NTNU
Norwegian University of
Science and Technology

Web Portals for Students

A study on students' interest in and intention
to recommend university web portals

Morten Vaale Noddeland

Master of Science in Informatics
Submission date: January 2018
Supervisor: John Krogstie, IDI

Norwegian University of Science and Technology
Department of Computer Science

Sammendrag

Høsten 2013 ble en nettside kalt instabart.no lansert. Nettsiden ble laget for studenter ved NTNU og samlet lenker til de 12 mest brukte eller relevante IT-tjenestene på ett sted. Én måned etter lansering hadde nettsiden 2200 ukentlige brukere, som tilsvarte 10% av NTNUs studenter. Den eneste formen for PR som ble gjennomført var to Facebook-innlegg.

Denne erfaringen førte til et ønske om å besvare to spørsmål:

1. Kan portalsider som instabart bli like nyttige ved andre universiteter?
2. Er det mulig å forklare frivillig bruk og spredning av IT-tjenester ved å utvide teknologiakseptansemodellen (TAM)?

For å besvare disse spørsmålene ble portalsider for to ulike universiteter laget. Nettsidene ble lansert og promotert via Facebook. Tre spørreundersøkelser ble gjennomført, der totalt 214 studenter testet én av portalsidene før de så besvarte spørreskjemaet. TAM-modellen ble utvidet med konseptet «adferdsmessig intensjon om å anbefale». PLS-SEM (som står for «partial least squares structural equation modelling») ble gjennomført for å vurdere kvaliteten til den foreslåtte TAM-utvidelsen.

Resultatet viste at det finnes en interesse for portalsider for studenter. Deltakerne i spørreundersøkelsen omtalte nettsidene svært positivt. Ingen av de nye nettsidene ble like mye brukt som Instabart, men de fikk begge en moderat mengde faste brukere.

PLS-SEM-analysen viste at tre av de fire foreslåtte faktorene hadde en signifikant påvirkning på «adferdsmessige intensjon om å anbefale». Analysen understøttet også funn fra tidligere TAM-studier, slik som at «oppfattet nytteverdi» er den sterkeste predikatoren for «adferdsmessig intensjon om å bruke».

Abstract

In the autumn of 2013, a website called instabart.no was launched. The website catered to students at NTNU and focused on gathering links to the 12 most useful IT services for students. Within a month of its launch, the website had gained 2200 weekly users, equivalent to 10% of NTNUs student body. The only form of PR was two Facebook posts.

This experience led to a desire to answer two questions:

1. Can university web portals similar to Instabart be just as relevant at other universities?

2. Is it possible to better explain voluntary adoption of IT services by extending the Technology Acceptance Model?

To answer these questions, two new university web portals were created. The websites were then launched and afterwards promoted via Facebook. Three surveys were conducted, where a total of 214 students tested the web portals before answering a questionnaire. The Technology Acceptance Model (TAM) was extended with a construct called "behavioral intention to recommend". PLS-SEM, short for partial least squares structural equation modelling, was conducted to assess the quality of the new TAM extension.

The results revealed a clear interest in university web portals. Students rated the web portals highly in the survey. The websites did not become as popular as Instabart, but gained a modest amount of loyal users.

The PLS-SEM analysis showed that the construct "behavioral intention to recommend" was significantly affected by three of the models construct: "behavioral intention to use", "perceived usefulness" and "perceived enjoyment". The model also conformed to earlier TAM findings, such as "perceived usefulness" being the strongest predictor of "behavioral intention to use".

Preface

This thesis has been written by Morten Vaale Noddeland, and is the final delivery for my masters degree in Informatics at the Norwegian University of Science and Technology. The idea for the thesis was proposed by me, and then further refined in consultation with my supervisor, professor John Krogstie at the Department of Computer Science. I would like to thank him for his guidance and input throughout the project.

I would also like to thank the Karlsen Pedersen family, both for their help getting in contact with students at UiB, and for providing excellent board and lodging during my trip to Bergen.

A big thanks goes to my parents. Their unwavering support and encouragement throughout my education has really been invaluable.

Lastly, I want to thank Silje, whose care made writing this thesis much easier than it otherwise would have been.

Morten Vaale Noddeland
Oslo, January 26, 2018

Contents

1 Introduction **1**

1.1 Motivation 1

1.2 Research Questions 2

1.3 Thesis Structure 2

2 Background **5**

2.1 Presentation 5

2.2 Launch and Usage Statistics 6

3 Theories of Technology Acceptance **13**

3.1 The Technology Acceptance Model 13

3.2 Variations of TAM 14

3.2.1 TAM2 15

3.2.2 UTAUT 15

3.2.3 TAM for Hedonic Systems 16

3.3 Criticism of TAM and its Variations 17

3.4 Adding "Intention to Recommend" to TAM 18

3.4.1 TAM + ECM 18

3.4.2 TAM + TPB 19

4 Research Design **21**

4.1 Research Outline 21

4.1.1 Step 1: Development of a Research Model 21

4.1.2 Step 2: Development of New University Web Portals 21

4.1.3 Step 3: Data Collection 22

4.1.4 Step 4: Data Analysis 22

4.2 Research Methodology 22

4.2.1 Guidelines for Design Science Research 23
4.3 Research Model 24
4.3.1 Reasoning Behind the Model 25
4.3.2 Model Hypotheses 26
4.3.3 Model Analysis 27

5 Creating the University Web Portals 29
5.1 Presentation of the Websites 29
5.2 Link Selection 32
5.3 Branding 34
5.4 Design and Usability 35
5.4.1 Responsive Web Design 35
5.4.2 Accessibility 35
5.4.3 Adding Delight 36
5.5 Technical Details 37
5.5.1 Performance 38
5.5.2 Usage Statistics 38
5.6 Pre-launch Testing 39
5.6.1 Method 39
5.6.2 Results 39
5.7 Launch 40

6 Survey 41
6.1 Survey Items 41
6.2 Survey Rigidity 43
6.3 Sampling Technique 43
6.4 Conducting the Survey 44

7 Results: Descriptive Statistics 47
7.1 Structure of the Descriptive Statistics 47
7.2 Demographics 48
7.3 Perceived Usefulness 49
7.4 Perceived Ease of Use 50
7.5 Perceived Enjoyment 52
7.6 Behavioral Intention to Use 53
7.7 Behavioral Intention to Recommend 55
7.8 Comparison of the Surveys 58

8 Results: Inferential Statistics **59**
8.1 Assessing Differences Between the Surveys 59
8.2 Assessing Reliability and Validity 60
8.2.1 Internal Consistency Reliability 60
8.2.2 Convergent Validity 61
8.2.3 Discriminant Validity 62
8.3 Assessing the Structural Model 67

9 Results: Usage Statistics **69**
9.1 Common Terms 69
9.1.1 Users 69
9.1.2 Events 70
9.1.3 Pageviews and Sessions 70
9.2 DUiO 70
9.2.1 Sessions 70
9.2.2 Users 71
9.2.3 Traffic Sources 73
9.2.4 What Links Were Used 73
9.3 Ugleredet 74
9.3.1 Sessions 74
9.3.2 Users 74
9.3.3 Traffic Sources 75
9.3.4 What Links Were Used 76

10 Discussion **79**
10.1 Interest in University Web Portals 79
10.1.1 Assessing the Survey 79
10.1.2 Assessing the Usage Statistics 80
10.1.3 Implications 81
10.2 Evaluating the Proposed TAM Extension 82
10.2.1 Comparison of Explained Variance 82
10.2.2 Assessing the Hypotheses 82
10.2.3 Limitations 83
10.2.4 Implications 84

11 Conclusion and Further Work **85**
11.1 Conclusion 85
11.2 Future Work 86

A Rejected Brand Names **87**
A.1 University of Oslo 87
A.2 University of Bergen 88

B Survey Script **89**

C Survey (in Norwegian) **91**

D Statistical Summary of the Surveys **95**

E Comments **99**
E.1 DUiO Survey 99
E.2 Ugleredet Survey 101
E.3 Instabart Survey 102

Bibliography **103**

List of Figures

2.1 Screenshot of Instabart 6
2.2 Facebook Post Promoting Instabart 7
2.3 Instabart - Users 8
2.4 Instabart - Traffic Sources 8
2.5 Instabart - New vs. Returning Visitors 8
2.6 Instabart - Sessions (2013-2017) 10
2.7 Instabart - Intranet Module 11

3.1 The Technology Acceptance Model 14
3.2 TAM2 15
3.3 UTAT 16
3.4 TAM for Hedonic Systems 17
3.5 TAM + ECM 18
3.6 TAM + TPB 19

4.1 The Design Science Research Process 22
4.2 The Proposed Research Model 25

5.1 Screenshots of the University Web Portals 30
5.2 Information Modal on DUiO 31
5.3 Print Modal on Ugleredet 31
5.4 University Web Portal Branding 34
5.5 DUiO as Seen on a Tablet, Phone and Laptop 36
5.6 Hover Effect on the Links 38

6.1 Characteristics of the Likert Scale 44

7.1 The Four Levels of Measurement 48

8.1 The Structural Model 68

9.1 DUiO - Sessions 71
9.2 DUiO - Weekly Visitors 72
9.3 DUiO - New vs. Returning Visitors 72
9.4 DUiO - Traffic Sources 73
9.5 Ugleredet - Sessions 75
9.6 Ugleredet - Weekly Visitors 76
9.7 Ugleredet - New vs. Returning Visitors 76
9.8 Ugleredet - Traffic Sources 77

List of Tables

2.1 Instabart - Link Usage 9

4.1 Comparative Analysis of SEM Techniques 27

5.1 Potential Portal Links 33
5.2 Excerpt of the WCAG 2.0 Success Criteria 37

6.1 Constructs and Items Used in the Survey 42

7.1 Demographics - Gender 49
7.2 Demographics - Year 49
7.3 Demographics - Heard of Website 50
7.4 Demographics - Used Website 50
7.5 Distribution Table - Perceived Usefulness 51
7.6 Statistical Summary - Perceived Usefulness 51
7.7 Distribution Table - Perceived Ease of Use 53
7.8 Statistical Summary - Perceived Ease of Use 53
7.9 Distribution Table - Perceived Enjoyment 54
7.10 Statistical Summary - Perceived Enjoyment 54
7.11 Distribution Table - Behavioral Intention to Use 56
7.12 Statistical Summary - Behavioral Intention to Use 56
7.13 Distribution Table - Behavioral Intention to Recommend 57
7.14 Statistical Summary - Behavioral Intention to Recommend 57
7.15 Mean for Each Survey Item 58

8.1 Results of the PLS Multigroup Analysis 60
8.2 Internal Consistency Reliability 61
8.3 Outer Loadings 63

8.4 Average Variance Extracted (AVE) 64
8.5 Cross Loadings 65
8.6 Fornell-Larcker Criterion 66
8.7 HTMT Ratios 66

9.1 DUiO - Link Usage 74
9.2 Ugleredet - Link Usage 77

10.1 Summary of the Hypothesis Results 83

D.1 Statistical Summary - NTNU 96
D.2 Statistical Summary - UiO 97
D.3 Statistical Summary - UiB 98

Acronyms

AVE Average Variance Extracted

BI Behavioral Intention (to Use)

BIR Behavioral Intention to Recommend

CSS Cascading Style Sheets

ECM Expectancy Confirmation Model

HTMT Heterotrait-Monotrait Ratio

NTNU Norwegian University of Science and Technology

PE Perceived Enjoyment

PEOU Perceived Ease of Use

PLS Partial Least Square

PU Perceived Usefulness

SEM Structured Equation Modelling

SUS System Usability Scale

TAM Technology Acceptance Model

TPB Theory of Planned Behavior

TRA Theory of Reasoned Action

UI User Interface

UiB University of Bergen

UiO University of Oslo

UTAUT Unified Theory of Acceptance and Use of Technology

WOM Word of Mouth

Chapter 1

Introduction

1.1 Motivation

In the autumn of 2013, a website called instabart.no was launched. The premise of the website was simple: Provide links to the 12 most useful IT services students at NTNU. Within a month of its launch, the website had gained 2200 weekly users, equivalent to 10% of NTNUs student body. Apart from two Facebook posts, no marketing was done to promote the website.

Most universities offer IT services such as email, schedules and course registration to their students. These are the types of IT services shown on Instabart. This begs the question: Did Instabart uncover an unfulfilled need among students? Could similar web portals do just as well at other universities?

Another interesting aspect of the Instabart launch was the speed of which the link spread among students. It is difficult to tell exactly what made the website go viral in this manner, and the topic has only seen limited coverage in the Information Systems (IS) field. While a number of studies have examined which factors affect a systems acceptance and usage [Davis, 1989; Venkatesh et al., 2003], only a few have tried expanding those theories to cover the user's intention to recommend a system [Hsu et al., 2013].

The goal of this thesis is to examine what factors affect the user's intention to recommend university web portals, as well as measure the interest for such systems among students.

1.2 Research Questions

The following questions has served as the foundation for this thesis:

- **RQ 1:** Is there an interest in university web portals among students?
- **RQ 2:** Is it possible to extend an IS acceptance model in such a way that it better explains the spread of voluntary IT systems?

The first research question deals with whether there is an interest for this kind of websites. The success of Instabart in Trondheim suggests that university web portals might meet a common and unfulfilled need among students. However, it is unclear whether Instabarts success is caused by factors specific to NTNU or if it applies to other universities as well.

The second research question aims to expand a suitable acceptance model to better explain a users intention to recommend a system. Such a model could potentially be of great value, especially when it comes to systems without natural ways of gaining users, such as the above-mentioned web portals.

Two types of artifacts have been created during this study: An acceptance model adapted to explain intention to recommend, and two launch-ready university web portals.

1.3 Thesis Structure

The thesis is structured as follows:

Chapter 2 - Background introduces Instabart, the website that inspired this study.

Chapter 3 - Theories of Technology Acceptance presents some of the most prominent acceptance models. This literature review informed the creation of the research model.

Chapter 4 - Research Design presents the research model created and explains how it was analyzed. Furthermore, the general research methods used are presented.

Chapter 5 - Creating the University Web Portals shows the process of creating and launching the new university web portals.

Chapter 6 - Survey presents the survey used to measure students' reaction to the university web portals.

Chapter 7 - Results: Descriptive Statistics describes the results of the surveys.

Chapter 8 - Results: Inferential Statistics presents the results of the research model analysis.

Chapter 9 - Results: Usage Statistics presents the real world usage of the two university web portals.

Chapter 10 - Discussion considers the findings of this study

Chapter 11 - Conclusion sums up the results and provide some recommendations for future work.

Chapter 2

Background

This chapters introduces Instabart, the website that inspired this study. Section 2.1 presents the website and explains some of the thinking behind it. Section 2.2 describes the launch of the website and presents some usage statistics.

2.1 Presentation

Instabart (https://instabart.no) is a website made for students at the Norwegian University of Science and Technology (NTNU). A screenshot of the website is shown in figure 2.1. The website contains links to twelve of the most commonly used IT services for NTNU students, such as assignment delivery, email, room booking, timetable and more. In general, this type of website can be categorized as a web portal [Nam, 2014]

The idea came into being through a combination of own experiences as a student at NTNU and observations made while working in IT support at the IT Division. While NTNU offered a lot of excellent IT services to their students, several of them were hard to find.

In some cases, the problem was long and obscure links. As an example, the following was the direct link to Itslearning, one of the most frequently used IT services: https://sats.itea.ntnu.no/sso-wrapper/web/wrapper?target=itslearning

In other cases, the issue was that students didn't even know that the website existed. Often the only references to the IT services were hidden within lengthy documentation articles on the intranet. Room booking and historical grade statistics are examples of such websites.

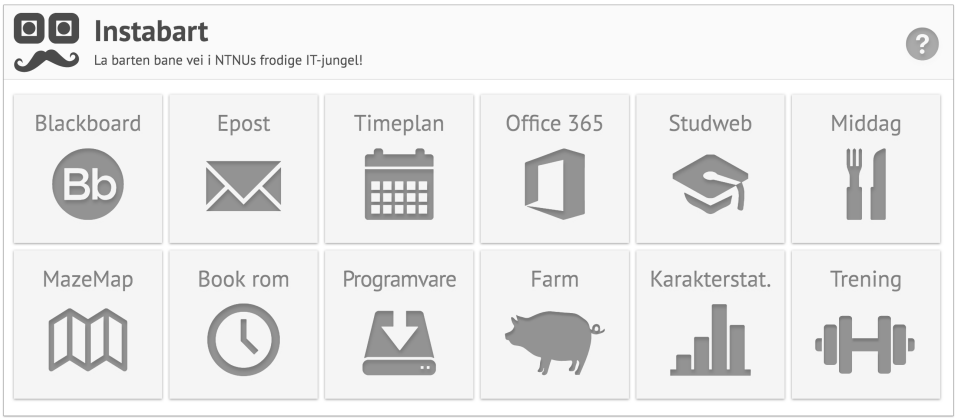


Figure 2.1: Screenshot of Instabart

Instabart aimed to improve this by putting the IT services front and center. By making them more accessible, students might...

1. Discover IT services they didn't even knew existed
2. Make it effortless to visit websites they used frequently

The IT services were chosen using two guiding principles: First, the IT services should let the student *do* something and not just link to information pages. This would make the website more useful to returning visitors. Secondly, the selection of links should be based on the real needs of the student. This entailed including links to IT services not officially approved by the university itself, such as the widely used schedule generator ntnu.1024.no.

Another consideration during the design process was branding. The name Instabart was for several reasons: It was short, was easy to remember and was somewhat humorous to NTNU students. The website featured several mustache puns to add a whimsical tone.

Lastly, the website used responsive web design to ensure that it worked properly on phones, tablets, and computers.

2.2 Launch and Usage Statistics

Instabart was launched 18th August 2013. Usage data was collected using Google Analytics. No real effort to promote the website was made. The only form of

promotion was two Facebook posts posted to the creators' friends (see figure 2.2). While both posts garnered a positive response, none of them got more than 40 likes or 13 shares.

Figure 2.2: Facebook posts promoting Instabart. Translation : *"NTNU student? Do you you have control over all the IT services NTNU provides? No? This summer I made www.instabart.no, a start page for students in mustache city. You'll get how it works in two seconds - take a look, and spread the word!"*

Despite the seemingly limited response to the Facebook posts, the website started gaining traction fast. Within the first 24 hours, approx. 1800 users visited the website. Figure 2.3 shows the number of weekly users during the websites first semester. As can be seen, the number of weekly users stabilized around 2300 within a few weeks. For context, NTNU had approx. 22 000 students at that point in time.

Figure 2.4 shows a graph of the traffic sources during the websites first semester. Initially, social media had the most significant impact. However, after a few weeks, most of the users came to the website directly, either by remembering the correct URL or by saving it as a bookmark.

Figure 2.5 shows the distribution of new vs. returning visitors. A large percentage of the students that visited the website, became returning visitors. By the third week, 87% of the users were returning visitors.

