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Challenges in Implementing Universal Design of ICT Among Teachers in Higher Education in Norway

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Abstract. Equal access to education for all is a prioritized goal in many parts of the world and included in several national and international regulations. Universal Design (UD) of information and communication technology (ICT) can ensure accessibility of digital learning materials (DLMs). However, until recently the implementation of UD of ICT in higher education institutions (HEIs) has been lacking. This study investigates the practical implementation of UD of ICT of DLMs among teachers in HEIs, challenges experienced by them, and what support is offered by their HEI or what support they believe would be helpful when implementing UD in DLMs. Data was collected through interviews and an online survey from a total of twelve faculty members recruited from eight universities in Norway and analyzed using thematic analysis. Findings indicate that teachers in HEIs do not practice UD of ICT on their DLMs, and that they lack training, sufficient time, and practical support from their HEIs to make their DLMs universally designed. The paper concludes that although HEIs appear willing to provide the necessary support and actions to implement UD of ICT, there seems to be a lack of internal policy on UD.

Keywords. Universal design, ICT accessibility, digital learning materials, higher education.

1. Introduction

The current rise in the digitalization of education across many areas of the world and accelerated due to the COVID-19 pandemic has increased the use of digital learning materials among teachers in higher education. According to a 2021 European survey [1], an average 15% of students in higher education (HE) report having an impairment that limits them in their studies. Norway, with 23%, is one of the five countries in that survey with the highest share of respondents reporting they have a limiting disability (including chronic diseases). The right to equal access to education for all is stated in national and international legislation, including the United Nations Convention on the Rights of Persons with Disabilities [2], and reflected in the United Nations Sustainable Development Goal no. 4, Quality education [3]. The Norwegian regulations on universal design of information and communication technology (ICT) solutions [4] connected to Section 18 in the Norwegian Equality and Anti-Discrimination Act of 2018 [5]

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specifically includes DLMs. This indicates HE teachers' skills and practice in making their DLMs accessible are important factors for ensuring equal access to HE.

Existing research has shown that accessibility barriers present in DLMs are the most common hindrance for students in higher education in Norway [6], and that HEI teachers are positive towards UD and willing towards implementing UD in their teaching and learning materials, but they seem to lack time and sufficient training, and practical knowledge about how make their DLMs universally designed [7-8].

The study presented in this paper aims to extend previous research by investigating how teachers in HEIs cope with implementing UD of ICT on the DLMs used in the classes they teach, what challenges and barriers they experience when doing this in practice, and what support from their institution they think could be helpful in this process and towards meeting requirements for UD of DLMs. This is done through thematic analysis of data collected through interviews and an online survey involving seven faculty members teaching at eight HEIs in Norway. As the data collection was conducted in 2020, while the COVID-19 pandemic necessitated universities migrate to a digital mode of teaching almost overnight, it became particularly interesting and important to also include an exploration of how the university teachers in Norway handled this transition with regards to their efforts towards UD when making DLMs. By gaining a better understanding of how teachers in Norwegian HEIs implement UD in their DLMs in practice and exploring their views and experiences, the presented study proposes to contribute towards knowledge on how teachers in HE can practice universal design of digital learning materials in an effective and efficient way as well as offer insights into how the HEIs can support the teachers in this work.

The paper is organized as follows: Section 2 gives an overview of the methods used for data collection and data analysis as well as the recruitment of participants. The results are presented in Section 3, while Section 4 discusses the main findings and considers the limitations of this research. Section 5 concludes this paper and gives suggestions for further work.

2. Methods

This study used a qualitative approach with a combination of individual interviews and an online survey to investigate teachers' patterns of behavior towards and views on creating digital learning materials. Qualitative methods can offer a deeper understanding of a problem than quantitative methods [9]. Combining different qualitative methods can provide more in-depth insights into participants behavior and views regarding the topic of concern. Individual interviews were chosen for this study to better understand the experiences and challenges teachers face in practicing UD for DLMs.

Online survey was chosen due to a lack of teachers' availability to participate in individual interviews in relation to the transition to a digital teaching mode during the COVID-19 pandemic at the time of data collection. To lessen the risk that collecting data this way would affect the quality and richness of the data, measures such as offering more descriptions in the formulation of the survey questions were taken into consideration.

