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Universal Design taught as a part of other courses in higher education

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Preface

This master thesis is based on the Universal Design taught as a part of other courses in higher education within Norway. This study mainly focuses on the concept of Universal Design taught in different higher education institutions (HEI). The study also finds out the perspective of Universal Design in HEI and barriers to introducing Universal Design as a part of other courses. The role of Universal Design of ICT in designing courses and making them accessible is also part of this research study. This thesis has provided me an in-depth understanding of how research is done using a qualitative approach and helped me understand the concept of Universal Design in different subject areas thoroughly.

The research has been possible with the help of several people and institutions. Thank my supervisor, Norun Christine Sanderson, for continuous guidance, support, and suggestions to complete this research. I would also like to thank Universities from Norway for guiding me to find suitable participants for interviews.

Abstract

The concept of Universal Design taught as a part of other courses may be different in various Higher Education Institutions. It is well-established that Universal Design taught as a part of other courses, the perspective of understanding it should be similar across subject areas and courses. The study aims to determine the concept and perspective of understanding Universal Design taught as a part of other courses in Higher Educations. It also finds out the barriers to introducing Universal Design and how Universal Design of ICT helps to make the course accessible.

The qualitative method was the best-fit method for this research. A questionnaire has been chosen to collect data from participants. It also consists of recruiting participants, preparing the questionnaire, connecting with participants, and collecting the data following ethical considerations. Respondents were selected according to the listed participants from different Universities associated with Universal Design. The responses were analysed with Thematic Analysis using a bottom-up approach. While analysing different iterations were done, and finally, four themes were extracted. The results showed some similarities and differences in the concept and perspective of Universal Design in some subject areas. The result also showed possible barriers and solutions applied for those barriers and how the Universal Design of ICT helps make the courses more accessible.

These results suggest that there are differences in understanding perspectives of Universal Design. On this basis, there should be proper measures taken while introducing Universal Design as a part of other courses in Higher Education Institutions.

Contents

List of Acronyms

HEI	Higher Education Institutions
UD	Universal Design
NSD	Norsk Senter for Forskningsdata
CUD	Centre of Universal Design
NCSU	North Carolina State University
WCAG	Web Content Accessibility Guidelines
ICT	Information and Communication Technology
IT	Information Technology
STEM	Science, Technology, Engineering, and Mathematics
AT	Assistive Technologies

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1   Introduction

Universal design, the term can be used as the design of a product which is designed for all. Every product usable for people should be universally designed and accessible for all. Universal Design is the design and composition of an environment to be understood and accessed by the greatest extent of people regardless of age, size, ability, or disability(Design). The design philosophy helps maintain sustainability in society and inclusive where most people can participate to the greatest extent possible. The other terms often used to designate Universal Design are Accessible Design, Designing for accessibility, Inclusive Design(Persson, Åhman, Yngling, & Gulliksen, 2014). Regardless of their different names, the main objective is to make a design accessible and usable for the diverse abilities of users. The final step of formal learning that occurs after secondary education is known as Higher Education. It is a significant level where students can utilize and implement their learnings into product outcomes. Every aspect of Universal Design provided to the student through lectures or optional courses could help design a Universally Designed product.

Suppose the Universal Design principles included in higher education institutions (HEI) may result in a wide variety of features for educational products. The Tomar Resolution from the European Union Committee of Ministers includes introducing the principles of Universal Design into the curriculum of all occupations working in the built environment(Ministers, 2001). This resolution states that Universal Design principles should be included in the curricula using different training or vocational courses, particularly in architects, engineers, and town planners. There are relatively few countries that have made universal design a legal concept(VEGHEIM, 2014). When it comes to legislation, no countries have so far implemented in their legislation anything about including the concept of Universal Design as part of other courses. European Union Directive for the Accessibility of Web and Mobile Applications says that accessibility is a term which should be understood as principles and techniques and should be observed while updating, maintaining, designing, and constructing websites and mobile applications to make the site more accessible for users, especially persons with disabilities(Directive, 2016).

The purpose of this Master's thesis is to investigate how the concept of Universal Design is taught in Higher Education in different institutions. Different people have a different perspective of understanding Universal Design. To make some products universally designed,

the engineers or developers involved in product design must have good knowledge of universal design. This can be achieved by building up a good base about Universal Design from the beginning. The design developed by less experienced people on the concept of Universal Design may lead to the replacement of the system or the design in a short period. Nowadays, most job opportunities in industries also require compulsory knowledge of universal design. For example, software developers with good knowledge of Web Content Accessibility Guidelines are often preferred more in employment opportunities over those with less knowledge. The main factor which was found in the primary research on defining Universal Design and Shaping Universal Design Teaching was the need to state and shape the exact meaning of Universal Design and what exactly teaching Universal Design should involve(TrinityHaus, 2010). The primary focus of this Master's thesis is to find out how the concept of Universal Design is taught in different HEI. Suppose the idea of Universal Design is already implemented. In that case, the research aims to find how the perspective of understanding Universal Design differs in courses within Computer Science. And if the concept is not implemented, then the purpose is to find out the barriers to introducing the concept of Universal Design as a part of other courses.

1.1 Problem Statement

The concept of Universal Design is taught in different parts of other courses in higher education, so understanding the definition of Universal Design may be categorized according to the curriculum of the courses. According to the research, including Universal Design on all levels of programs might be reasonable to the practitioners, but the understanding or the ways of achieving it may not be equally apparent (Christophersen, 2002). There may be several institutions where Universal Design has not been introduced in any courses, and Higher Educations Institutions (HEI) may not know how Universal Design of ICT helps make courses accessible.

The concept of Universal Design should not be understood differently according to the subject areas and courses. While introducing Universal Design in any institution of Higher Education, the faculty member, Co-ordinator or supervisor may face difficulties implementing it in different courses. There may be an issue for users accessing and making the learning material provided in different courses, so this Master's thesis discusses how Universal Design of ICT helps to access the study materials to be more readable and

understandable for every user. Lack of time, feeling of unscientific, too broad, and lack of resources are some of the reasons for not including Universal Design as a part of other courses(Cauwer, Clement, Buelens, & Heylighen, 2009). The problem may exist when the Universal Design course is first introduced in other parts of the courses. The difference in understanding concepts and perspectives may impact society in the upcoming future

The basis of the problem is not having proper knowledge of Universal Design concepts. The way of teaching, using different teaching methods and way of assessing them. Another basis of the problem may be not trying to include Universal Design in any subjects thinking that it is only for the people having disabilities.

1.2   Research Question

The topic itself talks about the broad aspect of Universal Design for Higher Education. There are different subject areas available, so covering all the areas may not be possible in the short time frame. So, according to my subject of interest, I decided to work on the specific subject area, Computer, Architecture, and Engineering. The plan to cover the three subject areas was unsuccessful due to fewer participants, so the area on Computer Science was more prioritized and mainly focused.

This Master's project primarily focuses on answering the given research questions:

1) How is the concept of Universal design taught as part of other courses within Higher Education?
2) How does the concept of the Universal Design perspective differ while taught as part of other courses?
3) What are the barriers to introducing Universal Design as a part of other courses in Higher education?
4) How does the Universal Design of ICT play a role when making courses accessible?

In order to answer research questions, the plan was to collect information on how the concept of Universal Design is taught in different educational institutions with various subject areas. The central theme of this thesis covers the concept, understanding, and perspective of Universal Design taught in Higher Education within Computer courses. This thesis also identifies the barriers of introducing Universal Design and the role of Universal

Design of ICT while making the courses accessible. This may be helpful for institutions trying to include Universal Design as a part of other courses and may help to understand the concept and perspective of Universal Design in different courses.

1.3   Organization of Thesis

The remainder of this thesis is organized as follows. In chapter two, a literature review is presented, covering the areas of Universal Design in Higher Education. The literature review also covers data from other different subject areas such as Computer Science, Engineering, Architecture, Health, and Pedagogy. The information has been collected through journals, articles, and other available resources.

In chapter three, methods are described together with the rationale for the choice of methods for this research. Chapter four presents the results and analysis together with a brief description of the reason behind choosing the Thematic Analysis with a bottom-up approach. This chapter also includes the process followed while doing analysis and the number of iterations to achieve the results finally. Chapter five is about the findings and discussions where the results have been discussed in relation to the research questions. The second last chapter describes the conclusion and future work. The last chapter covers the Appendices with a sample consent form and interview guide.

2   Literature Review

The literature review on different research papers shows that there are a lot of techniques included while implementing Universal Design as a part of other courses. There are other practical and theoretical concepts used to implement the Universal Design concept. Different faculties have their techniques and principles for implementing Universal Design in the courses. This Master Thesis project also targets different institutions that have implemented Universal Design, the way of teaching, and the perspectives of Universal Design according to different subject areas. It also focuses on the barriers to implementing the Universal Design concept as a part of other courses in different institutions, teaching methods of universal design, the effectiveness of Universal Design principles, evaluating the use of design techniques like personas and simulation in various institutions.