Table 2.1 shows a list of what links were used the most. Itslearning was by far

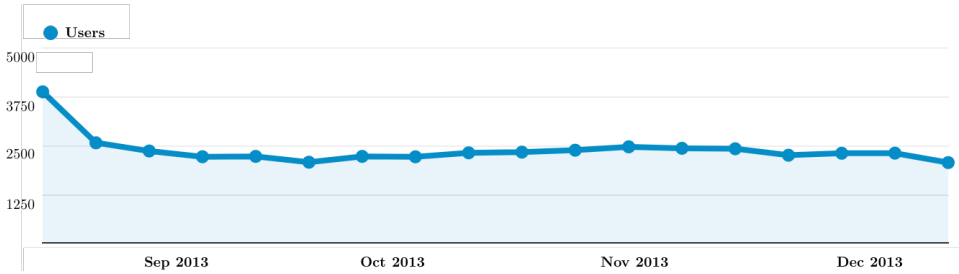


Figure 2.3: Users per week (18th August - 23rd December 2013)

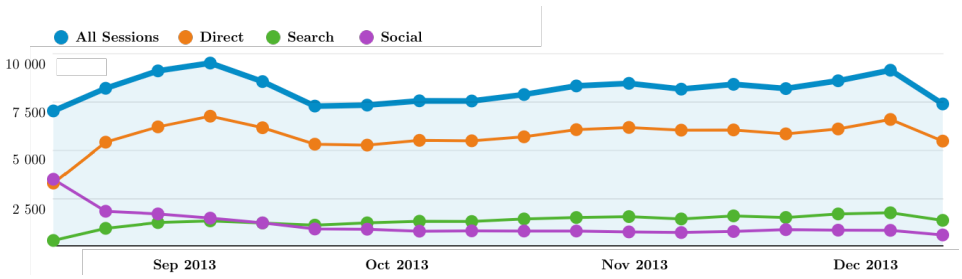


Figure 2.4: Traffic sources (per week)

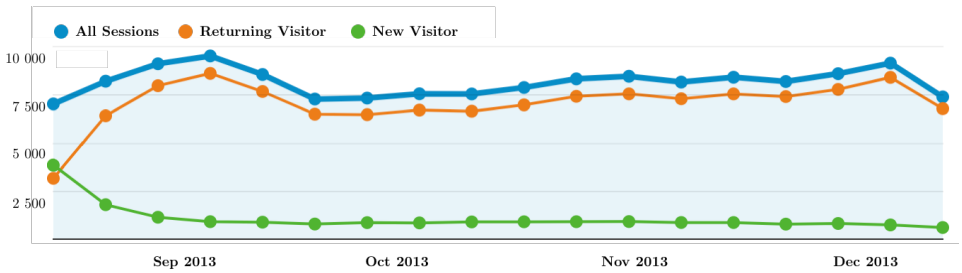


Figure 2.5: New vs. Returning Visitors (per week)

the most frequently clicked link, accounting for 63.7% of the total clicks. While such a high percentage is a bit surprising, it doesn't necessarily mean that the rest of the links aren't useful. While most NTNU students have to check itslearning several times a week (to deliver assignments and such), they only have to use studentweb a few times per semester (to register for courses, etc.).

All the usage statistics up until this point has focused on Instabarts first semester. This is the period that it was most relevant to compare new web portals

Table 2.1: Link usage (18th August - 23rd December 2013)

Link	**n**	**%**
Itslearning	96295	63,7 %
Email	22240	14,7 %
Studentweb	7082	4,7 %
Schedule	6960	4,6 %
Dinner	4090	2,7 %
Room reservation	3662	2,4 %
Grade statistics	3170	2,1 %
Software farm	3065	2,0 %
Campus map	1687	1,1 %
FileSender	1202	0,8 %
Create email list	857	0,6 %
IT help	806	0,5 %
Total	151116	100 %

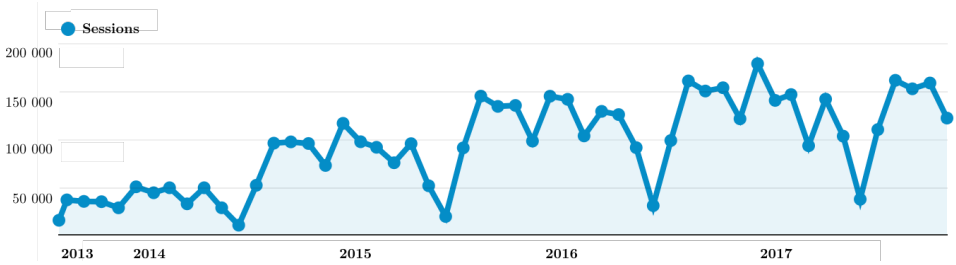


Figure 2.6: Sessions per month (2013-2017)

with. However, it is worth mentioning how Instabart fared in the following years.

Figure 2.6 shows an overview of monthly sessions from August 2013 to December 2017. In January 2014 the number monthly increased slightly (to approx. 50 000 sessions/month). Half a year later, the amount of traffic nearly doubled (approx. 100 000 sessions/month). One theory that could explain the increase in traffic is that the website is most popular among new students. When the freshmen became sophomores, they might have introduced the new freshmen to the website.

All in all, the website has been visited 4.9 million times since its launch in 2013. As of 2017, approx 9000 users visit the website weekly.

By request from the IT director Håkon Alstad at NTNU IT, a version of Instabart was ported to NTNUs intranet in 2014. Figure 2.7 shows a picture of the module. The module was placed on the intranets frontpage. Usage statistics for this module is not available, as it is controlled directly by the IT division.

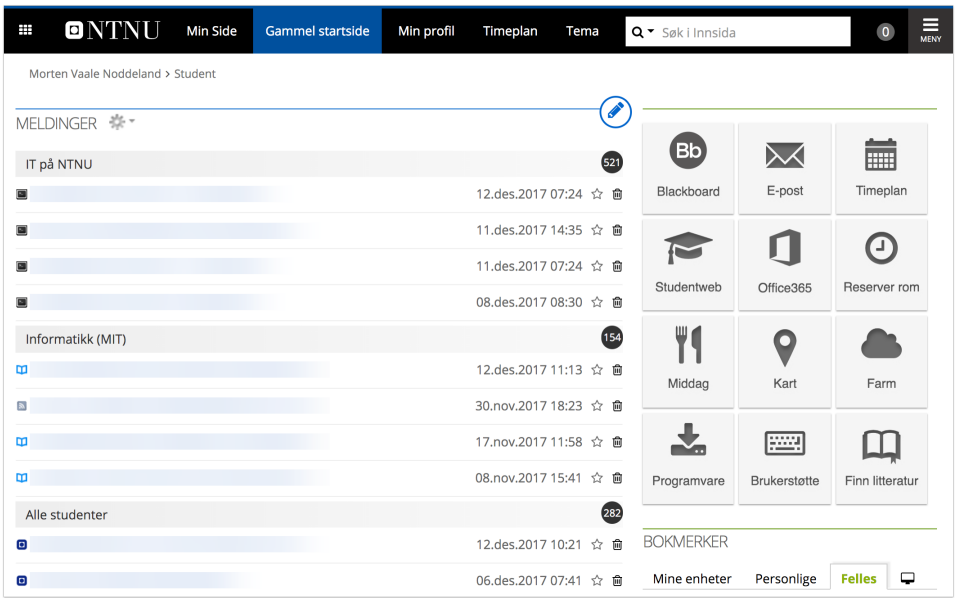


Figure 2.7: Instabart module created for NTNUs Intranet

Chapter 3

Theories of Technology Acceptance

Through the years a lot of research has been conducted to better predict and explain IT acceptance and usage. This chapter aims to present some of that prior research.

Section 3.1 introduces the Technology Acceptance Model (TAM), the theory that has served as the foundation of this research. Section 3.2 presents some variations of TAM. Section 3.3 describes the limitations and criticism of TAM. Lastly, section 3.4 presents two TAM extensions that account for the users "intention to recommend".

3.1 The Technology Acceptance Model

The Technology Acceptance Model (TAM) is a well-known acceptance model developed in the late 80' [Davis, 1989]. It is based on the Theory of Reasoned Action (TRA), a general social psychological theory which has been used to study various behaviors, such as exercise, voting and condom use [Fishbein and Ajzen, 1975].

TAM was originally proposed due to concerns that white collar workers weren't using the IT systems available to them [Davis, 1989; Davis et al., 1989]. Davis reasoned that to increase use, one should first aim to increase the acceptance of the IT system. He theorized that the acceptance could be assessed by asking individuals about their future intentions to use the system. By knowing what affects the user's intention to use the system, the organizations could manipulate

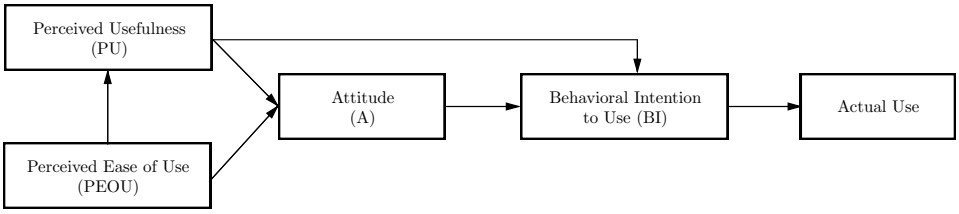


Figure 3.1: The technology acceptance model

those factors to increase acceptance, and thus IT usage [Holden and Karsh, 2010].

Figure 3.1 shows the technology acceptance model. As mentioned, TAM indicates that *Behavioral Intention to Use* (BI) can be used to identify actual systems use. Furthermore, BI is affected by the users *Attitude* (A) to use the system. The attitude towards the system is affected by two factors: *Perceived Ease of Use* (PEOU) and *Perceived Usefulness* (PU). Davis [1989] defined the constructs as follows:

- **Perceived Ease of Use:** The degree to which a person believes that using a particular system would be free of effort
- **Perceived Usefulness:** The degree to which a person believes that using a particular system would enhance his or her job performance.

The original paper also made references to *External Variables* which might affect PEOU and PU. However, identifying such variables was not done in the original TAM model and was left to future research (such as the TAM2 model [Venkatesh and Davis, 2000]).

Since its creation, TAM has become a mainstay of the information systems field. It has been estimated that as much as 10% of IS publications is related to TAM research [Lee et al., 2003].

3.2 Variations of TAM

Many variations of TAM has been proposed. Some have tried to make it more suited for specific purposes, while others have wanted to create a broader model that takes more factors into consideration. The following are some of the more prominent variations of TAM.

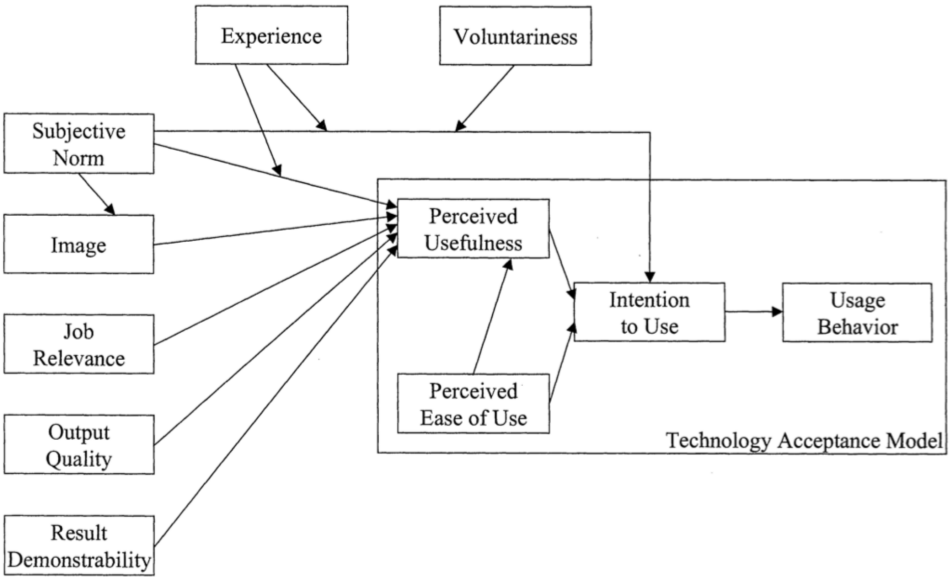


Figure 3.2: TAM2 (taken from Venkatesh and Davis [2000])

3.2.1 TAM2

Figure 3.2 shows TAM2, a model developed by Venkatesh and Davis in 2000. The model removed the attitude construct and added several new constructs. The perhaps most interesting of them is *Subjective Norm* (SN). SN is meant to reflect the things that compel the user to accept the system, such as social influence from colleagues. The model also added several different determinants of PU, such as *Job Relevance* and *Image*.

The model was tested by using it on four different systems, where two of them were mandatory to use and two were optional. SN was shown to have an impact, but only on mandatory systems. The external variables ended up explaining approx. 60% of the PU variance [Venkatesh and Davis, 2000]. Lastly, the predictive power of PEOU and PU remained consistent across the systems.

3.2.2 UTAUT

UTAUT stands for *Unified Theory of Acceptance and Use of Technology.* It is the result of an effort to combine seven different IT acceptance models into one. Examples of such models are TAM, TRA and TPB (theory of planned behavior).

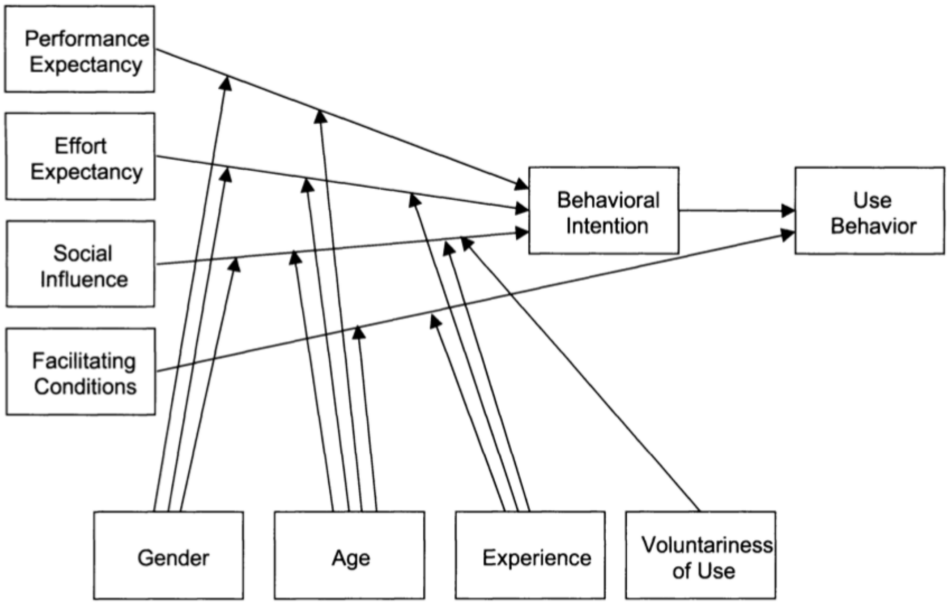


Figure 3.3: UTAUT (taken from Venkatesh et al. [2003])

Figure 3.3 shows the model. It is a bit difficult to see the similarities with TAM, as many of TAMs constructs are incorporated into other constructs: PU is incorporated into *performance expectancy*, PEOU into *effort expectancy*, and SN into *social influence*.

The model seems to perform well. In the original paper, the seven original models explained between 17% and 53% of the variance in BI, while UTAUT was able to explain 70% of the variance. [Venkatesh et al., 2003].

3.2.3 TAM for Hedonic Systems

TAM for hedonic systems was originally proposed by Davis et al. [1992]. It is based on the original TAM model, but adds the construct *Perceived Enjoyment* (PE). He defined PE as follows:

- **Perceived Enjoyment:** The extent to which the activity of using the computer system is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated.

The model has not been widely used, as PU has proved to be a stronger indicator

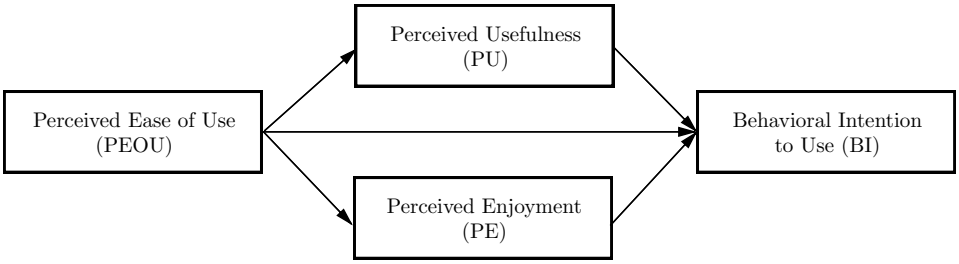


Figure 3.4: TAM for hedonic systems (taken from van der Heijden [2004])

of BI than PE. However, in 2004 Van der Heijden showed that there is a difference between productivity-oriented (utilitarian) systems and pleasure-oriented (hedonic) systems. While PU remained the strongest predictor of BI for utilitarian systems, PE became the strongest predictor for hedonic systems [van der Heijden, 2004]. Van der Heijden also theorized that PE could prove beneficial for utilitarian systems since a focus on enjoyment might help improve the acceptance.

In Van der Heijdens study, the model was only able to explain 35% of the variance in intention to use. However, some newer studies using the model has gotten higher percentages. Chesney [2006] were able to explain 62% of the total variance in intention to use LEGO Mindstorms, while Haugstvedt and Krogstie [2012] were able to explain 57% of the variance in intention to use a mobile AR app for accessing cultural heritage resources.

3.3 Criticism of TAM and its Variations

TAM has some shortcomings worth mentioning. One of the problems is its limited explanatory power. According to Legris et al. [2003] TAM and TAM2 only accounted for 40% of a systems use. Furthermore, the van der Heijden [2004] model only accounted for 35% of the variance in intention to recommend. These examples of low predictive power are part of why the creators continued to redefine and update the model. UTAUT improved the predictive power, but at the cost of its simplicity.

Another problem with TAM is the lack of a systematic approach to adapting it to various environments and IT systems. Benbasat and Barki [2007] argued that "the inability of TAM as a theory to provide a systematic means of expanding and adapting its core model has limited its usefulness in the constantly evolving IT

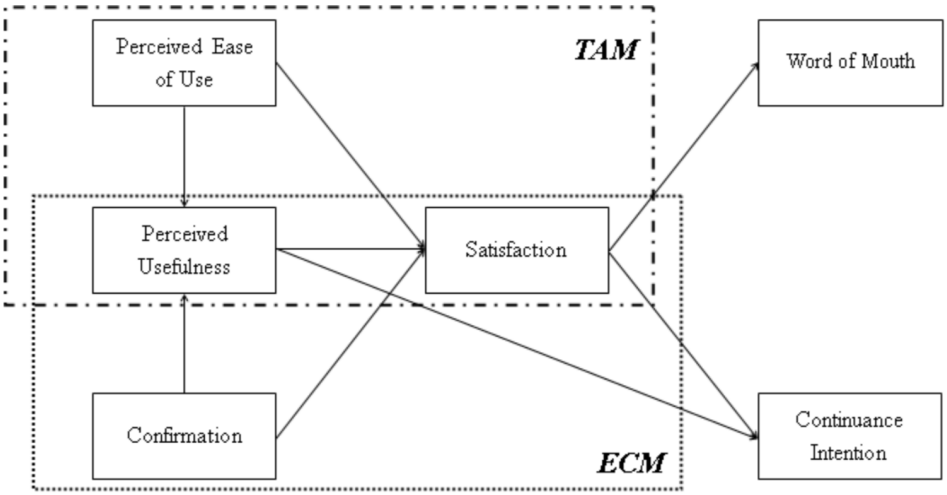


Figure 3.5: TAM + ECM (taken from Hsu et al. [2013])

adoption context".

One way of handling this issue is to expand TAM by adding extra constructs. The hedonic TAM model shown in the previous section is an example of this. However, the problem with this approach is that the researchers are forced to propose their own scales, which in turn will be less verified by the scientific community. This dilution of models also makes it harder to compare findings between studies.

3.4 Adding "Intention to Recommend" to TAM

As mentioned in the introduction, a goal of this thesis is to study how the voluntary usage of IT systems spreads. This concept has not been covered in any of the models so far. This section will present two (lesser known) models that have defined ways to measure an *Intention to Recommend*.

3.4.1 TAM + ECM

The Expectancy Confirmation Model (ECM) is a model normally used to assess consumer satisfaction and usage behavior [Tse and Wilton, 1988]. The model posits that the consumers' expectation and perceived performance affects their satisfaction.