2.1. Participants and Data collection

Participants were primarily contacted through emails sent to the 23 different heads of department in 8 different universities in Norway. The participant recruitment criteria were faculty members teaching at Norwegian HEIs. The data collection was performed in October - November 2020. In total, 12 faculty members from 8 universities in Norway participated in the interviews or the online survey. Seven faculty members (2 males and 5 females) participated in the interviews. All participants gave an informed consent before taking part in the study. Only written notes were taken during interviews, and the collected data anonymized. Participants' subject areas for teaching covered the following areas: Computer and Information Technology, Social and Political Sciences, and Public Health and Nursing. The detailed demographics of these participants are presented in Table 1.

Table 1. Demographics of participants for individual interviews

Data type	Detail
Gender	Male (2), Female (5)
Age range	35-50 (3), 51-65 (2), 65+ (1), do not want to answer (1)
Faculty	Computer and Information Technology (3), Social and Political Sciences (2), and Public Health and Nursing (2)
Role (some with multiple)	Professor (3), Associate Professor (4), Research Scientist (3)
Teaching experience (in years)	5-20 (2), 20+ (5)
Use of computer and IT services (in years)	20-35 (5), 36+ (2)
Digital learning material development (in years)	5-15 (3), 16-25 (3), 26+ (1)
UD and accessibility knowledge	Expert (2), Knowledgeable (3), Some knowledge (1), No knowledge (1)
Main role (some with multiple)	Teaching (7), Research (7), Software development (1), Administration (2)
Area of subject (some with multiple)	Climate Change and Global Health (1), Health Care and Nursing (2), Research Methodology (3), Interprofessional Communication and Collaboration (1), Universal Design of ICT (2), Human Computer Interaction (1), Technology and Society (1), Software Engineering (1), Artificial Intelligence (1), Social and Political Sciences (2), and Theory About Disabilities (1)
Course level (some with multiple)	Undergraduate level (4), Master's level (7), and Ph.D. level (3)

Table 2. Demographics of online survey respondents

Data type	Detail
Gender	No answer
Age range	35-50 (4), 51-65 (1)
Faculty	Data Science (1), Public administration (1), Political Sciences (1), and Statistics (2)
Role	No answer
Teaching experience (in years)	3-10 (4), 10+ (1)
Use of computer and IT services (in years)	20-30 (3), 30+ (2)
Digital learning material development (in years)	2-10 (3), 10+ (2)
UD and accessibility knowledge	Expert (1), Knowledgeable (1), Some knowledge (0), No knowledge (3)
Main role	No answer
Area of subject (some with multiple)	Statistics (2), Research Methods (3), Data Analysis (1), Public Policy (1), Quality Improvement (1)
Course level	No answer

For the online survey, participants were recruited from the same faculties as for the individual interviews. Five faculty members teaching within the following subject areas participated: Statistics, Data Science and Artificial Intelligence, Political Science, Public Administration, and Biology. The online survey was open for responses for 4 weeks. The detailed demographics of the respondents to the online survey are presented in Table 2.

Participants were asked about their field of teaching, personal experience in their respective fields, the type of DLMs they usually develop, their way of creating video lectures and their knowledge about texting these videos, their expertise in using tools for developing DLMs, knowledge about UD of ICT and related, their thoughts on considering UD in higher education, and their intentions with supporting diverse students and practicing UD. Participants were further asked whether they knew if the tools offered by their universities are universally designed, and how their universities facilitate them in practicing universal design. In addition, they were asked about how they managed migrating to the digital mode of teaching due to the COVID-19 pandemic. Although none of the survey respondents answered questions about their roles and course level, many said in their comments that they have several roles and teach at more than one course level.

2.2. Data Analysis

The collected data consisted of unstructured notes based on participants' expressed experiences, knowledge, observations, interactions, etc. The notes were then structured and anonymized, while keeping the original context. A six-phase framework developed by Braun and Clarke [10] for thematic analysis was used for the data analysis. After three iterations, three main themes emerged from the individual interviews and online survey. These are: *Type of digital learning materials*, *Issues with implementing universal design of ICT*, and *Teachers' needs and the role of HEIs in the implementation of UD* as shown in Figure 1. Each of the main themes have subthemes that are detailed in the results section.

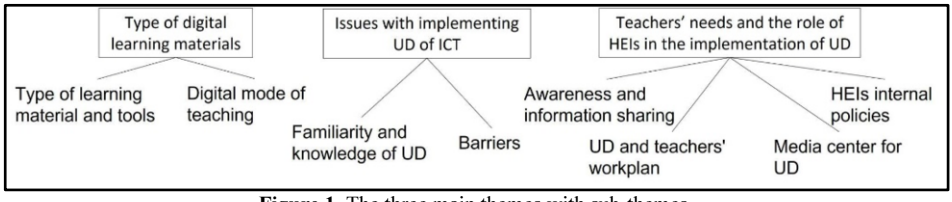

Figure 1. The three main themes with sub-themes.