Trinity College in Dublin was chosen as a research site to know the history of Universal Design because it contains a wide variety of programs. The representatives from different subject areas, Engineering, Computer Science, School of Business, Occupational Therapy and Physiotherapy, were interviewed (Design). According to the research, every participant in the survey was aware of the concept of Universal Design. Participants accepted that Universal Design should be included in part of other courses because it is essential. The research also showed that introducing Universal Design to curricula will help them to overcome encountering the barriers caused by excluding Universal Design. Encouraging on expanding Universal Design in various other courses was funding, legislation, growing pressure from industry, awareness, collaboration, etc.

Universal Design (UD) is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design regardless of their diverse abilities or status(R. N. C. S. U. Mace). Usable by all people, in definition, defines that everything that is developed should be usable for everyone regardless of some disabilities. Universal design isn't strictly about disability, but it wouldn't exist if disability didn't exist(Pruett, 2017). A product should be accessible for all people in every stage of their life, independent of vision, motor, cognitive, and hearing impairments. Universal design is a set of rules which should be followed by every aspect of the design of products or architectural design and can be used by great variety of people with different diversities.

Centre of Universal Design (CUD) at North Carolina State University (NCSU) has started the widely accepted seven principles of Universal Design(R. L. Mace, 2008). According to the CUD NCSU, the Principles "may be applied to evaluate existing designs, guide the design process and educate both designers and consumers about the characteristics of more usable products and environment." The first principle, Equitable Use, is about the usefulness and ability to be sold or marketed. The second principle, Flexibility in Use, helps to cover a wide range and diverse skills. The third principle, Simple and Intuitive, is about product understandability without user experience and skills. The fifth principle, Perceptible Information, covers the required communication of information despite any ambient environment conditions or the user's sensory abilities. The design should reduce errors and hazards to the minimum and prevent accidental results from unintended actions, as covered by the Tolerance of Error principle. The second last principle, Low Physical Effort, expresses that the users should quickly and efficiently use the product with minimum effort. The final guideline, Size and Space for Approach and Use, states that regardless of different user's body size and posture, the product should be designed to use the product independently of their body size or posture.

These design principles are applied to different aspects virtually and as a theoretical knowledge in which Web Content Accessibility Guidelines (WCAG 2.1) are mainly used as a best practice for web content(w3c, 2018). The guidelines in WCAG are organized into four principles. The first principle, Perceivable, states that the user should be able to perceive the information introduced. The second principle, Operable, deals with the interface components that must be operable and navigable. The third principle, Understandable, talks about the content on the webpage or website should be easily understandable and should not be beyond the user's ability to understand. The last principle, Robust, states that the content should be robust enough that the user agents (i.e., software that the user uses such as browser, Assistive Technologies (AT), Operating System, etc.) can interpret it. Principle 4, therefore, covers backward compatibility of software, including AT, as well as documentation. The content should be accessible, although there is advancement in technologies.

This chapter covers different sections and is organized with different subject areas. The first section, 2.1, discusses UD in Higher Education, second section, 2.2, discusses UD in

Computer Science. The third 2.3 and fourth 2.4 section is about UD in Engineering and UD in Architecture. UD in Health and UD in Pedagogy has been discussed in 2.5 and 2.6 sections. The last section is about UD taught as a part of other courses in Higher Education.

2.1   Universal Design in Higher Education

Every new product is involved in a part of the design at earlier phases. Design has been a part of fulfilling human needs from the very beginning of the human era. The Universal Design principle should be applied to every product or structure from the initial phases. To overcome the upcoming barriers due to less knowledge of UD after completing studies, there should be different Universal design courses that should be integrated and taught in Higher Educations. UD requires considering all characteristics of potential users, including abilities and disabilities, when designing a system or service. Higher education includes the different sectors of courses. E.g., education, health, engineering, computer, architecture, etc.

Nowadays, we mostly find the integration of universal design in the technology education curriculum (Sandnes & Eika, 2017). Students related to engineering and computer science design the system or new product without the proper knowledge of Universal Design, resulting in poorly designed systems. So, to make a product universally designed, the concept of Universal Design should be taught as a part of other courses in Higher Education. The main objective is to accomplish the design for the least common denominator. We can take an example of an online store that is not universally designed, and the unjust or prejudicial treatment of different categories of people can lead the business to loss. This can be improved by making the design accessible for both non impaired and impaired people. For incorporating the Universal Design into the course components in Norway, four models were defined: thematic intro seminars or summer schools, integrated model, module-based, and specialization(EIKA, 2017). Thematic intro seminars are about discussing and exchanging among different faculties of Master's students with organized workshops. Bergen University has been experimenting with these types of workshops for several years. The integral module includes universal design as a part of the course. The Module Based approach deals with the compulsion of universal design courses for students. It gives the student an option to choose the course as compulsory or optional. This module-based approach has been employed at Oslo and Akershus University College of Applied Sciences (Oslomet University)

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with 10 ECTS course in Universal Design for the computer science students, which runs in the third year of the bachelor programs and at the Norwegian University of Science and Technology, Gjøvik campus which offers 15 ECTS online course on Universal Design. The last model is specialization, in which the student can specialize in universal design courses to get in-depth knowledge. Oslo and Akershus University College of Applied Sciences (OsloMet University) developed an international master program for the specialization of Universal Design in ICT(University, 2019).

There are several kinds of evidence-based practices which are related to the application of Universal Design in higher education. In Central New Mexico Community college, a game for the professional development of the Universal Design was introduced to identify barriers to student success and open a dialogue about Universal Design and how it supports student success. The game focuses on an activity teaching teachers to the need for and principles of UD at a community college with a population of non-residential and largely non-traditional students (Langley-Turnbaugh et al.).

Due to the absence of accessibility, ICT systems may create insufficient accessibility competence between designers, developers, and project managers. The solution for this problem is to raise awareness on including the concept of Universal Design in Higher Educations(Nishchyk & Chen, 2018). In this study by Nishchyk & Chen (2018), research was performed with the search engine Oria and the ACM digital library with the help of search strings digital accessibility, accessibility, universal design, inclusive, design for all, course, University, curricula, curriculum, and computer science to find out the practices of including accessibility and Universal Design concepts in the curriculum. The exact search was done with the International Association of Universities unique online reference tool to find out the Universities that include Universal Design as a concept in Computer Science and ICT courses in their curricula using the keywords such as accessibility, universal design, inclusive design, design for all, and Web Content Accessibility Guidelines within Norway. The findings showed that the highest publications that explain integrating Universal Design into Computer Science course were the universities from the USA and Canada (20 out of 26), and only six publications were from Europe. The courses found through different mediums are listed below.

Table 2.1 Courses found through different resources

Courses Found	Courses
Research Network	Universal Design, Accessible Documents, Assistive, Technologies & Accessibility, Accessible Design in ICT, Designing Usable and Accessible Technologies, Ergonomics and Design for All, Design for All
Norwegian Universities	Mobile Media, Social Interaction, Web Technologies, Usability and Human Factors in Interaction Design, Web Design, IT environment and Society, Universal Design of ICT, Web Programming, Universal Design of Interactive Systems, Interaction Styles and Technologies for Accessibility, User Diversity and ICT Barriers, Web Design, Software Testing, Systems Requirements and Consequences, Administrative Informatics, and Information Architecture and Content Management

The most common Universal Design concept was based on Universal Design Principles, Web Accessibility, Usability, Web Content Accessibility Guidelines, National and International Legislation, Universal Design of ICT, etc.

The University of Hawaii has a geographically diverse population where different types of online courses for Universal Design have been introduced (Rao, 2012). Universal Design Principles were taken into account while designing the course. The main focus for this online course was on non-traditional students, which comprise students living far from the main centers and rural sides with different disabilities and those interested in certification and degrees. Lecturers designed the course before knowing the students to be involved. They create different types of universal design elements. The result of the study was quite impressive. The course, which was aligned to Universal Design, was widely accepted by the non-traditional students from rural and remote communities as different course design takes a lot of time and planning, as well as additional effort and resources, are needed for a lecturer to include the concept of Universal Design during the instructional design phase. The paper suggests implementing the Universal Design concept incrementally into the courses rather than defining every Universal Design principle simultaneously, and the better way is to

add few Universal Design strategies every time the course is taught to make a good base for an accessible and adaptable learning environment that can be updated when needed.

A study on how universal design is taught as part of other courses in universities and colleges (TrinityHaus, 2010) found that there were different theoretical and practical ways of teaching Universal Design. Theoretical teaching includes preparing the students from an early stage of their education on product design and the issues of design exclusion. For practical learning focus was on the techniques like interaction with users, personas, and simulation.