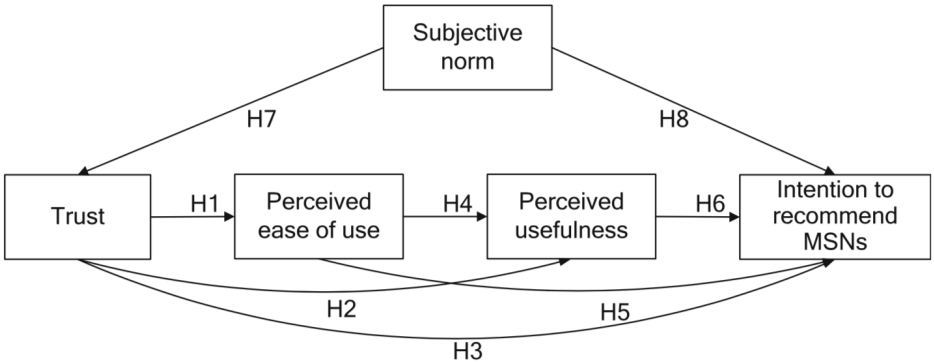


Figure 3.6: TAM + TPB (taken from Chang et al. [2017])

In 2013, Hsu et al. tried combining ECM with TAM. Figure 3.5 shows their proposed model. In their model, the construct *satisfaction* determines *word of mouth* and *continuance intention* (mostly the same as BI).

The results showed that satisfaction was indeed affected by PU, PEOU, and confirmation. Continuance intention and word of mouth were affected by satisfaction. In total, the model explained 66.3% of the variance in WOM and 49.1% of the satisfaction variance.

One potential downside of this model is that satisfaction is the only construct which directly affects word of mouth. This can make the model somewhat less useful, as it becomes harder to identify what can be done to make the WOM score higher.

3.4.2 TAM + TPB

Figure 3.6 shows a model that combines TAM with the *Theory of Planned Behavior* (TPB). The model was proposed by Chang et al. in an attempt to examine users intention to recommend multimedia content on social networks. In addition to PEOU and PU, the model includes the constructs trust and subjective norm.

The results of the study ended up varying between heavy and light users of social media. For heavy users, all paths in the model were deemed statistically significant and the model explained 60.9% of the variance in intention to recommend. For light users, the model was less successful, as only half of the paths proved to be significant [Chang et al., 2017].

It is also worth noting that the usefulness of the model will depend on the IT

systems it aims to describe. In some context, such as e-commerce, trust has proved valuable [Gefen et al., 2003]. In others, such as hedonic systems, it might be of less relevant.

Chapter 4

Research Design

This chapter shows how the study was structured and which research methods that were used. First, Section 4.1 summarizes the research plan. Then section 4.2 presents the research methodology used in this study, as well as showing how the methodology was followed. Lastly, section 4.3 presents the research model and the approach used to assess it.

4.1 Research Outline

The following summarizes the different stages of the research. All the topics mentioned here will be covered more thoroughly in later chapters.

4.1.1 Step 1: Development of a Research Model

A new TAM inspired research model, which accounts for the user's intention to recommend a system, was developed. The model is presented in section 4.3.

4.1.2 Step 2: Development of New University Web Portals

Two new university web portals were created. The websites were tailored to the needs of students at two different universities: The University of Oslo (UiO) and the University of Bergen (UiB). The websites were launched at the beginning of the fall semester in 2017. The only form of promotion was social media. The development process for the web portals is covered in chapter 5.

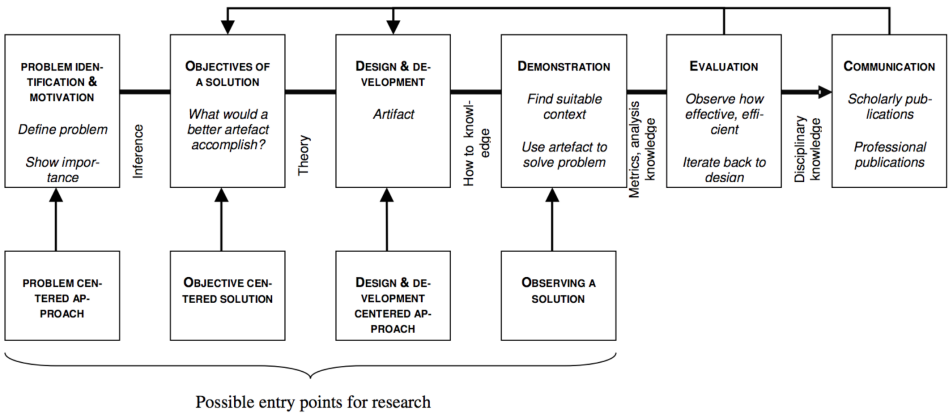


Figure 4.1: The design science research process (taken from Peffers et al. [2006])

4.1.3 Step 3: Data Collection

A survey was conducted at three universities, NTNU, UiO, and UiB. Roughly 70 students from each university tested the web portal related to their university before answering a survey. Chapter 6 covers how the survey was created and conducted.

Usage statistics from students visiting the websites was gathered using Google Analytics.

4.1.4 Step 4: Data Analysis

Using the results of the surveys, the research model was analyzed using statistical analysis (PLS-SEM). The results of the surveys were also used to evaluate the interest in university web portals. Lastly, the usage statistics gathered throughout the semester were analyzed. These topics are covered in chapter 7, 8 and 9.

4.2 Research Methodology

The methodology used in this study is *Design Science Research*. The main purpose of the methodology is to gain knowledge about a problem domain through the development and evaluation of artifacts [Hevner et al., 2004].

Figure 4.1 shows an overview of the process. The methodology can be broken into six sequential steps, with the four first being possible entry points for the research. After the research has completed step 5 (evaluation), the researcher can

choose whether to proceed to step 6 (writing an academic paper) or revisit an earlier step.

The entry point for this study was step 3, the design & development-centered approach. The existence of instabart.no had to some extent helped defined the problem, by uncovering a possible unfulfilled need among students. However, the choice of entry point was not entirely clear-cut, as the research also involved developing a new, TAM inspired model. The work on the model started from step 1, the problem centered approach.

4.2.1 Guidelines for Design Science Research

In a paper from 2004, Hevner et al. suggested seven guidelines for conducting proper design science research. The guidelines, as well as a quick remark on how each guideline has been met, are listed below.

> ***1. Design as an Artifact:*** *Design science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation*

Two types of artifacts were created in this study: (1) A TAM inspired model with the purpose of measuring intention to recommend, and (2) two new university web portals.

> ***2. Problem relevance:*** *The objective of design science research is to develop technology-based solutions to important and relevant business problems*

The relevance of developing and acceptance testing university web portals is explained in the introduction (see section 1.1).

> ***3. Design evaluation:*** *The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods*

Both of the artifacts were rigorously constructed and tested. Chapter 5 presents the effort put into creating launch-ready university web portals, as well as the result of the pre-launch testing. Chapter 8 presents the evaluation of the proposed acceptance model.

> ***4. Research contributions:*** *Effective design science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies*

This research will provide several contributions: (1) An evaluation of the usefulness and interest in university web portals. (2) An analysis of the proposed acceptance model. (3) The artifacts themselves.

> ***5. Research rigor:*** *Design science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact*

The acceptance model was evaluated using PLS-SEM statistical analysis (see section 4.3), while the university web portals were assessed through a combination of usage statistics and survey results.

> ***6. Design as a search process:*** *The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment*

This research started by defining the research questions to be answered. The direction of the research changed several times as new information became available. The results of the research reflect the knowledge gained by iterating and exploring the problem space.

> ***7. Communication of research:*** *Design science research must be presented effectively to both technology-oriented and management-oriented audiences*

This thesis aims to present the findings of the research. Thought has been put into making the language accessible to a broad audience.

4.3 Research Model

One of the two research questions of this research reads as follows: *"Is it possible to extend the Technology Acceptance Model in such a way that it better explains voluntary adoption of IT systems?* To help answer that question, a new extension of the TAM model was developed.

Figure 4.2 shows the proposed research model. The model consists of five constructs: The *perceived ease of use*, *perceived usefulness* and *behavioral intention to*

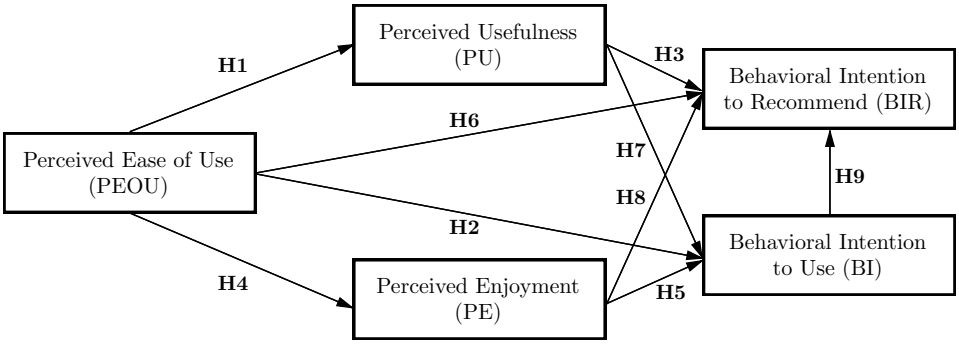


Figure 4.2: The proposed research model, adapted from van der Heijden [2004]

use constructs are a core part of the original TAM model. The *perceived enjoyment* construct was introduced by van der Heijden [2004]. Lastly, the *behavioral intention to recommend* construct and the paths to it were introduced by this study.

4.3.1 Reasoning Behind the Model

The choice of hedonic TAM as the foundation for the new model might be a bit surprising, as other models might seem more relevant. For example, UTAUT could have been a natural starting point, as it is able to explain a high percentage of the variance in intention to use. Unfortunately, the model is not easily extendable. The model is also quite complex and consists of a lot of constructs. This means that gathering enough quantitative data would be quite an undertaking.

Both of the models containing the "intention to recommend" construct were considered. The constructs of the TAM+ECM model are applicable to university web portals. However, since there is only one construct that directly affects "word of mouth", trying to understand what should be done to increase "word of mouth" using the model might prove difficult.

The TAM+TPB model was dropped due to a lack of relevance in its construct. While the trust construct might be superb for e-commerce, it seemed like a less relevant for the evaluation of university web portals.

The choice of hedonic TAM is related to Instabarts qualities. Instabart has a casual, almost whimsical tone and a straightforward design. It was deemed interesting to see whether this would affect the users' willingness to recommend the website to others.

4.3.2 Model Hypotheses

To test whether the model was valid, several hypotheses were needed. Each hypothesis corresponds to one path between constructs. The hypotheses were split into three groups:

Hypotheses from the original TAM model

- **H1:** There is a positive relationship between *perceived ease of use* and *perceived usefulness.*
- **H2:** There is a positive relationship between *perceived ease of use* and *behavioral intention to use.*
- **H3:** There is a positive relationship between *perceived usefulness* and *behavioral intention to use.*

Hypotheses from the van der Heijden TAM variation

- **H4:** There is a positive relationship between *perceived ease of use* and *perceived enjoyment.*
- **H5:** There is a positive relationship between *perceived enjoyment* and *behavioral intention to use.*

Hypotheses introduced by this study

- **H6:** There is a positive relationship between *perceived ease of use* and *behavioral intention to recommend.*
- **H7:** There is a positive relationship between *perceived usefulness* and *behavioral intention to recommend.*
- **H8:** There is a positive relationship between *perceived enjoyment* and *behavioral intention to recommend.*
- **H9:** There is a positive relationship between *behavioral intention to use* and *behavioral intention to recommend.*

The two first groups of hypotheses were used to check the validity of existing models. The last group of hypotheses was used to validate the *intention to recommend* construct added by this study.

Table 4.1: Comparative analysis of SEM techniques (taken from Gefen et al. [2000])

Issue	Covariance-based	PLS-based
Objective of Overall Analysis	Show that the null hypothesis of the entire proposed model is plausible, while rejecting path-specific null hypotheses of no effect.	Reject a set of pathspecific null hypotheses of no effect.
Objective of Variance Analysis	Overall model fit, such as insignificant X^2 or high AGFI.	Variance explanation (high R^2)
Required Theory Base	Requires sound theory base. Supports confirmatory research.	Does not necessarily require sound theory base. Supports both exploratory and confirmatory research.
Assumed Distribution	Multivariate normal, if estimation is through ML. Deviations from multivariate normal are supported with other estimation techniques.	Relatively robust to deviations from a multivariate distribution.
Required Minimal Sample Size	At least 100-150 cases.	At least 10 times the number of items in the most complex construct.

4.3.3 Model Analysis

The research model was assessed using *Structural Equation Modeling* (SEM). SEM is a statistical modeling technique that has been widely used in behavioral sciences [Hox, 1999]. It can be described as a combination of factor analysis and regression analysis.

When using SEM, two models are assessed:

- **Measurement model.** Relates the measured items to the constructs
- **Structural model.** Tests the assumed causation between the constructs

Combined, the models allow the researcher to perform factor analysis and hypothesis testing simultaneously.

There are two categories of SEM techniques: *Covariance-based* analysis and *Partial-Least-Squares-based* analysis. Table 4.1 outlines the differences between the approaches.

Despite covariance-based SEM producing a somewhat more accurate model analysis, PLS-SEM was chosen for this study. PLS-SEM is more suited when the data sample is small. Where covariance-based SEM requires at least 100-150 cases, PLS-SEM can make due with a sample size of only ten times the number of items in the most complex construct (in this case, 50 samples)[Gefen et al., 2000].

The choice of PLS-SEM made analyzing each of the three university web portals separately feasible. The program SmartPLS[1] (v3.2.7) was used to perform the PLS-SEM analysis.

[1] https://smartpls.com

Chapter 5

Creating the University Web Portals

This chapter presents the websites created as part of the master thesis. The websites are web portal sites that gather links to the most useful IT resources in one place. Two websites were created and launched:

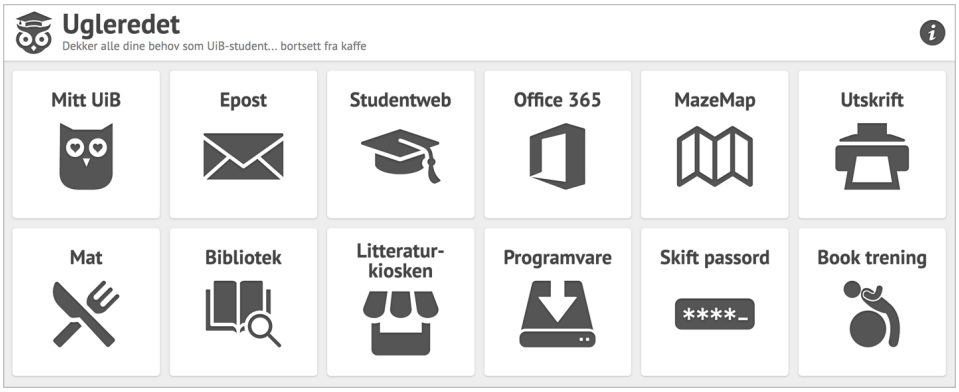
- **ugleredet.no**. Made for students at the University of Bergen (UiB)
- **duio.no**. Made for students at the University of Oslo (UiO)

While the concept is simple, many considerations went into creating solid, launch-ready websites. This chapter aims to present those considerations.

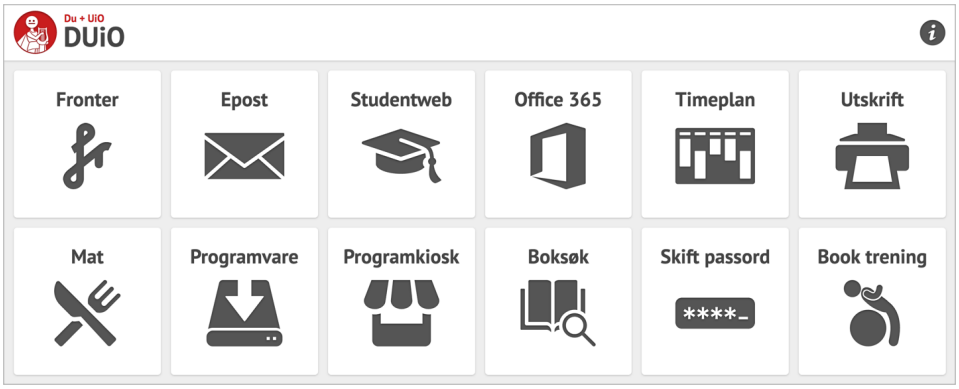
Section 5.1 begins by presenting the finished university web portals. Section 5.2 to 5.5 describes different aspect of the process used to create the web portals. Section 5.6 presents the pre-launch testing that was performed. Lastly, section 5.7 describes the launch plan.

5.1 Presentation of the Websites

The websites are shown in Figure 5.1a (Ugleredet) and 5.1b (DUiO). Both websites consist of twelve links to the most important IT resources at each university. Clicking a button takes the user straight to that resource. Clicking the question mark button (top right corner) opens a modal with some information about the website, privacy policy, and contact information (see Figure 5.2).



(a) ugleredet.no



(b) duio.no

Figure 5.1: Screenshots of the university web portals

Figure 5.2: Information modal on DUiO

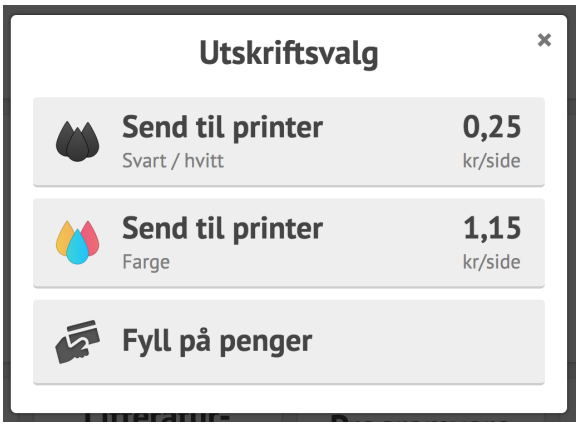


Figure 5.3: Print modal on Ugleredet

Apart from the branding and the selection of links, the websites are nearly identical. There are, however, some differences. While clicking the "Utskrift" button on duio.no takes the user directly to UiO's print page, on ugleredet.no the button opens a new modal, displaying three options (see Figure 5.3).

The websites are quite similar to instabart.no. This is by design. While it would have been tempting to rethink the structure of the sites or add more functionality, doing so would make it harder to compare results. For example, a big redesign could accidentally remove some of the allure of Instabart. This would make a potential decline in "intention to use" related to the redesign, not the viability of the concept itself. For that reason, the web portal concept was only tweaked, not redesigned.

5.2 Link Selection

For the web portals to be successful, the IT resources provided must be useful to the students. For that reason, proper selection of those links was essential.

The link selection started by compiling a list of all links that might be useful. This list was primarily created by searching the university websites and reading discussion forums. Experiences from Instabart also made it easier to distinguish the most useful links. However, the process was complicated by the fact that most of the IT resources required a university user account. A request for access was sent to the respective IT departments, but due to security reasons, none of them were willing to provide grant access to their systems.

When the preliminary list was finished, the list was sent to three students acquaintances the at each university. They were asked to add any missing systems to the list. IT support was also contacted, for the same reason.

Lastly, ten students from each university were asked to rank the list of links from most to least useful. The participants were recruited via acquaintances at the two universities. The results of this ranking can be seen in Table 5.1

Only the top twelve links were used. While the limit might seem arbitrary, it was enforced for a reason. Since the number twelve is divisible by two, three, four and six, each row will have an equal amount of links regardless of the number of columns. There is also a limit to how many links the site can have before it becomes cluttered. Less is more.

