cost UX services. The mentoring received from the graduate students and faculty affiliated with the UX Lab is a crucial component of the model and a valuable source of capabilities for small and medium-sized companies employing the students as consultants, which often lack in-house expertise in HCI and UX.

2.1.3 Applying the user-centred approach

A user-centred approach is one more characteristic shared by the advanced methods of teaching UX and HCI. The examined models involve users early on into the process of development of the software as part of the course assignments. Examples are highlighted below.

Koppelman and van Dijk (2006) describe two introductory courses in HCI, one for bachelor students in Computer Science and the other for bachelor students in Business Information Technology, at the University of Twente. User-centred approach is applied in the courses through the focus on the explicit incorporation of the roles of clients and users in projects to provide them with a realistic context. The aim is to introduce to the basic concepts in human-computer interaction while concentrating on interaction design with a user-centred approach.

As part of the projects lasting for 10 weeks and carried out by teams of 5 or 6 students, they build a system and evaluate prototypes with users, and are expected to develop an understanding of the users' needs in the process.

The context of the projects is that each team works for an IT company. The client, a representative of the company, has an idea of a new consumer product, which needs further refinement. The details of the idea and its subsequent implementation need to be clarified by the students in negotiation with the client and the users, as well as within the teams. The essence of the assignment from the company is that the team should refine the initial ideas to prepare the design of the product, including the prototype.

The design process includes 3 stages, each emphasising user-centricity. During the first phase, analysis of the users is performed in the context of the work environment by designing and administering questionnaires, interviewing users, and observing them perform their tasks. Next, based on the interviews and observations, a user profile and a task model are developed. The first interview with the client takes place, during which an approximation of the requirements is discussed by the teams. At the second stage, the students develop several scenarios and metaphors to design a conceptual model of the system, and build and evaluate a low-fidelity prototype. Further discussions with the client are held, which help to clarify the details of the requirements. During the third phase, the specifics of the system are determined, including all aspects that the user should be aware of during interaction. The dialog and the look and feel of the system are implemented. The third phase results in a hi-fi prototype, which is evaluated with the users, and a set of specifications.

As the course emphasises user-centricity, the teams are expected to engage in at least three episodes of interaction with the users. The first instance takes place fairly early in the development process, during analysis, when the students interview users, administer questionnaires, and engage in user observation to find out how the users perform their tasks and what difficulties they face. The second case of interaction is during usability testing with actual users, which is recommended to take place already at the stage of conceptual design. Finally, the users are approached during detailed design, when a second usability test, this time of the high-fidelity prototype, is performed.

Hartfield *et al.* (1992) explore an experimental course on human-computer interaction taught at Stanford University. At the core of the approach is engaging mentors from the local industry. The course focuses on interface design of computer systems, applying the user-centred approach and paying special attention to the role of systems embedded in a work environment. The students are divided into small groups and work on 12-week projects. The goals are to analyse a work environment from a user's perspective, to design and implement a prototype of a user interface, and to evaluate the prototype with clients.

Throughout the course of the studies, emphasis is placed on the importance of communicating with the potential users of the prototype. The instructors present the techniques for interviewing, observing, and working with users. The students apply a participatory design approach, in which specific characteristics of the system emerge from the interactions between designers and users.

Two projects are implemented during the course to facilitate learning by doing. The first involves redesigning interactions with a familiar product or process. The second is a more challenging software prototyping project. At the end of the course, each group summarises its work for a panel consisting of clients, software and interface designers, and faculty.

The groups that are formed for the course are small, egalitarian, and consensus-driven, rather than applying a more hierarchical approach, because the focus is on innovative design for small-scale software systems and on the prototypes emphasising the human-computer interface, while the skills needed for large-scale software development and production are not addressed.

The course sets an intensive agenda for all the parties involved. The students are expected to experiment with an unfamiliar working style, to interact personally with the users, and to develop programs working out specifications in negotiation with them. The instructors engage in coaching. The industry mentors can take on one of the following roles: group process facilitator, project site liaison, design expert, software development expert, experienced interlocutor, presentation and writing expert, and reflective observer.

Aberg (2010) discusses the process of an update of an introductory course on human-computer interaction and usable systems taught to first-year computer science students and to second-year computer engineering students at Linköpings Universitet, which was redesigned, because it initially suffered from somewhat low evaluations by the participants. Focus groups with the students were conducted in order to elucidate ways of improvement, and a new course was developed as a result.

The initial course began with a set of 5 introductory lectures and moved on to the students completing a group project and participating in class exercises and

seminars. The topic of the group project was redesigning an interactive system employing the user-centred approach. To this end, the students applied techniques like paper prototyping, contextual inquiry, interviewing, and user evaluations. The purpose of the class exercises was to complement the group project. Preparing for the seminars, the students carried out assignments in advance and discussed them in class in a group format under the teacher's supervision.

The focus groups conducted to identify measures for improving the course resulted in a redesigned discipline. The new course comprised several exercises with accent on user-centricity. As the first assignment, the students worked in pairs assessing the current prototype of an interactive system (a desktop application), employing heuristic evaluation or usability testing. The second task consisted in porting the desktop application to a handheld device. The students explored the design space and special characteristics of small devices by sketching and developed a paper prototype. As the third assignment, the students were required to implement a usable high-fidelity prototype. The three exercises were supported by a series of lectures.

2.1.4 Challenges with implementing the innovative teaching models

Implementation of the innovative techniques of teaching user experience, interaction design, and human-computer interaction entails a number of challenges. The common ones are detailed further.

The first challenge that is faced by the authors of the innovative courses is the dynamic nature of the disciplines. Both Sousa Santos (2006) and Talone *et al.* (2017) emphasise that technology and human-computer interaction are evolving quickly, requiring a continuous effort to keep the course programme, bibliography, and practical assignments up to date and on a par with the developing technology, while IT discipline faces new challenges and opportunities every day due to fast-paced changes and the rapidly growing importance of technology in the society. Sousa Santos (2006) writes that in practice this means that the course assignments should respond to the real needs of research or industry. To achieve this, the author tried to include an assignment that corresponded to the proposal of a user interface prototype or the participation in usability tests or controlled experiments as subjects or evaluators for a real client external to the course. Talone *et al.*

(2017) propose using industry sponsored project-based experiential learning in the classroom as a means of adapting to the rapid changes of the discipline.

Shumba (2006) accentuates the challenges that come with group work. According to the author, group work both comprised an advantage of the course and presented a number of barriers. First, due to the emphasis on group collaboration, the problems were, on the one hand, getting the right composition in each team so the skills could be leveraged. To this end, a criterion for group formation needed to be put in place. On the other hand, getting each and every student contribute equally for group work was challenging.

In line with these observations, according to Sousa Santos (2006), what comes to groupwork, the experience was generally positive and this approach is particularly interesting, because the need of a good teamwork strategy becomes more evident as teams get larger. However, it requires a tight control of the work each member is doing, otherwise the risk of getting a collection of modules that cannot be integrated is too high.

Other challenges pinpointed by Shumba (2006) were developing course assignments that motivate students from different disciplines, while at the same time promoting critical thinking, and the need for special facilities, tools and technology.

Hartfield *et al.* (1992) also emphasise the value of groupwork, and write that working together as a group turns out feasible for the students and is judged by them to be of great worth. However, a challenge is assessment of design quality, which poses problems given the broad nature of the project definition, with emphasis on the social and situational aspects of software design, as well as the more immediate questions of interface usability and functionality. Another challenge highlighted by the authors is the breadth of the problem, as the students felt overwhelmed trying to take into account and prioritise among organizational politics, social embedding of computer systems, testing methods, cognitive theories of interfaces, design metaphors and many other topics they were exposed to.

2.1.5 Lessons learned from the advanced models

Sousa Santos (2006) and Mulder (2015) write that the lessons learned from the implementation of their respective courses were that various forms of collaborative learning are especially beneficial for the students. In the course described by Sousa Santos (2006), besides participating as users in controlled experiments, the students performed heuristic evaluations of web sites and participated as observers in usability tests. The author considers that this collaboration has been very constructive, allowing the students, on the one hand, to be exposed to the use of evaluation methods in real circumstances, and on the other hand, to better understand the importance of correctly dealing with people who collaborate as users in usability tests and controlled experiments. Mulder (2015) writes that the chaordic space of Applab in the HCI curriculum enabled experimenting within accredited education, which is not always easy to pursue. Applab offers an inspiring environment in which students are given space to learn by experimenting in multidisciplinary teams. Moreover, students engaged in various collaborations, which were not initiated by their course leaders. An important conclusion is that learning by collaboratively designing not only worked for students, but also the involved urban stakeholders learnt.

Brown and Pastel (2009) find the combined course model that they propose to be feasible. The successful aspects of this approach to organising learning also have to do with collaborative techniques. As evidenced by this case, the students benefit from the results of both courses. They also interact with the students in the counterpart course. In the case of the analysed course, each graduate student contributed to the development of several user interfaces and led on the usability testing for a user interface. On the other hand, each undergraduate group received feedback on their UI design from several graduate students and contributed to the usability testing of their UI.

Further, many of the graduate students appreciated the collaborative learning approach by saying in the exit interviews that the course helped them better understand the evaluation process, since they were practicing on developing projects, instead of completed devices. They also experienced many of the pitfalls

that a released product could not provide, including delays, incomplete prototypes, and uncooperative developers.

Shumba (2006) touches upon a different aspect of the problem, observing that a lesson learned was that for faculty who have taught HCI to computer science majors, there was a tendency to use and discuss complex interface development examples from the computer science discipline. Instructors had to watch out for this discrimination and try to present truly interdisciplinary examples.

Cliburn (2017) writes that the lessons learned during the implementation of the course had to do with the students' feedback regarding the various activities. Thus, the students shared finding the low-fidelity prototyping assignment to be the most useful, as it helped them to save time because they could discover problems with their interface's design before writing code. Students also found value in designing an evaluation plan and writing the final report, while they rated writing the interview script, creating cover letters and resumes, and taking the online training course required by the IRB as less useful.

Talone *et al.* (2017) observe that while the inaugural project of their course, the UX Lab, was largely successful, it was noted by the authors that students, at times, felt uncomfortable providing constructive criticism regarding the client's product, as they were unsure how the client would react to their recommendations. The authors found that it is important to encourage students to speak their mind and be open to defending their recommendations, as this is a normal part of working within a team.

Koppelman and van Dijk (2006) note that it can be very stimulating for students to deal with a realistic case and a real client from business and outline a few lessons learned from the course observed by the lecturers, based on the student experiences. The authors point out that teams dealing with clients can learn that:

- the client does not usually have a detailed and complete list of requirements at the beginning of the project. Often, clients do not exactly know what they want, and usually only have a vague and global image of the system to be developed;

- information that is relevant to the client should be presented in such a way that it takes the client minimal time to read it. Clients usually do not like to have to screen 10 or 20 or even more pages searching for relevant information;

- the final presentation to the client should meet the wishes of the client. Often the instructors have observed that clients are interested in the product in the first place. Usually the main questions of clients are: what does the device look like, can I see a demonstration, can the device possibly become a commercial success, do the users like it? But many teams use a large portion of the limited time to cover the design process, to discuss the models and techniques they have used, and so on;

- the relation between teams and client is not a symmetric one. The client can be hard to handle, inconsistent and unreasonable and the teams have to cope with this kind of behaviour;

- the client is not always at their service in very short time. Some teams have to learn that they have to plan their communication with the client.

As to the involvement of the customers, the student teams can learn:

- that the user evaluation is important. For many students it is not a natural inclination to include users in the design process and to understand the importance of this;

- that the evaluation should be prepared thoroughly and be performed seriously;

- how to conduct an empirical study. Most of the students have little insight into the kind of questions one might ask and hardly any experience with measuring and interpreting data and in drawing conclusions. For most of the students the project is a first acquaintance with empirical studies;

- that they should have a critical attitude as to the designed product. This critical attitude is not self-evident for the students. Therefore, the instructors have to stress that the teams should try to find users who can reveal flaws in the interface and that they should use evaluation techniques that can stimulate the users to find these flaws.

2.1.6 Methodological conclusions drawn from the reviewed teaching models

The reviewed models share certain approaches to delivering the content of the courses in UX and HCI, while differing as to the desired learning outcomes and teaching methods applied. These are summarised in Table 1.

Table 1. Conclusions from the models of teaching UX and HCI

Consensus	Variance
1. Approach: emphasis on teamwork	Learning outcomes: concepts of human-computer interaction (Sousa Santos, 2006); psychological aspects of using products, methods of evaluating user interfaces, cognitive models of users, simple interactive design methods and tools, and the future of user interfaces (Shumba, 2006); a process for developing interactive products that are useful and usable (Cliburn, 2017); completing a prototype of a device (Borriello, 2000); applying technology to the work of the student groups with the urban stakeholders on solving a societal problem (Mulder, 2015); designing and testing a high-fidelity prototype application (Brown and Pastel, 2009); applying user experience skills working for the local companies as part-time consultants, while receiving mentoring from a faculty member and a graduate student (Talone *et al.*, 2017); introducing to the basic concepts in human-computer interaction while concentrating on interaction design with a user-centred approach (Koppelman and van Dijk, 2006); interface design of computer systems, applying the user-centred approach and paying special attention to the role of systems embedded in a work environment (Hartfield *et al.*, 1992); introduction to human-computer interaction and usable systems (Aberg, 2010).
2. Approach: experiential learning techniques	Teaching methods and types of tasks: designing a user interface and implementing and evaluating a prototype; evaluating a user interface, applying assessment methods like observer techniques, controlled experiments, and heuristic evaluation; usability evaluation of an e-shopping web site; heuristic evaluation of an application or a web site; a mobile phone usability test; performing requirements analysis, proposing a conceptual model, implementing a prototype, and evaluating a user interface (Sousa Santos, 2006); a usability testing lab-based project (Shumba, 2006); design and subsequent evaluation of the usability of interactive applications: project proposal presentation, resumes and cover letters, interview script, use cases, low-fidelity prototype, evaluation plan, final project report (Cliburn, 2017); laboratory assignments, selection and refinement of the projects, and identifying the components and development environments to use, as well as potential users, followed by developing the prototype of the project concept and preparing documentation and presentations (Borriello, 2000); meaningful design via group work, developing breakthrough applications in co-production with local stakeholders, and bringing design thinking into HCI education (Mulder, 2015); creating a proposal and a web site, developing and

3. Approach: applying the user-centred methodology	demonstrating a low-fidelity prototype, creating and usability testing of a high-fidelity prototype (Brown and Pastel, 2009); completing projects for the industry partners, while benefitting from the supervision of faculty members (Talone *et al.*, 2017); analysis of the users in the context of the work environment by designing and administering questionnaires, interviewing users, and observing them perform their tasks; based on the interviews and observations, developing a user profile and a task model; the first interview with the client, during which an approximation of the requirements is discussed; developing several scenarios and metaphors to design a conceptual model of the system, and build and evaluate a low-fidelity prototype; further discussions with the client, which help to clarify the details of the requirements; determining the specifics of the system, including all aspects that the user should be aware of during interaction, implementing the dialog and the look and feel of the system; preparing a hi-fi prototype, which is evaluated with the users, and a set of specifications (Koppelman and van Dijk, 2006); redesigning interactions with a familiar product or process and a software prototyping project ((Hartfield *et al.*, 1992); assessing the current prototype of an interactive system (a desktop application), employing heuristic evaluation or usability testing; porting the desktop application to a handheld device; implementing a usable high-fidelity prototype (Aberg, 2010).

There is a broad consensus among the authors of the examined courses in UX and HCI as to the approaches to teaching. They for the most part agree that teamwork skills should be practiced as part of the course assignments. Another area of focus is experiential learning: students are expected to partake in hands-on assignments and to hone their skills by solving real-world problems. Finally, the authors concur that user-centred approach should be applied to the assignments, projects, and practical works. At the same time, there is a considerable variance in the expected learning outcomes and the suggested teaching methodologies. While the examined courses aim to provide an introduction to UX, HCI, and interaction design, the learning outcomes range from psychological aspects of using products to designing and testing a high-fidelity prototype application and to interface design of computer systems, applying the user-centred approach and paying special attention to the role of systems embedded in a work environment. The teaching methodologies and types of tasks vary considerably, although implementation and testing of a high-fidelity prototype is at the core of the curricula. The tasks

performed by the students include evaluation of user interfaces, analysis of the users, usability testing, and creating conceptual models of the systems.

2.2 Innovative models of course redesign

2.2.1 Methodologies of the course innovation

Harden *et al.* (2018) detail the process of redesign of an introductory information systems course taught to business majors at Stephen F. Austin State University. The course was overhauled due to three reasons. First, the course content needed to be kept current and abreast of the technological developments transforming business models. Second, an administrative change took place, with the discipline transferred from the College of Business to the College of Science and Mathematics. Finally, the course included outdated content like basic introductory computer concepts and an overview of office productivity software, which was not directed toward the skills crucial for business majors to progress through the remainder of the programme and, further, in the workplace.

The process of introducing the new course included the following stages. As the first step, a Special Task Force, charged with developing a proposal for a new course and made up of the representatives of each academic department in the College of Business, was established. The Dean called a preliminary meeting and accentuated that faculty, students, members of the College Advisory Board, and recruiters indicated that many business students failed in the spreadsheet tasks required in the programme's upper-level courses and for the entry-level positions. Thus, the expectation for the new course was that it would serve as a venue for acquiring advanced spreadsheet skills.

To solicit the skills that needed to be addressed in the redesigned course, each member of the Special Task Force conducted a focus group within their faculty. Focus groups were also held with students in six junior level classes to elucidate their opinion about the content of the introductory IS course that they had already taken. The results of the focus groups indicated a demand for data analytical skills. It was found that the students were not adequately prepared to apply the basic spreadsheet skills required for quantitative exercises in Accounting, Finance, Operations Management, and Economics courses. The students complained that

the introductory course focused on the concepts of basic computing, operating systems, and word processing, all skills that they had already mastered, while instruction in spreadsheet skills was highlighted as an area that was lacking.

The Task Force came to the conclusion based on the assessment by the Dean and the results of the focus groups that spreadsheet skills needed to be a primary component of the new course, reinforced by productivity enhancements offered by information systems. As the next step, a new name, "Management Productivity Systems" was chosen for the course. In selecting the name, the Task Force was guided by the consideration that it should reflect the new emphasis on productivity, yet keep the focus on management information systems. In the course description developed at the next stage, the focus on data processed with the spreadsheet software was paired with the concentration on its use in managerial decision-making.

Next, to guide a discussion on the type of content deemed indispensable to include, as well as portions of content that were no longer relevant, the Task Force reviewed course names and descriptions of the introductory IS courses from six peer institutions in the region. Each Task Force member came up with lists of the items that the faculty considered critical to include. The lists were merged and edited in conjunction with several textbooks on spreadsheet skills. The textbook was selected based on the assumption that rather than concentrating on specific features of the software that change easily over time, the focus should be on the business application of these skills. The textbook was based on various business projects, requiring the learning of specific skills to process the data using real world examples.

The course objectives were determined at the next stage. In the process, it was necessary to balance the technical requirement of the course content with the focus on IS issues in a business environment. It was taken into consideration that a link should be made between the business and technical requirements to satisfy corporate recruiting needs.

Based on the course name, description, textbooks, and student learning objectives, a syllabus was put together outlining a timeline for the various topics to be

covered. The topics included the main components of management information systems: people, information, and information technology. Considered were the major systems used in business like enterprise resource planning systems and the underlying structures that support them, including databases, data warehouses, and data mining tools. A discussion of business analytics and decision support systems was easily integrated, alongside the internet, e-commerce, and the associated business models. The topic of information ethics was emphasised as well. Issues of networking and security were covered to equip the students with an understanding of information ownership and the responsibilities that go with it, including business continuity plans. A concluding topic was a discussion of the latest trends in information systems.

A number of challenges have been identified by the authors of the course. First, they mention the need to keep course materials current in such a dynamic discipline. As technology continues to transform traditional business models with digital innovations, business students need to stay abreast of technological developments.

Second, being exposed to updated technologies similar to those currently utilized in organizations can spur students' interest in IS courses, as opposed to technologies they are already familiar with. Keeping technologies updated presents an ongoing challenge to educators.

Drab-Hudson *et al.* (2012) provide a set of recommendations for initiating course redesign process, which they have empirically tested in reforming an Introductory Psychology course at Missouri State University.

The cycle starts by identifying a need for the redesign. Candidate courses include those that have poor learning outcomes or problems with retention or require significant financial resources from the institution. A crucial consideration is that the processes should be bottom-up, with the faculty leading on implementation of the innovation, because an administratively mandated course redesign would typically be ill-received and lack the faculty commitment.

In the initial stages, the scope of the redesign should be determined, and, based on that, a decision made whether the institution would partner with outside course

redesign specialists. The question regarding scope is whether the redesign would concern only one or all sections of the course.

Once the target course is identified, the redesign team is assembled, including the faculty who have a history of teaching the course and who are interested in the course transformation. Administrators and support personnel need to be included in the redesign team. A faculty leader should be identified, who understands the specific course challenges and is able to serve as a liaison in the redesign process.