Table 2.2 UD related courses and design techniques

Universal Design Related Courses	Human Diversity, recognizing multiple facets of identity, Everyday Living Design, People-environment relationship, Human Abilities, Human dimensions and form, Ergonomics, Human Factors, Anthropometrics
Design Techniques included while teaching Universal Design	Seven Principles of Universal Design, Design by Story Telling, Lifespan Design, Persona, Extreme users, Simulations, User pyramid design approach, Design pattern analysis, Evaluation checklists, Post-design evaluation, User engagement for which Interviews and Focus groups were specific practice, Rehabilitation design for specific barriers or impairments

There are three different methods of including Universal Design into the design curriculum that has been described such as infusing Universal Design into an existing course, infusing Universal Design into a studio problem, and infusing Universal Design into the entire curriculum (Welch, 2002) (Afacan, 2006; Morrow, 2002). The main reasons for not teaching the concept of Universal Design as part of other course was the feeling of unscientific, too broad, lack of time, and lack of resources.

Due to the increased number of students with disabilities, the University of Southern Marine decided to update the curriculum, assessment, and environment to solve the needs of population changes(S.J. Langley-Turnhaugh, 2013). Students with disabilities from Science, Technology, Engineering, and Mathematics (STEM) decided to conduct a training program for the faculty development, which provided tools for creating different accessible course contents for all their students. Identifying different challenges faced by professors and ensuring every student could have an equal chance to succeed, the STEM enlisted sixteen different members for a five-year program Universal Design education, implementation, evaluation, and dissemination. Within Universal Design Learning Education, there were two seminars organized. The first seminar was to identify the actual problems faced by the people having different abilities and make different types of accessible PowerPoint presentations, training sessions website. The second seminar focused on the plan and OSSD presentation to the faculty member to retrieve more information on specific disabilities. UDL implementation step was the second step for the process. In this stage, based on the UDL education prepared, they redesigned curricula including Universal Design on the course. The third stage was the Reflection/Feedback, in which the faculty observed and recorded the observations and the feedback from the students about the Universal Design concept. The faculty also helped students by creating self-reflection in which they described the changes which were made to the courses, concepts related to Universal Design. They also used a questionnaire to get feedback from the students. The value of the concept of Universal Design as a part of other courses was highly noted after the feedback was taken.

2.2 Universal Design in Computer Science

Software development is a combination of design and development. Different software design approaches are from the beginning "Code and Fix" to the new technologies like Agile methodologies, which focus on the user interface as well as designing the whole system(Gordon, 2015). Human-computer interaction has its ISO standard. ISO 9241 states seven dialogue principles defined as Suitability for the task, Self-descriptiveness, Controllability, Conformity with user expectations, Error tolerance, Suitability for individualization, and Suitability for learning(Bevan, 2005). The relation between the Universal Design principles described in section 2.0 and the dialogue principles shows that they have a good relationship with the software design and the user interface. A well-written

code should be focused on being easily modified and updated by any old or new developers. WCAG is introduced to make web content accessible for individuals as well as organizations. These guidelines contain four principles: perceivable, operable, understandable, and robust, described in section 2.1, that define how to make content accessible for people having different abilities.

The research initiated by the Dublin Institute of Technology finds out different models to solve different significant challenges faced by both lecturers and students. The unnoticed characteristics of Universal Design in designing the software are to consider the software itself, the way it is developed by using the lens of Universal Design(O'Leary, 2015). According to the paper, principles of Low Physical Effort, and Size and Space for Approach, and Use of Universal Design are less relevant to software development in the context of online delivery. The principles can be reconstructed and can be made more oriented to the software development part that can be helpful for user's developers' point of view, after creating the module ladder for eLearning by creating the teaching environment through traditional and online settings. So, the authors have layered the principle of Universal Design in three layers dividing the principles within the layer with descriptions. The detailed view of these principles was categorized from the developer and user perspectives. So, for diverse users, the new principles were proved to be highly successful and stable for including it into the course curricula.

Table 2.3 The Principles of Universal Design

Layer	Principle	Description
Layer 1	Equitable Use	Overriding Philosophy
Layer 2	Flexibility in Use Simple and Intuitive Perceptible Information Tolerance of Error	General Principles for Realising Philosophy
Layer 3	Low Physical Effort Size and Space for Approach and Use	Principles for Realising Philosophy within the Built

		Environment Domain

2.3 Universal design in Engineering

The application of Universal Design in making different products and services is an important factor to be considered. Universal design in engineering is widely spread as: strollers and delivery-people also use the ramps which were originally made for wheelchairs, the silent feature of a cell phone is being used by people with hard of hearing as well as the people who want a silent conversation(Variawa. C, 2010). There are many areas of engineering such as Agricultural, Civil, Control, Design, Electronics/Electrical, Mechanical, Marine, Minerals, Structural("Engineers Ireland," 2009).

The research done with online discussion and site visits to engineering labs with students with disabilities shows the potential of including Universal Design in engineering Curricula(Blaser, Steele, & Burgstahler, 2015). According to the paper, Universal Design provides the framework for summing up usability, accessibility, and disability. The concept of Universal Design should be taught as a part of other engineering courses. The important thing is the course should be Universally Designed so that a more diverse group of students, including women, students with disabilities, could choose the course. The response given by students after the Universal design concept was included in the course was varying. Some say they don't want to learn about disability in any of their engineering courses, some focused on implementing the concept of Universal Design in specific application like biology, few students were already pursuing their careers related to accessibility, so some students found it useful and some did not, and some students were highly interested in including the Universal Design concept in Engineering courses. The paper had the research of around five hundred individuals for online community discussion from community college, undergraduate, and graduate students to know their view if the Universal Design concept has been useful while taught as a part of STEM courses. The research concludes with incorporating Universal Design into the curriculum of engineering courses within statics or dynamics classes and evaluating loads and motions with distinct modes of transportation. There are lots of free tools for digital design in computer-aided design courses, such as thingaverse.com, where students with vision impairments can use it as a teaching aid. These design helps to be a starting point discussion on Universal Design. And in programming

classes, for making the website, accessible students can be given an assignment to reconstruct any of the websites to make them accessible to students with disabilities. This research showed the reaction of students after implementing the Universal Design concept as a part of other courses, but this could be helpful for professional engineers to develop and design products that are accessible for all.

To know the effectiveness of the concept of Universal Design in engineering curricula research was performed in a first-year engineering course students for awareness to the need of Universal Design in a product and retrieving the new information and updating the Universal Design curricula which can make the Universal Design concept as a suitable part of other courses(Bigelow, 2012). For this research, forty-eight first-year engineering students were involved. They were given a task in which they have to redesign the engineering laboratory by applying Universal Design Principles. Staff from the University's disability service and people who have first-hand experience of disability helped the student as a project mentor. The result from the research showed that students were able to apply almost all principles while redesigning the laboratory but it is not so much clear that how this knowledge translates to project which are not especially focused on universal design. So, it is clearly stated that the Universal Design concept should be introduced and promoted in the engineering curricula like the project described.

2.4   Universal Design in Architecture

The process of constructing buildings, planning, designing any product are some forms of architecture. All buildings, services, and websites should be Universally Designed so that every person can access the buildings, services, and websites so that accessibility is formed into solutions that solve a technical problem and promote integration(Ginnerup, 2009). Universal Design concept in Architecture plays an important role in building an architect a universally designed building.

As the estimation of the World Health Organization, 15 % of the population have some disability, and by looking at the ratio of the aging world population, the architecture programs in the universities of the United States of America (US) are not as fast enough to implement the Universal Design concept in architecture curricula (Tauke, Basnak, & Weidemann, 2016). So, an online survey for architectural educators and administrators was done within 120 institutions in the US with different degree programs. The result showed

that 68.8% of people addressed Universal Design in their program's curriculum, 13.2 % of people didn't know whether the Universal Design concept was addressed or not, and the remaining 18 % of people said that Universal Design was not addressed in their curriculum. The presence of Universal Design in the curriculum was categorized with three-course type in which 32.5 % of student found that Universal Design concept appears in studio courses, 13.9 % stated that Universal Design content appears in non-studio courses, and the remaining 53.6 % said that the concept of Universal Design appears in bot studio and non-studio courses. The suggestion for increasing relevancy of Universal Design in general architectural education clearly stated that a higher percentage of responses (46.8 %) stated that it should be integrated into curriculum/coursework, 11.9 % suggested that the concept of Universal Design would be more suitable if it was associated with accreditation or licensure requirements. Only a very small percentage of respondents supported providing better tools for teaching philosophy (8.3%), Better clarity in defining Universal Design (6.7), Offer more workshops/ opportunities for learning (5.6 %), provide more support for faculty and administration (4.8%).