3. Results

In this section, the main results and findings are presented. The results are organized into the three main themes that resulted from thematic analysis of interviews and online surveys. A table summarizing the main results is included for each main theme.

3.1. Types of digital learning materials

The first main theme relates to how teachers in HEIs develop and use learning materials in teaching, lecturing, and communication with students. This theme is divided into these

two sub-themes: *Type of learning material and tools* and *Digital mode of teaching*. The main results are summarized in Table 3.

Type of learning material and tools: All 12 participants reported they use text and written materials (documents, PDFs). Some also use videos of lectures or course-related topics, mathematical exercises, scripts, and LMS quizzes and discussion forums. Tools for developing DLMs included Microsoft (MS) PowerPoint, MS Word, LMS tools, Google Docs, Prezi, Excel, and RStudio and R programming language. No particular tools for making videos were mentioned by the participants.

Digital mode of teaching: All 12 participants used a digital mode of teaching. Ten said they had adapted quite well to the situation, although 2 were feeling more overworked than before the pandemic. All reported they received help from the university to conduct courses online. Nine said their preferred tools for online teaching were Zoom and/or MS Teams. Three reported the tools for online teaching were not fully accessible. The main challenges with online teaching were reduced interaction and less active students in online classes, and communicating with students through the LMS. The Norwegian regulations [4] require videos be texted if used as DLMs. Eight reported they did not know how to text videos, but two said they instead made the manuscripts available to students. The main reasons given for not texting videos were lack of time and no help with texting videos at the university.

Table 3. Summary of results Type of digital learning materials (N=12)

Sub Theme	Category	Participants reported	No. replies
Type of learning material and tools	Type of DLM	Textual/written materials (documents, PDFs)	12
		Videos of lectures or course-related topics	9
		Mathematical exercises, scripts, quizzes and discussion forums (LMS)	3
	Tools for making DLMs	Microsoft (MS) PowerPoint, MS Word, LMS tools	9
		Google Docs, Prezi, MS Excel, RStudio, R	3
Digital mode of teaching	Online teaching	Adapted/adjusted quite well	10
		Prefer Zoom and/or MS Teams	10
		Tools used for online teaching not fully accessible	3
	Challenges online teaching	Reduced interaction & less active students	3
		Communicating with students through LMS	5
	Texting videos – (knowledge & practice)	Does not know how to text videos	8
		Not done due to lack of time	10
		No help available from university	7

3.2. Issues with implementing UD of ICT

The second main theme relates to experienced issues when implementing UD on DLMs and what they know about UD of ICT, accessibility, and the Norwegian regulations [4]. This theme is further divided into two sub-themes: *Familiarity and knowledge of UD* and *Barriers*. The results for this theme are summarized in Table 4.

Familiarity and knowledge of UD: Nine participants showed partial or full knowledge of UD and would consider UD when making learning materials, while three reported they were not familiar with or have any knowledge of UD of ICT or any requirements on texting of videos for DLMs. Regarding UD practice, all 12 participants reflected that UD practice is important and must be considered and implemented within

the frames of the relevant subject field. Five with UD knowledge said UD is hard to practice, particularly the technical part of implementing requirements.

Barriers: The reported barriers mainly concerned the three main areas *technical aspects*, *awareness of UD*, and *organizational barriers*. All 12 participants expressed interest in learning more about the technical aspects of UD for digital tools and DLMs. The main challenges mentioned include overload of technical information and no time to learn the necessary technical aspects. Lack of UD awareness was stated by participants with no knowledge of UD as the main reason for not considering UD when developing DLMs. Eight participants reported they were not offered courses on UD or training on how to make DLMs accessible, although four had learned and adopted UD by their own initiative. Regarding organizational barriers, two participants reported that there is a lack of UD expertise in the university's public procurement.

Table 4. Summary main results Issues with implementing UD of ICT (N=12)

Sub theme	Participants reported	No. replies
Familiarity and knowledge of UD	No familiarity or knowledge of UD of ICT	3
	Partial or full knowledge of UD	9
	Considers UD for DLMs (participants with UD knowledge)	9
	UD hard to practice (participants with UD knowledge), especially implementing requirements	5
Barriers	Lack of UD awareness the main reason for not considering UD while developing DLMs	3
	Not offered UD course nor training on how to make DLMs accessible	8
	Learned and adopted UD by their own initiative	4
	University procurement lacks expertise in UD	2

3.3. Teachers' needs and the role of HEIs in the implementation of UD

The third main theme covers aspects such as what kind of support towards implementing UD teachers may need from their university, how HEIs are involved in the implementation of UD of ICT, and the institution's internal policies. This main theme is further divided into four sub-themes: *Awareness and information sharing, HEIs' internal policies*, *UD and teachers' work plan,* and *Media center for UD*. The results are summarized in Table 5.