The established redesign team goes on to identify short-term and long-term project plans and engages in brainstorming on the objectives and specific tasks to meet each of them. Based on the results of the brainstorming, the team leader identifies the resources necessary for the redesign. The team leader should ensure support from the administration, that will make the process smooth and contribute to the team's motivation throughout the project.

It is essential to evaluate and present to the stakeholders the costs that come with the redesign process. The costs associated with the course prior to redesign and the costs of start-up and delivery of the reformed course allow designers and administrators to perform cost-benefit analysis before the course implementation.

Successful implementation of the redesign depends on having an assessment process in place. Prior to redesigning the content, a preliminary assessment plan should be established. Team members should define the operational goals, identify the strategy for obtaining them, and empirically evaluate the outcomes. The focus on assessment provides information for continuous course improvement and serves as a basis for administrative support.

Next, a publisher who can provide the text and online resources for the course needs to be identified. Multiple logistical considerations need to be taken into account, including availability of space for the class or lab and of appropriate technology, scheduling the course sessions, and development of the redesigned materials. In some cases, the logistical considerations might limit the scope of the redesign.

Finally, it should be taken into account that while public perceptions of the redesign process are crucial throughout its stages, they become critical as

implementation approaches. The team should be instrumental in applying change management methodologies, which means that they should be aware of the public perceptions of the effort. The status quo can be comfortable for constituency groups, while change can be seen as threatening. The redesign team must therefore educate the stakeholders about the potential benefits of the course redesign.

The steps involved into curriculum redesign outlined in Harden *et al.* (2018) and Drab-Hudson *et al.* (2012) are summarised in Table 2.

Table 2. Steps involved in course redesign

	Harden *et al.* (2018)	Drab-Hudson *et al.* (2012)
1	Establishment of a Special Task Force charged with developing a proposal for a new course	Identifying a need for the redesign
2	Focus groups to solicit the skills that needed to be addressed in the redesigned course	Determining the scope of the redesign and decision whether to partner with external redesign providers
3	Selecting a new name for the course	Assembling the redesign team, identifying a faculty leader
4	Development of the course description	Identifying short-term and long-term project plans
5	Reviewing course descriptions of the peer institutions	Brainstorming on the objectives and specific tasks to meet each of them
6	Lists of the items that the faculty considers critical to include into the redesigned course content	Team leader identifies the resources necessary for the redesign
7	Merging and editing the lists in conjunction with textbooks	Cost-benefit analysis before the course implementation
8	Selection of the course textbook	A preliminary assessment plan: defining operational goals, identifying the strategy for obtaining them, and empirically evaluating the outcomes
9	Determining the course objectives	Identifying a publisher who can provide the text and online resources for the course
10	Putting together a syllabus outlining a timeline for the various topics to be covered	Managing the course logistics
11		Change management: managing stakeholders' perceptions of the redesign process

The approaches to course redesign implemented by the international universities share the focus on active learning, as opposed to the lecture-centred instruction. These are discussed in detail in the next section.

2.2.2 Flipped classroom model, San Francisco State University

Albert and Beatty (2014) discuss applying the flipped classroom model to redesign a course in introduction to management at San Francisco State University as a means of involving students into active learning. A flipped classroom drastically changes the lecture-centred mode of instruction to a learning-centred approach. In this model, the instructor focuses on using class time to improve understanding that the student obtains from watching prerecorded video lecture material and completing assigned readings. This way, the lecture is moved outside the classroom, while practice with the concepts is moved inside via learning activities. While the flipped classroom can be organised in a variety of ways, the techniques used in such courses all share the underlying principle that students should not passively receive the information in class and then be tasked with applying that information on their own outside the class. In contrast, the learning-centred approach involves students in actively constructing knowledge, whereby they develop mental models, test their validity, and then change potentially faulty understanding and misconceptions. From the point of view of Bloom's (1956) taxonomy, the focus of class time is on applying, analysing, and evaluating, rather than on basic understanding.

Although the approach is technology-based, the authors point out that technology is only one part of the learning system and needs to be integrated with appropriate pedagogies, so that added value can be derived from both the recorded video lecture and from the in-class activities. Albert and Beatty emphasise that it is not the instructional videos on their own, but the way they are integrated into the overall pedagogical approach that makes a difference.

The following key factors were focused on when redesigning the introduction to management course into a flipped classroom model:

1. converting each lecture chapter into video capture, broken down into several short learning segments, so students can watch and learn at their own pace. Each

of these video chapters summarises the weekly lecture material. Students watch these videos and complete assigned readings before each class. It is essential to have supporting slides that students can view during the digital presentation;

2. redesigning the curriculum: for the purposes of the redesign, the instructors developed and selected content for in-class discussion that promoted active learning focused on key course concepts. The critical few key concepts for each chapter that would provide the context for in-class discussion and be the focus for active learning were identified;

3. creating incentives for student participation, as the students are expected to provide application-to-work examples during class;

4. providing students with an understanding of the flipped classroom model;

5. creating a sense of ownership and commitment: students should take on responsibility to make the model a success, so a feeling of engagement to be part of the flipped classroom needs to be encouraged in them;

6. making key changes to the syllabus and supporting materials: syllabi and web site postings need reassessment for the flipped classroom.

Albert and Beatty conclude that the most significant factor for a flipped classroom to have a positive impact on student performance is for the instructor to redesign the course content so that the videos watched prior to class are integrated into the curriculum with active learning pedagogies.

2.2.3 Comprehensive redesign of a course in object-oriented programming, University of Turku

Kaila *et al.* elaborate on a comprehensive redesign of a course in object-oriented programming to shift to active learning. They apply the best practices of existing computing education research to the four aspects involved in the overhaul process. First, half of the lectures were turned into active learning sessions. Second, measures were introduced to encourage student collaboration. Third, communication between teachers and students was enhanced by weekly surveys identifying the students' perceptions of the lectures and active learning sessions.

Finally, an automatically assessed electronic exam was introduced to replace the traditional testing methodology.

The refactoring of the course was based on using a web-based collaborative education tool developed by the implementing department, called ViLLE, that supported different exercise types.

In redesigning the course, the first step was facilitation of active learning. This was achieved by changing half of the lectures into tutorials, representing a combination of study material and ViLLE exercises. Each tutorial was designed to underline the topics discussed in the week's lecture, with the lecture and tutorial forming a holistic module. The theory was first introduced in lecture format and then rehearsed with the exercises.

The second goal of the redesign was to facilitate student collaboration. The tutorials were built with collaboration in mind, encouraging discussion while the students paired for the sessions to work together using one computer. The demonstration sessions were also modified to support collaboration and discussion. The students registered the completed assignments using ViLLE, and then were divided randomly into groups, followed by a 20-minute discussion and comparison of their solutions, before the presenters were chosen. The presenters then displayed and discussed their solutions to the programming tasks, while additional discussion was encouraged. An extra assignment was provided after the previous ones were presented.

The third aim of the redesign was to enhance communication between the faculty and the students. Two surveys were collected each week, the first one soliciting opinions about the lecture and the second one about the tutorials. The feedback was analysed and the outstanding questions were addressed in the next lecture. The tutorials were modified between instances, and the final tutorial was created based on the issues reported by the students in the surveys. Besides, after each demonstration session a short feedback survey was conducted. The consecutive demonstrations were modified accordingly. A survey was also completed after the exam, since this was the first time an electronic exam was implemented.

For additional support between lectures and tutorials, a group of more experienced students were nominated as mentors, and a weekly mentoring session was held, during which the students could ask for assistance with tutorials, demonstrations, and weekly assignments.

As the last step in the redesign process, a fully automatically assessed electronic exam was implemented in ViLLE. The students could write, compile and test their code and see the results on screen, which created an environment where writing code was as close to an authentic situation as possible. A typical programming task included a task description and a predefined set of code. Students were asked to write the required code using the code editor in ViLLE. The code could be submitted (compiled and executed) as many times as wanted. The exam score was based on the final submission.

Finally, after the course redesign, the list of topics remained the same, but the method was changed significantly. Active learning, collaboration, and communication were significantly enhanced in the new course.

Another advanced approach implemented by the universities worldwide is integration of the business and entrepreneurship topics into the user experience and human-computer interaction programmes. An example is discussed in the next section.

2.2.4 A methodology for conducting HCI and entrepreneurship courses in parallel, Federal University of São Carlos

Zaina and Ȧlvaro (2015) propose a methodology for conducting HCI and Entrepreneurship courses in parallel within the Computing area. They put forth the Design for User-Centred Innovation (DUCI) approach that guides software development projects integrating the concepts of both fields. The aim of the methodology is to encourage conception of new ideas concerning the business and the user's needs.

According to Global Entrepreneurship Monitor, the lack of specific education in innovation is the main barrier to entrepreneurship. Zaina and Ȧlvaro posit that the problem in computer science degrees is that the curriculum focuses on the technical lectures, instead of complementing the course subjects with business

lectures. This problem is addressed by the leading universities all over the world, that introduce lectures in the context of Entrepreneurship into the computing curriculum.

Therefore, the authors propose to innovate the curriculum by driving the courses in Entrepreneurship and HCI in parallel. They suggest to ground the model on practical projects, in which students have face-to-face contact with the users of the software.

Observing the models of the user-centred design and Lean Startup, Zaina and Álvaro noted that they intersect in a way that allows for the UCD methods and tools to contribute to the evolution of the Lean Startup process.

User-centred design is defined as the philosophy that puts the user at the centre of the development process. Within UCD, techniques and methods are used to bring users into the design process to create products that match the real needs of the people, also following the good usability practices.

In its turn, Lean Startup is a concept that determines a set of processes combining the principles of agile software development and new product development. Lean Startup comprises creation of rapidly built prototypes designed to validate market assumptions and using customer feedback to involve them much more quickly. The approach centres on the concept of the minimum viable product, which is a functional version of a new product, generated in an agile way. Building a minimum viable product allows an entrepreneur to test the hypotheses that guide a new product to market.

Based on the integration of the Entrepreneurship methodologies and UCD phases, and on the demand for methodologies to guide Entrepreneurship focused learning in software development areas, the authors propose DUCI as a methodology that aims at several outcomes: providing mechanisms to develop a software solution meeting a real-world problem; creating a startup that could deliver a product to the market, and that identifies the needs of the end-user and the market; applying techniques for user-centred design during the minimum viable product development phase; supporting the design and development of the new ideas, and defining the business model that could work in the startup market. Design for

User-centred Innovation is conceived as an approach for motivating the development of skills for Entrepreneurship in the software development area, which guides the creation of new products based on the end user's real needs by the development of practical projects.

The lessons learned during the course include the following: the students developed entrepreneurial skills, learned the importance of focusing on the real market user, and dealt with current design world techniques centred on the user and entrepreneurship.

3 Data collection method

The present thesis aims to explore the process of developing curriculum in the fields of user experience, human-computer interaction, and interaction design, and seeks to answer the following research questions:

1. What topics are indispensable to be included in user experience courses?

2. What approaches to teaching UX programmes can be borrowed from the experience of the universities worldwide?

3. How can different elements of the curricula in the fields of business and marketing, design, art, information and knowledge management, information behaviour, psychology, and communication studies be incorporated to support the development of UX programmes?

4. What recommendations can be made for developing content of the courses in UX/HCI for the universities with technological profile, based on the experience of the Department of Future Technologies at the University of Turku?

This chapter is organised as follows. First, an overview of the qualitative research methods is provided. The strengths and weaknesses of the methodology are analysed. Next, the section focuses various types of interviews (in-depth, structured, semi-structured, unstructured, focus group) and outlines their advantages and limitations. Third, strategies and techniques of qualitative data analysis, including analytic induction, grounded theory, content analysis, narrative analysis, discourse analysis, semiotic analysis, and thematic analysis are briefly overviewed. Finally, the method for collecting empirical data is introduced, followed by a discussion of the data analysis methodology employed in the thesis.

3.1 Overview of qualitative research methodology

3.1.1 Qualitative research: definition of the term, principal characteristics, and key methods

According to Flick (2008), the term "qualitative research" was used in the literature for a long time to label an alternative to quantitative research. However,

qualitative research has undergone a long process of development in many disciplines. For instance, social research as a methodology initially implemented approaches that would now be summarized under the term "qualitative research." Flick (2008) elaborates that as this development progressed, the definition became clearer. Nowadays, the profile of the term is no longer defined *ex negativo* – e.g., qualitative research is 'not quantitative' or 'not standardized.' Instead, several features are cited as being intrinsic to the approach. First, qualitative research uses text as empirical material instead of numbers. Further, it is based on the concept of social construction of the studied realities. Finally, the methodology pursues the outlooks of participants as to the studied issues. Therefore, methods employed in qualitative research should be suitable and open enough to allow an understanding of a process or relation. Denzin and Lincoln (2005) offer the following definition of the term:

> Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memos to the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. (2005, p. 3).

Bryman and Bell (2011) emphasise that the connection between theory and research is somewhat vaguer in qualitative than in quantitative research. Theory and categorization are deemed to develop out of the collection and analysis of data, and to be a product of a study rather than preceding it.

Qualitative research unfolds in a series of the following principal steps:

1. general research questions;

2. choosing the pertinent sites and subjects;

3. collection of relevant data;

4. interpretation of data;

5. conceptual and theoretical work, broken down into specification of research questions and collection of further data;

6. writing up findings and conclusions.

According to Bryman and Bell (2011), the key research methods associated with qualitative research are as follows:

a. ethnography/ participant observation: the researcher is immersed in a social setting for a period of time in order to observe and listen to develop an understanding of the culture of a social group;

b. qualitative interviewing: a broad term encompassing a wide variety of interviewing styles;

c. focus groups;

d. language-based approaches to data collection: discourse and conversation analysis;

e. collection and qualitative analysis of texts and documents.

A mixed-methods approach is often used. Thus, researchers employing ethnography or participant observation would often perform qualitative interviews, and collect and analyse texts and documents.

3.1.2 Differences and similarities between qualitative and quantitative methods

According to Bryman and Bell (2011), three features distinguish qualitative from quantitative research. First, as discussed above, there is an inductive relationship between theory and research: the former originates from the latter. Second, qualitative research acquires an interpretivist epistemological position with the emphasis on understanding the social world via exploration of its interpretation by its participants, as compared to the natural scientific model in quantitative research. Finally, a constructionist ontological position is characteristic of qualitative research, positing that social properties are generated by interactions

between individuals, rather than by phenomena distinct from those involved in their construction.

A number of further differences between quantitative and qualitative methods are cited in Bryman and Bell (2011). Quantitative researchers apply measurement procedures to social life, while qualitative investigators use words to analyse social phenomena and to present the findings, in some cases also processing visual data. Quantitative researchers lead the investigation and shape its process. In qualitative research, the point of view of those being studied is at the forefront. In quantitative studies, researchers are not involved with the subjects, and in some types of research have no direct contact with them. At the same time, qualitative research is grounded on close interaction and relationships established with the subjects of the study. Quantitative research represents a static image of social reality, focusing on the relationships between variables. Qualitative research tracks the unfolding of events in time and the interconnections between the actions of the subjects. Quantitative research is highly structured, so that the precise concepts and issues are examined, while the approach in qualitative research is unstructured. Due to this, the possibility to make sense of the actors' meanings and of concepts emerging from data collection is enhanced in qualitative research. Quantitative research aspires for generalizability of the findings to the pertinent populations, while qualitative research concentrates on understanding behaviour, values, and beliefs in the context of the study. Quantitative data are robust and unambiguous, because the measurement approach suggests precision; in qualitative research, rich data are generated by the contextual approach and lengthy involvement in a setting. Quantitative researchers uncover large-scale social trends and connections between variables, while qualitative investigators are interested in small-scale aspects of social reality, such as interaction. Quantitative research is concerned with people's behaviour, while qualitative researchers are preoccupied with the meaning of actions. Finally, quantitative research is conducted in a contrived context, while qualitative researchers investigate people in the natural environments.

Bryman and Bell (2011) also highlight a number of similarities between quantitative and qualitative research. To begin with, both methodologies are

concerned with data reduction: in quantitative research, statistical analysis is performed to this end, while qualitative researchers develop concepts out of rich data. Although research questions are typically specific in quantitative research and open-ended in qualitative research, both primarily seek to answer questions about the nature of social reality. In both types of research, the findings take on significance when they are related to the literature. Both categories of researchers explore how the units of analysis differ and the factors of the variation, although the form that the variation takes is different. In quantitative research, frequency is the core outcome of collecting data, while in qualitative research in reports terms like "often" or "most" are typically employed. Besides, when analysing qualitative data, the frequency with which certain themes occur acts as a catalyst for which ones are accentuated when producing findings. Researchers in both instances seek to eliminate willful bias, or consciously motivated misrepresentation of the data. Both types of investigators aspire to be clear about their research procedures to allow others to judge the quality and significance of their work. Both quantitative and qualitative researchers must address the question of error. In quantitative research, error must be reduced in such a way that the uncovered variation is not the product of problems with how questions are asked or how research instruments are administered. In qualitative research, error is reduced by ensuring that there is a correspondence between the concepts and the collected evidence. Both groups of researchers aim to ensure that when specifying research questions they select approaches to data analysis that are pertinent to those questions.

3.1.3 Strengths and weaknesses of qualitative research methods

Adcroft *et al.* (2014) pinpoint the strengths of qualitative research methods summarised in Table 3:

Table 3. Advantages of qualitative research methods

1. Addressing complexity	The new digital context in which businesses function calls for complex research methodologies, in particular for qualitative techniques. The qualitative dimension is indispensable in coping with complexity in decision-making.
2. Applicability to the analysis of multimedia online databases	Multimedia online content provides ample prospects for qualitative research.

3. "Case bounding"	The focus in qualitative research is on "a specific case, a bounded phenomenon embedded in its context" (Miles and Huberman, 1994).
4. Richness and holism	Qualitative data provide '"thick descriptions" that are vivid, nested in real context, and have a ring of truth that has strong impact on the reader' (Miles and Huberman, 1994). Qualitative methods do not apply a simplifying approach, do not focus on any single aspect, do not attempt to break complex problems down into simpler issues. The problems are explored in their entirety with respect to one or several subjects of the analysis.
5. Ability to study processes in their development	Qualitative data are usually collected over a period of time, so hold potential for exploring the studied process in its evolution, and for investigating causality.
6. Flexibility	Data collection times and methods can be changed as a study proceeds.
7. Relationship between the observer and the observed	Direct and multifaceted, unlike in the case of quantitative methods, where the contexts of the investigator and the studied phenomena are remote.
8. Sharing the context	Qualitative methodology allows the researcher to share the context of management practitioners. The research setting and the management context overlap, so methodologies like ethnography or participant observation can be applied to formulate theory or a research hypothesis.
9. Triangulation of multiple methods	Flexibility allows to elicit narratives and views of reality and to create text from words and discourses.

Adcroft *et al.* (2014) emphasise that the new global digital setting is accompanied by a transition to more complex research methodologies, which favours recourse to qualitative methods of investigation: "such changes have led to greater complexity, and in addressing such complexity, the qualitative dimension is essential."

Among the advantages of qualitative research, Miles and Huberman (1994) mention that properly gathered qualitative data provide "a focus on naturally occurring, ordinary events in natural settings, so that we have a strong handle on what 'real life' is like. That confidence is buttressed by local groundedness, the fact that the data were collected in close proximity to a specific situation, rather than

through the mail or over the phone" (Miles and Huberman, 1994, p. 10). The same authors go on to describe the qualitative research method as "case bounding," in that "The emphasis is on a specific case, a focused and bounded phenomenon embedded in its context."

Another feature of qualitative data is their richness and holism, with high probability of revealing complexity.

Qualitative data are often collected over a sustained period of time, making them suitable for studying any process, including history: as Miles and Huberman (1994) put it, "we can go far beyond 'snapshots' of 'what?' or 'how many?' to just how and why things happen as they do – and even assess causality as it actually plays out in a particular setting. And the inherent flexibility of qualitative studies (data collection times and methods can be varied as a study proceeds) gives further confidence that we've really understood what has been going on" (Miles and Huberman, 1994, p. 10).

Moreover, "qualitative research can help establish a different relationship between observer and observed, and hence aid in overcoming the so-called 'Cartesian dualism,' since the relationship between observer and observed appears somewhat more direct and multifaceted" (Mintzberg, 1979), and therefore not amenable to measurement via the techniques of the 'hard sciences' (Bonoma, 1985, p. 200; Woodside, 2010).

A significant aspect of qualitative research is that it provides the researcher an opportunity to share the context of management practitioners (Miles and Huberman, 1994). In quantitative research, the analytical setting is remote from the context of the object of study by virtue of the instruments employed. In its turn, in qualitative research, in particular when case studies are used, the research setting and the management context intersect. This enables to use methodologies like ethnography or participant observation and to achieve results that are impossible to attain by other methods - for instance, formulating a theory or a research hypothesis (Adcroft *et al.*, 2014).

Qualitative research allows investigators to study the context, intricacy, and uncertainty of a phenomenon. According to Gummesson (2006), it provides a

systemic view of a situation or problem with an unlimited number of variables and their links. Textual data contain mostly both qualitative and quantitative aspects (Miles and Huberman, 1994): while the content, evaluations, and emotions contained in a text are qualitative in nature, frequency, or spatial proximity of mentions are quantitative aspects of the data.

On the other hand, Bryman and Bell (2011) write about the following common criticisms of qualitative research.