The importance of including the Universal Design concept in the Architectural course has been more clarified with the research paper (Larkin, Dell, & Hitch, 2016). The usefulness of Universal Design teaching in architecture curricula helps in upgrading and enhancing the uptake of Universal Design during any type of design process in architecture. The paper compares and contrasts the attitudes between two different groups in which one group has good knowledge of diversity and Universal Design, and another hasn't received the education of Universal Design of build environments. Different positive attitudes were noted on items that were used to measure attitudes to Universal Design. Some of those attitudes are: A building should have access to security, privacy, and access to all features regardless of any personal capabilities, A building or a built environment should be appealing to the users, enough spaces for assistance devices such as wheelchairs and oxygen tank, A user should not feel any disgrace while using the built environment or buildings regardless of any personal capabilities. The positive attitude towards this finding shows that the concept of Universal Design is a valuable aspect of the curriculum of Architecture within higher education.

The University of Idaho has implemented the concept of Universal Design in different program contents. The program has focused on Universal Design as a part of the curriculum,

and different courses are offered to form an elective course of architecture and landscape for graduates and undergraduates' students (Corry, 2003). The program content follows, Architecture (The Build Environment) is required to introduce an abstract idea of inclusive in connection with disabilities. The second course, Introduction to Interior Design, includes the social and cultural design responsibility and as well an overview of the Principles of Universal Design. The third course, Interior Design Studio, was required to design a building for some clients and apply Universal Design principles and the establishment of interaction between disabilities consultants and visit Universally Designed Homes. The fourth course, History of Interiors, needs to discuss how people having physical disabilities have problems accessing the built environment and how the arrangement is encouraging exclusive spaces.

2.5 Universal Design in Health

Health is an important aspect of human life. Around the world, health education to the students is widely spread. The education provided for health is through different training, course curricula related to health. The council of Ministers in Norway finalized that there is some need for education and training on the Universal Design concept to make a society live active, without adding supplementary and this was fulfilled by the initiation of the first academic educational training in Universal Design at Nordic School of Public Health (NHV) in 2006(Bjork, 2015). After the initiation was done, in 2011, the first diploma program was introduced at NHV. Although there are no such articles regarding the concept of Universal Design as a part of Health Courses, I have tried to explore some of the articles related to Health Services and Universal Design.

A summer school was hosted for people working in the Health clinical placements by Ireland's Association for Higher Education in collaboration with Access and Disability (AHEAD) and Nursing University College Dublin to explore different Universal Designed principles and to collect knowledge on how to translate those principles into practice (Halligan & Quirke, 2019). According to the paper, the participants constituted 25 academic workings with health-related courses such as nursing, medicine, and physiotherapy. The discussions on the paper stated that the application of Universal Design in health-related science courses focusing on students with disabilities have more chance of clinical placements than without including Universal Design. The summer school helped students to create an environment to have an in-depth analysis of the Universal Design concept and principles and fitness-to-

practice requirements.

The accessibility tips for some healthcare providers and facilities prepared by the Florida Disability of the Health/University of Florida stated different communication tips for health care providers with people having physical, visual, hearing, and cognitive or intellectual disabilities(Program, 2017). Some of the tips for health care providers in communication with people with disabilities are using polite language, using people's first language when speaking about an individual with a disability, and avoiding inappropriate descriptors such as handicapped, offering help, and waiting for acceptance not playing and distracting the service dogs. So, to achieve a proper Universal Design in Health, the concept of Universal Design should be taught as a part of Health courses.

2.6   Universal Design in Pedagogy

Pedagogy is a term where a student learns from the influences of learning provided by teachers. The work of teaching or the function of teaching in which the art of science of teaching and education instructional methods are included is called pedagogy(Education, 2009). Universal Design, in general, is mostly understood as the technical part where Universal Design should be implemented in buildings, websites but Universal Design in pedagogy is the instructional practice and inclusive teaching methods that incorporates aspects of pedagogy and is done for the students with and without disabilities.

According to a paper (Dell, 2015), for online curriculum development in higher education, Universal Design of Learning provides the student with more options to retrieve a course based on three principles: presentation, action and expression, and engagement and interaction. The paper also suggests that people or instructors who are involved or have the concept of Universal Design can plan the course material and content, which can be benefited for all people without redefining or adapting for the student with and without disabilities as well as non-traditional students. The paper also talks about the ten simple steps to implement UDL in online classes which were aligned with the UDL principles. The steps aligned to the UDL principle, presentation, were creating content before designs, the navigation should be consistent and simple, an accommodation statement should be included, implementing colour with care, and choosing fonts carefully. The steps which are aligned to the UDL principle, Action and Expression, modelling and teaching good discussion board protocol and the last UDL principle, Engagement and Interaction, includes content-

management-system should be chosen carefully, documents format should be accessible, converting PowerPoint to HTML, and the auditory content should be made visual and vice versa. The three principles mentioned above and the ten steps are considered to be implemented while developing a syllabus for a course with Universal Design.

The implementation of Universal Design in learning within post-secondary education institutions research was performed at Colorado State University. The research was based on Student perceptions of Faculty Implementation of Universal Design for Learning. The study measured different updates in instruction received by students with Universal Design Learning instructor training and modifications of the way of delivering the course(Catherine L. Schelly, 2011). The survey was conducted based on three principles of Universal Design in Learning, and the first principle stated multiple means of representation of information, where the instructor presented information in multiple formats like a lecture, text audio, video. The second principle, multiple means of students expressing their knowledge, includes multiple means of student expression. The third principle stated multiple means of engaging students in the learning process, where the instructor's enthusiasm is expressed for the topics covered in class. The pilot survey was done, and the result indicated that higher education instructors with information on Universal Design Learning principles are more promising, and they have a lot of strategies for implementing those principles in the courses. This leads to the enhancement of the learning experiences for people with and without disabilities. The research also concluded that the behaviour of the instructor also matters, and the behaviour can be recognized within few hours of Observation on the training provided by an instructor. The paper also suggests that Universal Design Learning strategies should be widely used and should be considered as a standard component.

Universal Design is mostly used to decrease the barriers inside the classroom and helps to increase learning for students, having visible and invisible disabilities(Poch). The research was done to explore the new opportunity within postsecondary education using universal design for administrative leadership, planning, and evaluation. The paper focuses on two case studies of how Universal Design has been implemented by several participants on institutions and post-secondary educations. The case studies on Green River Community College resulted from the initiation of Universal Design in different institutions engender interest and implementation of Universal Design within different student affairs and

academics. The researcher tried to use Universal Design in a normal language on communication with staff and fellow administrators. The researcher had organized and sponsored workshops on Universal Design awareness for the faculty staff. Another research was performed on Seattle Central Community College, where the case study focuses on the influences created on post-secondary institutions by adopting the Universal Design practices. Regardless of research with different institutions, the primary and common goals for the research were regarding the widespread implementation of Universal Design, enabling knowledge and awareness among all the faculty staff, and making sure that access to opportunity and higher student outcomes with creating the responsibility of Universal Design. It also focuses on executing Universal Design in classrooms and as well as services activities, creating continue possession for students, constructing partnerships on all the institutions to support stability for Universal Design, and minimizing physical and cognitive barriers on such institutions.

3   Methods

This chapter describes the types of methods used for data collection and analysis done within this research. The chapter is divided into the following sections in which 3.1 explains the data collection methods, such as qualitative methods to collect data for this research. Section 3.2 describes the procedure, 3.3 is about recruiting participants, 3.4 and 3.5 are about the interview guide, ethical consideration, and method for analysis.

This research is based on different universities inside Norway. There are many other courses, faculties, and subject areas taught at different Universities around Norway. This research uses the data collected from various Universities about the faculties in which they include the Universal Design as a part of other courses or not. The theories of institutional and institutional change (Coccia, 2018) are used to briefly describe the barriers in different institutions towards implementing Universal Design as a part of other courses and assess those barriers to change an organization.

The qualitative data for this research is collected through semi-structured interviews with different organizational representatives associated with Universal Design and document data identifications. Understanding how people feel and think and providing in-depth and weighty data that is not possible otherwise is possible through Qualitative data(Willson, 2019).

3.1   Qualitative Methods & Data Collection

Qualitative methods are the scientific research methods that help produce findings from the users, systematically using a predefined set of procedures to answer the questions. These qualitative methods are primarily essential for finding answers to questions about experience and retrieving the data from their standpoint, meaning, and perspectives (Hammarberg, Kirkman, & de Lacey, 2016). Furthermore, they use different techniques for data collection such as small-group discussions, semi-structured interviews to collect information on focused topics, observations, in-depth interviews to identify the conditions. This research involves conducting semi-structured interviews with a representative from different Universities within Norway. Survey forms are also used for representatives who cannot manage the time for interviews.