	DUiO	**Ugleredet**
1	Email	"My UiB"
2	Fronter	Email
3	Studentweb	Studentweb
4	Schedule	Print
5	Print	Library search
6	Office 365	"What's for dinner?"
7	Download software	Office 365
8	Change password	Compendium kiosk
9	Library search	Download software
10	"What's for dinner?"	Change password
11	Remote desktop software	Book group exercise
12	Book group exercise	Campus map
13	Room booking	Student newspaper
14	Survey creator	Room booking
15	Book resale	Room overview
16	Book student cabin	University newspaper
17	"Speak up" university feedback	Exchange student info
18	Wiki	
19	Dentist disbursements	
20	Interview courses	

Table 5.1: List of potential links, ranked from most to least useful

5.3 Branding

Branding is an important part of creating the websites. How a brand is perceived can greatly affect its success. It can increase trust and awareness, and help create a loyal user base [Wheeler, 2012].

Many different ideas for logo and name were created during brainstorming sessions. To make it easier to evaluate the quality of each brand suggestion, the following list of criteria was created:

The brand name should be...

1. Short
2. Humorous
3. Easy to remember
4. Easy to spell
5. Say something about what the website does
6. Create associations to the university and/or city
7. Have an available domain name

A complete list of rejected proposals can be found in Appendix A. While many of the suggested brand names where decent, most of them failed at least one of the criteria. For example, while the UiB candidate "The Umbrella" had a name that explained what the site did and had a clear association to Bergen, the domain name was not available. Another example is "Hallaien", which is a type of greeting in Bergen. This name turned out to be a bit difficult to spell for new students and the name did not properly convey the intended purpose of the website.

In the end the names **Ugleredet** and **DUiO** were chosen. A logo was then created for each of the websites (See Figure 5.4).

(a) UiO

(b) UiB

Figure 5.4: The final brands for the two university web portals

Ugleredet can be translated to "The Owl Nest" and plays on the fact that (a) UiB has an owl as its logo and (b) owls are known to be wise. The "nest" part of the name creates associations to "home", which was deemed fitting.

The branding for UiO was more difficult than UiB. While Bergen has a well known "city identity", Oslos identity is a bit blander. In the end, the name "DUiO" was chosen for its brevity and strong connection to UiO. The name DUiO was created by combining the Norwegian word "du" (translated as "you") with UiO.

5.4 Design and Usability

This section explores the different techniques and strategies used to make the websites as user-friendly as possible.

5.4.1 Responsive Web Design

As of October 2017, approximately 37% of all internet traffic in Norway comes from phones or tablets [Statcounter, 2017]. This means that websites should be designed with a breadth of devices in mind.

Responsive web design is an approach that aims to make websites look good on a large variety of devices and screen sizes [Marcotte, 2016]. This is achieved through techniques such as fluid layouts that change based on the width of the screen.

The web portals were created with responsive design in mind. Depending on the screen of the size, the twelve buttons are displayed in either six, four, three or two columns (see Figure 5.5). The icons and text inside the buttons will also shrink or expand depending on the space available.

To see how the web portal was adapted to different screen sizes, one can open a desktop web browser and drag the edge of the window to make the browser size bigger and smaller.

5.4.2 Accessibility

Universities have students with a wide range of disabilities, such as blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, etc. In an effort to create inclusive university web portals, the Web Content Accessibility Guidelines (WCAG) 2.0 was used [W3C, 2008].

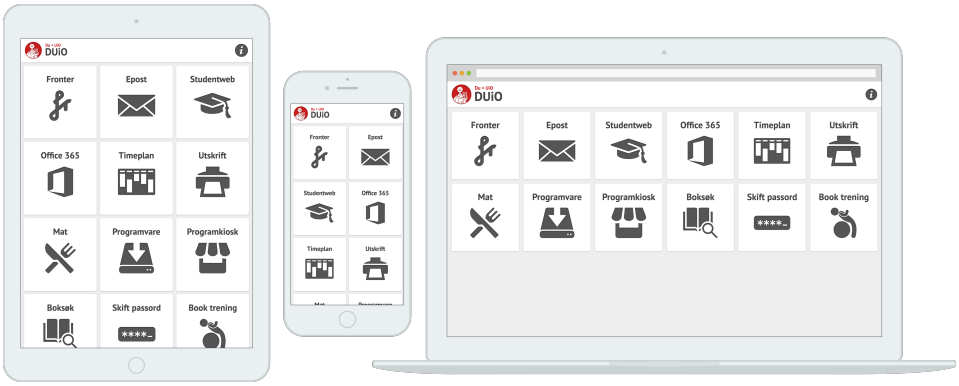


Figure 5.5: DUiO as seen on a tablet, phone and laptop

WCAG 2.0 has become the de-facto standard for accessibility on the web. It consists of twelve guidelines and 61 testable success criterion. The university web portals conform to WCAG Level AA, meaning that at least 38 of the 61 success criteria are met. This is the conformance level required by the Norwegian Agency for Public Management and eGovernment (Difi) [Difi, 2014]. Table 5.2 shows a few of the most relevant success criteria and how they were tested.

It is important to note that just following WCAG 2.0 does not guarantee accessibility. In a study where disabled users tested websites in a controlled usability test, only 32% of the issues discovered could have been avoided by following WCAG 2.0 [Rømen and Svanæs, 2012]. However, for the purpose of this study following the WCAG guidelines was deemed "good enough".

5.4.3 Adding Delight

In his research, van der Heijden [2004] suggests that user acceptance of utilitarian systems can be increased by adding hedonic elements. This notion was taken seriously during the development of the new university web portals, as it might help explain why Instabart became a success.

Effort was put into making the web portals as delightful to use as possible. One area where this can be seen is the hover effect on the buttons (see Figure 5.6). When moving the cursor over the button, the icons change color, the button grows a bit, and the shadow around the button becomes darker. These effects are done with a quick animation.

Another example is the taglines displayed under the branding. Every time the

Table 5.2: Excerpt from the WCAG 2.0 list of success criteria [W3C, 2008]. The comments explain how each criteria was fulfilled

WCAG 2.0 Sucess Criteria	Comment
1.1.1 Non-text Content: All non-text content that is presented to the user has a text alternative that serves the equivalent purpose	Satisfied. Tested using the text-to-speech tool "Mac VoiceOver"
1.4.1 Use of Color: Color is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.	Color usage is limited and is only ever used for "visual flair"
1.4.4 Resize text: Except for captions and images of text, text can be resized without assistive technology up to 200 percent without loss of content or functionality	Solved using responsive design. The websites can be zoomed to 400% using the browsers built in zoom function. Since all icons are vector based, everything will still look crisp
1.4.6 Contrast (Enhanced): The visual presentation of text and images of text has a contrast ratio of at least 7:1 (Level AAA)	All text has a contrast of 9.7:1. The icons has a contrast of 7.5:1
2.1.1 Keyboard: All functionality of the content is operable through a keyboard interface [...]	Satisfied. All parts of the web portal can be navigated to using TAB and ENTER

web portal is reloaded, a new, slightly humorous tagline such as "Everything you need as a student... except coffee" appears.

5.5 Technical Details

From a purely technical standpoint, the websites are very simple. They were created using HTML, CSS, Javascript and little else. Despite this simplicity, there are some technical considerations worth discussing. The code is open sourced and is available on Github[1][2].

[1] https://github.com/mortenvn/duio.no
[2] https://github.com/mortenvn/ugleredet.no

Figure 5.6: Example of hovering effect (middle button)

5.5.1 Performance

Web performance refers primarily to the speed at which a website loads. Neglecting this aspect of web development can have grave implications for the website. A study examining e-commerce sites found that 40% of users will exit if it takes more than 3 seconds to load [Wagner, 2016].

Several decisions were made to enhance performance. No front-end frameworks were used on the websites. This improves load time because (a) less data has to be transferred (approx. 150 KB for React) and (b) no javascript has to run before the content is displayed.

Only vector-based images are used on the websites. Vector images have the advantage of having much smaller file sizes than regular raster images while remaining crisp regardless of display size.

Lastly, gzipping was activated on the server. This further reduces the amount of data that has to be transferred. Before being gzipped, duio.no had a total file size of 45KB. After gzipping, the size was reduced to 18KB. This focus on performance means that the website will load almost instantly, even on phones with slow connections. It is also worth mentioning that the low size also makes hosting the websites very cheap, regardless of the amount of traffic.

5.5.2 Usage Statistics

Every time a user visited one of the web portals, usage statistics were gathered. This data made it easier to answer questions such as "how many users have visited the website in the past week?" or "what are the most popular links?"

The data was gathered using Google Analytics[3], a popular web analytics tool. As recommended by the Norwegian Data Protection Agency, the option to anonymize IPs was turned on [Datatilsynet, 2013].

[3] https://www.google.com/analytics/

Not all visits are registered, as adblock software will block Google Analytics. According to Cortland [2017], 27% of all Swedes and 25% of Danes use adblock software. While no number is available for Norwegians, the percentage is likely to be in the same ballpark.

5.6 Pre-launch Testing

Before the university web portals were launched, a quick pre-launch test was performed. The purpose of the testing was to reveal potential flaws and evaluate the websites' usability.

5.6.1 Method

A total of ten students (five from each university) participated in the tests. The students were not randomly selected, but were instead recruited through acquaintances. While this might skew the result, the risk was rated as acceptable since recruiting students would otherwise be too time-consuming.

All the test were performed in the same way: First, the users tested the website for five minutes. Then the users rated the usability on the *System Usability Scale*. Lastly, they were encouraged to provide their thoughts on the website.

The System Usability Scale (SUS) was used to provide a "quick and dirty" measure for usability [Brooke, 1996]. The SUS survey is a five-point Likert scale, consisting of ten items. It is widely used and has been cited by more than 1000 articles since its conception.

5.6.2 Results

The feedback on the systems was generally positive. No major problems were discovered, and several participants said that they liked the idea.

A few minor issues were brought up. Three out of the ten participants said that they wished the links would be opened in a new tab. That way they could open several websites (such as email and Fronter) at the same time.

The other issue was the selection of links. Four of the participants had suggestions for links to be included. Three out of the four suggestions had already been ranked during the link selection (see Table 5.1). However, none of the links were suggested more than once. Due to the lack of consensus on (a) what links should be added, and (b) what links should be removed, the websites remained unchanged.

Both websites got a high SUS score. DUiO got a score of 89/100 and Ugleredet got a score of 91.5/100. The lowest individual score was 80 and the highest was 97.5. According to Bangor et al. [2009], any score over 85 can be described as "Excellent". The usability result should, however, be taken with a grain of salt. Since the university web portal concept has very low complexity, a high usability score is to be expected.

5.7 Launch

The websites were launched at the beginning of the fall semester in 2017. Usage statistics from Instabart indicate that students are more willing to try new IT services at the beginning of a semester. DUiO was launched August 20th. Ugleredet was planned to launch a week later, but was postponed to September 19th due to illness.

No regular marketing was used to promote the websites. No posters were printed and no ads were bought. The websites were only promoted using Facebook. This was done for two reasons: First, this is how Instabart was launched. By launching the new websites in the same way, it became easier to compare usage results with Instabart. Second, the extended technology acceptance model proposed in Section 4.3 aims to better explain peoples willingness to spread awareness through word-of-mouth. Using only social media makes it easier to compare usage statistics with the results from the surveys.

On the launch day, several entries were posted:

- One Facebook post was shared with the researcher's own friends
- For each university, three acquaintances shared a post with their friends
- For each university, two posts were shared with closed Facebook groups. The closed groups were groups for "informatics students" and "law students". In total, the number of members who could see the posts were 1900 for Ugleredet and 2100 for DUiO

One exception is worth mentioning. Nearly a month after the launch of Ugleredet, the website was covered in an article written the student newspaper Studvest[4].

[4] http://www.studvest.no/student-fra-trondheim-laget-nettsted-for-bergensstudenter/

Chapter 6

Survey

To measure the constructs of the research model proposed in section 4.3, a survey was created. This chapter aims to present the survey itself, as well as some of the thoughts that went into creating it.

Section 6.1 presents the survey items. Section 6.2 discusses the measures that were taken to ensure data collection of high quality. Section 6.3 presents the sampling technique used to gather data. Lastly, section 6.4 explains how the survey was conducted.

6.1 Survey Items

The survey consisted of six parts: One part for each of the model constructs plus a part for background information. Table 6.1 shows a translated version of the most important questions. The complete, non-translated survey is included in Appendix C.

Each construct that was measured in the survey consisted of 4-5 items. These items were taken from earlier research whenever it was possible. By using existing measures, the survey became more rigorous and made it easier to compare findings to earlier research.

The measures for *perceived ease of use* and *behavioral intention to use* were taken from the TAM2 model [Venkatesh and Davis, 2000].

The measures for *perceived enjoyment* was taken from van der Heijden [2004] and were based on earlier enjoyment research performed by Chang and Cheung [2001] and M. Igbaria [1995]. The scale used to measure PE was four semantic-

Table 6.1: The constructs and items used in the survey

Construct	**Items**
Perceived ease of use (PEOU)	**peou1:** Interaction with the app is clear and understandable **peou2:** Interaction with the app does not require a lot of mental effort **peou3:** I find the app easy to use **peou4:** I find it easy to get the app to do what I want it to do
Perceived usefulness (PU)	**pu1:** By using the website I can quickly and easily find the IT services I need **pu2:** By using the website I discover IT services I didn't know about before **pu3:** By using the website my life as a student becomes more efficient **pu4:** By using the website my life as a student becomes easier **pu5:** By using the website I end up using more IT services for students than I otherwise would
Perceived enjoyment (PE)	**pe1:** Using the app is: disgusting-enjoyable **pe2:** Using the app is: dull-exciting **pe3:** Using the app is: unpleasant-pleasant **pe4:** Using the app is: boring-interesting
Behavioral intention to use (BI)	**bi1:** I want to use the website **bi2:** I'm going to use the website regularly **bi3:** I'm going to save the website as a bookmark **bi4:** I'm going to use the website as my startpage
Behavioral intention to recommend (BIR)	**bir1:** This is a website other students will benefit from **bir2:** I'm going to ask other students if they've heard about the website **bir3:** I want to tell my friends about the website **bir4:** I'm going to recommend the website to fellow students **bir5:** I'm going to recommend the website to new students

differential scales. This was different from the other measures, which used likert scales.

The measures for *perceived usefulness* were created specifically for this study and are specific to tasks achieved using university web portals. The items were modelled on the work done by van der Heijden [2004]. He noted that the original TAM models PU measure focused heavily on "job performance". While this is a great fit for mandatory information systems, it is less fitting for voluntary or hedonic systems.

The measures for *behavioral intention to recommend* were created for this study. Unlike the PU measures discussed above, these items are *not* specific to any particular system and can (with a few changes) be reused by other surveys.

The last part of the survey was dedicated to background information. The respondents were asked about their gender, area of study, how long they had studied at the university, and whether they had heard of or used the system before. There was also an optional comment field where the respondent could provide feedback.

6.2 Survey Rigidity

There are many ways in which the result of the study could have become skewed. Care had to be taken to ensure data of high quality.

With the exception of *perceived enjoyment*, all the measures in the survey are seven-point Likert scales. According to Ueberfax [2006], only scales that fulfill all of the six requirements mentioned in Figure 6.1 should be called Likert scales. As can be seen in Appendix C, all six requirements are fulfilled.

One possible pitfall of the survey is the *selection bias*. Selection bias is a bias caused by selecting respondents in such a way that proper randomization is not achieved, and thus achieving a non-representative sample [Cuddeback et al., 2004]. To detect a potential selection bias, several questions were added to the background information section. Factors such as study program and how long they have studied at the university could affect the result. The respondents were also asked whether they had heard about or used the website before.

6.3 Sampling Technique

The survey population consisted of active university students. Therefore, the sample should ideally be a representative mix of students from different years and fields

1. The scale contains several items.
2. Response levels are arranged horizontally.
3. Response levels are anchored with consecutive integers.
4. Response levels are also anchored with verbal labels which connote more-or-less evenly-spaced gradations.
5. Verbal labels are bivalent and symmetrical about a neutral middle.
6. In Likert's usage, the scale always measures attitude in terms of level of agreement/disagreement to a target statement.

Figure 6.1: The characteristics of a Likert scale [Ueberfax, 2006]

of study. However, this proved to be difficult to guarantee in practice. Only the university itself has access to the complete list of all students and gaining access to that list was not feasible.

Instead, a "best effort" approach was used. Respondents were recruited from main hubs such as cafeterias and libraries. These are locations where students from many different fields of study are likely to reside in. This is an example of *cluster sampling*, which is a type of probability sampling [Oates, 2006]. Cluster sampling leverages instances where the population you are interested might naturally occur together in clusters.

Collecting responses by recruiting random students in libraries and cafeterias has its limitations. One disadvantage is that it is pretty time-consuming. Another is the interviewer bias caused by the researcher being present while the respondent fills out the form. The main advantage is the broad variety of respondents it provides. While it does not guarantee a representative sample, it was considered sufficient for this survey.

6.4 Conducting the Survey

The survey was conducted at three different universities, one for each web portal. As mentioned previously, respondents were recruited from cafeterias and libraries. The following procedure for conducting the survey was used:

1. First the potential respondents were asked if he/she was interested in participating in the study. A simple script was created in advance to ensure that all respondents were asked in a similar way (see Appendix B).

2. If the respondent agreed to join, he/she was handed a short introduction to the survey. The introduction is included in Appendix C.

3. After reading the introduction paper, the respondents were asked to visit the web portal that corresponded to their university. They got three minutes to become familiar with the website. No information about the website was given. This was done to mimic normal conditions in which they would have discovered the website by themselves. The respondents could choose whether they wanted to test the website on their own computer/phone, or if they wanted to borrow a computer.

4. When the three minutes were up, the respondent was handed the survey. The survey is included in Appendix C.

5. After finishing the survey, the respondent could choose to enter a contest to win a gift card for 1000 kr. To enter, they had to provide their name and email address. This information provided was only used for the contest and was kept separate from the actual survey to maintain anonymity.

Chapter 7

Results: Descriptive Statistics

This chapter will present a summary of the data gathered in the surveys. Section 7.1 introduces the structure used to present the data. Section 7.2 presents the demographics. Section 7.3 to 7.7 presents the results for each of the five constructs. Lastly, section 7.8 compares the results of the surveys. The answers to the surveys optional "comments" field in can be found in Appendix E.

7.1 Structure of the Descriptive Statistics

All of the following sections are structured in the same way: Each section consists of a frequency distribution table and a statistical summary. The only exception is the demographics section, which only consists of frequency distribution tables.

The *frequency distribution tables* shows the respondents' answers to the different items. The answers range from 1 ("strongly disagree") to 7 ("strongly agree"). In some of the tables, color has been applied to make the table easier to read. The darker the color in the table cell is, the more respondents choose that option.

The *statistical summaries* presents the min, max, mean, median and standard deviation of each survey item. *Min* and *max* are the smallest and largest value in the dataset. They show how much of the Likert scale range was used by the sample. The *mean* and *median* are both used to indicate a central tendency of the data. The *standard deviation* gives an indication of the average distance from the mean. A small standard deviation indicates that more of the data is clustered

1. **Nominal data:** Categories without numerical representation
2. **Ordinal data:** Data where an ordering or ranking of responses is possible but no measure of distance is possible
3. **Interval data:** Integer data where ordering and distance measurement are possible
4. **Ratio data:** Data in which meaningful ordering, distance, decimals, and fractions between variables are possible

Figure 7.1: The four levels of measurement [Allen and Seaman, 2007]

around the mean, while a larger one indicates the data is more spread out.

While it is tempting to assume that the mean gives a more accurate representation of the central tendency than the median, there are some important caveats worth mentioning. According to Allen and Seaman [2007], the data gathered using Likert Scales should be categorized as "ordinal data" (see Figure 7.1). In Likert Scales, each integer value is tied to a verbal anchor. The problem is that there is normally no way to measure the distance between the values. For example, respondents might perceive the distance between neutral" and "slightly agree" to be larger or smaller than the distance between "agree" and "strongly agree". So while the mean is a useful way to point to the general direction of the average answer, the median gives a more accurate representation of the central tendency.

In the summaries, all the samples from the three surveys have been pooled into the same table. To see a statistical summary for each of the universities separately, see Appendix D.