First, qualitative research is described as being too subjective. Qualitative findings ensue from the researcher's interpretations regarding what is significant and from the close personal relationships with the study subjects.

As qualitative studies are unstructured and dependent on the researcher's resourcefulness, it is impossible to achieve a true replication of this type of research. Formal procedures to be followed are often absent, while the investigator acts as the instrument of data collection. Because of the unstructured nature of the data, interpretations depend on the preferences of the researcher, making it difficult to replicate the study.

Next, generalisation tends to be problematic in qualitative research, due to the fact that the scope of the findings is often restricted.

Lack of transparency is another drawback cited by Bryman and Bell (2011). It is sometimes difficult to establish what the researcher actually did in the process of the study or how he or she arrived at the conclusions.

3.1.4 Motivation for choosing a qualitative methodology as the study design

A qualitative research methodology of in-depth interview was selected as the study design in this thesis for a number of considerations. First, because of the open-ended nature of the questions, it allowed to elicit from the interviewees rich accounts of their perspectives regarding the need to introduce new topics and courses on user experience and interaction design. The open-ended questionnaire was designed to allow the respondents freedom in sharing their views on the topic. However, it also provided structure to the talks, so that the interlocutors did not deviate from the focal issues discussed.

On the other hand, the nature of the method allowed interaction between the interviewer and the respondents, through which the researcher gained insights regarding the research questions, acting as a "student" and "learning" from the experienced respondents.

The views of the respondents emerged gradually in the course of the interview in a process of reconstruction of their perspectives on the subject, which would have been impossible in the case of a survey, a focus group, a group interview, or a case study.

Further, deep understanding of the positions regarding the redesign of the curriculum and the practical formats of introducing changes to the content of the courses was sought. Although the respondents' views regarding questions of integrating content from business, design, and art differed significantly, such deep understanding of their standpoints was achieved in all cases.

Following the interview guide, the interviewees felt enough freedom to elaborate on the aspects of the topic that they deemed crucial, while sharing limited comments regarding the facets that they saw as less pertinent. That is, freedom in expressing the views was instrumentally paired with the structured questionnaire, with the same questions presented to all interviewees in the same order.

In the case of the present study, the focus of the interviews was on understanding the varying viewpoints regarding the issue of curriculum reform, which was highly sensitive for the respondents, and on exploring facets of their argumentation and propositions – that is, on grasping an aspect of social reality via investigation of its interpretation by its participants. This would have been impossible if a quantitative methodology was applied. The meaning-making occurred during the interviews in the course of interaction between the researcher and the subjects.

Analysis of data in the present study was driven by the views of the respondents – that is, the analytical effort concentrated on reconstructing the social reality of the interviewees shared in response to the structured questionnaire, as well as on understanding the interplay between their vision of the studied topic and the organizational relationships that would make the reform a reality. The topic of

change management and the structures and processes available at the department to make the innovation a reality came up during most interviews, although it was not primarily targeted in the interview design. In such instances, the researcher had to follow where the data took and add a dimension to the reconstructed reality emerging from the interviews.

Rather than providing a static image of the studied questions, the interviews centered on unfolding of the process of curriculum development in time, providing a set of dynamic pictures of how the informants approach the topic, as well as their own actions to effectuate the course content redesign. The interviews thus generated dynamic images of the approaches suggested by the lecturers and researchers.

The focus of the study was on understanding behaviour (how the respondents would have gone about implementing changes to the curriculum), values (whether they see course redesign as a priority), and beliefs (the perceived efficacy of the faculty in introducing the innovation to the course offering), rather than on generalisability to the wider populations.

Further, the choice of the methodology was conditioned by the fact that the researcher aimed for close contact with the subjects and involvement in the social setting from which the respondents were recruited. The chosen data collection method allowed the investigator, who was immersed into the setting for three months as the project researcher, to share the context of the practitioners who answered the structured questionnaire, rather than acquiring a remote approach characteristic of quantitative research, in which the researcher is often distantiated from the social milieu of the studied subjects.

Moreover, the problem of redesigning the department-wide course offering was approached by the interviewees in its entirety, without breaking it down into simpler issues or trying to acquire a simplification stance. This was a valuable characteristic of the qualitative methodology selected, as it allowed to apply a holistic approach to the studied phenomena.

Flexibility of the study design was another valuable characteristic of the applied qualitative approach. In addition to the structured questionnaire, follow-up questions allowed to grasp the facets of the interveiwees' viewpoints, which would have been unattainable in the case of a survey or a group interview.

3.1.5 Reliability and validity in qualitative research

According to Bryman and Bell (2011), a number of concepts are used to define reliability and validity in qualitative research. External reliability characterises the degree to which a study can be replicated, and is difficult to achieve in qualitative studies, as it is in most cases impossible to 'freeze' the social setting and conditions of the original investigation. In the cases when there is more than one researcher, when one considers whether the members of the research team agree about what they see and hear, this process is referred to as establishing internal reliability. Internal validity describes whether the researcher's observations and the theoretical ideas developed are in accord. The term that describes the degree to which the findings can be generalised across social settings is external validity. Like external reliability, this indicator may not be applicable to case studies and small samples and therefore can pose a problem for qualitative researchers.

However, as Bryman and Bell (2011) write, an alternative position in the literature suggests that the criteria applied to quantitative studies do not hold in the case of qualitative research. Proposed instead were the terms "trustworthiness" and "authenticity." Trustworthiness encompasses four criteria: credibility (which parallels internal validity); transferability (external validity); dependability (close to reliability), and confirmability (parallels objectivity).

Bryman and Bell (2011) maintain that as in most cases several accounts of an aspect of social reality are possible, it is the degree to which an account is feasible or credible that determines its acceptability for others. Establishing credibility of findings encompasses ensuring that the research is carried out according to good practice. To carry out respondent, or member validation, the research findings can also be submitted to the members of the studied social world for confirmation that it was properly understood by the researcher. Another validation technique in

qualitative research is triangulation, i.e., using more than one method or source of data.

Further, as pointed out by Bryman and Bell (2011), because qualitative research comprises rigorous study of a small group, or individuals sharing certain characteristics, its findings tend to be orientated to the contextual uniqueness and significance of the study object and might not hold in some other context, or in the same context over time. Qualitative researchers are therefore encouraged to produce thick descriptions, or rich accounts of the study, to provide a database for making decisions about the possibility of transferring the findings to another context.

As a parallel to reliability in quantitative research, proposed is the idea of dependability. To achieve it, researchers should adopt an 'auditing' approach, including peer review of the collected evidence.

Finally, according to Bryman and Bell (2011), confirmability refers to ensuring that, although it is impossible to achieve thorough objectivity, the researcher can be testified to have acted in good faith – i.e., has not permitted personal values or theoretical inclinations to bias the research.

Thiétart *et al.* (2001) also write that to answer the question how research can be both precise and of practical value to other researchers, the work is evaluated in relation to the criteria of validity and reliability. Types of validity, according to the authors, include construct validity, the validity of the measuring instrument, internal validity of research results, and external validity of research results.

Validity, according to Thiétart *et al.* (2001), refers to assessing the relevance and precision of research results and evaluating the extent to which one can generalise from the results. To address the first question, one must test the validity of the construct, the validity of the measuring instrument, and internal validity of results. The answer to the question of the extent to which one can generalise from research results depends on assessing the external validity of the results.

In assessing reliability, as Thiétart *et al.* (2001) suggest, one posits to establish whether the study could be repeated by another researcher or at another time with the same results. The concept involves two different levels: the reliability of the measuring instrument and overall reliability of the research.

Thiétart *et al.* (2001) write that the process of operationalisation is one of the main difficulties in assessing construct validity in management research. Concepts are reduced to a series of operationalisation or measurement variables: evident or measurable indicators of a concept that is not directly observable. The operationalised concept is called the construct of research. When addressing construct validity, one does not attempt to examine the process of constructing the research question, but the process of operationalising it. Research results are not measures of the theoretical concept itself, but measures of the construct – i.e., of the operationalised concept.

When assessing construct validity in qualitative research, according to Thiétart *et al.* (2001), the investigator needs to establish that the variables used to operationalise the studied concepts are appropriate and to evaluate the degree to which the research methodology enables to answer the research question. It is essential to ensure that the unit of analysis and the type of measure chosen will allow to obtain the necessary information. One must then identify the research question, which will guide the observations in the field. Afterwards, central concepts need to be defined, which amount to the dimensions to be measured. The next step is establishing, on the basis of the research question and the literature, a conceptual framework through which the various elements involved can be identified. The conceptual framework stipulates what is to be studied. The researcher should demonstrate that the methodology used to study the research question really measures the dimensions specified in the conceptual framework.

In line with Bryman and Bell (2011), Thiétart *et al.* (2001) describe the following methods for improving the construct validity: using a number of different sources of data; establishing a "chain of evidence" linking clues that confirm an observed result, and having the case study verified by key actors.

Through measurement, as Thiétart *et al.* (2001) write, the researcher tries to establish a connection between one or several observable indicators and an abstract concept, which is not evident and measurable and which he or she aims to study. One tries to determine the degree to which a group of indicators represents a given theoretical concept. Researchers must prove that the instruments used enable them to obtain reliable and valid measurements. To be reliable, a measuring instrument must allow different observers to measure the same subject with the same instrument and arrive at the same results, or permit an observer to use the same instrument to arrive at similar measures of the same subject at different times. To be valid, the instrument must measure what it is expected to measure, and produce exact measures of the studied object.

Since the instruments are continually revised in qualitative research, instrument reliability and validity depend largely on the skills of the researcher. The process is the exact opposite of quantitative research, which is based on the stability of the instrument in measuring social reality.

Thiétart *et al.* (2001) write that the process of verifying internal validity consists in making sure that the results produced by a study are pertinent and internally coherent. Researchers must question to what degree their inferences are correct, and whether alternative explanations for the conclusions that they arrive at are possible.

To attain internal validity, researchers must make an effort to eliminate the biases concerning the context of the research, the collection of data, or sampling. It is essential that they test rival hypotheses and compare the revealed empirical patterns with those of the existing theory. In this way, researchers can establish if the relationship they identify between events is correct, and that no competing explanation exists.

The next step is to explain in detail the analysis strategy and the tools used. For Thiétart *et al.* (2001), careful explanation of the research process increases the transparency of the procedure through which the results are achieved, or makes it available for criticism.

Finally, it is recommended to try to saturate the observational field. In other words, Thiétart *et al.* (2001) propose that data collection should continue until the data bring no new information, and the marginal information collected does not cast any doubt on the construct design. A sufficiently large amount of data helps to warrant the accuracy of the data collection process.

In Thiétart *et al.* (2001), external validity of a research project is estimated by examining the possibilities and conditions for generalising and appropriating the model to other sites. The researcher first establishes the degree to which the results found from a sample can be generalised to the whole parent population. Next, inferences are made to what extent these results can be transferred or appropriated to the study and understanding of other observational fields.

Two approaches to improving external validity are applied in Thiétart *et al.* (2001): including control variables in the measuring instrument to define and accurately characterise the studied population, and examining carefully the variables used in the study, as generalising from research implies modifying how these variables are operationalised.

Thiétart *et al.* (2001) conclude that the reliability of qualitative research depends only partly on the reliability of the measuring instrument. Mainly, it is a derivative of the ability and honesty of the researcher in describing the entire research process employed, particularly in the phases of condensing and analysing the collected data.

3.2 Interviews as a method of collecting data in qualitative research

3.2.1 Technique of qualitative interviewing

According to Gubrium and Holstein (2001), qualitative interviewing is grounded on conversation, with the emphasis on researchers asking questions and listening, and respondents answering, which makes it comparable to standardized survey interviewing. However, unlike with the survey interview, the epistemology of the qualitative interview tends to be more constructionist than positivist. The informants actively participate in the meaning-making process, and are not viewed as passive channels for recovering information from an existing vessel of answers.

Thus, qualitative interviewing in most cases aims to elicit interpretations, not facts or laws.

Gubrium and Holstein (2001) define qualitative interviewing as a kind of guided conversation, in which the researcher carefully listens "so as to hear the meaning" of what is being conveyed. The concept of listening is extended by Spradley (1979), who suggests that the purpose of interviewing is to make "cultural inferences," thick descriptions of a given social world analysed for cultural patterns and themes.

The authors further write that in-depth interviewing involves a certain style of social and interpersonal interaction: to ensure effectiveness and usefulness, in-depth interviews develop and foster intimacy. To some extent, they can be compared to the forms of conversations among close friends. However, in the case of in-depth interview, the researcher posits to use the information obtained in the interaction for some other purpose.

According to Seale (2004), "Interviews are, by their very nature, social encounters where speakers collaborate in producing retrospective (and prospective) accounts or versions of their past (or future) actions, experiences, feelings and thoughts."

Thiétart *et al.* (2001) define interviewing as "a procedure whereby discursive data that reflects the conscious or unconscious mindset of individual interviewees is collected for further analysis." In qualitative research, the procedure of an interview involves questioning the subject while sharing their frame of reference. This involves attuning to the subjects' feelings and has an impact on the interpretation of the relevance of their utterances. Subjects speak freely, and all of their utterances are considered to have a certain value, because they refer directly or indirectly to the analytical elements of the research question. In this sense, qualitative interviewing contrasts with structured interviewing for quantitative research, which follows a predetermined set of questions with defined answer options designed to aggregate the thoughts or knowledge of a large number of subjects (Thiétart *et al.*, 2001).

Kvale (2007) suggests that an interview inquiry unfolds in seven stages:

1. thematizing - articulation of the purpose of an investigation and the theme to be explored before the interviews start. The 'why' and 'what' of the investigation should be identified before the question of method is tackled;
2. designing - creating the strategy of the study with the purpose of obtaining the intended knowledge;
3. interviewing - carrying out the interviews based on an interview guide, with a thoughtful approach to the information sought and to the interpersonal relations;
4. transcribing - preparing the interview material for analysis, usually via transcription from oral speech to written text;
5. analyzing - deciding which approaches to analysis are appropriate for the interview data, given the purpose and topic of the investigation and the characteristics of the interview material;
6. verifying - establishing the validity, reliability and generalisability of the interview findings;
7. reporting - communicating the findings of the study and the methods applied.

3.2.2 Categories of interviews

Holstein and Gubrium (2011) write that interviews can be categorized using a number of dimensions, for example along a functional continuum (Moser, 1958), at one end of which are interviews whose purpose is to interrogate, help, educate, or evaluate respondents. Employment interviews or police investigations fall into this category. The goals of such interviews are practical. Interviews with more abstract or academic goals, like large-scale social surveys, are found on the opposite end of the continuum. According to Maccoby (1954), interviews can also be distinguished according to how "standardized" they are, whether they follow a structured questionnaire with a measurement orientation or are more flexible and pursue subjective meanings. Further, Madge (1965) draws a distinction between "formative" and "mass" interviews, based on whether the respondent is given opportunities to select the discussion topics and format. Most large-scale surveys fall into the mass interview category.

Alvesson (2010) distinguishes among types of interviews based on the criteria of structure, size, communication media, and category of respondents.

Interviews, in Alvesson (2010), are categorized into structured, semi-structured and unstructured. A highly structured interview unfolds according to a clear plan, which the interview statements should follow precisely. Unstructured talks, found at the other extreme of the continuum, target a broad theme, while the researcher is open to the interview taking unexpected turns. The interviewee is given freedom to partly outline and develop sub-themes or issues, but the interviewer wants to evade from too wide deviations from the theme of the research project. Most of the time, unstructured interviews are loosely structured.

Regarding the criterion of size, interview preparation involves a choice between a single interviewee and a group of informants. Group interviews can take different form, including brainstorming groups with little or no structure, and highly structured set-ups like focus groups and delphi groups, whereby expert knowledge is collected.

Further, Alvesson (2010) suggests that as far as communication media are concerned, the types of interviews vary from face-to-face to telephonic and electronic. Most of the interviews for qualitative research are conducted face-to-face. Telephonic and electronic interviews are seen as much poorer interview media, not sufficient in most cases where complex phenomena are being investigated.

Finally, certain groups of people are believed to require particular considerations regarding interview methods: for example, there is literature on how to interview children, the elderly, elites, ethnic minorities, the culturally diverse, men and women (Alvesson, 2010).

Fontana and Prokos (2007) suggest that in structured interviewing, the interviewer asks all respondents the same series of pre-established questions with a restricted set of response categories. Variation in response is constrained, except where open-ended questions (which are rare) are used. The interviewer records the responses according to a coding scheme and controls the pace of the interview "by treating the questionnaire as though it were a theatrical script to be followed in a standardized and straightforward manner" (Fontana and Prokos, 2007). Thus,

all interlocutors receive the same set of questions asked in the same sequence by an interviewer, allowing for little flexibility in the way in which questions are asked or answered.

Thiétart *et al.* (2001) also draw a distinction between unstructured and semi-structured types of interview. According to the authors, in an unstructured variety, the interviewer establishes a general subject area or theme and refrains from intervening to direct the subject's remarks. In a semi-structured interview, an interview guide allows the researcher to touch upon a series of subject areas defined in advance. The main questions can be modified, if, in the course of the interview, the subject touches upon the planned subject areas without being pressed by the interviewer. In some cases, certain questions can be abandoned.

3.2.3 Sampling in qualitative research and for interviews

According to Robson (2002), sampling plans can be categorized into ones based on probability samples, where the probability of selection of each respondent is known, and on non-probability samples, which is the exact opposite. The characteristic of probability sampling is that statistical inferences about the population can be made from the responses of the sample. Probability sampling is sometimes referred to as representative sampling: the sample is taken as representative of the population. In non-probability samples, one cannot make such statistical inferences.

Robson (2002) elaborates that probability samples are divided into a number of types. Simple random sampling involves selection at random from the sampling frame of the required number of persons for the sample. Each person has an equal chance of being included in the sample, and all possible combinations of persons for a particular sample are equally likely.

Systematic sampling means choosing a starting point in the sample frame at random and then choosing every *n*th person. While the initial chance of selection of any person is the same, once the first person has been chosen, most persons will have no chance of inclusion, and a few will be automatically selected. Most

combinations of persons are excluded from the possible samples that might be chosen.

When stratified random sampling is performed, the populations are divided into groups, or strata, with members sharing a particular characteristic or characteristics. Usually, proportionate sampling is employed, that is, the numbers in the groups selected for the sample reflect the relative numbers in the population as a whole. In disproportionate sampling, there is unequal weighting.

In its turn, cluster sampling involves dividing the population into a number of units, or clusters, each containing individuals with a range of characteristics. The clusters are selected on a random basis. A subpopulation within the cluster is then chosen. This tactic is employed when the population is widely dispersed and large. Multistage sampling, an extension of cluster sampling, involves selecting a sample in stages, that is, taking samples from samples.

On the other hand, as posited by Robson (2002), non-probability sampling is any sampling plan where it is impossible to specify the probability that any person or other unit of analysis will be included in the sample.

Robson (2002) specifies that the strategy of quota sampling implies that representatives of the various elements of the population will be obtained, usually in the relative proportions in which they occur in the population. Researchers would be given a quota of each category. Within the category, convenience sampling is used. An extension of quota sampling is dimensional sampling. The various dimensions thought to be of importance in an analysis are incorporated into the sample in such a way that at least one representative of every possible combination of these factors or dimensions is included.

Convenience sampling involves choosing the nearest and most convenient persons to act as respondents. The process is repeated until the required sample size has been reached.

Further, according to Robson (2002), the principle of selection in purposive sampling is the researcher's judgment as to the typicality or interest. A sample is

built up that enables the researcher to satisfy his or her specific needs in a project. For example, researchers following the grounded theory approach carry out initial sampling, and from analysis of the results extend the sample in ways guided by their emerging theory (the process is referred to as "theoretical sampling").

Robson (2002) identifies additional types of samples that can be used for specific purposes. Time samples involve sampling across time, can be probabilistic or non-probabilistic, and are used widely in observational studies. Homogeneous samples cover a narrow range or a single value of a particular variable or variables. Heterogeneous samples involve a strategy for selecting individuals varying widely on the characteristics of interest. Extreme case samples involve concentration on extreme values, assuming that they will throw a particularly strong light on the phenomenon of interest. Rare element samples refer to cases when values with low frequencies in the population are over-represented in a sample.

According to Liamputtong (2013), because qualitative research seeks an in-depth understanding of the explored issues and relies on the rich accounts of the subjects' experience, investigators in this type of studies usually work with smaller sample sizes. Because the aim is to examine the process or the meanings that people assign to their social situations, the method does not entail generalisation of the findings, as in positivist science. Two types of sampling approaches are employed in qualitative research: purposive sampling and convenience sampling.

Purposive sampling strategies, as suggested in Liamputtong (2013), involve deliberate selection of specific individuals, events, or settings that can provide crucial information, which is not reachable from other sources. Information-rich cases, that is, individuals, events, or settings from which the researchers can learn extensively about the issues under consideration are used. They offer in-depth understanding and insights into the findings instead of empirical generalisations.

Further, as Liamputtong (2013) writes, convenience sampling refers to accessing individuals who are conveniently available and willing to take part in a study without explicit use of conceptual frameworks or theoretical focus characteristics of the sample.