3.1.1   Semi-Structured Interviews

Semi-structured interviews are widely used to collect as much information as possible from the respondent. The questions are prepared ahead of time, and it gives the respondents

freedom to express their views in their own words. Semi-structured interviews are primarily suitable for an important task where there is the requirement of follow-up queries more than a few open-ended questions (W. Adams, 2015). The semi-structured interviews consist of a combination of structured and unstructured interviews, so it has the advantages of both types of interviews.

The well-known way of gathering different qualitative research data is also known as Interview Data, which is also taken as "talking," and talking is natural (Griffee, 2005). It is the most common format of data collection in qualitative research methods. Different interview types are used in Qualitative methods, such as semi-structured, structured, and unstructured interviews. The most common form of interview used mostly in different research articles is semi-structured interviews. Semi-structured interviews are also called in-depth interviews, where preset open-ended questions are answered by the respondents and are widely employed by different healthcare professionals (Jamshed, 2014).

The interview which will be selected for this research is the semi-structured interview. However, some challenges come with semi-structured interviews, such as it requires some skills, staying focused, and control emotions (E. Adams, 2010). And the respondents may answer the question from their memory that they can remember. The data was collected by taking down notes during the interview. No audio or video recordings were used.

3.1.2 Survey Form

The method of collecting information from a group of people to generalize the outcome to a huge population is called a survey. The online survey form for collecting data is new and evolving, helping researchers create and conduct different online surveys with the help of web authoring software (Wright, 2017). Online survey forms and programs have made the data collection or online survey research more efficient and faster. The main advantage of the survey form is that the data can be collected from individuals from different geographical locations, reducing effort on reaching participants and helping with automated data collection. Despite having different advantages of the survey form, there are some risks and disadvantages, including fewer reactions, limited or incomplete data, security, and taking online surveys as spam (Evans & Mathur, 2005).

In this research, we decided to include the survey form to collect the information from participants. We used those forms for the participants who wanted to participate in the data

collection process but could not manage time for an interview. Nettskjema [1]form builder has been used to create an online survey that ensures the anonymity of the participants. The form consisted of some questions as of Interview guides, and the link to the survey form was sent upon request. The consent form was sent to the participants before attending interviews and for the participants who chose to fill up the survey form. Every participant that answered the online survey also gave their consent.

3.1.3   On-site Observation

The process of collecting data by observing participants gather more reliable insights and capture data is known as Observation. It is also a qualitative research technique where researchers study participants in a natural situation based on ongoing behavior.

The on-site Observation was also selected as a data collection method for this research. Due to the COVID-19 pandemic, it was difficult to schedule an on-site observation because every class was organized digitally. Therefore, an email request was sent to different participants. The plan was to take an on-site observation in relevant classes in courses, including Universal Design, to observe how Universal Design is taught in the course. It was mentioned in an email that the class would not be disturbed, and Observation would be done quietly. There was also an option provided for participants if there are no classes scheduled now, which included Universal Design to provide access to any recorded version of relevant. A copy of pertinent teaching materials, such as lecture slides, lecture notes to better understand what is taught about Universal Design, such as what areas of Universal Design are emphasized and the terminology used, etc., were also requested from participants.

3.2   Procedure

The interviews were planned to be face-to-face interviews, but due to the pandemic situation of COVID-19, the face-to-face interview was not possible to collect data, so it was conducted through a digital environment. All the participants were asked to give their consent for taking part in the interview through the consent form provided. All information was noted down during the interview, and no audio or video recordings were performed through the interview process. The consent form is included in Appendix A of this report. The verbal cues and facial expressions were not recorded while doing an interview since the

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[1] https://www.uio.no/tjenester/it/adm-app/nettskjema/

interview was conducted online. The consent form was sent through email and was sent back by the participants after accepting the terms and conditions provided.

The online survey form was also an option for participants who chose not to attend the interviews. The first priority was to conduct an interview to collect data, and the survey form was given as the second option for the participants. Three participants were interviewed through a digital platform called ZOOM provided by the University, and one participant chooses to fill up the survey form, which was prepared in Nettskjema. The consent form provided for interviews and survey form was the same.

3.3   Recruiting Participants

The list of ten Universities with twenty participants was prepared to be contacted for the data collection procedure. The contact information for participants was retrieved from the university websites and courses that include Universal Design as a part of other courses. The list of universities and potential participants was prepared, and they were contacted through email regarding the interview schedule.

An email was sent to every respondent requesting them to take part in the interview process for the data collection of this research. The first email was sent to a total of twenty participants, and the responses were not as much as expected. Some emails were sent to the relevant departments, and some of the emails did not receive any replies. The response to the first emails helped to do interviews with two participants. As the response was not expected, we decided to send reminder emails to all the participants. The reminder email helped find one interview participant and another participant who responded to the survey form. The further plan was to include different Universities outside Norway having Universal Design as a part of their courses if the difficulties with recruiting participants continued. The email was also sent to different universities outside Norway, but there were no responses from the Universities and probable participants outside Norway.

3.4   Interview Guide

The interview guide consisted of many open-ended questions and some closed-ended questions. Some of the close-ended questions were followed up by open-ended questions if the answer was yes so that the respondents could elaborate on their answer. Consequently, some of the open-ended questions were not answered when the respondents didn't know what to answer the question. The interview guide was mainly focused on answering the

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research questions. There are different groups within the questions in which the first groups consist of the information of interviewees such as Gender, Age Group, and Subject Areas. In the second part, the questions were divided into four groups; the understanding the concept of Universal Design, the perspective of Universal Design while taught as a part of other courses, the barriers while introducing Universal Design, and Universal Design of ICT playing a role to make courses accessible. The main themes for the semi-structured interview guide were to understand the concept of Universal Design taught as a part of other courses in higher education, Universal Design perspective in different subject areas, and barriers to introducing Universal Design in higher education. The interview guide needed to be slightly adjusted to achieve the research goal.

The interview guide can be read in Appendices Section B.

3.5   Ethical Considerations

The ethical considerations were classified in different forms within this research. It was taken into consideration before data collection, during the data collection, and after data collection. We need to inform Norsk Senter for Forskningsdata[2] (NSD) if we collect any personal information from respondents. NSD is a center for research that deals with the respondents' data protection involved in different data collection procedures. In this research, we were not collecting any personal information from the respondents. The interviews were not recorded, but the information provided from the respondents was noted down on the paper, so it was not necessary to inform NSD for approval of the data collection procedure. The consent form was sent to all the participants after the interview date was confirmed. The participants that wanted to respond to the survey form also accepted the consent form by writing yes/no in the form, fill the date, and sent it back. The consent form included information regarding the anonymity of users, withdrawing from the study at any time without explaining. The information provided by respondents would be solely used for the research purpose, and the information would be treated in strict confidence.

3.6   Analysis

3.6.1   Thematic Analysis

Thematic Analysis is the most commonly used method of analysis for qualitative data. This

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[2] https://www.nsd.no/

method of analysis is used in a wide range of studies or a theory of the nature and grounds of knowledge concerning its limits and validity and research questions for qualitative research (Nowell, Norris, White, & Moules, 2017). In thematic analysis, the trustworthiness criteria have described the setup of trustworthiness within Qualitative Research by credibility, dependability, confirmability, and audit trails. Six phases of analysis are followed to finalize the subthemes and themes. The six phases include familiarizing with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report.

The main features of thematic analysis also include inspecting the perspectives of different respondents, pointing out the similarities and differences, and creating a deep intuitive understanding of a respondent. It is also useful for giving a brief statement of key features from the big data set, and it helps the researcher to make clear reports by enforcing to implement a well-structured approach for handling data (King, 2004). The process of analysing data can be focused on across the entire dataset, or one particular aspect of a phenomenon can be analysed in-depth (Braun & Clarke, 2012).

Thematic analysis was chosen for this research method because of its accessibility and flexibility (Braun & Clarke, 2012). Thematic analysis helps to identify the patterns or themes of the dataset within qualitative data. In this research, the amount of data collected were from four participants using semi-structured interview so to identify patterns of themes from the interview data the thematic analysis could be the best-fit.

3.6.2   Inductive and Deductive Approach

The inductive approach is also known as a bottom-up approach in which the analysis is driven as per the given data. The analysis performed by the researcher is closely equivalent to the themes and codes generated from the data(Braun & Clarke, 2012). The data collected from the participants also allow determining the themes in this approach. In this approach, the micro characteristics of data are identified first, and then it is followed to the top by making subthemes and themes. This approach doesn't rely on assumptions, but it lets the data speak and produce the patterns(Mereu et al., 2017).

The deductive approach brings out the concepts or topic to the data that is later used to code and interpret the data. This approach mostly follows the idea and concepts that the researcher brings to the data(Braun & Clarke, 2012). There may be a difference between the

concept or idea produced by the researcher and the main data content. This approach also mostly depends on the assumptions, so it could be harmful if the wrong assumptions are made and can result in delay or take longer to find a solution or even direct to wrong conclusions(Mereu et al., 2017).