7.2 Demographics

A total of 214 responses was gathered from the three universities. 70 of them were gathered at NTNU, 71 at UiO and 73 at UiB.

Table 7.1 shows the gender distribution of the surveys. In total 56% of the respondents were female and 44% were male.

Table 7.2 shows how many years the respondents had spent at the universities. A surprisingly high percentage (48%) of the respondents had been studied for less

Table 7.1: The gender of the respondents

Gender	NTNU		UiO		UiB		All schools	
	n	%	n	%	n	%	n	%
Female	39	56 %	42	59 %	39	53 %	120	56 %
Male	31	44 %	29	41 %	34	47 %	94	44 %
All genders	70	100 %	71	100 %	73	100 %	214	100 %

than a year. This was not intended, but is not necessarily a bad thing as experiences from Instabart indicates that fresh students are more likely to start using the web portal.

Table 7.2: The number of years each respondent had studied at the university

Years at university	NTNU		UiO		UiB		All schools	
	n	%	n	%	n	%	n	%
Less than a year	36	51 %	27	38 %	39	53 %	102	48 %
1 year	10	14 %	9	13 %	12	16 %	31	14 %
2 years	14	20 %	11	15 %	14	19 %	39	18 %
3 years	6	9 %	7	10 %	4	5 %	17	8 %
4 years	1	1 %	4	6 %	3	4 %	8	4 %
More than 4 years	3	4 %	13	18 %	1	1 %	17	8 %
All years	70	100 %	71	100 %	73	100 %	214	100 %

Table 7.3 and 7.4 shows the respondents awareness of the websites. Of the NTNU students asked, 2/3 of them had heard about Instabart, and 1/2 had used it. At UiO, none of the students had heard about DUiO. At UiB, two respondents had heard about Ugleredet, but not used it. They had not, however, heard about it from friends or directly from the Facebook promotion. Instead, they had both read about it in an article written by the student newspaper "Studvest".

7.3 Perceived Usefulness

In this section, the responses related to the construct *perceived usefulness* is presented. Table 7.5 shows the frequency distribution of the responses, while table 7.6 shows a statistical summary. A complete list of all survey questions can be found in table 6.1.

Table 7.3: The number of respondents who has heard about the website before

Has heard of website before	**NTNU**		**UiO**		**UiB**	
	n	**%**	**n**	**%**	**n**	**%**
Yes	46	66 %	0	0 %	2	3 %
No	24	34 %	71	100 %	71	97 %

Table 7.4: The number of respondents who has used the website before

Has used website before	**NTNU**		**UiO**		**UiB**	
	n	**%**	**n**	**%**	**n**	**%**
Yes	35	50 %	0	0 %	0	0 %
No	35	50 %	71	100 %	73	100 %

All of the items got generally favorable scores, with the median varying between 5 (*"slightly agree"*) and 7 (*"strongly agree"*).

Two of the items have a noticeably larger standard deviation than the rest. The item pu2 (*"By using the website I discover IT services I didn't know about before"*) has a standard deviation of 1.71, while pu5 (*"By using the website I end up using more IT services than I otherwise would"*) has a standard deviation of 1.51. This might suggest that they are affected by other factors.

7.4 Perceived Ease of Use

In this section, the responses related to the construct *perceived ease of use* are presented. Table 7.7 shows the frequency distribution, while table 7.8 summarizes the data.

The tables show that the items got very high scores. All the items have a median of 7 (*"strongly agree"*), with the lowest mean being 6.5.

As indicated by the low standard deviations, almost all of the respondents gave a score of 6 (*"agree"*) or higher. Only 5.6% of the answers had a score of 5 (*"slightly agree"*) or lower.

Table 7.5: Distribution of the scores of the five questions about perceived usefulness (pu1-5)

Item	Location	1	2	3	4	5	6	7
pu1	NTNU	0	0	0	0	5	22	43
	UiO	0	0	1	0	1	16	53
	UiB	0	0	0	0	1	15	57
pu2	NTNU	1	2	1	7	21	18	20
	UiO	6	7	7	4	12	16	19
	UiB	2	5	2	3	17	15	29
pu3	NTNU	0	0	0	12	22	23	13
	UiO	1	1	1	9	18	14	27
	UiB	0	0	1	5	17	26	24
pu4	NTNU	0	0	2	11	20	18	19
	UiO	0	0	1	9	18	23	20
	UiB	0	1	0	5	19	26	22
pu5	NTNU	0	1	4	10	22	21	12
	UiO	5	5	5	18	10	17	11
	UiB	3	2	0	19	17	18	14

Table 7.6: Statistical summary of the scores of the five questions about perceived usefulness (pu1-5)

Item	n	Min	Max	Median	Mean	Std. dev.
pu1	214	3	7	7	6,7	0,59
pu2	214	1	7	6	5,3	1,71
pu3	214	1	7	6	5,7	1,12
pu4	214	2	7	6	5,7	1,07
pu5	214	1	7	5	5,0	1,51

7.5 Perceived Enjoyment

In this section, the responses related to the construct *perceived enjoyment* is presented. Table 7.9 shows the frequency distribution, while table 7.10 summarizes the data.

The median of the items ranges from 4 to 6, with the mean ranging from 4.5 to 5.6. Of the four items, pe3 (*"unpleasant-pleasant"*) got the highest scores, while pe2 (*"dull-exciting"*) got the lowest scores.

For two of the items, only parts of the scale were used. Both pe2 (*"dull-exicting"*) and pe4 (*"boring-interesting"*) has a min value of 4. This high min value is interesting since so many of the respondents gave scores of 4 or 5. This effect can be seen in the frequency distribution table. There is a clear cutoff where very few respondents give scores of 3 or lower, but a lot of respondents answer 4 or 5. This cutoff might indicate that the respondents either are uncertain about what they feel, or that they don't really have no strong emotional response towards the websites.

Table 7.7: Distribution of the scores of the four questions about perceived ease of use (peou1-4)

Item	Location	1	2	3	4	5	6	7
peou1	NTNU	0	0	1	0	2	21	46
	UiO	0	1	0	0	3	17	50
	UiB	0	0	1	0	0	15	57
peou2	NTNU	3	0	0	1	4	14	48
	UiO	0	0	0	4	1	18	48
	UiB	0	0	0	1	0	15	57
peou3	NTNU	0	0	1	0	2	18	49
	UiO	0	0	0	1	1	16	53
	UiB	0	0	0	0	1	13	59
peou4	NTNU	0	0	0	1	6	20	43
	UiO	0	0	1	3	6	18	43
	UiB	0	0	0	3	3	17	50

Table 7.8: Statistical summary of the scores of the four questions about perceived ease of use (peou1-4)

Item	n	Min	Max	Median	Mean	Std. dev.
peou1	214	2	7	7	6,6	0,70
peou2	214	1	7	7	6,6	0,94
peou3	214	3	7	7	6,7	0,57
peou4	214	3	7	7	6,5	0,80

7.6 Behavioral Intention to Use

In this section, the responses related to the construct *behavioral intention to use* is presented. Table 7.11 shows the frequency distribution, while table 7.12 summarizes the data.

Table 7.9: Distribution of the scores of the four questions about perceived enjoyment (pe1-4)

Item	Location	1	2	3	4	5	6	7
pe1	NTNU	0	0	0	26	26	16	2
	UiO	0	0	0	20	32	15	4
	UiB	0	0	0	25	27	15	6
pe2	NTNU	0	4	5	36	16	8	1
	UiO	2	3	7	23	21	10	5
	UiB	1	2	8	24	19	13	6
pe3	NTNU	0	0	0	15	18	30	7
	UiO	0	0	0	14	22	15	20
	UiB	0	0	0	7	18	22	26
pe4	NTNU	0	0	1	21	23	19	6
	UiO	1	1	1	20	16	19	13
	UiB	0	0	3	14	26	17	13

Table 7.10: Statistical summary of the scores of the four questions about perceived enjoyment (pe1-4)

Item	n	Min	Max	Median	Mean	Std. dev.
pe1	214	4	7	5	5,0	0,88
pe2	214	1	7	4	4,5	1,22
pe3	214	4	7	6	5,6	1,03
pe4	214	1	7	5	5,2	1,13

The median of the items varies quite a bit. While bi1 (*"I want to use the website"*) and bi2 (*"I'm going to use the website regularly"*) has medians of 6, bi4 (*"I'm going to use the website as my startpage"*) has a median of 3. bi4 is the only item in the survey with a median lower than 4. The means ranges from 5.9 (bi1) to 3.1 (bi4).

The items bi3 (*"I'm going to save the website as a bookmark"*) and bi4 have the highest standard deviations in the survey. bi4 has a standard deviation of 1.85, and bi3 has a standard deviation of 1.77.

7.7 Behavioral Intention to Recommend

In this section, the responses related to the construct *behavioral intention to recommend* is presented. Table 7.13 shows the frequency distribution, while table 7.14 summarizes the data.

All the items have a median of either 5 or 6, with the mean ranging from 4.7 to 6.3). bir1 (*"This is a website other students will benefit from"*) and bir5 (*"I'm going to recommend the website to new students"*) are the items the respondents agreed the most with. Both have a median of 6, and the mean ranges from 6.3 (bir1) to 5.9 (bir5). Additionally, bir1 has a markedly lower standard deviation (0.74) than the rest of the items in the set.

bir2 (*"I'm going to ask other students if they've heard about the website"*) and bir3 (*"I want to tell my friends about the website"*) are the items with the lowest scores. They both have a median of 5 (lower than the rest) and a standard deviation of 1.53 to 1.55 (higher than the rest).

Table 7.11: Distribution of the scores of the four questions about behavioral intention to use (bi1-4)

Item	Location	1	2	3	4	5	6	7
bi1	NTNU	0	0	1	9	18	21	21
	UiO	0	0	2	5	7	27	30
	UiB	0	2	1	1	13	30	26
bi2	NTNU	0	3	4	15	16	15	17
	UiO	0	4	2	8	13	27	17
	UiB	1	2	2	9	20	18	21
bi3	NTNU	6	2	13	16	10	7	16
	UiO	5	4	3	14	6	12	27
	UiB	1	7	2	15	10	14	24
bi4	NTNU	16	17	12	16	5	2	2
	UiO	16	19	5	13	5	5	8
	UiB	16	12	12	15	11	5	2

Table 7.12: Statistical summary of the scores of the four questions about behavioral intention to use (bi1-4)

Item	n	Min	Max	Median	Mean	Std. dev.
bi1	214	2	7	6	5,9	1,07
bi2	214	1	7	6	5,4	1,37
bi3	214	1	7	5	5,0	1,85
bi4	214	1	7	3	3,1	1,77

Table 7.13: Distribution of the scores of the five questions about behavioral intention to recommend (bir1-5)

Item	Location	1	2	3	4	5	6	7
bir1	NTNU	0	0	0	1	10	27	32
	UiO	0	0	0	1	9	27	34
	UiB	0	0	0	0	9	25	39
bir2	NTNU	4	5	6	18	18	11	8
	UiO	4	3	8	17	14	14	11
	UiB	1	3	2	22	19	14	12
bir3	NTNU	4	4	8	18	17	11	8
	UiO	3	3	4	13	18	18	12
	UiB	0	4	1	18	20	14	16
bir4	NTNU	1	1	3	10	19	22	14
	UiO	1	2	2	8	23	16	19
	UiB	0	2	4	7	17	21	22
bir5	NTNU	1	1	0	5	14	20	29
	UiO	1	1	1	13	16	14	25
	UiB	0	0	1	3	18	23	28

Table 7.14: Statistical summary of the scores of the five questions about behavioral intention to recommend (bir1-5)

Item	n	Min	Max	Median	Mean	Std. dev.
bir1	214	4	7	6	6,3	0,74
bir2	214	1	7	5	4,7	1,55
bir3	214	1	7	5	4,9	1,53
bir4	214	1	7	6	5,5	1,31
bir5	214	1	7	6	5,9	1,20

Table 7.15: The mean for each survey item. A green background indicates that the value is the highest of the three universities, while a red background indicates that its the lowest.

	pu1	pu2	pu3	pu4	pu5	peou1	peou2	peou3	peou4	pe1	pe2	pe3	pe4	bi1	bi2	bi3	bi4	bir1	bir2	bir3	bir4	bir5
NTNU	6.5	5.6	5.5	5.6	5.3	6.6	6.4	6.6	6.5	4.9	4.3	5.4	5.1	5.7	5.2	4.5	2.9	6.3	4.5	4.5	5.4	5.9
UiO	6.7	4.9	5.7	5.7	4.7	6.6	6.5	6.7	6.4	5.0	4.5	5.6	5.2	6.1	5.5	5.2	3.3	6.3	4.7	5.0	5.5	5.6
UiB	6.8	5.6	5.9	5.8	5.1	6.7	6.8	6.8	6.6	5.0	4.7	5.9	5.3	6.0	5.5	5.2	3.2	6.4	5.0	5.2	5.6	6.0

7.8 Comparison of the Surveys

This section will provide an overview of the differences between the surveys.

As mentioned in the demographics section, both the difference in gender distribution and "years spent at the university" is rather similar among the surveys. The biggest demographic difference was that NTNU students were much more familiar with the website than students from other universities.

Table 7.15 shows the mean for each of the items in the survey. A green background indicates that the value is the highest of the three universities, while a red background indicates that its the lowest.

The means are for the most part pretty close to each other. 2 out of 3 items have a difference of 0.4 or lower separating the highest and lowest mean. Overall, UiB had the highest means, while NTNU had the lowest. Whether these differences are significant or not will be discussed in section 8.1.

There are, however, two exceptions to the trend mentioned above. On pu2 (*"By using the website I discover IT services I didn't know about before"*) and pu5 (*"By using the website I end up using more IT services for students than I otherwise would"*), NTNU students rank the web portal higher than the other universities.

Chapter 8

Results: Inferential Statistics

This chapter will present the results of the statistical analysis of the research model. Section 8.1 assesses whether the three surveys are significantly different from each other. Section 8.2 assesses whether the proposed model is sound, by calculating the reliability and validity of the model. Lastly, section 8.3 presents the results of the PLS-SEM analysis.

8.1 Assessing Differences Between the Surveys

The three surveys that were conducted consisted of the same questions. The only differences between the surveys were (1) the university in which the respondents were studying, and (2) which web portal the respondents were asked to test. This section will assess whether there are any significant differences between the surveys.

To check for significant differences between the surveys, a *Partial Least Squares Multigroup Analysis* (PLS-MGA) was conducted. PLS-MGA are performed by comparing pairs of data sets. In this case, there were three data sets in total, one for each university. Thus, the PLS-MGA had to be performed three times, one time for each combination of universities.

According to Henseler et al. [2009], a path coefficient is significantly different at the 5% probability level if its p-value is smaller than 0.05 or larger than 0.95.

Table 8.1 shows the results of the multigroup analysis. The results indicate that there are no significant differences between most of the path coefficients. However, one path did cross the 0.95 threshold: In the comparison of UiO and UiB, the path "PEOU $\rightarrow$ PU" has a p-value of 0.988.

Table 8.1: The results of the PLS multigroup analysis. Significant p-values are marked as red. A path coefficient is deemed significant if the p-value is smaller than 0.05 or larger than 0.95. TE stands for "Total Effects".

	NTNU – UiO		**NTNU – UiB**		**UiO – UiB**	
	TE	p-value	TE	p-value	TE	p-value
PEOU → PE	0.091	0.733	0.161	0.881	0.296	0.988
PEOU → PU	0.016	0.544	0.133	0.870	0.154	0.883
PEOU → BI	0.001	0.495	0.201	0.882	0.203	0.886
PEOU → BIR	0.035	0.388	0.088	0.769	0.124	0.817
PU → BI	0.192	0.921	0.212	0.900	0.121	0.791
PU → BIR	0.038	0.609	0.154	0.780	0.137	0.748
PE → BI	0.135	0.168	0.028	0.425	0.220	0.071
PE → BIR	0.021	0.434	0.027	0.420	0.065	0.331
BI → BIR	0.190	0.877	0.069	0.655	0.121	0.267

Due to the low amount of significant differences between the surveys, the samples from the different surveys were combined into one. While the individual surveys' sample sizes were all above the required minimal sample size, the increase in samples made the statistical analysis more reliable.

8.2 Assessing Reliability and Validity

To assess the reliability and validity of the proposed model, a Confirmatory Factor Analysis (CFA) was conducted. CFAs are useful as it makes it possible to test the existence of a relationship between observable variables and their underlying latent construct [Suhr, 2006].

The assessment consists of three parts: The internal consistency reliability, the convergent validity, and the discriminant validity.

8.2.1 Internal Consistency Reliability

Theory

The internal consistency reliability is a measure of how consistent the indicators are compared to each other. The reliability was assessed using *Cronbach's alpha* and *composite reliability*.

Table 8.2: Measures for internal consistency reliability. It is recommended that the values are greater than 0.7 and less than 0.9. Values outside of the recommended range are marked with red.

	Cronbach's Alpha	**Composite Reliability**
BI	0.827	0.885
BIR	0.901	0.927
PE	0.825	0.884
PEOU	0.803	0.872
PU	0.745	0.826
PU (without pu2)	0.730	0.834

Cronbach's alpha is the traditional choice for evaluating internal consistency. It measures the pairwise correlation between items in a scale. Cronbach's alpha is often a conservative measure of internal consistency, as it assumes that the indicators have equal loadings [Hair et al., 2017]. Therefore, it is often more appropriate to use composite reliability, as it takes into account the different outer loadings of the indicators.

The values for both the Cronbach's alpha and the composite reliability should be greater than 0.70 [Fornell and Larcker, 1981]. Ideally the values should also be less than 0.90, as high values indicate that all the indicators are measuring the same phenomenon [Hair et al., 2017].

Results

Table 8.2 shows the reliability measures that were calculated. All of the measures are above the 0.7 threshold. The values for "behavioral intention to recommend" (BIR) are, however, higher than ideal. The cronbach's alpha is 0.901 (slightly above the 0.9 recommendation), and the composite reliability is at 0.927 (well above the recommended level). This might indicate that the BIR indicators are just semantic variations of each other.

8.2.2 Convergent Validity

Theory

Convergent validity shows to what extent a measure correlates positively with its assumed theoretical construct. It is evaluated using the *outer loadings* of the

indicators and the *average variance extracted* (AVE).

High outer loadings indicate that the indicators associated with the construct have a lot in common. According to Hair et al. [2017], a common rule of thumb is that each outer loading should be 0.708 or higher. Outer loadings below 0.4 should be removed. For outer loadings between 0.4 and 0.7, Hair et al. [2017] recommends only removing the outer loading if doing so makes the AVE and composite reliability score cross their recommended thresholds.

While the outer loadings measure convergent validity on an indicator level, the average variance extracted measures it on a construct level. It is recommended that the AVE value is 0.50 or higher [Fornell and Larcker, 1981]. This indicates that the construct explains more than 50% of the variance of its indicators.

Results

Table 8.3 shows the outer loadings. While most of the indicators are above the 0.708 threshold, four indicators are not. Especially the indicators for perceived usefulness seems to have low outer loadings.

The effect of the low outer loadings is further reflected in the AVE scores (see table 8.4). All the constructs are above the 0.50 threshold except perceived usefulness, which got a score of 0.497.

The indicator with the lowest outer loading is pu2 (*"By using the website I discover IT services I didn't know about before"*) with a value of 0.505. Following the guidelines presented by Hair et al. [2017], pu2 was removed from the model. By removing pu2 the AVE for perceived usefulness became 0.563, thus crossing the 0.50 threshold.

8.2.3 Discriminant Validity

Theory

Discriminant validity determines whether the items of one construct are more related to each other than they are to items of other constructs. The discriminant validity is measured using three different methods: Cross-loadings, the Fornell-Larcker criterion, and the heterotrait-monotrait ratio (HTMT).