The following sampling strategies are described by Liamputtong (2013). Representative or comparative sampling techniques include two categories: typical case sampling, in which members of the groups who are representative, or average, are recruited, and extreme or deviant case sampling, which refers to choosing cases that are unusual in some sense. The strategy is also referred to as the 'outlier sampling.' Extreme or deviant cases are interesting people or situations that can be used as contrasts with others and that allow to make comparisons between cases.

Intensity sampling is similar to extreme case sampling, but the selected cases are not so unusual as in the extreme and deviant cases.

Liamputtong (2013) explains that maximum variation sampling involves finding heterogeneous samples across wide sample groups. Using this strategy, researchers target participants that cut across age, gender, ethnicity, social class, geographic location, health status, nationality etc. At the same time, homogeneous sampling is the exact opposite of the maximum variation strategy, seeking to explore a specific sub-group in depth. Homogeneous sampling is used in focus group interviews, for which individuals who come from similar backgrounds and have a shared experience are commonly recruited.

According to Liamputtong (2013), special, or unique case sampling technique is used in case study research. It is often referred to as intrinsic case study, and has three sub-categories: revelatory case sampling, in which a single case that may represent an issue or phenomenon is identified and accessed; critical case sampling, which involves cases that are specifically crucial for the research, and criterion sampling, which refers to selection of cases that meet a predetermined criterion.

The essence of sequential sampling is working with the samples that evolve as data are being collected. The approach is adopted when the aim of the research is to generate theory.

Liamputtong (2013) writes that opportunistic sampling occurs when there is a possibility to sample during data collection. In the course of research, new

opportunities may present themselves, and the investigators, following where the data take them, make on-the-spot decisions to include them into the process.

Another approach is to compare the discovered patterns and constructs against confirming and disconfirming cases, as described in Liamputtong (2013). At the outset of a research project, the investigator collects data and examines the emergent patterns. As the project progresses, these are explored in relation to confirming cases that fit within the emergent themes, and disconfirming cases that do not follow the discovered pattern.

When snowball sampling is used, the process resembles opportunistic sampling. Several research participants are initially identified and asked if they know others who fit the research criteria and would be willing to take part in the research. As a snowball effect develops, successive participants become involved in the study. This type of sampling is used with groups whose members are difficult to approach and are unlikely to participate without referral from others in their network.

Finally, Liamputtong (2013) maintains that with theoretical sampling, that occurs when the data are being analysed, the researcher constructs a sample that incorporates certain characteristics or criteria that contribute to the development and testing of an emerging theory or argument.

As opposed to surveys, the sample size for interviews is usually smaller. However, much deeper answers are collected, as interviews provide opportunity for open-ended responses. When the answers generate additional inquiries to analyse the viewpoints of respondents, these are asked as follow-up questions.

According to Mosley (2013), “Compared to an individual survey response, a single interview can generate more points of inferential leverage… And perhaps most important, the interviewer usually has more metadata at her disposal than does the survey researcher (assuming that the survey researcher does not administer each survey herself).” Further, “An interview researcher knows not only what a respondent says, but also how the respondent behaved during the interview, whether the respondent hesitated in answering some questions more than others, and the context in which the interview took place.” The metadata fosters more

accurate use and interpretation of interview data, which is not observed in quantitative approaches like survey responses.

Holstein and Gubrium (2011) write that selecting a sample for active interviewing follows a procedure that is different from sampling in standardized survey research. While the traditional approach is for the researcher to target a population in advance and then to select informants on the basis of their representativeness or informativeness, sampling for an active interview is an ongoing process. A group of respondents is identified tentatively, provisionally, and even spontaneously. For instance, respondents can be added as new research interests or needs dictate. The aim is not so much to identify a representative segment of the population as it is to continuously solicit and analyze representative horizons of meaning (Glaser and Strauss, 1967).

3.2.4 Interviewing as a means of obtaining "deep" knowledge. Analysis of interview data

Gubrium and Holstein (2001) emphasise that the purpose of in-depth interviewing is for the researcher to obtain "deep" information and knowledge, usually deeper than is collected via surveys, informal interviewing, or focus groups. The collected information may involve personal matters, such as the respondent's self, lived experience, values and decisions, occupational ideology, cultural knowledge, or perspective.

The authors explain that the word "deep" has several meanings in this context: "First, deep understandings are held by the real-life members of or participants in some everyday activity, event, or place. The interviewer aspires to obtain the same deep level of knowledge and understanding as the members or participants." If the interviewer is not a current or former participant in what is being investigated, he or she might conduct in-depth interviewing to learn the meanings of participants' actions. Further, if the interviewer happens to be a current or former member in the studied activity, he or she may use in-depth interviews to explore or check his or her understandings, to see if they are shared by other members or participants. As Gubrium and Holstein (2001) put it, "In this respect, the informant would be a

kind of teacher and the interviewer a student, one interested in learning the ropes or gaining member knowledge from a veteran informant."

Second, deep understandings go beyond commonsense explanations for and other understandings of some cultural form, activity, event, place, or artifact. According to the authors, "In-depth interviewing is an irremediably commonsensical (or intersubjective) enterprise. It begins with commonsense perceptions, explanations, and understandings of some lived cultural experience (which include scientific explanations) and aims to explore the contextual boundaries of that experience or perception, to uncover what is usually hidden from ordinary view or reflection or to penetrate to more reflective understandings about the nature of that experience" (Gubrium and Holstein, 2001).

Third, deep understandings can reveal how our commonsense assumptions, practices, and ways of talking partly establish our interests, and how we understand them.

Fourth, deep understandings allow the researchers to grasp and articulate the multiple views of, perspectives on, and meanings of some activity, event, place, or cultural object.

Holstein and Gubrium (2011) maintain that interviews are commonly analysed as descriptions of experience, as more or less accurate reports or representations of reality: "analysis amounts to systematically grouping and summarizing the descriptions, and providing a coherent organizing framework that encapsulates and explains aspects of the social world that respondents portray" (Holstein and Gubrium, 2011). However, in the case of an active interview, data are "analysed to show the dynamic interrelatedness of the what and the how. Respondents' talk is not approached as a collection of reality reports delivered from a fixed repository. Instead, the talk is considered for the ways that it assembles aspects of reality in collaboration with the interviewer" (Holstein and Gubrium, 2011). The focus is as much on the assembly process as on what is assembled. Using narrative and discourse analysis, conversational records are explored to reveal reality-constructing practices as well as the subjective meanings that are circumstantially

conveyed. The authors write that "the goal is to show how interview responses are produced in the interaction between interviewer and respondent, without losing sight of the meanings produced or the circumstances that condition the meaning-making process" (Holstein and Gubrium, 2011). The analytic goal is thus not merely to describe the situated production of talk, but to show how the utterances relate to the experiences and lives of the subjects.

Holstein and Gubrium (2011) posit that presenting findings from interview data is an analytically active undertaking. Instead of letting the data "speak for themselves," the active analyst empirically documents the meaning-making process. Using illustration and reference to the interview records, the analyst "describes the complex discursive activities through which respondents produce meaning. The goal is to explicate how meanings, their linkages and horizons, are actively constituted within the interview environment, which… is an increasingly prevalent 'window on the world'" (Holstein and Gubrium, 2011). Analytical reports are not limited to summarising and organising quotes from interview participants, but, rather, "deconstruct" participants' talk. Analysis in the qualitative interviewing goes beyond structuring the responses to "showing the reader the hows of the whats of the narrative dramas of lived experience" (Holstein and Gubrium, 2011).

The choice of in-depth interviewing depends on the nature of the research question. As discussed above, it is the recommended approach in the cases when the researcher is interested in obtaining information of greater depth. The practice is also applicable when the knowledge sought is not readily articulated or is taken for granted, when the research question elicits highly conflicted emotions, and when different individuals or groups that are involved in the study have complicated, multiple perspectives on some phenomenon.

3.2.5 Advantages and drawbacks of interviewing

Liamputtong (2013) writes about a number of strengths and limitations of in-depth interviewing. According to the author, the approach has the advantages of offering a tool for examining complex issues and topics about which little is known; providing an opportunity to explore the perception of the respondents and how they give meaning to their experiences, and allowing investigators to address

research issues from the subjective standpoint of the participants; capturing own words of the respondents, which empowers the researcher to concentrate on the issues important to the participants; more power and control over the utterances during the interview given to participants; allowing the researchers to probe and explore in great depth, and to follow up immediately if clarifications are needed; a possibility for the investigators to observe and note non-verbal behaviour during the interviews; flexibility of the format, which can be tailored to the needs of the participants; requiring minimum specialist equipment, and relying on the skills of communication and conversation, which most people possess.

For Liamputtong (2013), weaknesses of the technique include the following considerations. In-depth interviewing is a time-consuming process, especially the stages of transcription and data analysis. Due to the unstructured nature, the interview format may differ among participants, which makes it problematic for novice researchers. During in-depth interviews, the participants reconstruct events, while it remains unclear how they behaved; therefore, additional methods like observation and ethnography may be necessary to observe exact behaviours. For an unskilled researcher, it can be challenging to conduct a quality interview, as it requires sound knowledge and technique of eliciting in-depth information from the interlocutors. Inexperienced researchers elicit shallow information, because they do not know how to probe further and how to interview difficult participants. Furthermore, complicated interviews and interviews with certain groups of subjects require complex skills on the part of the researchers. Without practice and experience, the interviews may not go well, and the gleaned information may not be good enough. The method can be very demanding, even exhausting, for the researchers. Finally, care must be taken not to allow social structures like class, gender, ethnicity, and age of the researchers have an impact on the interview process. The position of the researchers must be taken into account during the interview and in the interpretation of the data.

Holstein and Gubrium (2011) write that in most cases, in-depth interviews are not the only source of data in research. They are triangulated with data gathered through such avenues as lived experience of the interviewer as a member or participant in what is being studied, naturalistic or direct observation, informal

interviewing, documentary records, and team field research. Researchers use in-depth interviewing as a means of verifying theories they have formulated through naturalistic observation, to check independently the knowledge they have developed through participation as members in particular cultural settings, or to identify multiple meanings of and perspectives on some phenomena.

Holstein and Gubrium (2011) conclude that in order to conduct in-depth interviewing, researchers must undertake substantial self-reflection to get to know themselves; they must also make a self-conscious effort to observe themselves in interaction with others: "The development and cultivation of trust with informants is slow, incremental, and emotional, in most cases, and the relationship can change quickly. The ideal goal is that the informant become a collaborative partner with the researcher in the intellectual adventure at hand."

3.2.6 Focus group interview: methodology, unique features, and prerequisites for success

Liamputtong (2013) writes that an alternative to in-depth interviewing is a focus group interview. This is a small group discussion focused on a particular topic and facilitated by a researcher. Typically, focus groups involve 6 to 10 people who come from similar cultural and social backgrounds and have similar experiences or concerns. They gather to discuss an issue with the help of a moderator in a setting where they feel comfortable enough to engage in a dynamic discussion for one or two hours.

As pointed out in Liamputtong (2013), focus groups enable in-depth discussion among a relatively small number of people, concentrate on a specific area of interest, allow the participants to discuss the topic in detail, and rely heavily on the interaction between participants, unlike a group interview. They are successful only when the participants talk to each other, rather than individually answering the moderator's questions. A unique feature of focus group interview, according to Liamputtong (2013), is interaction. The assumption is that group processes help the respondents to explore and clarify their points of view. The group interaction has been referred to as the "group effect." A moderator, often also the researcher,

plays an important role in the focus groups: he or she introduces the topic and facilitates discussion, encouraging interaction and guiding the conversation.

Bryman and Bell (2011) write that to distinguish focus groups from group interviews, three reasons are put forward. First, focus groups emphasise a specific theme or topic that is explored in depth, whereas group interviews span widely. Second, sometimes group interviews are carried out so that the researcher saves time and money by carrying out interviews with a number of individuals simultaneously. However, focus groups are not held for this purpose. Third, the focus group researcher is interested in the ways individuals discuss a certain issue as members of a group, rather than as individuals. He or she is interested in how people respond to each other's views and build up a view out of the group interaction.

Bryman and Bell (2011) elaborate that focus groups are used for the following reasons: to interview people who are known to have had a certain experience in an unstructured way about that experience; the technique allows the researcher to develop an understanding about why people feel the way they do. The approach offers an opportunity to probe each other's reasons for holding a certain view. Focus groups can also be helpful in elicitation of a wide variety of views in relation to a particular issue; the participants are able to bring to the fore issues that they deem to be significant; in one-to-one interviewing, the respondents are rarely challenged, which allows for inconsistencies in the utterances; in the context of a focus group, individuals would often argue and challenge each other's views. The researcher elicits more realistic accounts of what people think, because they are forced to think about and possibly revise their views; focus groups offer the researcher an opportunity to study the ways in which individuals collectively make sense of a phenomenon and construct meanings around it. The process of understanding social phenomena is not undertaken by individuals in isolation from each other. Instead, this is something that occurs in interaction and discussion with others. Focus groups reflect processes through which meaning is constructed in everyday life and are therefore more naturalistic than individual interviews (Bryman and Bell, 2011).

Liamputtong (2013) writes that focus groups can be used as an independent method, serving as the primary means of data collection. Focus groups are employed to explore the research questions from the point of view of the participants and to investigate new research areas. Group interaction is the feature that drives the process, while the method reveals participants' experiences and perspectives that may not be accessible without group interface. Focus groups also serve as a supplementary source of data: information from a focus group can be used as a source of preliminary data in quantitative research. Most often, focus groups are used to generate survey questionnaires. As Liamputtong (2013) elaborates, they may also be used for developing a program or intervention or to validate the findings of surveys when the latter cannot provide a deep understanding of the participants' perspectives. When focus groups are used in multimethod studies, a combination of several approaches to collecting information is employed. Focus groups can be used in conjunction with in-depth interviews and participant observation in an ethnographic study, for example. The main purpose of the multimethod is triangulation.

Liamputtong (2013) explains that a focus group interview differs from a group interview in that it is, rather, a group of people who convene to discuss a focused issue of concern. Group interaction is its unique feature that facilitates discussion and production of results. Interaction in focus groups results from the informal setting, relaxed atmosphere, and open-ended nature of questions. These features are intended to encourage participants to feel free from the constraints typical for one-to-one interviews, and to express their views openly and in a spontaneous manner. The interchange stimulates respondents to analyse their views more intensely than in the course of an individual interview, as Liamputtong (2013) emphasises. It is the presence of others that enhances the intensity of interaction and, ultimately, the richness of the garnered data. Because of this type of interaction, focus groups divulge dimensions of understanding that often remain untapped by one-to-one interviews or questionnaires.

Bryman and Bell (2011) describe a number of shortcomings characteristic of focus group technique. In their opinion, the researcher has less control over the proceedings than in the case of an individual interview. The degree to which it is

appropriate to surrender control of a focus group process to its participants is not clear. Next, the data are difficult to analyse. Developing a strategy of analysis that incorporates both themes in what people say and patterns of interaction is not easy. Moreover, this type of research can be difficult to organise, as participants need to show up at a specified time and place. It is common for people not to turn up. The recordings are more time-consuming to transcribe than equivalent recordings of individual interviews, because of the need to take account of who says what. There are possible problems of group effects, including reticent speakers and those who tend to dominate the discussion. An emerging group view may mean that a perfectly reasonable perspective held by just one individual may be suppressed. Further, as a group comes to share a certain point of view, group members come to think uncritically about it, and develop almost irrational attachment to it. Finally, according to Bryman and Bell (2011), in group contexts participants may be more prone to expressing culturally expected views than in individual interviews. There are also circumstances when focus groups may not be appropriate, because of their potential to cause discomfort among the participants. Such instances are when intimate details of private lives need to be revealed, when participants may not be comfortable in each other's presence (e.g., bringing together individuals in a hierarchical relationship to each other), and when participants are likely to disagree profoundly with each other.

3.3 Techniques of qualitative data analysis

3.3.1 Analytic induction and grounded theory

Two of the most frequently employed general strategies of qualitative data analysis, described in Bryman and Bell (2011), are analytic induction and grounded theory. They are referred to as iterative approaches, involving a repetitive interplay between the collection and analysis of data.

Analytic induction begins with a rough definition of a research question, proceeds to a hypothetical explanation of the question, and continues to the collection of data, or examination of cases. If a case is found that is inconsistent with the hypothesis, the researcher either redefines the hypothesis so as to exclude the deviant or negative case, or reformulates the hypothesis and proceeds with

collecting the data. In the second case, if a further deviant case is found, the researcher must choose again between reformulation or redefinition.

Thus, according to Bryman and Bell (2011), analytic induction is an approach to data analysis in which the researcher seeks universal explanations of phenomena by pursuing the collection of data until no cases that are inconsistent with a hypothetical explanation (deviant or negative cases) are found.

For Bryman and Bell (2011), analytic induction is a rigorous method of analysis, as encountering a single case that is inconsistent with the hypothesis is sufficient to necessitate further data collection or reformulation of the hypothesis. The selection of cases must be diverse, so as to have adequately challenged the theory. The final explanation of the analytic induction specifies the conditions that are sufficient for the phenomenon occurring, but rarely specifies the necessary conditions. It also does not provide guidelines (unlike grounded theory) as to how many cases need to be investigated before the absence of negative cases and the validity of the hypothesis (reformulated or not) can be confirmed.

Bryman and Bell (2011) define grounded theory as theory that was derived from data, systematically gathered and analysed through the research process. Two characteristics of grounded theory are that it is concerned with developing the theory out of data and that the approach is iterative, so that there is a close connection between data collection and analysis, referring back to each other.

The tools of grounded theory include the following: theoretical sampling; coding; theoretical saturation (refers to the coding of data, meaning that a researcher reaches a point when it no longer makes sense to review the data to see how well they fit with their concepts or categories, and to data collection, implying that once a concept or a category has been developed, the researcher may wish to continue collecting data to determine its nature, but then reach a point where new data are no longer illuminating the concept); constant comparison – a process of maintaining a close connection between data and conceptualization, so that the correspondence between concepts and categories with their indicators is not lost. The researcher constantly compares the phenomena being coded under a certain

category so that a theoretical elaboration of that category can begin to emerge (Bryman and Bell, 2011).

In Bryman and Bell (2011), different phases of grounded theory have various products:

- concepts, which can be viewed as the building blocks of theory, and represent labels given to discrete phenomena; the value of concepts can be determined by their usefulness; a useful concept will typically be found frequently and members of the organization under study will be able to recognize it and relate it to their experiences;

- categories – concepts that have been elaborated so that they are regarded as representing real-world phenomena. A category may become a core category, around which other categories pivot;

- properties – attributes or aspects of a category;

- hypotheses – original assumptions about the relationships between concepts;

- theory, which can be substantive and formal; substantive theory relates to theory in a certain empirical instance or substantive area, while a formal theory is at a higher level of abstraction and has a wider range of applicability to several substantive areas.

As described in Bryman and Bell (2011), the research process applying grounded theory unfolds as follows. The researcher begins with a general research question. Relevant people and/or incidents are theoretically sampled. Relevant data are collected. Data are coded, which at the level of open coding may generate concepts. Early coding suggests the need for new data, which results in the need to sample theoretically. There is a constant movement backwards and forward between the first four steps. Through a constant comparison of indicators and concepts, categories are generated. There needs to be a fit between indicators and concepts. Categories are saturated during the coding process. Relationships between categories are explored in such a way that hypotheses about connections between categories emerge. Further data are collected via theoretical sampling. The collection of data is likely to be governed by the theoretical saturation principle

and by the testing of the emerging hypotheses, leading to the specification of substantive theory. The substantive theory is explored using grounded theory processes in relation to different settings from that in which it was generated, so that formal theory may be generated. A formal theory will relate to more abstract categories, which are not specifically related to the research area in question.

Bryman and Bell (2011) point out that concepts and categories are perhaps the key elements in grounded theory. It works better for generating categories than theory. Studies that use the approach often generate grounded concepts rather than grounded theory.

3.3.2 Content analysis

Liamputtong (2013) discusses a number of data analysis approaches used in qualitative research. The first type is content analysis, an analytic approach that seeks to quantify content in terms of prearranged categories, so that it is organized and replicable. The process of content analysis comprises several steps: developing categories, searching the data to identify the categories, choosing the sample to undergo the process of categorization, and systematically recording (counting) the number of times the categories occur. Content analysis examines texts unobtrusively to determine the patterns, trends, frequency, and relationships of the words as they occur in the sample.

According to Silverman (2014), content analysis involves establishing categories and then counting the number of instances when those categories are used in a particular item of text. Researchers establish a set of categories and count the number of instances that fall into each category. The crucial requirement is that the categories are sufficiently precise to enable different coders to arrive at the same results when the same body of material is examined.

3.3.3 Narrative analysis

Bryman and Bell (2011) suggest that narrative analysis is an approach to the elicitation and analysis of language that is sensitive to the temporal sequence that people, as tellers of stories about their lives or events around them, detect in their lives and surrounding episodes and inject into their accounts.

Liamputtong (2013) explains that the essence of narrative analysis is exploring the participants' stories (narratives) and afterwards re-storying (retelling) them in a framework that will make sense to the readers. In the process of re-storying, the stories are scrutinized for the key elements like time, place, plot, and scene. Researchers need to provide a causal link between ideas in the process of re-storying and often have to rearrange the events to follow a chronological order, which makes this type of analysis distinct from other techniques. Besides chronology, the researchers may examine the text to identify themes emerging from the story to hypothesise about its meaning. Thus, the analysis embraces both the story and the emerging themes.