For this research, we found that the best approach to use is the bottom-up approach because we are not relying on the assumptions, but we are allowing the data to speak, and it is also the better exploratory technique because it doesn't rely on assumptions. Though the iterative process should be followed for both approaches, the exploratory analysis could explain more complex data. Our theme is to identify the micro attributes of the collected data and analyze them in a bottom-up approach to identify the subthemes and themes. Different phases were completed while making the bottom-up approaches to identify proper themes and subthemes.

4 Results and Analysis

The number of participants who participated in an interview was three through the digital platform ZOOM[3], and one participant chose to fill up the survey form prepared in Nettskjema. The reminder emails were sent again for the third time to find out if anybody is still interested in participating in the data collection procedure of this thesis. The data collected from survey form and interviews were integrated by listing them in an excel sheet and utilized that for producing themes and subthemes.

4.1 Participants and Procedures

4.1.1 Duration of interview sessions

The time to cover all the questions was supposed to be more than around 40-50 minutes, but after discussion, the duration finalized was 30 minutes. The average duration for an interview was also approximately 30 minutes. In some cases, certain conditions, like a pause in the interview due to the participant's work, sometimes extended the time of the interviews, but the average time for the interview was around 30 minutes.

Table 4.1 Duration of the interviews

Participants ID	Duration (min: sec)
1	29:30
2	35:20
3	28:12

Table 7.1 Interview Duration

The table shows the duration of interviews with four of the respondents. The minimum interview duration was 28 minutes and 12 seconds, and the maximum interview duration was 35 minutes and 20 seconds. The average interview duration time was around 30 minutes and 03 seconds.

4.1.2 Time and Location

The interview was conducted within the office hours of the respondents. The appointment was taken earlier for an interview, and interview time was scheduled as per the participant's

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[3] https://zoom.us/

schedule.

The plan was to conduct face-to-face interviews with every respondent, but due to Corona Pandemic, it was impossible. Hence, the interview was all conducted through the digital platforms. The digital platform ZOOM was used to conduct interviews, so the interview was mostly within office hours, so the respondents were also available for interviews from their offices.

4.1.3   Age

The age of the participants interviewed was categorized with the age groups provided them to choose from. There were five different age groups defined with a difference of ten to find the closest result possible and choose from. Two of the participants were from the same age groups, and others belonged to different age groups. We can see table 1.2 to view the age groups of the participants.

Table 4.2 Age groups

Age Groups	No. of Participants
20-30	0
31-40	2
41-50	1
51-60	1
60+	0

4.1.4   Gender

Both the male and female participants were involved in the data collection procedure of this research. Among the participants, two male participants and one female participant were interviewed. One participant involved in filling up the survey form was female.

4.1.5   Subject Areas

The subject areas to be covered while interviewing participants were defined to be within three categories. The categories were defined as Computer, Architecture, and Engineering. So, as per the response from the participants, the possible data collection was performed within the area of the computer because the availability of participants in other subject

areas like Architecture and Engineering was not available for interviews. Education and social science were also covered because some of the participants were involved with subject areas like Computer Science and Education. The courses in which the participants were involved within different subject areas were reading and writing disorders, language disorders, technology, assistive technology, and Universal Design for learning. Some participants were also involved in the general introduction to special education, comparative education for international education, Graphic Design, User Experience Design, User Interface Design, Technology, Knowledge Organization, Library Education (making websites, testing websites), Inclusive web design, Interdisciplinary innovation, and Computer Science.

4.2   Analysis

From the discussion above we knew that thematic analysis was chosen to be the best approach for our research. It is usually implemented to a set of texts, easier to identify themes, filter out the ideas and patterns that occur repeatedly, and is also the best approach for interview transcripts. There are different approaches to implementing thematic analysis in which the bottom-up approach was implemented for this thesis. The six-phase process of analysis is developed to find out the themes of the thesis; however iterative process should be followed to find out the in-depth analysis of the data(Braun & Clarke, 2006). The six-phase analysis procedure was followed, and the process is briefly discussed.

The first phase included a deep overview of the data collected from the participants. As the process included keeping notes of the information provided by the respondents, this phase included the thorough reading of the text. The written text was converted to the digital format (MS Word) by managing them as per the questions and their related answers. The first process of getting familiar with the data was completed in this process. Coding refers to highlighting data or sections of text to extract similar patterns or make shorthand labels to describe the content where different types of colors are used for coding. There are different tools available for making the coding part easier, such as Quirkos, MAXQDA, NVivo, Excel, etc. As the amount of data was small for this research, MS Excel was found appropriate for coding the data provided by the participants. The second iteration covered color-coding to extract the smaller attributes that might be interesting and helpful while developing subthemes and themes. Firstly, each question and answer were separated into different sheets. The shorthand labels were extracted from each answer by color-coding them. A similar pattern,

answers related to any other questions were highlighted differently to identify easily while developing subthemes and themes. Codes were identified for each answer provided by the participants, and it helped to achieve us a concise overview of the main points and similar pattern occurred within the data.

The next phase was to have a depth look at the codes we created and discovered the theme in the third iteration. So, similar patterns of codes were identified, and the subthemes were generated according to the pattern. The second iteration process was performed until the themes were finalized. The themes are mostly related to the research questions. For this purpose, a table was generated by categorizing the codes and displaying the micro attributes in MS Word. Those attributes were divided and more generalized to create new subthemes. As there were many subthemes created, the idea was to generalize one step more and create themes to answer each of our research questions. The process of collapsing and clustering the themes and subthemes was performed to identify the sharing of some unifying feature together so that it helps to find out the meaningful pattern of data. Some themes were discarded because they were too vague and were not relevant enough. This process took a longer time than the other phases of analysis.

This phase was about reviewing the developed or generated themes. The fourth phase was done, and the approach was helpful to find out if the themes are relevant or useful to make an accurate representation of data. The themes were compared to the dataset and checked if something was missing. There were six themes altogether, and we decided to combine some of them and created four themes finally, which were relevant to answer the research questions. The part of defining and naming themes was done in this step. According to the diagram prepared in MS Word, the decision was to finalize the name themes that are easily understandable and relatable to the research questions. The procedures or phases were followed, and the themes with their subthemes and micro attribute were almost ready to speak up as a report in the analysis part. The themes and subthemes are presented in the next section.

As we completed our data analysis through different phases, we created themes, subthemes, and attributes in a tabular format that helped us write the analysis part more easily and understandably. We followed the bottom-to-top approach to let our data speak instead of assuming the analysis. The themes and subthemes created following different iterative
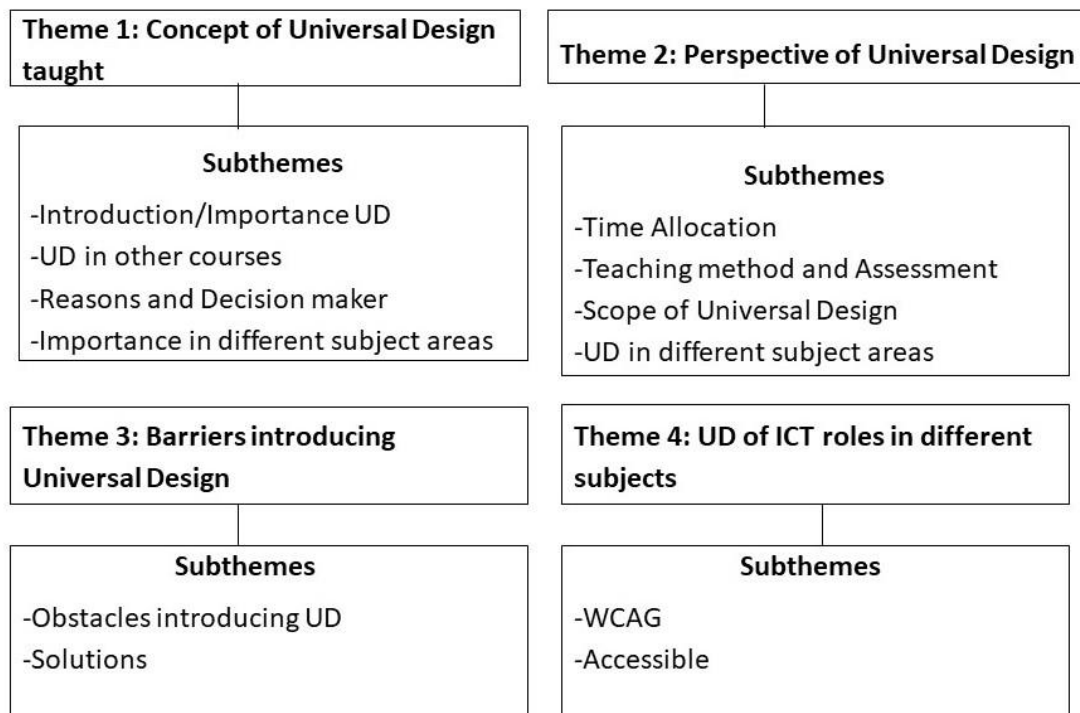
processes are listed in the figure.