Cross-loadings has traditionally been the go-to way of assessing discriminant validity. A construct is deemed to have sufficient discriminant validity if all its indicators outer loadings have higher values than its cross loadings of other constructs Hair et al. [2017].

Table 8.3: The outer loadings of all the indicators. As a rule of thumb, indicators should have an outer loading higher than 0.708. Outer loadings with lower than 0.708 are marked red

	Outer Loadings	
	With pu2	Without pu2
bi1 ← BI	0.875	0.875
bi2 ← BI	0.910	0.911
bi3 ← BI	0.815	0.815
bi4 ← BI	0.627	0.626
bir1 ← BIR	0.782	0.782
bir2 ← BIR	0.872	0.871
bir3 ← BIR	0.895	0.894
bir4 ← BIR	0.922	0.922
bir5 ← BIR	0.757	0.758
pe1 ← PE	0.759	0.759
pe2 ← PE	0.839	0.839
pe3 ← PE	0.777	0.777
pe4 ← PE	0.862	0.862
peou1 ← PEOU	0.761	0.760
peou2 ← PEOU	0.788	0.788
peou3 ← PEOU	0.831	0.832
peou4 ← PEOU	0.792	0.792
pu1 ← PU	0.609	0.630
pu2 ← PU	0.505	-
pu3 ← PU	0.853	0.873
pu4 ← PU	0.854	0.860
pu5 ← PU	0.632	0.594

Table 8.4: The average variance extracted (AVE) for each of the constructs. AVE values greater than 0.50 is recommended. Values below threshold is marked with red

	AVE
BI	0.663
BIR	0.719
PE	0.657
PEOU	0.629
PU	0.497
PU (without pu2)	0.563

The *Fornell-Larcker criterion* is another traditional measure of discriminant validity. To pass the criterion, the square root of the AVE for each construct should be larger than any of the inter-construct correlations, and be greater than 0.50 [Chin, 1998].

Unfortunately, a recent study found that neither of these measures were able to reliably detect discriminant validity issues. Instead, Henseler et al. [2015] proposed the *heterotrait-monotrait ratio* as it has been shown to outperform the traditional measures. The HTMT score for each indicator pair should be below 0.90, as higher values indicate a lack of discriminant validity.

Results

Table 8.5 shows the cross loadings between the indicators and the constructs. The values in bold are the specific constructs outer loadings. The table indicates good discriminant validity, as the value of each rows outer loading is greater than the cross-loadings on the same row.

Table 8.6 shows the result of the Fornell-Larcker measure. Since all the constructs (in bold) have both a score higher than 0.50, and are greater than the other values on the same row/column, good discriminant validity is indicated.

Lastly, table 8.7 shows the the HTMT ratios. All the values are lower than the 0.90 threshold, thus once again indicating discriminant validity. It is, however, worth noting that the PU/BI pair has a score of 0.870. While it *is* below the recommended threshold, it is still pretty close.

Table 8.5: The cross loadings of the research model. Good discriminant validity is indicated if the cross loadings for each row are lower than the outer loading (in bold).

	BI	**BIR**	**PE**	**PEOU**	**PU**
bi1	**0.875**	0.646	0.580	0.368	0.652
bi2	**0.911**	0.698	0.559	0.322	0.666
bi3	**0.815**	0.588	0.417	0.225	0.512
bi4	**0.626**	0.372	0.328	0.145	0.384
bir1	0.610	**0.782**	0.425	0.377	0.598
bir2	0.626	**0.871**	0.494	0.277	0.608
bir3	0.679	**0.894**	0.571	0.306	0.637
bir4	0.669	**0.922**	0.503	0.360	0.620
bir5	0.454	**0.758**	0.311	0.245	0.426
pe1	0.388	0.450	**0.759**	0.150	0.399
pe2	0.481	0.391	**0.839**	0.251	0.418
pe3	0.501	0.482	**0.777**	0.300	0.483
pe4	0.539	0.467	**0.862**	0.177	0.444
peou1	0.311	0.279	0.279	**0.760**	0.303
peou2	0.280	0.308	0.229	**0.788**	0.349
peou3	0.243	0.294	0.183	**0.832**	0.336
peou4	0.240	0.297	0.173	**0.792**	0.341
pu1	0.409	0.437	0.291	0.538	**0.630**
pu3	0.646	0.631	0.474	0.338	**0.873**
pu4	0.586	0.585	0.479	0.245	**0.860**
pu5	0.410	0.370	0.365	0.096	**0.594**

Table 8.6: The Fornell-Larcker criterion. Good discriminant validity is indicated if the values in bold is both higher than any other value on the same row/column, and higher than 0.50

	BI	**BIR**	**PE**	**PEOU**	**PU**
BI	**0.814**				
BIR	0.726	**0.848**			
PE	0.593	0.554	**0.810**		
PEOU	0.340	0.372	0.275	**0.793**	
PU	0.696	0.690	0.541	0.419	**0.750**

Table 8.7: The HTMT ratios. Good discriminant validity is indicated if the values are lower than 0.90

	BI	**BIR**	**PE**	**PEOU**	**PU**
BI					
BIR	0.814				
PE	0.698	0.630			
PEOU	0.399	0.434	0.330		
PU	0.870	0.830	0.694	0.534	

8.3 Assessing the Structural Model

Theory

Three measures were used to evaluate the model: The path coefficients, the *t-values* for each path coefficient and the R^2 values.

The *path coefficients* represent the hypothesized relationships between the constructs. There is a path coefficient for each of the hypotheses presented in section 1.2. Their values can range from approximately -1 to +1. The further away from 0 the value is, the stronger the relationship.

The path coefficients alone do not tell whether the relationships are significant or not. To determine the significance level of the path coefficients, t-values are calculated using a bootstrapping procedure [Hair et al., 2017]. A path coefficient is deemed significant if its t-value is greater than a given critical value. Three significance levels were used:

- **5% (*):** t-value of 1.960 or greater
- **1% (**):** t-value of 2.576 or greater
- **0.1% (***):** t-value of 3.291 or greater

Lastly, R^2 values are used to measure the model's predictive abilities. The value indicates the amount of variance in the endogenous constructs explained by all of the exogenous constructs linked to it [Hair et al., 2017]. The R^2 can range from 0 to 1, where higher values indicating greater predictive accuracy.

No real "rule of thumb" exists for R^2 values, as what values are considered good vary greatly between disciplines. For reference, the original TAM paper had a R^2 value of 0.51 for behavioral intention to use (BI) [Davis et al., 1989]. Van der Heijden's TAM for hedonic systems had a R^2 value of 0.35 for BI [van der Heijden, 2004], and UTAUT had a R^2 value of 0.69 [Venkatesh et al., 2003].

Results

Figure 8.1 shows the structural model. The figure shows that most of the path coefficients are significant at the 0.1% level. There are, however, some exceptions. The path "PE $\rightarrow$ BIR" was found to be significant at the 5% level. The paths "PEOU $\rightarrow$ BI" and "PEOU $\rightarrow$ BI" were both found not to be significant.

The modal explained 55.3% of the variance in intention to use and 60.6% of the variance in intention to recommend.

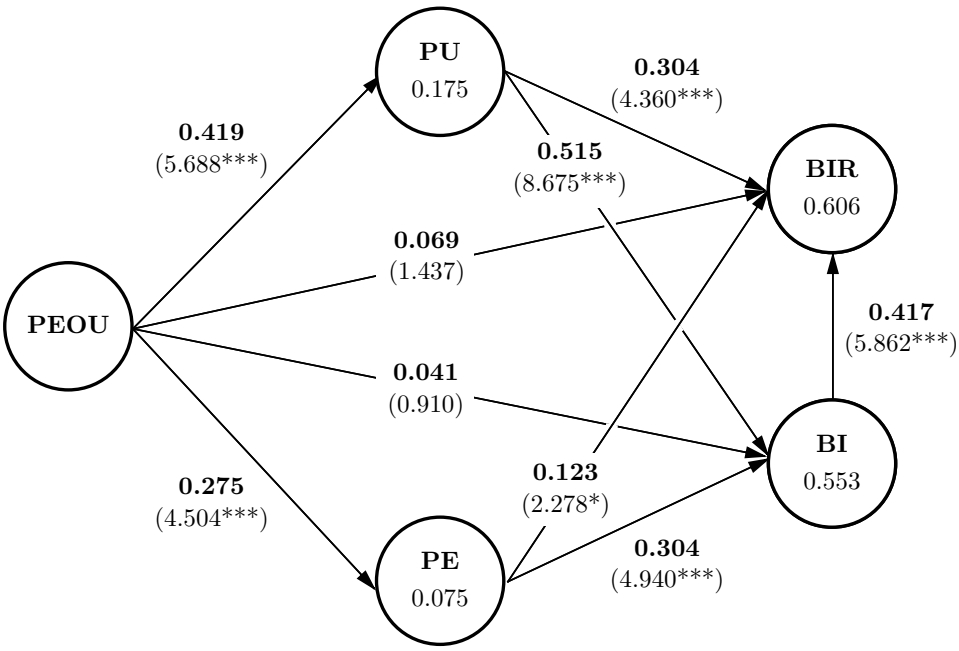


Figure 8.1: The structural model. The path coefficients are displayed next to the paths. The t values of the path coefficients are listed in parentheses. The R^2 values are shown inside the circles.

Chapter 9

Results: Usage Statistics

This chapter presents the real world usage of the university web portals. Section 9.1 introduces the terms used to describe the usage. The usage statistics of DUiO and Ugleredet will then be presented in section 9.2 and 9.3 respectively.

9.1 Common Terms

Before diving into the usage statistics, a quick clarification of the terminology used is in order. Some of the most commonly used terms to describe usage statistics are users, events, pageviews, and sessions.

9.1.1 Users

Users describes how many individuals have visited the website. However, it might be easier to think of it as how many different *devices* has visited the website. Since none of the websites requires the users to log in, it is impossible to determine whether a user is visiting the website for the first time or simply using his/her phone instead of his/her computer.

Users can further be split into two groups: New visitors and returning visitors. A user is counted as "returning" if it is less than two years since the last time the user visited the website.

9.1.2 Events

An *event* is registered every time a user perform an action on the website. Examples of actions are clicking one of the twelve links or opening the "about" modal.

9.1.3 Pageviews and Sessions

Pageviews are the number of times the website has been loaded. If a user refreshes the browser window three times, three pageviews will be counted.

Sessions are similar to pageviews, but with an important distinction: If a user visits the website several times in one sitting, all those pageviews are still just counted as one session. The session will stop after 30 minutes of inactivity or at the end of the calendar day.

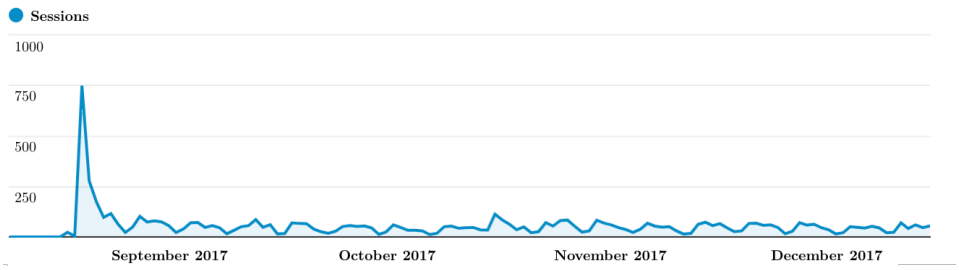
In the following sections, sessions will be preferred over pageviews. While pageviews can be interesting, they can be a bit misleading due to repeated reloads. While some users will revisit the website every time they want to access a link, others might just keep the window open. For those reasons, the combination of sessions and events was deemed the best way to accurately measure usage.

9.2 DUiO

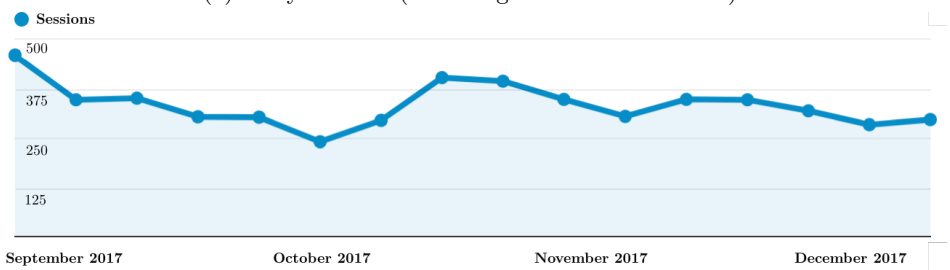
9.2.1 Sessions

In the first 17 weeks DUiO was available, 6854 sessions were registered on the website (pageview count is 9798). Figure 9.1 shows the number of sessions over time. The first week had a lot more sessions than any other time period. This initial traffic was most likely driven by the Facebook posts mentioned in section 5.7. After the first week, the number of sessions were greatly reduced, but became pretty stable. Excluding the first week, the average number of sessions per week was 335. The daily number of sessions usually varied between 80 on Mondays (the busiest day) and 12 on Saturdays (the least busy day).

The number of sessions declined until mid-October, where it suddenly rose again. This might be related to the survey. The DUiO survey was conducted on 13th-16th October and a total of 71 UiO students were introduced to the website.



(a) Daily sessions (20th August - 16th December)



(b) Weekly sessions (27th August - 16th December)

Figure 9.1: Session count for DUiO. Note that the launch week is excluded in the weekly view to make the smaller fluctuations easier to read.

9.2.2 Users

Figure 9.2 shows the number of users over time. The number of users follows a similar pattern to the sessions: The website initially drew a large number of visitors, with the number falling drastically after the first week. 1069 users visited DUiO in the first week, while only 178 users visited the second week.

On average, the number of weekly users was 126. The number of users was in decline until mid-October (86 users at its lowest), where the number of users grew to a peak of 177. Month by month the number of users fluctuated. September had 256 users, October had 387 and November had 297.

Figure 9.3 shows the distribution of new vs. returning users. The first week has been excluded to make the graph easier to read. On average, 14% of the users were new, while the rest were returning visitors. As can be seen in the figure, the ratio of new users increased mid-October. While some of the new users can be explained by the survey, the trend lasted longer than the survey period.

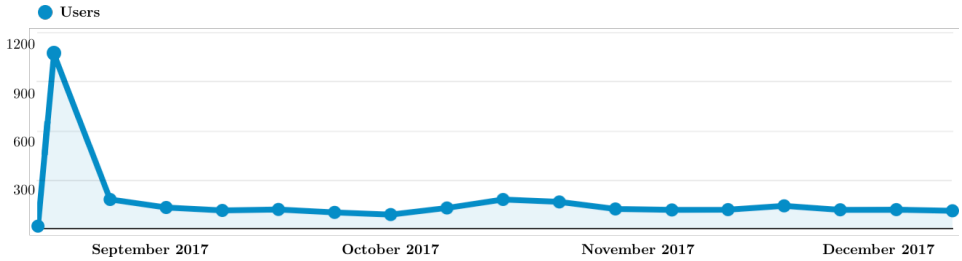


Figure 9.2: The weekly number of users on DUiO (20th August - 16th December)

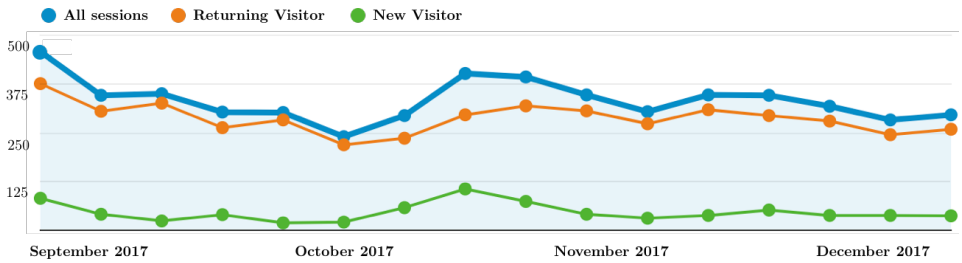


Figure 9.3: New visitors vs. returning visitors on DUiO (27th August - 16th December)

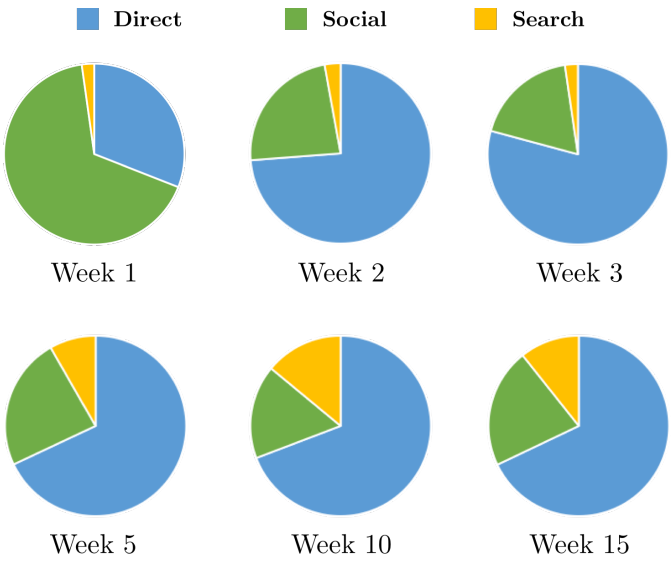


Figure 9.4: Pie charts showing change in traffic sources on DUiO

9.2.3 Traffic Sources

Figure 9.4 shows the breakdown of traffic sources. The first week, 66% of the traffic came from Facebook, while 31% entered the URL directly. The second week, direct traffic became the dominant traffic source 73%. Traffic from social media remained higher than anticipated (between 10% and 20% every week). Users entering the website via search results became more common as time went on. This might be affected by the website gaining better Google rankings as time went by.

9.2.4 What Links Were Used

Table 9.1 shows which links were most frequently clicked. The top three links accounted for 70% of the total usage. This doesn't necessarily mean that the rest of the links are useless, only that some links are more frequently needed than others.

It's worth noting that the total amount of events is higher than the number of sessions, but lower than the number pageviews.

Table 9.1: Link usage on DUiO

Link	n	%
Email	2199	27 %
Fronter	2058	25 %
Schedule	1452	18 %
Studentweb	665	8 %
Dinner	343	4 %
Download software	307	4 %
Remote desktop software	268	3 %
Office 365	257	3 %
Book training	207	3 %
Print	186	2 %
Library search	163	2 %
Change password	88	1 %
Total	8193	100 %

9.3 Ugleredet

9.3.1 Sessions

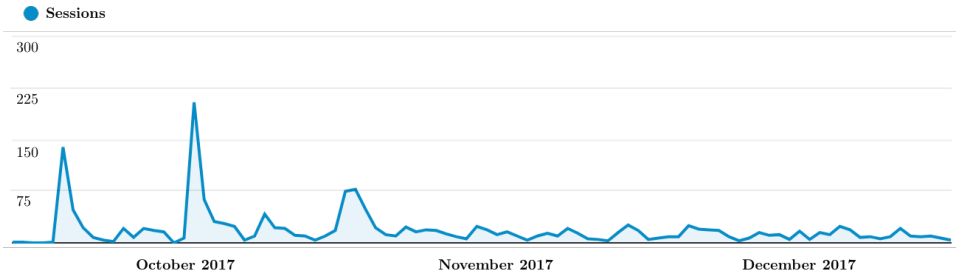
During the first 13 weeks, Ugleredet got a total of 1568 sessions and 3034 pageviews.

Figure 9.5 shows the number of sessions over time. The figure shows that there were three spikes in traffic at the beginning, followed by a lower, more stable amount of traffic later on. The first spike happened during the initial promotion on Facebook. The second spike happened after an article about ugleredet.no was published in the student newspaper Studvest. The third spike happened in mid-October, when the survey at UiB was conducted. After the three traffic spikes, the number of sessions per week stabilized at around 93 sessions per week.