Silverman (2014) maintains that narrative analysis offers a way to describe the structures of stories. It asks the following questions about narratives: in what kind of a story does a narrator place herself? how does she position herself to the audience and vice versa? how does she position characters in relation to one another, and to herself? how does she position herself to herself, that is, make identity claims?

According to Liamputtong (2013), the process of narrative analysis includes the following steps: getting familiar with the content and structure of the narratives, writing a short summary (the beginning, the middle, and the end of the story), noting the thematic ideas and structural points, identifying transitions between themes, determining the thematic ideas developed from the transcript and searching for disruptions and gaps that may challenge the themes, elucidating mini-stories or sub-plots in the transcript, finding emotive language, imagery, and metaphors that point to the participant's feelings, coding thematic ideas and developing a coding frame, and comparing the identified stories on a case-by-case basis.

3.3.4 Discourse analysis

Liamputtong (2013) writes that another analytical technique widely employed in qualitative research is discourse analysis. It is defined as a way of writing or speaking that constructs a particular type of knowledge with practical and rhetorical inferences. Discourse and language are approached as the construction

of social reality, discourse is treated as social action in its own right, and the rhetorical functions of discourse are emphasised. For the purposes of analysis, discourse, meaning "conversation," is understood as an interrelated set of texts, and the practices of their creation, distribution, and reception, that bring an object into being. The analyst explores the relationship between discourse and reality.

For Silverman (2014), discourse analysis describes a heterogeneous range of social science research based on the analysis of interviews and texts as well as recorded talk. It is grounded on the premise that many utterances do not simply describe a state of affairs, but perform an action.

In Liamputtong (2013), the steps of discourse analysis are as follows: formulating initial research questions, choosing the data or texts for analysis, reading and interrogating the data, which entails interrogating the researcher's assumptions with a great deal of scepticism, coding the text, revisiting the research questions as the patterns in the data emerge, examining regularity and variability of the analysed texts, putting forth tentative hypotheses, checking the reliability and validity of the results via deviant case analysis, analysis of coherence and participants' understanding, and writing up the analysis.

Discourse analysis, as described in Bryman and Bell (2011), exhibits two distinctive features at the levels of epistemology and ontology. First, it is anti-realist: it denies that there is an external reality that needs to be explored by a researcher and disavows the notion that any researcher can arrive at a privileged account of the aspect of the social world under investigation. Second, it is constructionist, meaning that the emphasis is on the versions of reality put forth by the members of the social setting being investigated and on the creation of that reality through their renditions. The researcher recognizes that discourse entails a selection from many viable renditions, while a particular depiction of reality is built up in the process.

Bryman and Bell (2011) mention that a number of further features are characteristic of discourse analysis. The first trait is reading the detail. The second is looking for rhetorical detail, which entails a sensitivity to the ways in which

arguments are constructed. The third is looking for accountability, which entails attending to the details through which the accounts are constructed.

Discourse, as Bryman and Bell (2011) emphasise, is not simply a neutral device for imparting meaning. To summarise, discourse analysis is concerned with the strategies people employ in trying to create different kinds of effect by writing and speaking.

3.3.5 Semiotic analysis

According to Liamputtong (2013), the aim of semiotic analysis is to penetrate deeper than identifying themes. Semiotics is the study of signs, sign systems, and their meanings. Semiotics posits to explore the deeper meaning of the data and to uncover the way meaning is formed through the process of signification or connotation. Semiotic analysis seeks to identify themes that have been left out or repressed and overlaid by other themes, and to reveal not just the author's view of the text, but how it fits in with that of the society. The assumption in semiotic analysis is that the researcher should bear in mind that there can be implicit meanings, therefore, theoretical frameworks to deconstruct a text are necessary to be adopted.

The steps of semiotic analysis comprise adopting a critical and sceptical standpoint while reading the texts, allowing the different parts of the text to challenge each other, looking for incongruities and discrepancies of ideas, identifying any generalizations, arguing against any argument that was made, searching for and simplifying the dichotomies, binary oppositions, and hierarchies, reading against the essence of the text to find other ways of understanding it, exploring connections with other texts, searching for what lies beyond the immediate area of analysis, and writing up the process. In producing the analysis, one should allow as many interpretations as possible, avoid making any concrete statements, stay close to the language used, and reveal ambiguity and ambivalence (Liamputtong, 2013).

3.3.6 Thematic analysis

In its turn, thematic analysis, which is employed in the present paper, has been described as a foundational method for qualitative research. According to

Liamputtong (2013), this is a technique for identifying, analysing and reporting patterns (themes) within the examined data. During the first stage of thematic analysis, the researcher reads through each transcript and makes sense of the interview data. Next, it is necessary to comprehend what is being said by the interlocutors as a group. In other words, the data set is searched across to reveal patterns of meaning that recur. To achieve this, the data is coded in order to deconstruct it and find connections within it. The procedure includes the following stages: the researcher makes sense of the data, generates primary codes, looks for themes by collating the codes, revises the initially developed themes, and, finally, defines and names the themes (Liamputtong, 2013).

3.4 Data collection and analysis method: interviews with the faculty of the Department of Future Technologies at the University of Turku

The thesis considers the example of a project for optimization of the UX and HCI curriculum at the Department of Future Technologies of the University of Turku, implemented in the course of September – November 2018. The author worked at the faculty as the project researcher. The empirical data for the study was collected via in-depth personal interviews with lecturers and researchers responsible for developing UX/HCI/interaction design curriculum. The interviews were conducted in September – October 2018 using the structured method.

In-depth interviewing was chosen because it allows to approach the problems under consideration from the point of view of the participants. Rich descriptions of the approaches to developing, reorganising, and redesigning the teaching in the areas of user experience and interaction design were sought. As discussed in the previous section, in-depth interview is a qualitative research technique, in which a small number of respondents undergo intensive individual interviews intended to elicit their perspectives regarding an idea, programme, or situation that does not have a ready solution, while the aim of a structured interview (a standardized interview, or a researcher-administered survey) as a common quantitative research method is to make sure that each interviewee answers the same questions in the same order.

During the procedure, the respondents were presented with an interview guide that comprised ten open-ended questions. The questions were designed to prompt comprehensive responses as to the interviewees' perspectives regarding integration of the components of the curricula in the areas of business, marketing, information science, and design into the content of the courses, as well as their vision as to the possible development of a new course in UX/HCI.

Each interview lasted between 40 minutes and one hour. The answers were video recorded and transcribed.

A total of eight interviews were conducted. Purposive sampling was used, that is, the lecturers and researchers involved or interested in the topic of modernising the UX curriculum were targeted and approached with an invitation to be interviewed. Purposive sampling was applied, because accounts by individuals possessing specific expertise were aimed for. The author sought to interview faculty members who had been involved in teaching introductory courses in user experience, human-computer interaction, and interaction design, and targeted them specifically with the interview invitation. Another characteristic sought after was the willingness to review the content of the existing courses and interest in redesigning the course offering to take into account recent trends and the international best practices in teaching in the field. The prospective respondents received a call for participation over e-mail that briefly introduced the essence and purpose of the project for developing the curriculum and of the interviews. The invitation was originally e-mailed to around 15 lecturers and researchers responsible for teaching courses in UX/HCI and for otherwise contributing content to the disciplines. Eight of the contacted specialists consented to participate in the interviews.

Instructors teaching both Bachelor's degree and Master's-level courses were contacted and included in the sample. The interviewees' background included lecturing and researching in the fields of computer science, software engineering, and interaction design. They varied considerably in terms of the teaching and research experience.

The interview guide asked each participant to detail the proposed changes to the learning activities and outcomes while expanding the content of the courses or creating a new discipline from scratch. The full interview protocol is presented in Appendix 1. The interviewees responded to a set of questions that concentrated on the following key topics: the skills related to user experience demanded by the job market, the international best practices in teaching UX, interaction design, and human-computer interaction that can be borrowed, the practice of inter-departmental programmmes, the module of the taught disciplines to be developed in response to the digitalization trend, and various configurations of the topics from the fields of technology, business and marketing, design and art, information studies, psychology, and communication science to be adopted in the teaching practice.

At the stage of analysis, the in-depth structured personal interviews proved to be an effective technique for collecting information about the perception of the potential directions of augmenting the programmes and courses in UX/HCI/interaction design. The methodology turned out instrumental in gathering expert input to inform curriculum development, particularly in the absence of similar prior research on the topic at the Department.

After each session, the interviewer interpreted the information by identifying agreements and disagreements among the respondents and extracted the key types of course content envisioned by the interviewees.

Thematic analysis of the responses was applied to explore the interviewees' reasoning. The technique allowed to identify common themes that were proposed by the majority of the participants for including into the content of the existing courses or into a new discipline to be produced. Potential drawbacks of expanding the curricula by incorporating the new course components were also detected in the course of analysis of the interview data.

The interviews uncovered new thematic areas that the respondents deemed necessary to include into the new curriculum, and the types of learning activities that might be introduced. The selected method enabled the reflections to be fully explored and systematized.

One limitation of the data collection methodology is the difficulty of generalization from the in-depth interviews. The sample size (n=8) can be regarded as one of the constraints of the applied methodology. It might be argued that the relatively small sample makes it impossible to generalize from the study results. As is often the case in qualitative research, selecting a suitable sample for this study posed theoretical and practical challenges. However, the technique of in-depth interviews requires the questionnaire to be presented to a small number of experts to find out and analyse their detailed views on a topic.

Alternatively, automated content analysis could have been implemented to process the data. The methodology treats text as data and is therefore an effective means for analysing large qualitative databases. Although methods of automated content analysis are rarely used for the purposes of qualitative analysis in survey designs with a small sample size, they could have supplemented the manual processing of the interview data sets.

Finally, the technique of interview control questions (ICQs) could have been used to enhance the causal validity of the interviews. The ICQ approach is grounded on the logic of control and is applied in experiments and statistical analyses. According to the logic, to identify the actual effect of an independent variable on a dependent variable, all other variables must be held constant. An ICQ is a probe question that controls an independent variable in the respondent's thinking.

Two modes of interview control questions are applied: simple control, or neutralizing an independent variable to explore whether it is a necessary condition for an outcome, and parallel control, or isolating an independent variable to identify whether it is an adequate condition for a result. In both modes, the method allows for additional independent variables to be detected. By using probe questions, the principle of control could have been applied in the process of interviewing for this study.

4 Analysis of the interview data

This chapter analyses the themes, or patterns, that deal with the respondents' vision as to reforming the course offering and that emerged in response to the ten questions of the interview guide.

4.1 Presentation of the interviewees

The background information about the respondents is presented in Table 4.

Table 4. Interviewee background

	Position	Background and teaching experience
Respondent 1	Senior Research Fellow, Interaction Design, Mixed Reality research group	software engineering, software development process modelling, gamification and serious games-related projects; has taught software engineering courses for 1,5 years
Respondent 2	Senior Lecturer, Adjunct Professor, Interaction Design unit	over 10 years of experience in teaching game development courses
Respondent 3	Doctoral student, Interaction Design unit	interaction design and game design; has taught an advanced level course in Principles of Interaction Design for 5 years
Respondent 4	Doctoral student, Interaction Design, Computer Science	2 years of experience in teaching game testing and software testing courses
Respondent 5	University Lecturer, Software Engineering	responsible for the courses in Distributed Systems, Software Architecture, and Web and Mobile Programming
Respondent 6	Professor of Software Engineering and Software Security, Head of the SE Lab	over 20 years of experience in teaching software engineering courses
Respondent 7	Doctoral student, University Lecturer, Software Engineering	teaches courses in Object-oriented Programming Methodologies, User Interface, and Advanced Programming Techniques; experience in teaching Distributed Systems and Functional and Declarative Programming
Respondent 8	Project Manager, Software Engineering	leads the Capstone project

The respondents represented two chairs of the Department of Future Technologies: the Interaction Design unit and the Software Engineering unit. Their positions varied from university lecturer to the chairperson of a unit, and the teaching background from 1,5 to over 20 years.

4.2 Theme: crucial professional skills

The question regarding the three crucial professional skills to be applied by the graduates elicited a variety of answers, summarised in Figure 1. Overall, the respondents ranked the technical skills, team management, and ensuring the best user experience highest among the requirements.

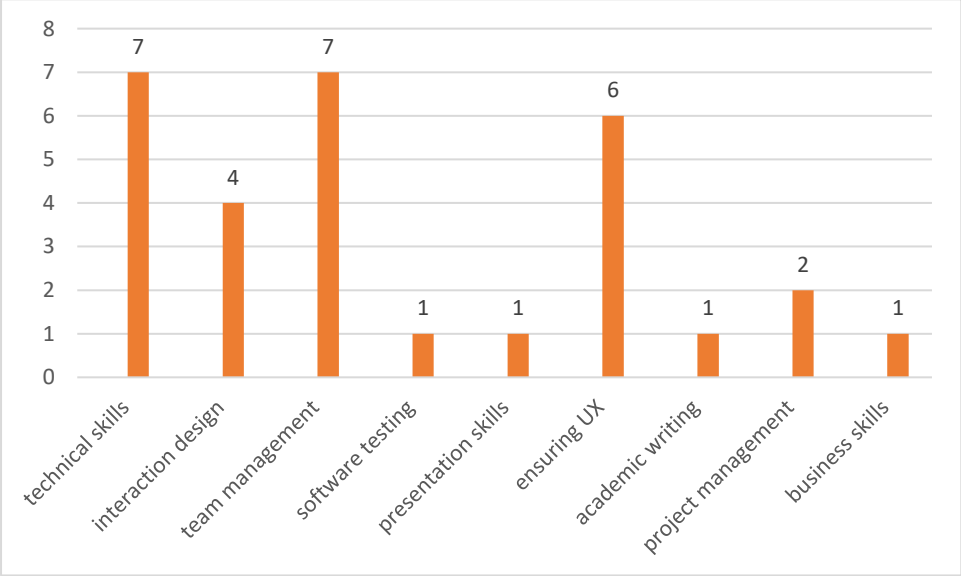

Figure 1. Breakdown of the answers to the question regarding 3 crucial skills to be applied immediately after graduation

Technical skills were pinpointed among the 3 crucial professional skills that the students are likely to apply immediately after graduation by 7 respondents. For example, interviewee 5 highlighted understanding of the role of software architect among the requirements: “understanding the significance of the architectural decisions that we make when we are planning the software system, choosing

technologies for the system and all other decisions that are connected with the quality attributes - that's a very important skill to realise this, and how it is connected with the end result."

Teamwork skills and team management emerged as another topical theme, also mentioned by 7 interlocutors. Interviewee 2 spoke about an ability to work in multi-disciplinary groups that include artists, programmers, designers, and managers: "If I focus now on the game development area, I think that one key issue, or one point that they have to learn and that they have to be able to use is to work in a multi-disciplinary group… By default, game development is a multi-disciplinary area. I would say that that's the most crucial skill: team skills, or being able to work as part of a team, development team." According to respondent 6, "Software engineering is a team activity mostly at the moment, meaning that one of the crucial skills that they typically apply after their graduation are the team skills, either it's team leading skills or just being part of the team."

Six respondents spoke in favour of user-centricity, that is, ensuring the best user experience and usability, as a key professional skill for the graduates. As interviewee 2 put it, "I would call it user-centered perspective on design or development, so that they can take the user's viewpoint whenever they are implementing or designing software, meaning that it's not that they are creating software for themselves or for the company, but that there is an imaginary average user that they focus on, so that they create something that the user is able to use and that fulfills the needs of the user."

Interaction design was viewed as a dominant theme by 4 respondents. As interviewee 3 put it, "Another skill that they are likely to apply I hope is the ability to apply the wide theoretical perspective to interaction and interaction design, so that they do not go with their first impression that this is how the system works, this is how people use it, but they are able to spread an outer perspective. Then it is like 'It looks like it's working like this, but could we do it like this, could we think outside the box' and this vision on how to improve the design, and could we see the crucial things that are good in the design and the things that are faulty, and also how the users are perceiving the system."

Other skills were mentioned by a smaller portion of the respondents. For example, two spoke about project management skills as being a requirement that the students are to meet. Interviewee 6 mentioned that the crucial skills differ depending on the progress in the graduates' careers, with the technical skills prevailing in the initial stages and project management becoming more prominent in the later phases: "programming skills, design skills, small-scale design skills… those are the ones that are dominating in the beginning of their career. But after a while, what we are hoping, as their career develops, is that (the students take on) more responsibility concerning design, I mean architectural design, and also something concerning taking in projects, and then it means requirements analysis."

One respondent concentrated on software testing with the actual users: "The focus is on testing as automated testing of user interfaces and program logic and on testing with the users. These are 2 crucial skills."

Presentation skills were also named by one interviewee in response to a follow-up question: "…presentation skills, that is sorely lacking in our students. It doesn't matter what it is, whether you come to present an exercise that you have done, or some project you have done, that's a skill you have to have later in your professional career. You will have to do that time and again, and that's something that many students lack. You ask them to give a short presentation about an idea they have, and they are at a loss, and then it becomes some list of technical details or something other than what is actually meant about that."

One respondent spoke at length about academic writing as a skill that is required and the way he tries to address the need in his course: "I'm putting some focus on my course on how to write technically in a proper manner. We have students who have the same problem I used to have and still have that they write too tense and they don't know how to put their whole idea into the text, so I'm giving them feedback and teaching them to write more verbously. I'm also teaching them about the style of language, how to be convincing… When they graduate, they will have to write texts at the office, write documentation of different things, so the skill to be clear on what they are saying, not use obscure terminology, being careful about how they use words, that's at least one or two skills already."

Finally, one interviewee advocated for including business skills among those crucial for the graduates: “I feel that the project work and technical programming and system configuration skills are more important, and if I pick a third skill it would be some business skills, how to run a business and make money and make the customer happy.”

4.3 Theme: new user experience and human-computer interaction skills demanded by the job market

Question 3 of the interview guide concerned new demands of the job market regarding the skills of the graduates specializing in UX and HCI (Figure 2).

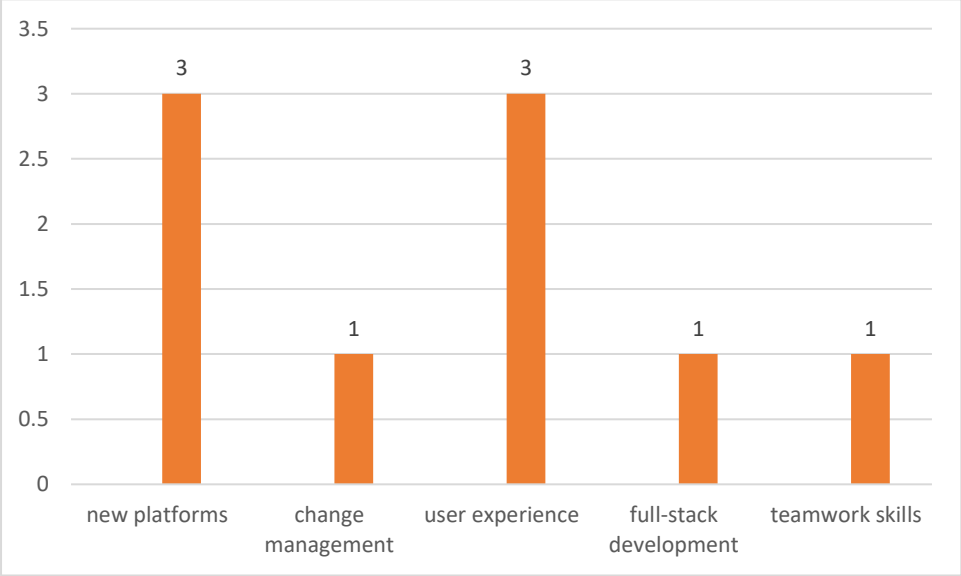

Figure 2. Responses to the question regarding new skills expected by the job market

A common theme that emerged in the answers to the question was the necessity for the students to be familiar with new platforms for software development, mentioned by three interlocutors. According to interviewee 1, “Platforms we are using to create the software, create the user interfaces, have become more advanced regarding user interaction, they have become easier to use, so basically the developers now have better tools to respond to this demand.”

Another common topic was ensuring user experience, also highlighted by three interviewees. According to the 8th respondent, “There is an increasing emphasis on or focus on good user interface. The users are using the service with different

devices, but this is not something for this year, this has been in development for past 5 years at least, so, yes, the user experience is in focus. And this is one of those elements that are in focus in almost all projects, regardless of the area it relates to."

One of the respondents deemed an ability to cope with the ever-changing environment to be a new skill that is now in the spotlight. In his opinion, the context in which software is developed is dynamic, with new platforms and tools constantly introduced, therefore the students have to develop a mindset of anticipating change and adapting to it: "it's also important that they learn to cope with this ever-changing area, because there will be new possibilities, new technologies becoming available while they are working and they have to have the flexibility, so that when something new comes up they would themselves find out and learn it and include it into their repertoire."

In addition, one respondent found full-stack development skills to be among the ones for which demand in the workplace has recently emerged: "I believe the full stack development skills are very important at the moment, and that's the message that we have gotten from the industry…"

Teamwork skills were also chosen by one interviewee, who elaborated in the following way: "within my 20 years teaching especially team skills have raised to a very high level. People used to be hired if you simply were a very good programmer, if you had a very good understanding of making complex programs or understanding a complexity of a system, you really had your place there, but now I hear rather different stories, I hear stories where people are thrown out of companies simply because they don't have the team skills, or their personality is not really fit for working with teams."