Figure 4.1 Themes and subthemes

4.3   Results from the Analysis

According to different themes created, we will discuss each theme with their subthemes and their attributes in this chapter. In this chapter, the sections are organized according to the themes which are defined. The first section discusses the results from the first theme concept of UD taught, and the second chapter discusses the perspective of UD in other courses. The third and fourth chapter discusses the barriers to introducing Universal Design and Universal Design of ICT roles in different subjects while designing the courses.

Theme 1: Introduction of Universal Design

The first theme talks about the introduction of the concept of Universal Design taught in other courses. The central theme was divided into two subthemes. The first subthemes talk about the *introduction/importance of Universal Design*, and second subtheme discusses the *concept of Universal Design in other courses*. The majority of responses from the participants on the importance of Universal Design was the product and service should be designed for everyone to the greatest extent possible. Some participants also described that it is focused on specific groups, but it is essential for everyone. The terms used for Universal Design were

categorized into two attributes in which the general attribute gives the terms used for Universal Design as Usability, WCAG, 'Utforming' (Norwegian for "Design"), Accessibility. Some participants explain it as a variation of Design such as Accessible Design, Inclusive Design, Barrier Free Design, Adaptive Design, Ethical Design, and Haptic Design.

The second subtheme, the *concept of Universal Design in other courses*, was categorized under two attributes, courses where participants were involved in different technical and non-technical courses. The technical courses in which participants were involved were Web Development, Inclusive Web Design, Computer Science, Graphic Design, and Digital Media. In contrast, the non-technical courses include "Interdisciplinary and Innovation and Quality of Life and Life conditions" related to social science. The participants also explained the *reasons* for including Universal Design as a part of other courses in which the reasons were societal and technical. The societal reasons speak about the social requirements and Universal Design as a human right to be included. The technical reasons were the needs of accessibility, courses demand, and online courses and seminars in which the concept of Universal Design needed to be mandatory in every aspect. The subtheme also covered asking participants who were the major person or the *decision-maker* to introduce Universal Design as a part of other courses. In response, we found out that most responsible persons were Co-Ordinator's/Program Leaders whereas in some cases, stockholders were also included in this decision. Participants also explained that the course Universal Design is unknown for everyone, but it is crucial for everyone, and it is needed to be included by looking at the previous experience where people were unable to understand or use different products or services and were unable to express their opinions. It should be included according to the industry needs.

Participants also discussed the *importance of Universal Design in the upcoming future* and discussed with participants, where they categorized them into two different attributes. The technical areas such as HCI, Virtual Reality, Voice Interactions, Architecture, Engineering, Digital Media, Digital Courses, and Sound Design were the major fields or subject areas where Universal Design has many scopes. Participants also focused on designing services and buildings, including Universal Design for special needs and wheelchairs, and accommodation. Interaction with voice and sound, Sound Design, can also be the best subject in which Universal Design can be meaningful. The non-technical field was the health profession, for

which the participant explains that everything in the health sector has been digitized. It is most necessary to include Universal Design because everyone grows old sooner or later and will be helpful for everyone in the future. Some of the participants talked about the importance of education where Universal Design should be in every practice field. Universal Design of learning can be necessary as a diverse group of learners is involved within this part.

Theme 2: Outlook of Universal Design as a part of other courses

Participants were asked about the perspective of Universal Design taught as part of other courses. When it comes to the lectures for Universal Design, the *time allocated* as a part of other courses was 1-2 lectures. The percentage covered by technical courses such as Inclusive Web Design was 20-30%, Universal Design related courses were up to (20-30%), and Universal Design focused course coverage was up to (10%). The non-technical courses such as interdisciplinary and innovation covered 10% of the whole course. The majority of participants stated that the *teaching methods* used for Universal Design were lectures. Guidance from mentors where people had experience using different devices like screen readers provided an idea of using the devices. Some participants talk about the demonstration, seminars, using accessible websites as a teaching method to provide the knowledge of Universal Design in their subject areas. Designing websites using WCAG guidelines, providing concrete examples of accessibility, organizing workshops were also used as a teaching method in different courses.

Participants also talked about *assessing Universal Design courses* where they mostly focused on Oral Exams, Creating Websites, and Assignments. Participants also discussed assessments done through reports, discussions, checking WCAG implementation while developing websites, and assessing learning. Some of the participants discussed the peer-reviewing of websites developed by some other universities and giving obligatory exercises. Universal Design principles were highly taken into account while performing these assessments.

Some of the courses included Universal Design initially, whereas some of the courses were first focused on web design but were converted into inclusive design. Universal Design was included first in education in one of the universities, and it was implemented in ICT afterward. The Universal Design courses were started in some Universities, and since it was started, there were some changes in the course afterward. Some of the changes included accessibility while making the learning materials. WCAG guidelines were followed to make a

curriculum or content accessible and make it easily readable and understandable for every student. Some changes were done based on the latest research, and some courses, literature was introduced where the history of Universal Design was also taught.

Universal Design was taken as a small part of teaching by some of the participants, whereas some discussed it should be included in web-related courses. Universal Design of Learning could be important, and it should be included as soon as possible and should be implemented in every product and service where users are involved. Some participants focused specifically on library education for accessing the library where differently-abled people access it. Participants also suggested that information about Universal Design should be spread to society as early as possible.

The questions also addressed if Universal Design should be included in different subject areas or not and found out that there is a different perspective on having Universal Design in different subject areas. Some participants agreed that Universal Design should be added to those subject areas if any subject areas include user involvement. For this purpose, participants also focus on the Universal Design awareness needed and mentioned that teachers are most interested in including Universal Design in different subject areas. Some participants did not agree to incorporate Universal Design in different subject areas due to limited time. Some also think that it is not natural to include Universal Design in various subject areas. While talking about the scope of Universal Design, there were some things to be considered to make Universal Design included in most subject areas. The needs of policy and practice, focusing more on research and learning theory, were some of the points covered by participants that need to be considered. Identifying needs based on marginalized groups and promoting the UDL framework for assignments and teaching were prioritized to make Universal Design a key learning outcome. Participants also addressed the challenges that may occur when it comes to the part of the practical measurement of Universal Design products and services in upcoming days.

Theme 3: Barriers to Introducing Universal Design

There were different barriers found while introducing Universal Design as a part of other courses. The subthemes were divided into *obstacles* and *solutions*. First and foremost, the participants described that the students were not ready to take a new course. The attitude was also the main issue with students not agreeing to Universal Design. Some participants

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explained that there is always an argument while introducing new courses. There will be many questions on whether Universal Design would replace any existing courses or identify differences that courses make. Some participant describes that it is always natural to include Universal Design so there shouldn't be any discussions or obstacles while including Universal Design as a part of other courses. Participants also mentioned that the administration was also worried about financial issues. While implementing a new course, the administration should spend more on fieldwork, hiring new staff, and investing extra time to make everything accessible, was related to funding.

The participants who faced different types of obstacles solved the issues with students' varying discussions. In some cases, their colleagues convinced them by showing the advantages of including Universal Design as a part of other courses. Some benefits of using Universal Design in technology development were also taken as an example to convince them. In some cases, when there was a problem of funding and the discussion came to the design part, most of them were persuaded and were ready to include Universal Design as a part of other courses. Because in the end, there is no major pitfall and disadvantage of having Universal Design as a part of other courses. The design would be the best design for all where Universal Design is included.

Theme 4: Universal Design of ICT roles on courses

While designing courses and curriculum, it is vital to take Universal Design as an essential factor to make the content accessible for students based on participants' answers. Participants also addressed the roles Universal Design of ICT has so much influence while designing the courses and study materials. Nowadays, every content or study material is provided digitally, and it has become important that the study materials be *accessible* to the wide diversity of the users. The Universal Design of ICT has played an important role in making new courses more accessible to a wide range of users. Participants also discuss different inbuilt features provided by different applications such as accessibility check in Office products, making them easier to design and make the study material more accessible. In developing websites, they also discussed the role of *WCAG* guidelines to make websites accessible.