Awareness and information sharing: UD awareness and information sharing was regarded as very important by nine participants, but requirements were not routinely considered. Two reported that accessibility support was available in the LMS they used. **HEIs' internal policies**: Five participants reported a lack of internal policies on UD of DLMs in their university, and one mentioned there were no initiatives regarding this from the university management. For advancing UD in HEIs, two suggested including UD in introductory courses for new employees and four said HEIs should provide UD experts to support teachers making their DLMs universally designed. **UD and teachers' work plan**: Ten participants said they need UD training and time for training, and all 12 said that not having the time to practice UD is a major issue. The help offered by the university for making DMLs universally designed did not solve the issue of not having enough time to practice UD. All 12 participants reported that they had no time in their work plan allocated to practicing or learning UD. **Media center for UD**: Five participants reported their university had a media center providing support with digital

teaching resources, while two reported UD support services, including help with video texting, were provided by third-party companies at their HEI.

Table 5. Summary of results Teachers' needs and the role of HEIs in the implementation of UD (N=12)

Sub theme	Participants reported	No. replies
Awareness and information sharing	UD awareness and information sharing important, but do not routinely consider the requirements	9
	Accessibility support is available in the university LMS	2
HEIs' internal policies	University lacks internal policies on UD	5
UD and teacher's work plan	Need UD training and time for training	10
	Help from university does not solve issue of lack of time for learning and practicing UD	8
Media center for UD	Media center available at university	5
	UD support provided by third-party company	2

4. Discussion

The findings in this study indicate that many teachers in HEIs in Norway do not practice UD on their DLMs, and that many lack awareness and knowledge of the UD regulations and requirements, training, sufficient time, and practical support from their HEIs to make DLMs universally designed. Practicing UD on DLMs is essential to ensure all students can access education, as demonstrated during the COVID-19 pandemic [11]. Further, the findings uncovered that most of the teachers in the study do not think that the guidelines are hard to follow when they are aware of the UD regulations and have enough time for practicing UD, but even then, many did not practice UD on their DLMs, which corroborates existing research [12]. Lack of time, UD knowledge and UD training are major issues that inhibits the practice of UD and confirms findings from previous research [7-8]. The results also indicate a lack of internal UD policy in HEIs, and that although HEIs may appear willing to provide their faculty members with necessary facilities and actions to implement UD of ICT, many HEIs seem to dedicate limited resources to media centers that can support the teachers in this area. The findings also indicate a lack of routines in HEIs for monitoring the tools available to teachers and students against compliance with universal design requirements.

Overall, the findings from this study suggest that HEIs effectively can prevent digital barriers by applying and implementing the regulations on UD of ICT and through adopting a top-down approach for implementing UD of DLMs in HEIs. In Norway, the HEIs and the authorities are important actors in promoting UD in DLMs and can help teachers in practicing UD when making DLMs. Corroborating with previous research [13-14], the present paper suggests that HEIs can do this by taking initiative through their internal policy, include accessibility as an integral part of the pedagogy, and making efforts towards practically promoting and ensuring that UD is being practiced in HEIs.

Limitations to this study include the relative low number of participants and that the study only covered HEIs in Norway. The former can partly be ascribed to the limited number of teachers in higher education institutions in Norway and the busy schedule of university teachers coping with the changes in teaching due to the COVID-19 pandemic at the time of data collection. Confining the study to only cover universities in Norway limits the usefulness of the study, although the situation for teachers in HEIs, their level of knowledge of UD, practice of UD, and experienced challenges when developing universally designed DLMs may be comparable to other countries in Europe.

5. Conclusion

This study investigated challenges faced by teachers when practicing UD of ICT and what support they might need from their universities to improve their practice of UD when developing DLMs. Based on the findings, we conclude that HEIs should prioritize UD of ICT in policies and ensure teachers get sufficient time and training on making universally designed DLMs. Further work within this topic could include evaluating whether ICT tools used in HEIs are equally accessible for teachers as well as students and extending the scope to also include HEIs in more countries. Finally, we would like to thank all participants that through the interviews and online survey contributed to the results of this study.

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