4.4 Theme: best practices in teaching user experience

Question four concerned the international best practices in teaching UX that the respondents deem applicable to the teaching at the Department. Figure 3 summarizes the responses.

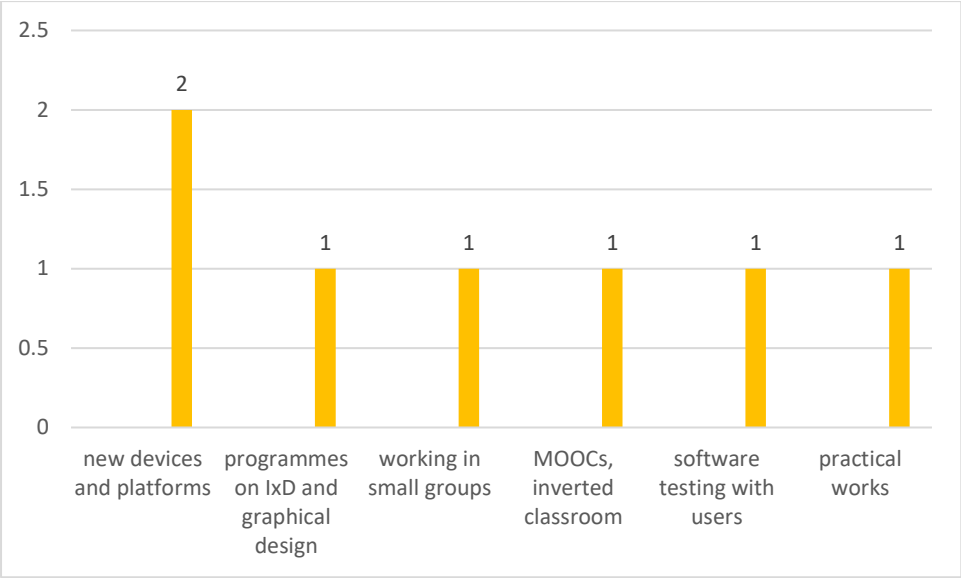

Figure 3. Responses regarding international best practices in teaching UX

The majority of the participants hesitated to name the exact university programmes or courses that may be regarded as the role models for updating the curriculum.

The theme that two respondents were unanimous about was taking the new devices, user interfaces, and platforms like touch screens and virtual and augmented reality glasses into account in the software development process. "UX is not only about desktop and laptop computers at the moment, but it's about the new devices that make use of the users' senses in different ways, and that's something that we are missing at the moment, at least in our software development courses," as respondent 5 commented. However, the question divided the participants. A variety of approaches to teaching UX and course delivery techniques implemented by the foreign universities were named, among them intensive programmes that concentrate on user interaction and graphical design, working in small groups, MOOCs and lecture videos (the so-called "inverted classroom"), software testing with actual users, and practical works.

4.5 Theme: inter-departmental programmes

When answering question 5, which deals with the benefits of UX programmes jointly offered by various departments, the respondents, as shown by Figure 4, were almost unanimous about the applicability and benefits of the approach, giving the following reasons: a possibility to cooperate with institutions in the

sphere of design; pertinence to the field of UX, which combines expertise from design to management science, business school courses, and psychology; overcoming the homogeneity of students and fostering communication skills with non-developers and an understanding of the users' perspective, which are indispensable in the workplace; opportunity to practice software development via real-life exercise projects, and exposure to the various stakeholders' viewpoints and to real assignments with specialists coming from a variety of backgrounds as part of the teams.

Interviewee 4 described the advantages in the following way: "I see a benefit of joint courses with different departments, because now in many courses our students are really homogenous, it's the different types of developers doing things together, that narrows their mindset. But if they work with people who don't think about programs as lines of code and CPU cycles, who see them only as tools to do something, that would be beneficial to them, because that's what they will be doing in actual companies, companies where you are not just programming something in your office: when you advance to becoming a consultant or an on-site developer, what you do is you communicate with people outside your own safe corner."

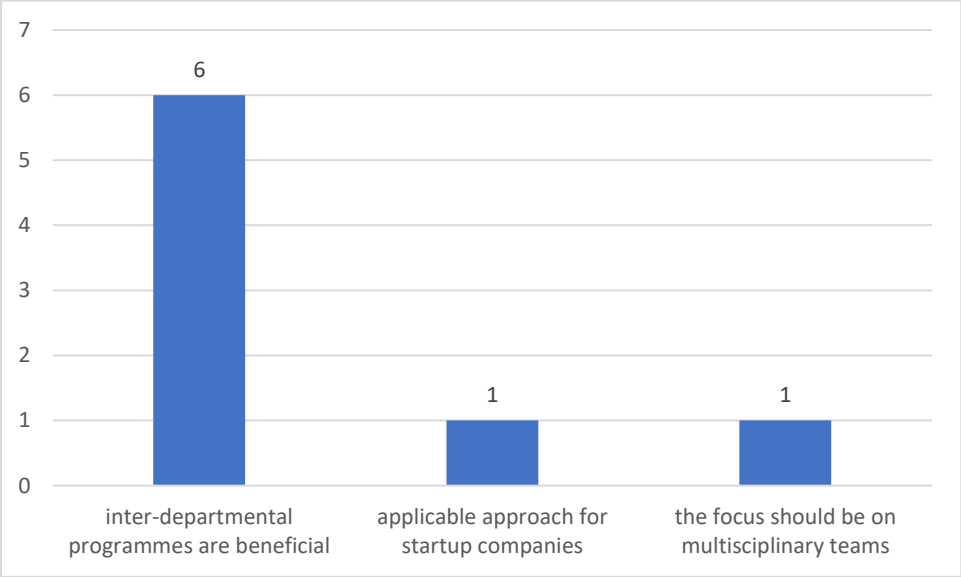

Figure 4. Viewpoints regarding inter-departmental programmes

As for the dissenting views, according to interviewee 6, the inter-departmental combination of efforts is more applicable in the case of startup companies, when marketing and business expertise are at the forefront. "Maybe this schools of

management and engineering combination is more for startup companies, when you are trying to create a new type of business and then you would need to have someone's understanding how you do marketing and how you find business for your new ideas," as he explained. In contrast to the opinion shared by the majority of respondents, the 8th interviewee accentuated the practice of multidisciplinary teams, as opposed to inter-departmental programmes. In his opinion, including students who specialize in nursing science, medicine, social sciences, business, law, physics, mathematics, and geography is indispensable.

4.6 Theme: new module responding to the requirements of digitalization

Ensuring the best user experience and UX design emerged as a common theme when the respondents answered the question asking to describe a new module to be developed in response to the digitalization trend. They accentuated such topics as psychological aspects of UX, pragmatic tools and techniques for interacting with real customers, getting information from them, and formalising the information so that students can use it when creating user interfaces or higher-level user experience. Three respondents touched upon user experience in their answers. Interviewee 5 explains his standpoint in the following way: "If I were to build a new module to meet the demands of digitalization trend, at least from my point of view and software engineering laboratory's point of view we would probably need something more about distributed systems, something more about usability… so I believe this kind of module could be a little less technical and maybe usability aspects and psychological aspects and sides of UX could be incorporated."

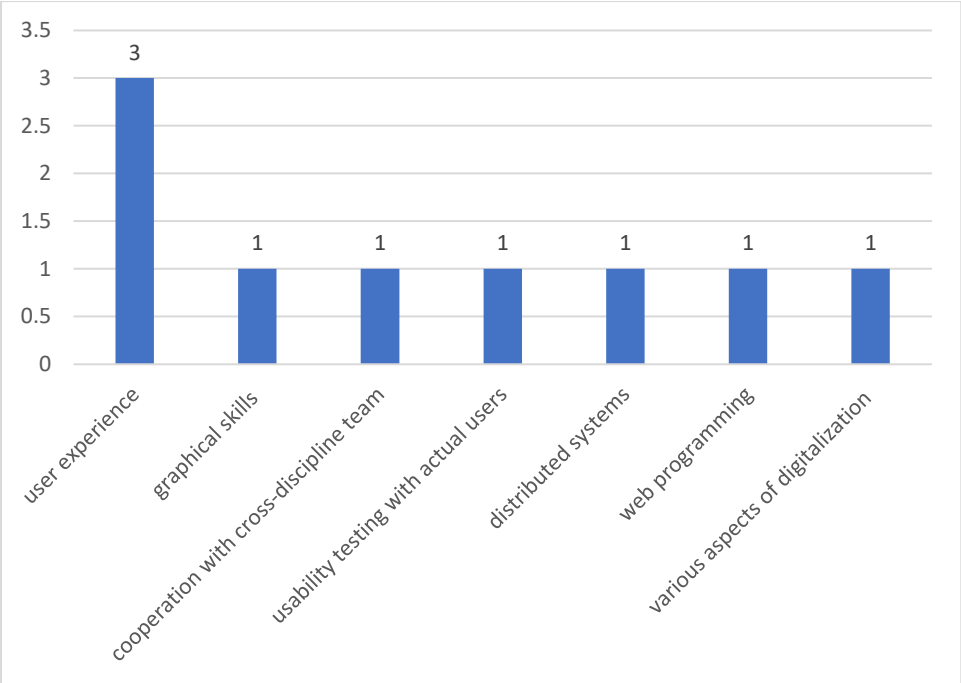

Figure 5. Suggested topics for the course responding to the digitalization trend

In the rest of the responses, shown by Figure 5, the suggested topics were distributed as below: a basic project course, focusing among others graphical skills and cooperation with cross-discipline teams; usability testing with actual users, with the new module coming right after a development course, so the students have already generated the program and now have to produce a user interface and UX for it; distributed systems; web programming, because the web is a big and popular execution platform, used also for the government's new digitalization projects and services, and offering various aspects of digitalization as separate topics for the students to choose from during the project course. The suggested course delivery techniques varied from a hands-on course with small groups and possibly a teaching assistant, that would concentrate on learning the handicraft of software development by doing; real-life exercise projects with participation of the industry partners, and an experimental module or course, in which the students would be applying new platforms, new input and output devices, and new ways of interacting with the systems.

4.7 Theme: adopting fragments of the curricula in business and marketing, design and art, information studies, psychology, and communication science

Questions 7-9 concerned incorporating fragments of the curricula in the fields of business and marketing, design and art, information studies, psychology, and communication science into the current course offering.

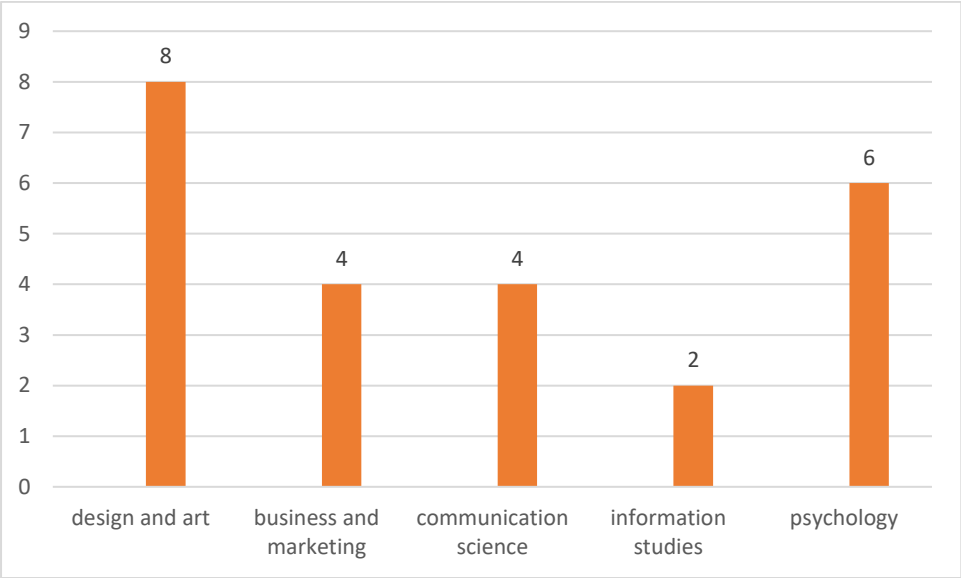

Figure 6. Responses regarding content from business and marketing, art and design, information studies, psychology, and communication science

To summarise the replies (Figure 6), all the respondents saw a need to integrate content from the fields of design and art, while 6 of them suggested to include topics from psychology, 4 spoke in favour of including business and marketing topics, 4 advocated for communication science, and 2 were proponents of information studies.

Four respondents spoke in favour of including business and marketing topics, while the rest did not see a way to integrate them into the content of the courses. The proponents gave the following arguments. Software development projects are only half way through when the products are ready. The more difficult part, which is marketing of the software and handling the publication, is left outside the scope of the courses. There is a need to teach how the digital marketplace works, and how to think about monetization of the would-be software already at the point when it is being produced. Further, a course in software business could be a way of

integrating marketing topics, so that students have an understanding how much they are generating costs, what they are bringing in, and what it means if their work is not covering all the expenses. Business cases, in which design and art meet the engineering design, are mentioned as a possible format by another interlocutor. The last respondent, who teaches a project course, mentioned that business and marketing are an aspect that is present in some of the projects, depending on the topic, although there is no requirement to build a solution for commercial use.

The dissenting views were as follows. The first interviewee believed that although marketing and business topics are highly relevant, the focus in the current courses should be on the product development, which is where software is prepared to be marketed and sold. Therefore, there is no need to go deeply into the theory of marketing and business. Respondent 3 maintained that courses from the School of Economics would be beneficial for the students taking his course, but saw no way of integrating content from business and marketing directly into it. The fifth respondent did not envision a need to directly incorporate business and marketing topics either, rather seeing them as part of exercise projects. Figure 7 presents the breakdown of the answers.

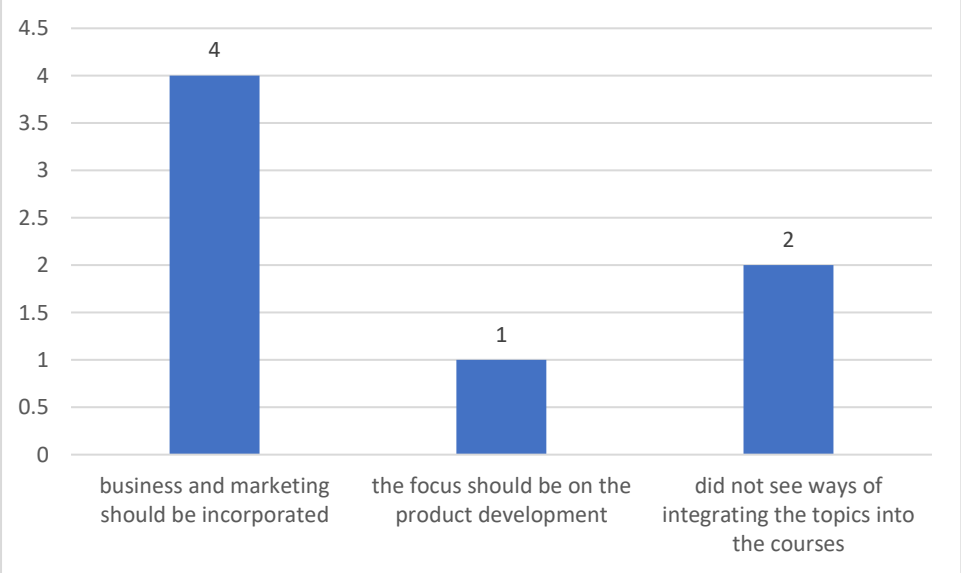

Figure 7. Viewpoints regarding integration of business and marketing topics

The interlocutors were unanimous about including fragments of the curricula in the fields of design and art. All 8 spoke in favour of such course redesign. They

proposed the following reasons. Art and design are natural topics to include, for example through cooperation projects, as when the students complete assignments, for example, in game design or user interface design, they would require graphical assets. Elements of art and design are also applicable to the process of system implementation, as it requires decisions pertinent to the broader user experience design. It is beneficial to involve specialists with design and art background, who have the knowledge and skills for improving the designs. Students can learn what artists are doing and how they see digital artifacts, which enhances teamwork. Talking about principles of interaction design, art has value in understanding perceptions and behaviour. Art and design could be taught alongside game testing, so that students specializing in software engineering learn to interact with specialists from other disciplines.

They also proposed the following formats for including the content: exposure to the topics in design and art could be gained via collaboration courses with the industry partners, or they can be incorporated in the formats of applied tasks, project works, and Capstone projects. In the project course, there is a need for components of design and art in some of the topics, so project team members from the Art School are involved.

Six respondents advocated for including content from the field of psychology. The motivation given was that human-computer interaction draws from it. Two respondents suggested that students should take psychology as a minor or as an additional course. The interviewee responsible for the capstone project elaborated that topics from psychology are included in the projects where the theme requires, and that students get exposure to it via cooperation with the specialised institutions.

To four respondents, fragments of the curriculum in the field of communication science seemed viable to be included into the course content, and two of the participants spoke about the need to explore and include content from information studies. The reason given by the first interviewee was that the knowledge is useful to make decisions as to how information can be visualised and expressed. The second informant would like to see more content from media studies incorporated into the study programmes. The third respondent suggested that information

studies and communication science be taken as minor subjects, while the fourth one recommended the same approach for media literacy. Cases and exercise projects seemed to the fifth participant feasible for including content from the field of information and knowledge management. The sixth interlocutor pointed out that some knowledge of communication science is indispensable for team projects.

4.8 Theme: combining technology, business, design, and art curricula

In answering question 10, which concerned the vision for combining curricula in the fields of technology, business, design, and art, the respondents were almost unanimous that there are ways of integrating such material within the courses they teach. Their approaches, however, differed.

Two common patterns emerged from answering the question regarding integration of technology, business, design and art within study programmes. The first tendency was for the participants to accentuate technology, art and design, and to see business topics as somewhat less relevant. The second common theme was integration of the business topics. Half of the respondents shared each of the views.

Proponents of the first view did not suggest to apply the combination of the topical areas, but, rather, concentrated on the skills that in their opinion are directly related to software development and design of user interface. As the first interviewee put it, "This is a good approach. These are the kinds of things you need, for example, to start your own business, start your own startup, you have to have someone who knows the business, you have to have someone who knows the technology, you have to have someone who knows design and can create nice-looking things for your company. But regarding the user experience, I think that design and art are closer to the topic." Interviewee 7 saw potential for including material from the area of design into the courses, and for cooperation with other organisations and universities to incorporate topics from the field of art: "I think that people working with art would really appreciate if we combine technology with art and that could benefit the university if we have art studies and we could cooperate within these fields, or maybe with other universities."

A portion of the respondents considered that business creates contexts for ICT professionals to act in, but when developing software and creating user interfaces, they need to possess more pragmatic skills. Some also posited that if attention is to the broad ideas and topics from business, this distracts from learning the tools to implement the ideas into actual applications. They saw a risk that while concentrating on the business issues there is a tendency to go too far away from the pragmatic area. Interviewee 6 raised the question of flat degrees and a risk that employers would not see the graduates as possessing in-depth knowledge in their domain of expertise, as the curricula are diluted by integrating components from design, art, and business. He therefore suggested a different approach, which concentrates on teaching the students to interact with specialists who have various backgrounds, instead of incorporating the various fields of knowledge into a study programme or a course: "I would not maybe so strongly mix these curricula areas as one degree programme, but rather try to educate people in one discipline to rather far, not to have flat degrees, but rather degrees that go rather deep, but to have skills to work with experts from other fields." This view was supported by the 8th informant, who accentuated that the way to go is to have multidisciplinary student teams working on ill-defined, open-ended, real-world needs: "The project course focuses on how the team members with different disciplines background work together, rather than how to provide different disciplines for the participants, or content from different disciplines." According to the interviewee, this experience is valuable for the students, who learn to cooperate with specialists in varying fields.

Half of the participants stressed the technological side of things, but believed that certain decisions regarding technology have an impact on the business outcomes, for example how long and costly the development process is, and what that means for maintaining the product lines.

The approach was viewed as applicable by the advocates of the first standpoint, but ways of implementing it remained an open-ended question. The respondents, for instance, suggested that exercise projects would be a natural venue for integrating the four topics. Further, examples of such systems where the design

and art side of things are very significant part of the delivered system can be shared with the students.

The respondents who favoured integration of business alongside technology, art and design spoke about separate courses as the prospective venues. For example, they suggested that in the courses dealing with mixed reality and human-computer interaction, there is a possibility to incorporate the combination to a greater extent than it is present now. They proposed that when new technological ideas are produced, it is necessary to validate how much they would make money, what are the risks, how expensive they are to implement, and what the business case is. In this sense, the topics from business are indispensable. In replying a follow-up question about the best way to address digitalization demands, the eighth informant suggested to have case studies highlighting instances when a technological solution worked especially well in implementing a business model or solving a business problem: "I would put to every course teaching these theoretical platforms or theoretical backgrounds which are then to be applied a sample, either a good one or a bad one, from something digitalized, or I would take real-life samples, not built by the students, but by someone recognized by the teacher. I would show those and link that to those theoretical courses. Case studies, real case studies, because that would benefit finally our professors, who will understand the outside world a little better, and our students would understand the outside world."