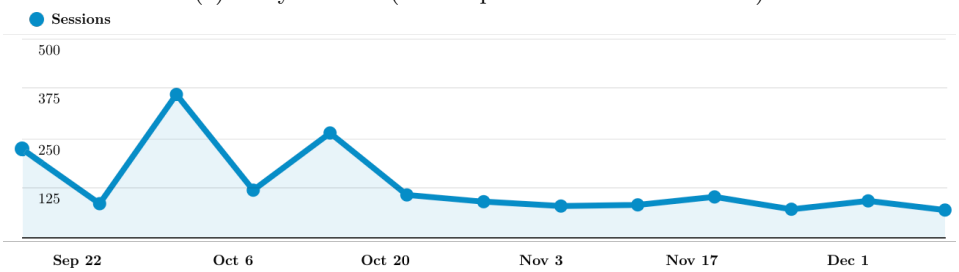
9.3.2 Users

Figure 9.6 shows the number of users over time. Just as with the sessions, the figure shows three peaks in traffic, followed by a lower, more stable number of users. Excluding the three traffic peaks, the average number of users per week was around 55.

182 users visited the website during the launch week, 276 users visited the



(a) Daily sessions (17th September - 16th December)



(b) Weekly Sessions (17th September - 16th December)

Figure 9.5: Session count for Ugleredet

websites in the week the Studvest article was published and 160 visited the website the week the survey was conducted.

Figure 9.7 shows the distribution of new vs. returning users. The percentage of new users increased markedly during the traffic spikes. The percentage for each of the three weeks was 81%, 72% and 50% new users. In the "normal" weeks the percentage of new users lay around 20%.

9.3.3 Traffic Sources

Figure 9.8 shows the breakdown of traffic sources. During the five first weeks, the traffic source varied greatly from week to week. Once again, this seems to be caused by the three traffic spikes mentioned earlier.

After the first five weeks, the source of traffic became more stable. From week 5 to 10 direct traffic accounted for about 75% of the traffic, search for 17% and social for 8%.

One interesting difference between DUiO and Ugleredet is that Ugleredet had a much less sustained source of traffic from social media. Whereas DUiO had relatively high percentages of traffic coming from Facebook even in week 15, Ugleredets

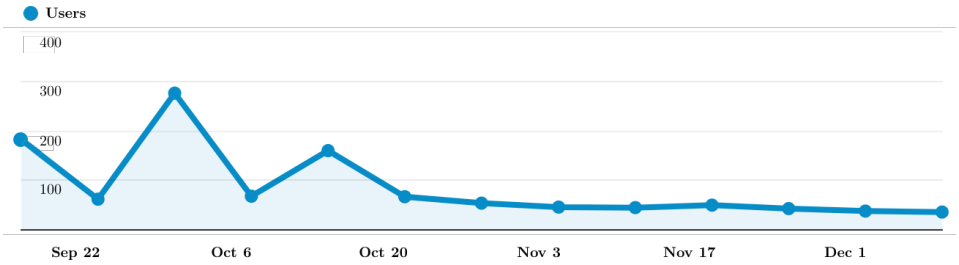


Figure 9.6: The weekly number of users (17th September - 16th December)

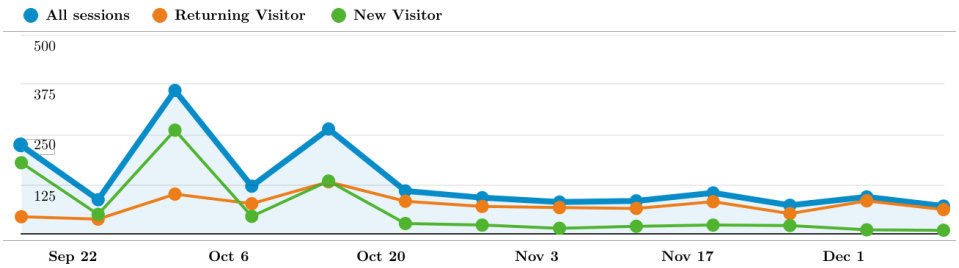


Figure 9.7: New visitors vs. returning visitors (17th September - 16th December)

social media presence had nearly died out by week 4.

9.3.4 What Links Were Used

Table 9.2 shows which links were most frequently used. The top three links only accounted for 38% of the events and the drop in usage was spread pretty evenly throughout the list. In contrast, the top three links on DUiO accounted for 70% of the events. At Instabart the statistics were even more extreme, with the top three links accounting for 83% of all clicks.

The slow drop from most to least used links might be explained by the relatively low number of regular users. Where new users might be inclined to explore the website, returning users are more likely to just use the specific link the need.

In total, the links were used 2791 times. This is higher than the total number of sessions (1568), but lower than the number of pageviews (3034).

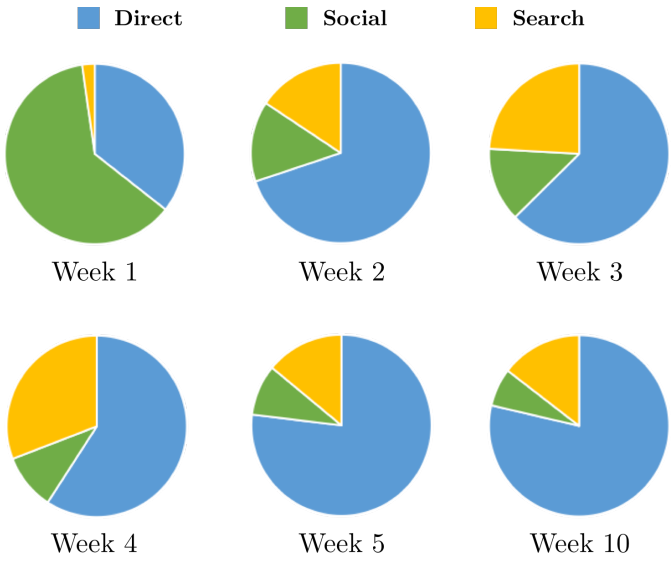


Figure 9.8: Pie charts showing the development in traffic sources on Ugleredet

Table 9.2: Link usage on Ugleredet

Link	**n**	**%**
My UiB	404	14 %
Print	354	13 %
Dinner	314	11 %
Email	312	11 %
Studentweb	236	8 %
Book training	219	8 %
Download software	218	8 %
Campus map	199	7 %
Office 365	163	6 %
Library search	137	5 %
Buy compendiums	135	5 %
Change password	100	4 %
Total	2791	100 %

Chapter 10

Discussion

This chapter aims to discuss the results presented in the three previous chapters. Section 10.1 and 10.2 will examine research question 1 and 2 respectively.

10.1 Interest in University Web Portals

Research question 1 asked if there is an interest in university web portals among students. Results from both the survey (chapter 7) and the usage statistics (chapter 9) help answer that question.

10.1.1 Assessing the Survey

The results of the survey indicate that there is an interest among students for university web portals.

When the respondents were asked if they would "want to use the website" (bi1), 72% answered 6 (agree) or 7 (strongly agree). 54% gave a score of 6 or 7 when asked whether they were "going to use the website regularly" (bi2). 86% said "this is a website other students will benefit from" (bir1) and 65% said they were going to "recommend the website to new students" (bir5).

Both the oral and written feedback from the respondents were positive. Some even mentioned that they had been looking for something like this. See appendix E for a complete list of all the written comments.

The results from UiO and UiB were not significantly different than the results from NTNU. This could indicate that there is nothing special about Instabart and that similar web portals might be needed at other universities as well.

Even though the results were favorable, they should be interpreted with some caution. Since the researcher was present during the survey, the respondents might have been influenced to give more positive responses than they otherwise would.

It is also worth considering that the respondents answered the surveys after using the web portal for just a couple of minutes. In other words, the respondents might not have had the time to fully evaluate whether the website will really be useful to them.

10.1.2 Assessing the Usage Statistics

As shown in chapter 9, none of the new web portals became nearly as successful as Instabart was in its first semester. Whereas Instabart had about 2200 weekly users a month after its release, DUiO and Ugleredet had only 117 and 68 respectively.

The potential causes are many. The following is a list of possible explanations as to what may have caused the low adoption of the web portals:

- The chosen links might be less useful than the ones for NTNU students
- The branding might be less memorable and whimsical branding than Instabarts
- The initial traffic caused by social media was lower for both DUiO and Ugleredet than Instabart. Since no other effort was made to promote the websites, this might have affected future usage
- When Instabart was promoted via Facebook, a significant amount of the researcher's circle of acquaintances were studying at NTNU. By comparison, the researcher had no substantial network of acquaintances at UiO or UiB. The lack of network was compensated for by finding relevant Facebook groups to promote the websites at, but that might not have been enough
- At NTNU, most IT services are relevant for all students. This might not be true for the other universities. For example: While almost all NTNU students submit assignments via Itslearning (now Blackboard), IT students at UiO use their own system (devilry.uio.no) to submit assignments
- It might be easier to access critical websites (such as Itslearning) at other universities than it is at NTNU. While NTNUs URL for Itslearning was incredibly long and difficult to remember, the equivalent URL for UiO students is just fronter.uio.no

All of this is speculation. Based on the information available, it is almost impossible to reveal the true cause.

Despite the web portals getting few visitors compared to Instabart, it is worth mentioning that the web portals did gain some loyal users. Of the 1069 users that visited DUiO the first week, about 12% stayed and continued to use the website. DUiO had 129 users in week 3 and 138 in week 14.

Ugleredet had fewer regular visitors, but a higher percentage of sustained visitors. In the first, week 182 users visited the website. By the end of the semester 50 users were still using the website per week.

It would have been interesting to see what could have happened with a more thorough marketing campaign. The Facebook posts for Ugleredet did not reach a lot of students, and the article in the student newspaper ended up attracting more visitors to the site.

All in all, while the web portals might not have become as virally successful as Instabart, they do seem to be useful to a sizable portion of the people that visit them.

10.1.3 Implications

The surveys showed that there is an interest in the university web portals. Several respondents expressed that their university lacked an easy overview of the available systems and that the proposed web portal solved this issue (see appendix E). That notion could be of interest to the university IT departments. While the proposed web portals are "external websites", nothing is stopping the universities from implementing similar solutions on their intranet.

Some of the respondents mentioned orally that while they liked the web portal, they were probably not going to use it. The reason was that they had already invested energy into creating their own routines for reaching the same resources. This substantiates the theory that the web portals should be introduced as early as possible.

While the proposed web portals failed to become as virally successful as Instabart, they did manage to turn a substantial percentage of the initial visitors into loyal users. Therefore, it would be interesting to see what might happen if a more coordinated effort to promote the web portals was initiated.

10.2 Evaluating the Proposed TAM Extension

Research question 2 considered whether it is possible to extend the Technology Acceptance Model to better explain the voluntary adoption of IT systems. The following will attempt to answer that question.

10.2.1 Comparison of Explained Variance

The model accounted for 60% of the total variance in behavioral intention to recommend (BIR). To put the number in perspective, it can be helpful to compare this models variance in intention (BI) to use to that of previous TAM studies. This study accounted for 55% of the total variance in BI. By comparison, Van der Heijden's model accounted for 35% [van der Heijden, 2004]. UTAUT accounted for 69% of total variance [Venkatesh et al., 2003]. Where Van der Heijdens model is very similar to the proposed model, UTAUT is a more complex model with many variables. Considering this, 60% explained variance is relatively high in the context of TAM models.

10.2.2 Assessing the Hypotheses

Table 10.1 shows a summary of the hypotheses testing. Most of the hypotheses were found to be significant at the p ¡ 0.001 level, but there are exceptions. Hypothesis 2 (PEOU → BI) and 6 (PEOU → BIR) were found not to be significant. This is not surprising, as earlier research has shown that PEOU is a weaker predictor of BI than PU [Davis et al., 1992].

Hypothesis 8 (PE → BIR) was found to be significant at the p ¡ 0.05 level. The value of the path estimate (0.123) is the smallest among the significant paths.

The strongest predictors of BIR was BI, followed PU and lastly PE. PU remained the strongest predictor of BI, just as other papers have suggested [Davis et al., 1992; M. Igbaria, 1995]. This indicates that the university web portals are more utilitarian in nature than hedonistic.

However, while the systems might be utilitarian in nature, PE had a relatively large impact on BI (path estimate of 0.304). This substantiates Van der Heijden's theory that even utilitarian systems might benefit by improving enjoyment [van der Heijden, 2004].

Table 10.1: Summary of the hypothesis results

Hypothesis		Estimate	Significance
H1	PEOU → PU	0.419	Significant at $p < 0.001$
H2	PEOU → BI	0.041	Not significant
H3	PU → BI	0.515	Significant at $p < 0.001$
H4	PEOU → PE	0.275	Significant at $p < 0.001$
H5	PE → BI	0.304	Significant at $p < 0.001$
H6	PEOU → BIR	0.069	Not significant
H7	PU → BIR	0.304	Significant at $p < 0.001$
H8	PE → BIR	0.123	Significant at $p < 0.05$
H9	BI → BIR	0.417	Significant at $p < 0.001$

10.2.3 Limitations

The model has some issues worth discussing. One of them is related to the questions used in the survey. While the questions that were taken from earlier TAM studies performed fine, some of the questions written for this study caused problems. BI and especially PU had outer loadings with a less than ideal scores. The model managed to pass the AVE requirement by removing pu2, but even then the score was just barely high enough (0.526).

The BIR construct had cronbach alpha and composite reliability scores slightly higher than recommended. This might indicate that the BIR items are just semantic variations of each other.

It is unclear how well suited the PE questions are for utilitarian systems. Several of the respondents displayed uncertainty when answering the PE and muttered things like "how should I answer this?". In the future, it might be wise to either construct PE items better adapted to utilitarian systems, or replace the PE construct with something more appropriate for utilitarian systems.

The researcher was present while the respondents filled out the surveys. This might have affected the outcome of the study, as the respondents could have felt obliged to rate the system more favorably than they otherwise would.

The BIR constructs ability to predict actual recommendations is up for debate. The students participating in the study rated pretty high on intention to recommend. Despite this, only a small increase in traffic was recorded in the weeks

following the survey. While it is possible that the respondents actually did recommend the web portals to their classmates or intends to do so in the future, a substantial percentage of the respondents most likely did not end up recommending it.

The survey assumed that the respondents would be able to correctly identify whether they would like to recommend the website to others after using it for a few minutes. This assumption might be erroneous and should be further examined.

10.2.4 Implications

Three constructs were found to have a significant impact on behavioral intention to use: BI, PU, and PE. Together these constructs were able to explain a relatively high percentage of the variance in BIR (60%).

Out of the three constructs, BI had the strongest influence on BIR. In other words: The strongest predictor of a users intention to recommend the system to others is whether he intends to use it himself.

The primary way of improving BI (and thus BIR) is to focus on the usefulness of the system. This is in accordance with findings from earlier TAM research [Davis, 1989]. In the context of university web portals, this means ensuring that the IT resources provided are of real value to the students. It could also mean expanding the web portal with additional functionality that the students would find helpful. However, adding new functionality should be done with care, as it runs the risk of detracting from the simplicity of the system.

Lastly, increasing the user's enjoyment of a system will make him more likely to recommend it, even for utilitarian systems. However, PE was found to be the weakest of the three significant predictors. So while enjoyment might make users more inclined to recommend an already useful system, it will not be enough to get them to recommend a useless system.

Chapter 11

Conclusion and Further Work

11.1 Conclusion

This thesis aimed to answer two questions:

1. Is there an interest in university web portals among students?
2. Is it possible to extend the Technology Acceptance Model in such a way that it better explains the voluntary adoption of IT systems?

To answer these questions, several things were done. A new version of the Technology Acceptance Model was proposed. In addition to the TAM models existing constructs, a new construct for "behavioral intention to recommend" was added.

Two university web portals were developed, one for students at University of Oslo and one for students at University of Bergen. The websites were promoted using social media and usage statistics was gathered whenever users visited the websites.

Three surveys were conducted, one for UiO, one for UiB and one for NTNU (which already had a university web portal). The participants used the web portal for three minutes and then filled out a questionnaire.

Lastly, a PLS-SEM analysis was performed using the data from the surveys. It was used to assess the quality of the proposed model.

The results show that there is an interest in university web portals. The new web portals managed to gain some loyal users who continued to use it throughout the semester. The students who tried the web portals during the survey rated it highly.

The PLS-SEM analysis shows that the model conforms to earlier TAM findings, such as "perceived usefulness" being the strongest predictor of "behavioral intention to use".

Furthermore, the proposed BIR construct was affected by three out of the four proposed construct. BI was found to be the strongest predictor, followed by PU and lastly PE. PEOU did not have a significant impact on BIR.

11.2 Future Work

To further enhance the usefulness of the web portals, they could be adapted to the individual student's field of study. IT students at UiO mentioned that they use their own website for handing in assignments. Thus, that website should show up on their web portal. Moreover, medical students at NTNU should see a link to their hospital calendars.

If some university were to implement similar web portals on their intranet, it would be interesting to measure whether that led to (a) higher utilization of the IT services, (b) less need for service desks, or (c) an increase in student satisfaction.

Further research into the proposed TAM extension should begin by examining the quality of the survey questions. The questions for both "perceived usefulness" and "intention to use" performed sub-optimally. The questions for "intention to recommend" should also be looked at, as the results indicate that they might just be semantic variations of each other. Lastly, the "perceived enjoyment" questions should be asked in a way that feels more natural for utilitarian systems.

The reliability of the BIR construct itself should be examined. An evaluation of the constructs ability to reliably predict actual recommendations should be conducted.

Appendix A

Rejected Brand Names

A.1 University of Oslo

- oslosjen.no
- oslolosjen.no
- uiolenker.no
- uioting.no
- allelenkene.no
- studentlenker.no
- instaporten.no
- studlink.no
- innogut.no
- allegreiene.no
- studbutler.no
- prikkedøden.no
- uio.guru
- uniseff.no - Links for the needing

A.2 University of Bergen

The Owl

- uglen.no
- uglr.no
- instahoot.no

Phrases used in Bergen

- hallaien.no
- hallaisen.no
- påanigjen.no
- tjommi.no
- instatjommi.no
- frekkogtidig.no
- gåmann.no
- studikken.no
- nystemte.no

Weather

- paraplyen.no
- parasollen.no
- plassk.no
- regnregnregn.no
- instasol.no

Non .no domains

- bergenser.me
- bergenser.life
- bergen.world
- uib.guru
- ☔.ws (yes, this is a valid URL)
- ☔☔☔.ws

Appendix B

Survey Script

All respondents were recruited by approaching them in the universities main hubs, and asking if they would like to participate in the study.

Since talking to the respondents before they answer the survey could affect the answers they provide, a simple script was created. The scripts covers both the recruitment, as well as guiding the respondents through the different stages of the study.

The script was followed as closely as possible. However, sometimes exceptions had to be made to avoid acting like a robot.

Recruitment

Hi! Do you think I could disturb you for a few minutes? I'm a master student studying computer science and am looking for students to participate in a study. It'll take ten minutes tops and by participating you can win a gift card for 1000 NOK.
[**If YES**] Excellent! Thank you!
[**If NO**] OK, then. Have a nice day!

Intro

So, the survey consists of three parts. First, I want you to take a minute or two to read this introduction.
[**Hand over the introduction paper**]
Then, I'll ask you to use three minutes to familiarize yourself with a website.
Lastly, I'll hand you a survey for you to fill out.
Also: I want to emphasize that you can decide to not participate at any time, and that the survey will be anonymous.
Does that sound OK to you?

Testing the website

[**When respodents has finished reading the introduction**] Do you have a computer/phone you can use or do you want to borrow one?
[**TESTING STARTS**]
[**If the three minutes are up**] The three minutes are up. Do you want a little more time?
[**When the respondent indicates that he/she is finished**] Done? Great!

Filling out the survey

[**Hand over the survey**] Here you go.
[**If respondent at any point has asked whether if I'm the creator of the website**] Also, feel free to be brutally honest. The research will be more interesting that way.
[**SURVEY STARTS**]
[**When finished**] Finished? Great, thank you. If you want a chance to win the giftcard for 1000 NOK, write your name and email on this list.
[**Hand over the "lottery list"**]
Do you have any questions?
Thank you so much! Have a nice day!