5   Discussions

This research suggests that the concept of Universal Design has some significant differences while taught in other courses in Higher Education. The perspective of understanding the Universal Design in terms of teaching methods, assessing the course, scope of Universal Design is identified in this research. A number of barriers were identified that are consistent with the past research (Welch, 2002). The results also explored the role of Universal Design on making the courses accessible. The terms used for Universal Design in some subjects have been varied and named Usability, Accessible Design, Adaptive Design, etc. The results show that implementing Universal Design as a part of other courses is social requirements and human rights. According to Sandnes(2017), Engineering and Computer Science students designing the system or new product without the proper knowledge of Universal Design can result in poorly designed systems (Sandnes & Eika, 2017). The result of this research also shows that the importance of Universal Design is for everyone, but in some cases, the product is focused on specific groups. The research performed by the Centre for Excellence in Universal Design shows that the teaching approaches used for Universal Design were Lectures, workshops, Projects, Design studios, and External Involvement. In contrast, according to our research, the teaching methods are lectures, the guidance of mentors, demonstrations, accessible teaching materials, seminars, concrete examples of accessibility. The students were assessed with the help of an Oral Exam, Report, Discussions, WCAG implementations, and Assignments.

For including the Universal Design into the course components in Norway, different models were suggested by EIKA (2017); the study from our research shows that 20-30 % of courses are included in inclusive web design. The courses are also categorized into UD-related courses and UD-focused courses on different Higher Education Institutions. The results from this research show that the policy and practice should be highly prioritized, learning theory should be focused, and needs should be identified based on marginalized groups. The curriculum was also changed since it was introduced. The changes were based on the latest research, introduction of literature and accessibility included in the curriculum. Barriers to introducing Universal Design as discussed by (Welch, 2002) are, unscientific, too broad, lacking time, and lacking resources. The result from our research on barriers to introducing Universal Design as a part of other courses shows the same barriers like students, lack of time, expensive, identifying differences of including Universal Design in a course. Our result

also suggests that the solutions to overcome the barriers were group discussions, practical demonstrations, providing concrete examples, and involving designers in discussions. Universal Design should be included in the different subject areas, and user involvements product and services must contain Universal Design according to this research findings. The technical courses within Computer Science that included Universal Design were Web Development, Inclusive Web Design, Computer Science, Graphic Design, and Digital Media. This research also shows that there are non-technical courses that included Universal Design in the social science area. The courses that include Universal Design in social science are Interdisciplinary and Innovative and Quality of Life Conditions. From the perspective of Universal Design in terms of Computer and Social Science, the differences were the approaches. In social science, there is less talk about quality and access and used case issues. In computer science, the policy and practices are more focused. According to the findings, the common theme of understanding Universal Design between Computer Science and Social science was UD-related principles and ideas. Both don't have a ground of innovation, no clear idea of design, and no entrepreneurship innovations of this research.

This research may help society understand how Universal Design is taught as a part of other courses. Researchers may also get benefitted by studying this thesis to further evaluating these terms more broadly. This research may be more fruitful to universities, Teachers, Course Coordinators while designing the curriculum and including Universal Design as a part of other courses. The research may also help identify the barriers to introducing Universal Design in different Computer Science courses courses and to know the roles Universal Design plays to make the course accessible.

5.1 Limitations

The main limitation of the research is the number of participants. The total number of participants was fewer than expected. A total number of twenty people, including participants and non-participants, were sent an email for participation in an interview. Three participants responded and were ready to participate in an interview, and one participant chose to fill up the survey form. The research targeted three subject areas when it was started Architecture, Engineering, and Computer Science. Still, due to few participants and the COVID-19 pandemic situation, it was challenging to meet the participants face-to-face, so I decided to focus on only one subject, Computer Science.

A literature review is an important part of the research where it helps to make a foundation to build upon to achieve the research objectives. Due to few articles found on the internet related to Universal Design taught as a part of other courses, the research is also limited with the scope of work that has been done in this research area.

Qualitative methods were chosen as a data collection method where Semi-structured interview and Observation was finalized in the first phase of the project. Due to the pandemic situation, the method used for the data collection was semi-structured interviews and was done digitally with the help of ZOOM.

6   Conclusion

This research study about the concept of Universal Design taught as a part of other courses in Higher Education Institution. Understanding Universal Design in different courses has been focused on, and the barriers to introducing Universal Design as a part of other courses have also been discussed within this thesis.

The problem was identified, and research questions were prepared based on the problems identified. Each of the research questions was answered by collecting the data using a qualitative approach and analysing the data using thematic analysis. There were altogether four participants who participated in an interview, and the semi-structured interview was chosen to collect data from the participants. The survey form was used as an alternative so that participants could have an option to fill up the form rather than attend an interview in any non-feasible conditions. Out of four participants, three participated in an interview, and one participant has chosen to fill up the survey form.

The first research question states that "How is the concept of Universal Design taught as part of other courses within Higher Education." The research study shows that the concept of Universal Design taught as a part of other courses is almost the same for every course. The terms used for Universal Design were different, but the theme of the definition of Universal Design was the same. Some specified that it is focused on certain groups, but most participants said it is designed for everyone. Introducing Universal Design in courses was the social requirement, accessibility, and demand of course, and some participants also took it as a human right.

The second research question "How does the concept of the Universal Design perspective differ while taught as part of other courses." The time allocation of the courses, including Universal Design, was higher than non-technical courses. The teaching methods used were lectures, guidance from mentors, demonstrations, and different assessment methods such as an oral exam, report, discussions, assignments were used. The general part of the perspective of Universal Design was that it should be included in web-related things, and Universal Design of Learning is essential, and it should be included as early as possible.

The third research question is about the barriers to introducing Universal Design as a part of other courses. The research question "What are the barriers to introducing Universal Design as a part of other courses in Higher Education?" covers different barriers to introducing

Universal Design as a part of other courses. The obstacles are students, expensive, and identifying differences in having Universal Design as a part of the courses. The solutions were group discussions, practical demonstrations, and raising funds.

The fourth research question, "How does the Universal Design of ICT play a role when making courses accessible?" addresses the use of Universal Design of ICT while making the courses accessible. Following WCAG guidelines while designing courses or designing websites has helped the courses to be more accessible. Providing multiple means of representation has helped while making the course to be more accessible.

6.1   Future Work

This research targets one subject area, Computer Science, but future research could explore different subject areas such as Architecture, Engineering, and Education. The research targets the participants from Norway, but a new study can be done constructing the same research in a new context or location.

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Appendices

A. Research Consent Form
(Participants used the same consent form for the survey form.)

RESEARCH CONSENT FORM (COPY)

Name of Interviewer(s): Min Prakash Khanal
Title of study: The concept of UD taught as a part of other courses within higher education.

Please read and complete this form carefully. If you are willing to participate in this study, tick the appropriate responses and sign and date the declaration at the end. If you do not understand anything and would like more information, please ask.

• I have had the research satisfactorily explained to me in verbal and/or written form by the researcher.	☐
• I understand that the research will involve: *(the opinions on the concept of Universal Design, barriers while introducing Universal Design and the difference on Universal Design perspective while taught as a part of other courses. The interview will be semi-structured type, and the data will be used for Master Thesis. The interview may last from 25 - 35 minutes.)*	☐
• I understand that I may withdraw from this study at any time without having to explain.	☐
• I understand that all information about me will be treated in strict confidence and not be named in any written work arising from this study.	
• I understand that any information provided by me will be used solely for research purposes and will be destroyed on completion of the research.	☐
• I agree to take part in the above study.	☐

I freely give my consent to participate in this research study and have been given a copy of this form for my information.

_____

Date

B. Interview Guide

(Participants used the same questions for the survey form.)

Interviewee Profile

- Current position
- Gender
- Age Group
- Subject areas

Universal Design Introduction

1. How would you describe the term Universal Design?
2. Have you heard any other terms used for Universal Design?
3. Do you think Universal Design is important? For whom?

Concept of Universal Design taught.

1) In which courses is Universal Design taught as a part of other courses?
   a) Could you elaborate on why it is included?
   b) How was the decision finalized to include Universal Design in the course, and who made the decision?
2) What is the total time allocated for Universal Design?
   a) Was the Universal Design included from the beginning of the course?
   b) Are there any changes to the Universal Design curriculum since it was introduced?
3) Could you please explain some teaching methods used to teach Universal Design?
4) How are the students assessed for Universal Design?

Barriers

1) Did you experience any difficulties introducing Universal Design as part of other courses? If Yes
   a) What were the obstacles while introducing Universal Design?
   b) How were the obstacles handled?

2) Does every subject area include Universal Design as a part of other courses in this University?

    a) If no, please explain why you think it is so.

Universal Design perspective

1) What do you think about the scope of Universal Design in the future?
2) What will be your suggestions on increasing and encouraging further Universal design to be as a part of other courses?
3) Do you know any other areas which include Universal Design? Do you find any differences?
4) Could you identify some areas in which Universal Design can increase the importance in upcoming years? If yes, Which and Why? – importance of universal design

Making Course Accessible

1) Does including Universal Design of ICT in courses have to influence the course to be more accessible?
2) Is there any difference in the way they have been practicing after Universal Design has been included?

Fi**nal**

1) Is there any extra information you want to add about the Universal Design teaching perspective related to different subject areas?
2) Are there any study programs in your University in which the Universal Design curriculum is included?

Thank you