Moreover, two participants shared that the combination of expertise from technology, business, design and art is implemented to some extent in their current courses. For example, informant 2, who is responsible for game design courses, elaborated that "that is something we have been doing already for many years in the game development courses, and something that we try to increase little by little all the time. And for interaction design in general, if I move from my special corner to a bit broader, I think that that's something I would like to see and something we have to try to do, especially with the interaction design seminar where we have people from other disciplines taking part… Even going beyond the interaction design to software development and the whole department… that would be a good thing to do." The four topics are also prominent in the project

course that the 8th respondent teaches, but he shared that they are not embedded as structural elements: "We are combining these, but we do not have a strong, well-structured curriculum to put together all the skills on all the listed aspects, mainly those outside technology." Respondent 3 also shared that he integrates the four components, albeit to differing degrees, in the Master's level course he is teaching: "My course is currently digging into these as well and drawing from there. Maybe a bit less from business but I'm telling the students they should be critical about why people are using the system, why they are doing things, and I think that this is a question that they ask in business education: there needs to be added value, there needs to be value in the system for the user."

Another common view was that if one adopts the students' standpoint, business topics are not something that they are immediately interested in, with the technical skills prevailing, but closer to graduation their focus shifts to having the developed software marketed. For example, when asked to rank the four components in a follow-up question, respondent 2 positioned them as follows: "In the beginning it's more about the technologies, that's the first thing you have to master, learn the skills. Design and art are something that quite naturally come with that. So those three, technology, design and art are very important at the beginning, and business is something that comes later on, at least that's my experience… In the beginning technology plays a more important role, then in the next courses it is a bit smaller, and then those other areas get more important."

4.9 Implementation techniques for curriculum redesign

Table 5 presents nine scenarios, or formats, for implementing changes to the curriculum that emerged from the interviews.

Table 5. Implementation techniques for curriculum redesign

Implementation technique	Description	Overview
1. Practice-oriented collaboration course	Integrating technology with elements of design and art (e.g., mixed reality applications) in	The approach is suggested by interviewee 1 based on his experience in running a collaboration course with Uniarts. The course brings together artists and students, who join forces to implement mixed reality solutions that are connected to art. In introducing a practice-oriented course like this, he

	cooperation with schools of design and other universities' design departments	suggested to explore partnership opportunities with study programmes that go deeply into the design issues, teaching about user interaction design, graphical design, and getting information from the actual user, as a lot can be learned from them. "If I would look at the collaboration possibilities, I would look at the schools that are doing design things, for example the Uniarts cooperation – well, there are some challenges there, but basically they are studying how to impact human beings. Of course, their starting point is artistic experience rather than commercial processes and commercial applications, and they are even afraid of it. But there are this kind of commercial-oriented design schools even in Finland, and that might be one direction to look." He pointed out that it is necessary to reach out to people with art and design background to have this kind of knowledge and skills inside the courses, as the collaboration would be beneficial in the case of the broader user experience design, and is pertinent to the whole process of creating a user-oriented system.
2. Exercises in small groups	Multi-disciplinary perspective from groupwork exercises and activities	The approach was suggested by 3 interviewees. Respondent 2 envisioned that the format would replicate the courses used by the universities abroad that aim at activating the students by exercises and working in small groups. He saw the technique as beneficial, because knowledge and skills in the field of user experience are acquired much like a handicraft, so there should be a proper environment to foster the process of learning by doing and of trying out various approaches: "What that could be is more of a hands-on course with small groups and possibly a teaching assistant who can really put time on supervising that group… I think it's the best way to meet the demands of the digitalization trend, because many of the software and systems that are being developed are more like a handicraft." The tendency for the respondents was to speak about exercise groups as a means of integrating the topics from business, design,

		and art into the courses. For example, interviewee 5 said: "I think it's a quite applicable approach, but we need to think how to implement it. I believe it's through the exercise projects and by integrating some examples of such systems where the design and art side of things are very significant part of the design of the system." Interviewee 6 described practical works in the courses as a way to embed more content related to user experience.
3. inter-departmental programme or courses	programme that combines courses from e.g. school of business and department of technology	Five interlocutors were in favour of inter-departmental cooperation programmes. They accentuated that the approach is applicable in the case of user experience, that combines knowledge from a variety of areas. Interviewee 2 said: "I think that there are definitely benefits for such joint programmes… You have students who take courses from business school or some other department, and they do it by themselves, but it would be good to have more formal or more coordinated packages that the students could take for this purpose." Further, the respondents saw benefits of joint courses with different departments, because currently in many courses the students are homogenous. However, in the workplace, cooperation and communication skills with non-developers will be required. Therefore, inter-departmental programmes and courses provide a valuable opportunity to practice skills in communicating with the users: "You have to learn that you are only a developer, you are not a user of a program, and users are the only thing that matters, how they feel and experience the system, their opinion can be based on totally different things than what you are thinking as a developer" (interviewee 4). Interviewee 5 commented that cross-disciplinary cooperation is useful in that it involves the students in real-life projects that are not made up by the lecturers. These views were also shared by interviewee 7, who said that one benefit of multidisciplinary courses is that they bring together opinions of different stakeholders. The format also fosters implementation of real applications

		and exposure to specialists from diverse fields. Interviewee 8 was a proponent of multidisciplinary student project teams and the corresponding cooperation among the departments: "Ideally, our student project teams would be multidisciplinary, meaning that there would be students from other schools and from other departments."
4. interim projects integrated into the courses	Smaller scale projects throughout the studies that follow the format of Capstone projects	The respondents believed that it does not suffice to have one big project in a capstone course, but it is beneficial to implement smaller projects throughout the studies to practice the skills on a smaller scale, for example by creating and implementing the idea of an application, as suggested by interviewee 3: "We are currently teaching algorithms, we are teaching Java. But there should be a project, so that they start with an idea and then as a result they have on their cell phone or on their computer an application that they can give to someone else… with an installation package and all that kinds of needs."
5. Additional courses	Electives from other departments' course offerings	Two respondents concentrated on this format. Interviewee 4 approached it from the point of view of the software testing courses, emphasising that courses in the fields of psychology, media literacy, and communication science should be taken as electives, without integrating them directly into the curriculum to avoid diluting it too much. Interviewee 3 saw a need for the students to take the courses from the School of Economics, and commented that he recommends the students taking his Master's level course to take a minor subject in medical science, psychology, or sociology.
6. Cooperation with the industry partners	Courses involving guest lecturers from the industry	Interviewee 5 spoke about involving industry expertise and integrating it into the content of the courses, especially the one dealing with web programming: "The Web and Mobile Programming course – we are negotiating with some companies, they are also going to teach some parts of this course, so it also depends on what kinds of skills they deem important, we are going to revise this course based on that."

7. Study module	Module within the existing disciplines	Interviewee 5 shared that if he were to build a new module to meet the demands of digitalization trend, he would include the topics of distributed systems and usability, as a course on that topic is currently not available. He saw the module as being less technical than the User Interfaces course, with usability aspects and psychological sides of user experience incorporated: "…(I would include) something about distributed systems, something about usability, something about what is the digitalization trend, what it means, what are the demands, and also some practical exercise projects, get the students involved in real-world projects so that the industry is involved."
8. New course	Separate course on UX	A separate course on user experience was proposed by 2 respondents. Interviewee 6 pointed out that a usability course is missing from the curriculum: "There used to be a course about usability, not only graphical user interfaces, but usability in general. That was given by the Information Systems, that was not part of our department, it was part of the Business School, and that course was dropped down from the programme about 5 years ago. That is something that in my opinion should be taken back, maybe in a modernized form, but that is something that is missing if we think about software engineering." Participant 7 envisioned an experimental course, which would involve practicing new ways of implementing the technological solutions: "If we have this module that covered all kinds of things, it could be an experimental course, students experimenting with new platforms, new input and output devices, maybe new ways of interacting with the systems…"
9. Case studies	Cases on implementation of digitalization projects	Case studies of implementing a digital strategy were brought up by interviewee 8, who suggested to include into every course that teaches theoretical platforms and backgrounds, for example machine learning, a sample of digitalization projects. These would be real-life examples of software, built by someone recognized by the teacher, showcased and linked to the theoretical

		courses. In his opinion, "If you know the algorithm very well, but you don't communicate any case where it's applied in a powerful way, then you are basically teaching the theory of walking… It could be guest lecturers… The only ones who know what has been done are those who have done it, who communicate it on the academic arenas or in other ways… I would enrich many of the theoretical courses with these cases."

Various formats for implementing changes to the curriculum were mentioned by the interviewees. Of these, inter-departmental cooperation programmes were discussed by 5 participants, who accentuated that the approach is relevant in teaching user experience, which combines knowledge from a variety of disciplines. This format was also seen as a way of overcoming the homogeneity of students and of honing the skills in communication with non-developers. Involvement in real-life projects that are not made up for the course, exposure to specialists in diverse fields, and considering the views of various stakeholders were also mentioned as benefits.

Three interviewees supported the approach of working in small groups, pointing out that it creates the context for learning by doing, which is indispensable for teaching software development, as it resembles a handicraft. Exercises in small groups were suggested as venues for integrating the content from business, design, and art curricula.

Two respondents spoke about additional courses taken from the relevant departments, e.g. in psychology, media literacy, and communication science. One of them recommended his students to take a minor in psychology, sociology, or medical science concurrently with his course.

A separate course on user experience was also proposed by two interlocutors. In particular, it was mentioned that the course would need to follow an experimental format, with the students trying out new platforms, new input and output devices, and new ways of interacting with the system.

Other mentioned approaches to integrating UX into the curriculum included a practice-oriented collaboration course aimed at incorporating design and art into the taught content through partnerships with design schools and programmes; interim projects following the format of the capstone exercise, but on a smaller scale, interspersed throughout the study programmes; involving partners from the industry to teach portions of the courses; a new study module that would focus on usability, and case studies highlighting examples of digitalization projects, in which an implemented algorithm helped achieve a business goal.

The suggested cooperation course centers on the idea of partnership with the programmes that profoundly study various topics in the area of design. The smaller projects replicating the capstone activity would concentrate on creating and implementing an idea for an application, following the product life cycle through to having a complete piece of software with an installation package ready to be disseminated. Involving industry expertise was mentioned as a means of getting exposure to real-life projects. The new study module was envisioned to incorporate psychological aspects of user experience. Finally, digitalization case studies showcasing implementation of digital technology at the core of a business model were suggested to be included into every theoretical course, so that they illustrate instances of applying an algorithm to serve a business goal.

5 Discussion

The structure of the present chapter comprises several parts. First, the most prominent findings from the interviews are discussed and reflected upon taking into account the literature examples to identify implications for the practice of teaching UX, interaction design, and human-computer interaction. Second, answers to the research questions are provided, which includes recommendations for revising the curricula in the fields of UX and IxD by the universities with technological profile similar to the case institution, the University of Turku. Finally, directions of future research are proposed, including questions that are suggested to be discussed during larger-scale structured interviews or during focus groups building on the findings of the present round of interviews.

5.1 Main findings from the interviews

The aim of the present study is to close the gap in the literature, in which there is a lack of systemic research and practical recommendations regarding innovating university courses in user experience, human-computer interaction, and interaction design in response to the demands of the digitalization trend. The thesis, in particular, seeks to develop a set of recommendations for the university professionals who face the challenge of updating the content of the pertinent courses, based on the analysis of the empirical data (in-depth interviews with the faculty) and the outcomes of the literature review.

The key findings from the interviews were as follows. There was a consensus among the respondents regarding the need to include user experience, user-centred design, and usability among the topics covered by the courses or as a separate course. Six out of eight interviewees ranked user experience among the three skills that the students are likely to apply in the workplace immediately after graduation, on a par with technical skills and team management. User experience was mentioned by three participants in response to the question about the new skills demanded by the job market. Three interviewees also named user experience among the topics to be included into the content of a new module that would take into account the demands of the digitalization trend.

This finding is in line with the literature on the best practices in teaching user experience. Thus, usability is in focus in two introductory courses in HCI at the University of Twente, described by Koppelman and van Dijk (2006), that accentuate incorporation of the roles of clients and users in projects. The focus is on introducing to the basic concepts in human-computer interaction while concentrating on interaction design with a user-centred approach. The students develop an understanding of the users while building a system and evaluating prototypes with users. The first step to this end is to develop a user profile and a task model based on questionnaires, interviews with users, and observation as the users perform their tasks. Then, a conceptual model and a low-fidelity prototype are designed. Finally, the specifics of the system are determined, resulting in a high-fidelity prototype, which is tested with the users. The student teams interact with the users at the stages of user analysis, conceptual design usability testing, and high-fidelity prototype testing.

As another example with which the findings resonate, in an HCI course taught at Stanford University and discussed in Hartfield *et al.* (1992), the students analyse a work environment, design and implement a prototype of a user interface, and evaluate the prototype with clients. The importance of communicating with the potential users of the prototype is highlighted throughout the course, while a participatory design approach is applied, whereby the characteristics of the system that is being developed emerge from the interactions, communication, and negotiation between the designers and the users.

Finally, a user-centred approach is implemented in both the original and overhauled course in human-computer interaction and usable systems at Linköpings Universitet discussed in Aberg (2010). The course was redesigned based on the focus groups with the students to overcome low evaluations. In both phases, user-centricity was the key consideration. In the initial course, the students redesigned an interactive system employing the user-centred approach, applying techniques like paper prototyping, contextual inquiry, interviewing, and user evaluations. In the reformatted course, several exercises with accent on user-centricity were performed. They included assessing the current prototype of an

interactive system (a desktop application), employing heuristic evaluation or usability testing, and implementing a usable high-fidelity prototype.

A surprising result of the interviews was that the respondents failed to name the foreign universities hosting programmes which might be viewed as examples of the best practices to adopt. However, they mentioned advanced techniques for teaching UX and interaction design implemented by the universities worldwide, among them the flipped (or, inverted) classroom model. A case of implementing a flipped classroom is described in Albert and Beatty (2014), who discuss applying it to reformat a course in introduction to management at San Francisco State University. The authors emphasise that it is the way the videos watched prior to class are integrated with active learning pedagogies that determines the success of the model.

The question about possibilities of integrating the content in the fields of business and marketing divided the respondents. Four of them advocated for including the topics, while four did not see ways of merging the content. An example of integrating entrepreneurship into the computing curriculum is given in Zaina and Álvaro (2015). They propose a methodology for conducting HCI and Entrepreneurship courses in parallel. Put forth by the authors is the Design for User-Centred Innovation (DUCI) approach, which allows to integrate concepts from both fields when implementing software projects, aiming to facilitate conception of new ideas concerning the business and the user's needs. Zaina and Álvaro suggest that lectures in business and entrepreneurship should complement the lectures in computing, as is the case in the curricula of the leading universities worldwide. The DUCI approach is based on the observation that the models of the user-centred design and Lean Startup intersect, and it is possible for the UCD methods and tools to contribute to the evolution of the Lean Startup process. DUCI motivates the development of skills for entrepreneurship in the software development area, which guides the creation of new products based on the end user's real needs by the development of practical projects.

A significant finding from the interview responses is that team management and teamwork skills were ranked high by the respondents. Teamwork was highlighted by 7 interviewees as a crucial professional skill that the graduates should possess,

alongside technical skills, also chosen by 7 participants. Besides, teamwork was mentioned as a new skill related to user experience and HCI demanded by the market: the respondents elaborated that it no longer suffices to possess domain knowledge, but programmers are thrown out of companies if they do not have the team skills, or are not fit for working with teams.

An implication of this result is that group projects emphasising teamwork should be included into the content of the courses in user experience that are being redesigned.

Another conclusion from the interview data is that interaction design was cited by 4 participants as a crucial professional skill. This implies that the theme should be incorporated into the curricula.

An interesting finding was that familiarity with new platforms for software development was mentioned among the new skills demanded by the job market. Three participants were convinced about its topicality. The theme also came up in the responses to the question about the best practices in teaching UX implemented by the universities worldwide, mentioned by 2 participants. Therefore, new platforms need to be taught as part of the refactored courses.

As far as best practices are concerned, although the respondents failed to name the exact programmes that might serve as sources for redesigning the course offering, they mentioned the following approaches and techniques: intensive programmes that concentrate on user interaction and graphical design, working in small groups, MOOCs and lecture videos (the so-called “inverted classroom”), software testing with actual users, and practical works. The conclusion from these findings is that active learning pedagogies should be applied in the redesigned courses.

Six respondents viewed inter-departmental programmes as being beneficial and applicable especially to the field of UX, which is multidisciplinary. The approach brings a number of advantages to teaching UX and interaction design, including cooperation with diverse partners, fostering communication skills with non-developers, real-life exercise projects, and exposure to the various stakeholders’ viewpoints in the process, so it should be applied when redesigning the courses.

The following composition of the module to be created to respond to the digitalization demands was suggested: user experience skills (3 respondents), graphical skills, cooperation within cross-discipline teams, usability testing with actual users, distributed systems, web programming, and various aspects of digitalization (1 respondent each). These findings indicate that this combination of skills needs to be implemented so that the courses keep abreast of the digitalization requirements.

The question about integrating fragments of curricula in the fields of business and marketing was answered in the positive by 4 respondents, who saw ways of incorporating the topics into the content of the current courses. They cited arguments like the necessity to think about monetization already at the development stage, and the need for the students to understand how much they are generating costs and what they are bringing in. The suggested formats were a course in software business and business cases, in which design and art would meet the engineering design.

It was found that all the respondents support the idea of including fragments of the curricula in the fields of design and art. They were thought of as pertinent, for example, in game design, game testing, user interface design, and the broader process of system implementation.

Psychology was viewed as a field to adopt topics from by six interlocutors, who highlighted it as an area from which human-computer interaction draws extensively.

The findings also indicate that portions of the curriculum in communication science seemed pertinent to four respondents. Two participants spoke about the need to include content from information studies.

The participants were unanimous about a possibility to combine topics in technology, business, design and art in the content of the courses they are teaching, but differed as to the techniques of making such additions. Four of them accentuated technology, design and art and deemed business to be less relevant, while another four advocated for including business topics.

The implication of these findings for updating the curricula is that the combination of topics from technology, business, design, and art is pertinent to be included as part of the study programmes.

From the author's standpoint, an important finding from the interviews was the suggestion to include case studies in various aspects of digitalization into the contents of the theoretical software engineering courses. Although this opinion was not based on a broad consensus, this approach is in line with the literature on the advanced methods of teaching UX and HCI, and resonates, for example, with Zaina and Ȧlvaro's (2015) methodology for conducting entrepreneurship and human-computer interaction courses in parallel. This innovation puts digitalization into the spotlight for software engineering professionals and helps acquire a practical perspective on how an implemented software allows to achieve a business need and innovate a business model.

Another conclusion that is significant in the author's opinion and corroborated by the literature review is that psychology was viewed by the majority of respondents as an important field from which content should be adopted. In a similar vein, Churchill *et al*. (2013) write that cognitive science, design, and philosophy are all subjects that are indispensable for the content of user experience courses, while Sundblad *et al.* (2006) propose a project course on User Oriented Interaction Design, which combines guest lectures by specialists in areas like industrial design, psychology, anthropology, ethnology, human-computer interaction, computer science, and cinema studies.

A multi-disciplinary approach to teaching UX and HCI was mentioned by the majority of the participants, who commented on the various configurations of integrating technology, business, design and art as part of the courses. This finding from the interviews invokes Hartson (1998), who writes that HCI draws on fields that include human factors, ergonomics, cognitive psychology, behavioural psychology and psychometrics, systems engineering, and computer science. Further, in Churchill *et al*. (2013), respondents in a global survey agreed that accessibility, teamwork, social computing, social media, and ubiquitous computing are the core topics in HCI, while Agile and iterative design is the crucial method. As pointed out in the literature, UX and HCI are multidisciplinary in their

implementation, a view supported by the interview participants, who proposed various ways of combining the four components as part of the discipline.

5.2 Answers to the research questions. Recommendations as to UX curriculum redesign

Based on the analysis of the interview data and the literature review, it is now possible to answer the research questions. The first question is "what topics are indispensable to be included in user experience courses?" The reply is based on the answers to questions 2 and 3 of the interview guide. The topics can be divided into those pertaining to "hard" and "soft" skills and vary from ensuring the best user experience, interaction design, new platforms for software development, full stack development and software testing to team management, project management, presentation skills, academic writing, business skills, and change management.

The reply to research question 2, "what approaches to teaching UX programmes can be borrowed from the experience of the universities worldwide?" is derived from the interview question 4. The range of techniques to be adopted includes working with new devices and platforms, intensive programmes that concentrate on user interaction and graphical design, working in small groups, MOOCs, lecture videos (the so-called "inverted classroom"), software testing with actual users, and practical works.

Interview questions 7-9 shed light on the 3rd research question, "how can different elements of the curricula in the fields of business and marketing, design, art, information and knowledge management, information behaviour, psychology, and communication studies be incorporated to support the development of UX programmes?" The responses suggest that topics from design and art are to be incorporated in the first place, followed by fragments of the curricula in the fields of psychology, business and marketing, communication science, and information studies.

The 4th research question is "what recommendations can be made for developing content of the courses in UX/HCI for the universities with technological profile,

based on the experience of the Department of Future Technologies at the University of Turku?" The following guidelines can be proposed:

1. make sure that the changes suggested for implementation are motivated: it is worthwhile to determine the skills that are in demand in the job market, as well as new tendencies regarding the skillsets, and to base the alterations to the curriculum on these indicators;

2. ensure experiential learning opportunities: for the redesigned courses to be effective, active learning in the format of projects and small group assignments should be pursued alongside lectures and assigned readings;

3. consider using advanced teaching techniques like the flipped classroom. The essence of the model is making lecture material available to the students in the format of videos prior to the class sessions, which are devoted to concept application activities. There are a number of characteristics common to the flipped classrooms: the educational process transforms students from passive to active learners; technology facilitates the approach; class time and homework time are inverted so that homework is done first; content is given real-world context, and class activities engage students in higher orders of critical thinking and problem-solving, or help them grasp particularly challenging concepts (Albert and Beatty, 2014);

4. create opportunities for mastering soft skills: in the course of the interviews, communication and presentation skills were mentioned as being equivalent to the technical skills, and sometimes even prevalent to them;

5. pay attention to usability testing in the real-world context: usability testing with end-users should be sought after;

6. involve industry expertise; industry representatives can be invited as guest speakers, and provide real-world software development assignments;

7. overcome classroom homogeneity: multidisciplinary student teams provide exposure to working with specialists from diverse backgrounds and opportunities for communication between developers and non-developers, which are crucial for the would-be work environment;

8. decide on the model for integrating new types of content: for example, collaboration with programmes specialising in graphic and interaction design was suggested in the case of the Department of Future Technologies as a way of incorporating the topics from design and art, while business and marketing content was proposed to be integrated via additional disciplines from the pertinent departments or in the format of case studies highlighting digitalization examples;

9. encourage development of skills needed to cope with the ever-changing environment: with the new tools and technologies becoming available daily, it is indispensable to be able to anticipate change and adapt to it, making the innovations part of the skillset;

10. provide opportunities for practicing teamwork skills: teamwork has risen to a very high level among the skills demanded in the workplace during the last years, where it is prevalent to programming and other professional skills, therefore, it should be honed in the classroom;

11. concentrate on new technologies, platforms, and user interfaces: touch screens and virtual and augmented reality glasses are part of the software development process, and should be addressed in the curriculum;

12. pursue the benefits of inter-departmental programmes, which are especially pertinent in the case of user experience and human-computer interaction as multidisciplinary fields drawing on design, psychology, ergonomics, management science, and business. Inter-departmental cooperation is a means of practicing software development in real-life projects within teams mingling a variety of expertise areas;

13. take into account that the area of focus shifts from software development to business and marketing expertise as the students move closer to graduation: initially, the concentration is on technological skills, complemented with art and design, while with time business topics become more prominent;

14. ensure that user-centricity is a run-through theme throughout the projects implementation: the students should be prompted to concentrate on an average end-user while developing the software.

5.3 Future research directions

Future research should concentrate on the separate themes that emerged from the interviews and explore them in greater depth and detail.

For example, ways of teaching user experience, usability, and user-centred design were a common theme highlighted by the participants, and should be examined separately to find out how the topics can be made prominent in the curricula, what teaching methodologies are pertinent, how active learning can be applied to facilitate the acquisition of the corresponding skills, how to integrate the themes into the content of the existing courses or how to present them in a dedicated course, how to develop practical assignments that would train the skills, and how to keep up with the rapidly developing subjects. In order to answer these questions, a focus group approach can be employed. Group interaction is likely to elicit a variety of viewpoints and insights regarding the best way of reflecting UX and usability topics in the curricula.

Another theme that merits additional attention, and should be researched in focus group format, are various methodologies of teaching UX implemented by the universities worldwide. It is not clear from the present findings, for example, how the models of intensive programmes that concentrate on user interaction and graphical design can be followed within the existing curricula. Working in small groups, another international best practice, is already part of the course set-up, but further investigation of how it can be applied more intensively and on a larger scale is critical. The possibilities of MOOCs and inverted classroom are not self-evident from the data collected and need to be analysed further, as a separate interview or focus group topic. The best way of incorporating software testing with actual users into the content of the courses deserves a more in-depth analysis as well. Finally, practical works were a topic that was mentioned among the international best practices, but needs to be studied via a devoted in-depth interview or focus group.

Because the respondents were divided in answering the question about integrating the content from the fields of business and marketing, the controversies should be explored further. A focus group should be held to include respondents that favour

and disagree with the approach, to identify the arguments put forth by the opponents in greater detail than this was possible during the original interviews. A topic that could be discussed during the focus group are the examples of integrating business and marketing content by various universities, for instance the case of conducting HCI and Entrepreneurship courses in parallel at the Federal University of São Carlos presented in Zaina and Ȧlvaro (2015).

Ways of teaching teamwork skills should also be explored further as part of the focus groups or larger-scale structured interviews, as they were ranked very high by the participants answering the questions about the crucial skills demanded from the graduates and the new skills required by the job market. The questions for further research are how to adjust the curricula so that teamwork is practiced even more intensively than it currently is, in what formats to practice the skill, and how to balance this "soft skill" with the technical ones that are being taught.

The present interviews did not aim to look in-depth at how familiarity with new platforms for software development should be acquired, but this topic can be raised during further studies in focus groups. The questions to be addressed are the new possibilities that innovative platforms present to the software developers, how users interact with the new user interfaces, and how this should be reflected in the curriculum.

Another topic to be discussed in focus groups or expanded interviews is how to realize the benefits of inter-departmental programmes. The approach seems appealing to a large number of interviewees, but the concrete mechanisms of organizing inter-disciplinary studies are outside the scope of the conducted interviews. It should be clarified in further research how to establish inter-departmental cooperation, what units should be involved, how smooth interaction among them can be organized, how the taught content should be divided among the participating departments, how to achieve a holistic programme taught by the partnering departments, so that the curriculum is not a compilation of disparate modules, but a monolithic whole, and how to deliver value via the combined curriculum so that students benefit from the integrated courses.

Only one question of the interview guide concerned the impact of digitalization on the UX curriculum, asking about the composition of the module to be designed in response to digitalization demands. However, the implications of digitalization for the curricula should be a topic of a broader discussion, that would focus on how teaching methods and content of the courses should be adjusted to take the tendency into account. Further exploration of the content of the envisioned module is also necessary. The composition of the module proposed as part of the conducted interviews (user experience skills, graphical skills, cooperation within cross-discipline teams, usability testing with actual users, distributed systems, web programming, and various aspects of digitalization) should also be studied in greater detail to elucidate the types of learning activities and outcomes that are expected from such module, the relative weight of the different topics suggested by the interviewees, and the ways of seamlessly integrating the content so that the module is holistic, and not an arbitrary combination of the various disconnected topics.

Although the interview findings demonstrated a consensus as to the necessity to integrate fragments of the curricula in the fields of design and art, this topic deserves further attention. A focus group could be devoted to soliciting the views on how to merge the content, what disciplines are candidates for such additions, or how to teach these topics in parallel with the computing courses, what considerations need to be taken into account for this combination to be beneficial, how the synergy can be achieved in practice, and how to overcome artificially adding portions of the course content, so that a holistic programme emerges.

One more topic on which there was a near unanimity among the respondents is the desirability of integrating topics from psychology into the UX programmes. The topics outside the scope of the present study are how to review the corresponding courses to make the adjustment, how to introduce the psychological content, and how to make the transitions between the core course and the additions smooth. The same concerns adding content in the fields of communication science and information studies, which was proposed by the respondents. It is not evident from the results of the interviews which topics from communication science and information studies are deemed important to be included, how they should be

introduced, in what format and to what extent, and what the resulting courses should look like in terms of learning activities, learning outcomes, and key modules.

The interviewees also consented that the approach for integrating technology, business, art, and design is pertinent to the disciplines they teach, differing as to the specifics, that is, on whether accent should be placed on technology, art and design, or on business aspects. Just like the impact of digitalization, the topic is broad and deserves a separate in-depth study. It should be investigated in what proportions each of the four proposed components should be represented, in what formats content from the different disciplines should be incorporated, how to balance the various topics, and how to achieve a holistic study programme, which would not be composed of the disparate fragments, but provide a smooth learning experience to the students.

6 References

Aberg, J. (2010). Challenges with teaching HCI early to computer students. *Proceedings of the 15th Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE'10)*, June 26-30, Bilkent, Ankara, Turkey.

Adcroft, A., Bruns, A., Guercini, S., Murphy, P. and Weller, K. (2014). *New qualitative research methodologies in management*. Bradford: Emerald Group Publishing Limited.

Albert, M. and Beatty, B.J. (2014). Flipping the classroom applications to curriculum redesign for an Introduction to Management Course: Impact on grades. *Journal of Education for Business*, 89, 419-424.

Alonso-Ríos, D., Vázquez-García, A., Mosqueira-Rey, E., Moret-Bonillo, V. (2009). Usability: a critical analysis and a taxonomy. *International Journal of Human-Computer Interaction*, December, 26(1), 53-74.

Altay, B. (2014). User-centered design through learner-centered instruction. *Teaching in Higher Education,* 19(2), 138-155.

Alvesson, M. (2010). *Interpreting Interviews*. London: SAGE Publications.

Bestavros, A., Lapets, A., and Varia, M. (2017). User-centric distributed solutions for privacy-preserving analytics. *Communications Of The ACM,* Feb., 60(2), 37-39.

Bloom, B. S. (1956). *Taxonomy of educational objectives, handbook I: The cognitive domain*. New York, NY: David McKay.

Bonoma, T.V. (1985). Case research in marketing: opportunities, problems and a process. *Journal of Marketing Research*, 22 (2), 199-208.

Borriello, G. (2000). Capstone design at the University of Washington: User interfaces for portable devices. *CHI 2000*, 1-6 April, 30-31.

Brenner, W., Osterle, H., Petrie, C., Uebernickel, F., Winter, R., Karagiannis, D., Kolbe, L., Kruger, J., Plattner, H., Leifer, L., Lamberti, Hj., Leimeister, Jm., Schwabe, G., and Zarnekow, R. (2014). User, use & utility research: the digital user as new design perspective in business and information systems engineering. *Business Information Systems Engineering*, 6(1), 55–61.

Brown, C. and Pastel, R. (2009). Combining distinct graduate and undergraduate HCI courses: An experiential and interactive approach. *SIGCSE Bulletin Inroads*, 41(1), 392-396.

Bryman, A. and Bell, E. (2011). *Business research methods* (3rd ed.). Oxford: Oxford University Press.

Chandor, A., Graham, J., and Williamson, R. (1985). The penguin dictionary of computers (3rd ed.). London: Penguin.

Cheng, D-Y., Chao, K-M., Lo, C-C. and Tsai, C-F. (2011). A user centric service-oriented modeling approach, *World Wide Web*, 14(4), 431-459.

Churchill, E., Bowser, A. and Preece, J. (2013). Teaching and learning human-computer interaction: past, present, and future. *Interactions*, 01 March, 20(2), 44-53.

Cliburn, D. (2017). An interdisciplinary course on human-computer interaction. *JCSC*, 33(2), December, 38-45.

Cooke, L., Mings, S. (2005). Connecting usability education and research with industry needs and practices, *IEEE Trans. Prof. Commun.*, 48(3), 296-312.

Corrigan, M. and Miller, H. G. (2011). Toward a user-centric digital ecosystem. *IT Professional,* July-Aug., 13(4), 12-15.

Costa, C. (2014). User centric media research challenges. *Multimedia Tools and Applications*, 70(1), 263-265.

Dabrowski, M. and Acton, T. (2013). The performance of recommender systems in online shopping: a user-centric study. *Expert Systems with Applications*, October, 40(14), 5551-5562.

Denzin, N. K., and Lincoln, Y. S. (2005). *The Sage handbook of qualitative research* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Dijiang, H., Tianyi, X., Huijun, W. (2013). Mobile cloud computing service models: a user-centric approach. *IEEE Network*, September-October, 27(5), 6-11.

Drab-Hudson, D., Whisenhunt, B.L., Shoptaugh, C.F., Newman, M.C., Rost, A., and Fondren-Happel, R.N. (2012). Transforming Introductory Psychology: A systematic approach to course redesign. *Psychology Learning and Teaching*, 11(2), 146-157.

Faiola, A., Matei, S. A. (2010). Enhancing human-computer interaction design education: teaching affordance design for emerging mobile devices. *International Journal of Technology and Design Education*, 20(3), 239-254.

Flick, U. (2008). *Designing Qualitative Research*. London: Sage Publications Ltd.

Fontana, A. and Prokos, A. H. (2007). *The Interview: From Formal to Postmodern*. Left Coast Press, Inc.

https://www.gartner.com/it-glossary/digitalization/, retrieved January 23, 2018.

Getto, G. and Beecher, F. (2016). Toward a model of UX education: training UX designers within the academy. *IEEE Transactions on Professional Communication*, June, 59(2), 153-164.

Glaser, B., and Strauss, A. (1967). *The discovery of grounded theory*. Chicago: Aldine.

Gubrium, J. F. and Holstein, J. A. (2001). *Handbook of interview research: Context and method*. SAGE Publications Inc.

Gulliksen, J., Göransson, B., Boivie, I., Blomkvist, S., Persson, J., Cajander, Å. (2003). Key principles for user-centred systems design. *Behaviour and Information Technology*, November, 22(6), 397-409.

Gummesson, E. (2006). Qualitative research in management: Addressing complexity, context and persona. *Management Decision*, 44 (2), 167-179.

Harden, G., Crocker, R.M. and Noe, K. (2018). Introductory information systems course redesign: Better preparing business students. *Journal of Information Technology Education: Innovations in Practice*, 17, 113-126.

Hartfield, B., Winograd, T. and Bennett, J. (1992). Learning HCI design: Mentoring project groups in a course on human-computer interaction. *ACM SIGCSE Bulletin*, 24(1), 246-251.

Hartson, H.R. Human-computer interaction: Interdisciplinary roots and trends. (1998). *Journal of Systems and Software*, November, 43(2), 103-118.

Hertzum, M., Clemmensen, T. (2012). How do usability professionals construe usability? *International Journal of Human-Computer Studies*, January, 70(1), 26-42.

Hienerth, C., Keinz, P., and Lettl, C. (2011). Exploring the nature and implementation process of user-centric business models. *Long Range Planning*, 44(5), 344-374.

Holstein, J. F. and Gubrium, J. A. (2011). *The active interview*. Thousand Oaks: Sage Publications.

Huang, S. and Shiu, J.– H. (2012). A User-centric adaptive learning system for e-learning 2.0. *Educational Technology and Society* 2012, 15(3), 214-225.

Kaila, E., Kurvinen, E., Lokkila, E., and Laakso, M.-J. (2016). Redesigning an object-oriented programming course. *ACM Transactions on Computing Education,* 16, 4, August, 18-39.

Koppelman, H. and van Dijk, B. (2006). Creating a realistic context for team projects in HCI. *ACM SIGCSE Bulletin*, 38(3), 58.

Koutsabasis, P. and Vosinakis, S. (2012). Rethinking HCI education for design: Problem-based learning and virtual worlds at an HCI design studio. *International Journal of Human-Computer Interaction,* August, 28(8), 485-499.

Kvale, S. (2007). *Doing interviews*. Sage Publications.

Liamputtong, P. (2013). *Qualitative research methods* (4th ed.). South Melbourne: Oxford University Press.

Ludi, S. (2005). Providing students with usability testing experience: Bringing home the lesson "the user is not like you." In *Proceedings of Frontiers in Education 35th Annual Conference*, T3G.

Maccoby, E. E., and Maccoby, N. (1954). The interview: A tool of social science. In G. Lindzey (Ed.), *Handbook of social psychology* (449–487). Reading, MA: Addison-Wesley.

Madge, J. (1965). *The tools of social science*. Garden City, NY: Anchor.

Miles, M.B. and Huberman, A.M. (1994). *Qualitative data analysis: An expanded sourcebook*. Newbury Park, CA: Sage.

Mintzberg, H. (1979). An emerging strategy of 'direct' research. *Administrative Science Quarterly*. 24 (4), 582-589.

Monserrat, J., Alepuz, I., Cabrejas, J., Osa, V., López, J., García, R., Domenech, M., and Soler, V. (2016). Towards user-centric operation in 5G networks. *EURASIP Journal on Wireless Communications and Networking*, 1, 1-7.

Moser, C. A. (1958). *Survey methods in social investigation*. London: Heinemann.

Mosley, L. (2013). *Interview research in political science*. Ithaca and London: Cornell University Press.

Mulder, I. (2015). A pedagogical framework and a transdisciplinary design approach to innovate HCI education. *Interaction Design and Architecture(s) Journal - IxD&A*, 27, 115-128.

Parida, V. (2018). Digitalization. In Frishammar, J., Ericson, Å. (Eds.), *Addressing societal challenges*. Luleå University of Technology, 23-38.

Parviainen, P., Tihinen, M., Kääriäinen, J., Teppola, S. (2017). Tackling the digitalization challenge: how to benefit from digitalization in practice. *International Journal of Information Systems and Project Management*, January, 5(1), 63-77.

Patton, J. (2007). Understanding user centricity. *IEEE Software*, Nov. - Dec., 24(6).

Porter, M. E., and Heppelmann, J. E. (2014). How smart, connected products are transforming competition. *Harvard Business Review*, 92(11), 64–88.

Preece, J., Keller, L. (1991). Teaching the practitioners: developing a distance learning postgraduate HCI course. *Interacting with Computers*, 3(1), 92-118.

Robson, C. (2002). *Real world research: A resource for social scientists and practitioner-researchers.* 2nd edition. Blackwell Publishing.

Seale, C. (2004). *Qualitative research practice*. London: Sage Publications.

Shumba, R. (2006). The development of a Human Computer Interaction course at a senior synthesis course. *ACM SIGCSE Bulletin*, 38(2), June, 102-104.

Silverman, D. (2014). *Interpreting qualitative data.* 5th edition. Sage Publications.

Sousa Santos, B. (2006). An introductory course on human-computer interaction: Programme, bibliography, practical classes and assignments. *Computers and Graphics*, 30, 658-668.

Spradley, J. P. (1979). *The ethnographic interview*. New York: Holt, Rinehart & Winston.

Sundblad, Y., Winberg, F., Westerlund, B., and Lantz, A. (2006). User oriented cooperative interaction design: A multidisciplinary project course. In: *Proceedings of HCI Educators Workshop - Inventivity: Teaching Theory, Design and Innovation in HCI*, 81-84.

Talone, A., Basavaraj, P., and Wisniewski, P.J. (2017). Enhancing human-computer interaction and user experience education through a hybrid approach to experiential learning. *SIGITE'17*, October 4-7, Rochester, NY, USA, 83-88.

Thiétart, R. *et al.* (2001). *Doing management research: A comprehensive guide*. London: Sage.

Woodside, A.G. (2010). *Case study research: Theory, methods and practice*. Bingley: Emerald Group Publishing.

Yazidi, A., Granmo, O-C., Oommen, B., Gerdes, M. and Reichert, F. (2011). A User-centric approach for personalized service provisioning in pervasive environments. *Wireless Personal Communications*, 61(3), 543-566.

Yelmo, J.C., del Álamo, J.M., Trapero, R. and Martín, Y.-S. (2011). A user-centric approach to service creation and delivery over next generation networks. *Computer Communications*, 34(2), February, 209-222.

Zaina, L. and Ἀlvaro, A. (2015). A design methodology for user-centered innovation in the software development area. *The Journal of Systems and Software*, 110, 155-177.

7 Appendices

Appendix 1. Protocol of in-depth personal interviews with the faculty of the Department of Future Technologies, University of Turku

1. What disciplines pertaining to UX/ HCI/ interaction design are you responsible for, and how long have you been teaching each of them?

2. In each of your subjects, what are the three crucial skills that the students are most likely to apply in their practice immediately after graduation?

3. While you were teaching the subject(s), has the job market generated demand for new skills that are now indispensable for the specialists in UX/ HCI? If so, what are those?

4. If you were revising the content of the courses related to UX currently offered by the University of Turku, what new approaches and methodologies of teaching these disciplines employed by other universities in Finland and abroad would you implement in the first place?

5. Considering the current demands of the job market, do you see benefits for the graduates of the programmes in UX/ HCI that are jointly offered by several departments, e.g. schools of engineering and schools of management? Why or why not?

6. If you were to develop a new module for your discipline that in your opinion would best prepare the graduates to meet the demands of the digitalization trend, which topic(s) would you focus on and why? Please describe the potential content of the module, the type of learning activities, and the expected learning outcomes.

7. Do you see the need to integrate components of the curricula in the fields of business and marketing into the content of the course(s) that you are teaching? How would you implement these adjustments?

8. Do you envision ways of integrating components of the curricula in the fields of design and art into the content of the course(s) that you are teaching? How would you accomplish this?

9. Do you consider that fragments of the curricula in the fields of information studies (e.g., information behaviour, information and knowledge management), psychology, or communication science (e.g., media literacy, social media) need to be incorporated into your current courses? Please describe the changes that you would make in detail.

10. Academic institutions worldwide are currently exploring various models of integrating the curricula pertaining to technology, business, design, and art. In your opinion, is this approach applicable to teaching your course(s)? How would you apply it in developing the content of the discipline?