Appendix C

Survey (in Norwegian)

Introduksjon til spørreundersøkelse

Spørreundersøkelsen er en del av masteroppgaven «Bedre oversikt over tjenestetilbudet ved universiteter». Oppgaven handler om å lage og teste en akseptansemodell for IT-systemer. Akseptansemodellen har som mål å undersøke hvilke faktorer som avgjør om et system vil bli tatt i bruk eller ikke.

I forbindelse med masteroppgaven er det laget tre nettsider. Oppgaven din er å teste én av disse nettsidene i ca. 3 minutter, for deretter å svare på noen spørsmål om din opplevelse av nettsiden.

Navnet på nettsiden du skal teste er **<nettsiden.no>**

Spørreundersøkelsen er helt frivillig og du kan avbryte når som helst.

Spørreundersøkelsen er anonym. Om du ønsker, kan du være med i trekningen av et universalgavekort til en verdi av 1000 kr. Kontaktinformasjonen vil ikke bli brukt til noe annet formål enn å kontakte vinneren.

Takk for hjelpen!

Med vennlig hilsen,
Morten Vaale Noddeland
Masterstudent i informatikk

Epost: morten.noddeland@ntnu.no
Telefon: 91 83 38 35

Masterveileder:
John Krogstie
Professor ved IDI
NTNU

NTNU

Spørreundersøkelse om <nettside>

Organisator: Morten Vaale Noddeland **Epost:** morten.noddeland@ntnu.no **Telefonnummer:** 91 83 38 35

Alle spørsmålene i undersøkelsen skal besvares. Hvert spørsmål besvares ved å sette et kryss i en av rutene til høyre. Om du skulle ombestemme deg, fyll hele ruten og sett deretter kryss i ønsket rute.

Spørsmålsgruppe 1:	**Svært uenig**	**Ganske uenig**	**Litt uenig**	**Verken eller**	**Litt enig**	**Ganske enig**	**Svært enig**
Ved å bruke nettsiden kan jeg raskt og enkelt finne frem til IT-tjenestene jeg trenger	☐	☐	☐	☐	☐	☐	☐
Ved å bruke nettsiden oppdager jeg IT-tjenester jeg ikke visste om fra før	☐	☐	☐	☐	☐	☐	☐
Ved å bruke nettsiden blir livet som student mer effektivt	☐	☐	☐	☐	☐	☐	☐
Ved å bruke nettsiden blir livet som student enklere	☐	☐	☐	☐	☐	☐	☐
Ved å bruke nettsiden bruker jeg flere IT-tjenester for studenter enn jeg ellers ville gjort	☐	☐	☐	☐	☐	☐	☐

Spørsmålsgruppe 2:	**Svært uenig**	**Ganske uenig**	**Litt uenig**	**Verken eller**	**Litt enig**	**Ganske enig**	**Svært enig**
Jeg synes nettsiden er klar og forståelig	☐	☐	☐	☐	☐	☐	☐
Å bruke nettsiden krever ikke mye konsentrasjon	☐	☐	☐	☐	☐	☐	☐
Jeg synes nettsiden er lett å bruke	☐	☐	☐	☐	☐	☐	☐
Jeg synes det er lett å få nettsiden til å gjøre det jeg vil den skal gjøre	☐	☐	☐	☐	☐	☐	☐

Spørsmålsgruppe 3:
Å bruke nettsiden er...

Grusomt	☐	☐	☐	☐	☐	☐	☐	Underholdende
Ensformig	☐	☐	☐	☐	☐	☐	☐	Spennende
Utrivelig	☐	☐	☐	☐	☐	☐	☐	Hyggelig
Kjedelig	☐	☐	☐	☐	☐	☐	☐	Interessant

Spørsmålsgruppe 4:	**Svært uenig**	**Ganske uenig**	**Litt uenig**	**Verken eller**	**Litt enig**	**Ganske enig**	**Svært enig**
Jeg har lyst til å bruke nettsiden	☐	☐	☐	☐	☐	☐	☐
Jeg kommer til å bruke nettsiden jevnlig	☐	☐	☐	☐	☐	☐	☐
Jeg kommer til å lagre nettsiden som bokmerke	☐	☐	☐	☐	☐	☐	☐
Jeg kommer til å bruke nettsiden som startside	☐	☐	☐	☐	☐	☐	☐

Spørsmålsgruppe 5:	**Svært uenig**	**Ganske uenig**	**Litt uenig**	**Verken eller**	**Litt enig**	**Ganske enig**	**Svært enig**
Dette er en nettside andre studenter kommer til å dra nytte av	☐	☐	☐	☐	☐	☐	☐
Jeg kommer til å spørre andre studenter om de har hørt om nettsiden	☐	☐	☐	☐	☐	☐	☐
Jeg har lyst til å fortelle om nettsiden til vennene mine	☐	☐	☐	☐	☐	☐	☐
Jeg kommer til å anbefale nettsiden til medstudenter	☐	☐	☐	☐	☐	☐	☐
Jeg kommer til å anbefale nettsiden til nye studenter	☐	☐	☐	☐	☐	☐	☐

Har du *hørt om* <nettside> tidligere?

☐ Ja

☐ Nei

Har du *brukt* <nettside> tidligere?

☐ Ja

☐ Nei

Kjønn

☐ Mann

☐ Kvinne

Hvor lenge har du studert ved <universitet>?

☐ Mindre enn 1 år

☐ 1 år

☐ 2 år

☐ 3 år

☐ 4 år

☐ Mer enn 4 år

Hva studerer du?

Har du noen kommentarer?

Dette er helt frivillig

Appendix D

Statistical Summary of the Surveys

Table D.1: Statistical summary of survey conducted at NTNU

Item	n	Min	Max	Median	Mean	Std. dev.
pu1	70	5	7	7	6,5	0,63
pu2	70	1	7	6	5,6	1,33
pu3	70	4	7	6	5,5	0,99
pu4	70	3	7	6	5,6	1,14
pu5	70	2	7	5	5,3	1,18
peou1	70	3	7	7	6,6	0,69
peou2	70	1	7	7	6,4	1,32
peou3	70	3	7	7	6,6	0,68
peou4	70	4	7	7	6,5	0,72
pe1	70	4	7	5	4,9	0,85
pe2	70	2	7	4	4,3	1,02
pe3	70	4	7	6	5,4	0,94
pe4	70	3	7	5	5,1	0,99
bi1	70	3	7	6	5,7	1,07
bi2	70	2	7	5	5,2	1,41
bi3	70	1	7	4	4,5	1,86
bi4	70	1	7	3	2,9	1,55
bir1	70	4	7	6	6,3	0,76
bir2	70	1	7	5	4,5	1,60
bir3	70	1	7	5	4,5	1,59
bir4	70	1	7	6	5,4	1,29
bir5	70	1	7	6	5,9	1,23

Table D.2: Statistical summary of survey conducted at UiO

Item	n	Min	Max	Median	Mean	Std. dev.
pu1	71	3	7	7	6,7	0,65
pu2	71	1	7	5	4,9	2,01
pu3	71	1	7	6	5,7	1,34
pu4	71	3	7	6	5,7	1,06
pu5	71	1	7	5	4,7	1,76
peou1	71	2	7	7	6,6	0,78
peou2	71	4	7	7	6,5	0,79
peou3	71	4	7	7	6,7	0,57
peou4	71	3	7	7	6,4	0,92
pe1	71	4	7	5	5,0	0,85
pe2	71	1	7	5	4,5	1,33
pe3	71	4	7	5	5,6	1,10
pe4	71	1	7	5	5,2	1,29
bi1	71	3	7	6	6,1	1,03
bi2	71	2	7	6	5,5	1,35
bi3	71	1	7	6	5,2	1,92
bi4	71	1	7	3	3,3	2,01
bir1	71	4	7	6	6,3	0,75
bir2	71	1	7	5	4,7	1,65
bir3	71	1	7	5	5,0	1,56
bir4	71	1	7	5	5,5	1,35
bir5	71	1	7	6	5,6	1,37

Table D.3: Statistical summary of survey conducted at UiB

Item	n	Min	Max	Median	Mean	Std. dev.
pu1	73	5	7	7	6,8	0,46
pu2	73	1	7	6	5,6	1,64
pu3	73	3	7	6	5,9	0,98
pu4	73	2	7	6	5,8	1,02
pu5	73	1	7	5	5,1	1,48
peou1	73	3	7	7	6,7	0,60
peou2	73	4	7	7	6,8	0,52
peou3	73	5	7	7	6,8	0,44
peou4	73	4	7	7	6,6	0,76
pe1	73	4	7	5	5,0	0,94
pe2	73	1	7	5	4,7	1,28
pe3	73	4	7	6	5,9	1,00
pe4	73	3	7	5	5,3	1,10
bi1	73	2	7	6	6,0	1,08
bi2	73	1	7	6	5,5	1,37
bi3	73	1	7	6	5,2	1,70
bi4	73	1	7	3	3,2	1,70
bir1	73	5	7	7	6,4	0,70
bir2	73	1	7	5	5,0	1,37
bir3	73	2	7	5	5,2	1,36
bir4	73	2	7	6	5,6	1,31
bir5	73	3	7	6	6,0	0,96

Appendix E

Comments

The survey had a non mandatory field named *Comments* where the user could write whatever they wanted. The following is a list of all the responses to that question.

E.1 DUiO Survey

- Det er fint at alt er på samme plass. Da jeg begynte som student var det kronglete å finne fram. Fint og oversiktlig
- Nytt og spennende
- Veldig god og lett nettside!
- Noen ganger gikk det ikke å klikke seg tilbake til startsiden.
- Syns nettsiden duio.no er mer ryddig og tydelig enn uio.no
- Logg inn burde være på første side
- Likte navnet godt
- En bonus ved siden kunne være en trygg måte å lagre passord, så man slipper å logge inn på f.eks. mine sider
- Jeg synes at siden ser fin ut. Det største problemet er konkurranse i fra google
- Godt alternativ til uio.no

- Jeg er på udveksling, og derfor har jeg ikke stor kjendskab til UiO
- devilry.ifi.uio.no
- Litt tungvindt at siden man velger kommer opp på samme side; hadde vært bedre om det kom opp i en ny fane slik at duio blir værende i den ene fanen :)
- Det er ikke klart hva forskjellen mellom programvare og programkiosk er. Liten info der? utskrift.uio.no har lite informasjon og foteller ikke hvordan man printer. Lenke til doc istedet? uio.no/tjenester/it/utskrift
- Personsøk
- Veldig oversiktlig og enkel å forstå. Kunne godt brukt den som startside, godt utgangspunkt. Anbefales veldig for nye studenter, men ikke supernyvinnende.
- Fungerer veldig fint som en startside
- Navnet er lett å huske. Mulighet for arrangementer?
- En kort forklaringstekst for hvert ikon. For eksempel ved "hovring" med pekeren over
- Siden jeg er masterstudent har jeg blitt kjent med mange av disse funksjonene det siste halve året. Men hadde jeg visst om denne siden ville jeg nok brukt de før
- Utrolig praktisk! UiO sin egen hjemmeside er kronglete å bruke - her er alt samlet
- Jeg har reagert på hvor uoversiktlig UiO sine IT-tjenester har vært å lære seg og vende seg til, fordi alt har vært så spredt. Duio løser nettopp dette problemet
- Et sårt trengende alternativ til UiOs gamle nettsider
- Flott opplegg! Effektivt!
- Nettsiden gjør det mye raskere å finne frem til ellers kronglete sider - genialt
- Fint å ikke forlate siden, når du trykker på en av lenkene
- Denne siden var veldig praktisk og er absolutt noe jeg kommer til å begynne å bruke!

- Veldig fin og ryddig layout
- Ikke mulig å gå tilbake fra UiO program til portalen
- Jeg ville at nettsidene skulle åpnet seg automatisk i nye fane, ikke i samme fane

E.2 Ugleredet Survey

- Fantastisk, dette trengte jeg!
- Spesielt nyttig for nye studenter. Bra å få samlet nettstedene
- Veldig smart nettside!
- Effektiv, oversiktlig og brukervennlig
- Så ikke info om hva passord de spør etter når jeg trykker på programvare
- Bra design
- En måte å se dagens middag på, uten å trykke på mat hadde vært kult, men litt klussete kanskje?
- Veldig fin nettside, men litt grå og kjedelig. Definitivt en nettside nye studenter kan ha bruk for!
- Veldig oversiktlig og dekker dei viktigaste sidene! Perfekt for nye studenter, ettersom det på begynnelsen var veldig mye info på kort tid! :)
- Ville gjerne ha som app i stedet for nettside
- Hvis nettsiden var en app ville jeg helt sikkert brukt den hver dag!!!
- Hadde det vært en app hadde den nok blitt brukt mer
- Det er enklere for meg å berre gå til sidene direkte og meir tidsbesparande fordi eg er så godt inne i systemet allerede, men det er supert for nye studenter som ikkje har like god oversikt over alle dei ulike sidene
- Ti ganger bedre med, enn utan
- Veldig oversiktlig og enkel side å bruke :)
- Sats på å opprettholde sidens raske respons

- Bra design, lett å finne det man ser etter. Bra verktøy
- Siden var lite tematisk og før man kjenner logoer var det lite intuitivt å vite hvor man havner. PS: Jeg har bokmerket alle disse sidene og kommer ikke til å bruke tjenesten
- Savner link til IT-avdelingen (it.uib.no)
- Om mulig legge inn snarveier for offentlig transport
- Veldig fin, enkel og gunstig nettside
- Veldig fin og praktisk side
- Kunne hatt bruk for en app. Roombooking burde vært implementert. Grå var en litt kjedelig farge

E.3 Instabart Survey

- Kjekt for å få et system i det rotete systemet til NTNU.
- Bruke farger på nettsiden. Kortere quote under instabart
- Det kunne vært mer farger for å gjøre siden enda mer spennende
- Hendig
- I ❤️ Instabart
- Bruker svært sjelden bokmerker og slikt
- Fin layout, bra manøvrering
- Mer oversiktlig enn systemet som brukes nå av NTNU
- Minner veldig om menyen på Innsida

Bibliography

Allen, I. E. and Seaman, C. A. (2007). Likert scales and data analyses. *Quality Progress*, 40(7):9–12.

Bangor, A., Kortum, P., and Miller, J. (2009). Determining what individual sus scores mean: Adding an adjective rating scale. *Journal of Usability Studies*, 4(3):114–123.

Benbasat, I. and Barki, H. (2007). Quo vadis tam? *Journal of the Association for Information Systems*, 8(4):211–218.

Brooke, J. (1996). Sus - a quick and dirty usability scale. *Usability evaluation in industry*, 189(1).

Chang, M. K. and Cheung, W. (2001). Determinants of the intention to use internet/www at work: a confirmatory study. *Information & Management*, 39(1):1–14.

Chang, S. E., Shen, W.-C., and Yeh, C.-H. (2017). A comparative study of user intention to recommend content on mobile social networks. *Multimedia Tools and Applications*, 76(4):5399–5417.

Chesney, T. (2006). An acceptance model for useful and fun information systems. *Human Technology*, 2(2):225–235.

Chin, W. W. (1998). Issues and opinion on structural equation modeling. *MIS Quarterly*, 22(1):7–16.

Cortland, M. (2017). *2017 Adblock Report*. `https://pagefair.com/blog/2017/adblockreport/` [Accessed: 2017-11-17].

Cuddeback, G., Wilson, E., Orme, J., and Combs-Orme, T. (2004). Detecting and statistically correcting sample selection bias. *Journal of Social Service Research*, 30(3):19–33.

Datatilsynet (2013). *Aksepterer bruk av Google Analytics*. `https://www.datatilsynet.no/regelverk-og-skjema/lover-og-regler/avgjorelser-fra-datatilsynet/andre-avgjorelser-og-vedtak/eldre-vedtak/aksepterer-bruk-av-google-analytics/` [Accessed: 2017-06-04].

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3):319–340.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8):982–1003.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, 22(14):1111–1132.

Difi (2014). *Oppbygging av WCAG 2.0*. `https://uu.difi.no/krav-og-regelverk/wcag-20-standarden/oppbygging-av-wcag-20` [Accessed: 2017-05-28].

Fishbein, M. and Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Addison-Wesley.

Fornell, C. and Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1):39–50.

Gefen, D., Karahanna, E., and Straub, D. (2003). Trust and tam in online shopping: an integrated model. *MIS Quarterly*, 27(1):51–90.

Gefen, D., Straub, D. W., and Boudreau, M.-C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information Systems*, 4(7).

Hair, J. F., Hult, G. T. M., Ringle, C. M., and Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. SAGE Publications.

Haugstvedt, A.-C. and Krogstie, J. (2012). Mobile augmented reality for cultural heritage: A technol- ogy acceptance study. *IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*, pages 247–255.

Henseler, J., Ringle, C. M., and Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1):115–135.

Henseler, J., Ringle, C. M., and Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. *Advances in International Marketing*, 20:277–319.

Hevner, A. R., March, S. T., Park, J., and Ram, S. (2004). Design science in information systems research. *MIS Quarterly*, 28(1):75–105.

Holden, R. J. and Karsh, B.-T. (2010). The technology acceptance model: It's past and it's future in health care. *Journal of biomedical informatics*, 43(1):1–30.

Hox, J. J. (1999). An introduction to structural equation modeling. *Family Science Review*, 11:354–373.

Hsu, H.-H., Chang, C.-C., and Lin, T.-H. (2013). An empirical study of users' continuance intention and word of mouth toward sna (social network app). *Proceedings of the 2013 International Conference on Technology Innovation and Industrial Management*, pages 174–183.

Lee, Y., Kozar, K. A., and Larsen, K. R. T. (2003). The technology acceptance model: past, present, and future. *Communications of the American Informatics Society*, 12(50):752–781.

Legris, P., Ingham, J., and Collerette, P. (2003). Why do people use information technology? a critical review of the technology acceptance model. *Information & Management*, 40(3):191–204.

M. Igbaria, J. Iivari, H. M. (1995). Why do individuals use computer technology? *Information & Management*, 29(5):227–238.

Marcotte, E. (2016). *Responsive Design: Patterns & Principles.* A Book Apart.

Nam, J. (2014). Understanding the motivation to use web portals. *Computers in Human Behavior*, 36:263–273.

Oates, B. J. (2006). *Researching Information Systems and Computing*. SAGE Publications.

Peffers, K., Tuunanen, T., Gengler, C. E., Rossi, M., Hui, W., and Bragge, J. (2006). The design science research process. *Proceedings of the First International Conference on Design Science Research in Information Systems and Technology*, page 83–106.

Rømen, D. and Svanæs, D. (2012). Validating wcag versions 1.0 and 2.0 through usability testing with disabled users. *Universal Access in the Information Society*, 11(4):375–385.

Statcounter (2017). *Desktop vs Mobile vs Tablet Market Share Norway*. `http://gs.statcounter.com/platform-market-share/desktop-mobile-tablet/norway` [Accessed: 2017-10-03].

Suhr, D. D. (2006). Exploratory or confirmatory factor analysis? *Proceedings to SUGI*, 31.

Tse, D. K. and Wilton, P. C. (1988). Models of consumer satisfaction: An extension. *Journal of Marketing Research*, 25:204–212.

Ueberfax, J. S. (2006). *Likert Scales: Dispelling the Confusion*. `http://www.john-uebersax.com/stat/likert.htm` [Accessed: 2017-08-10].

van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Quarterly*, 28(4):695–704.

Venkatesh, V. and Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2):186–204.

Venkatesh, V., Morris, M., Davis, G. B., and Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3):425–478.

W3C (2008). *Web Content Accessibility Guidelines (WCAG) 2.0*. `https://www.w3.org/TR/WCAG20/` [Accessed: 2017-05-28].

Wagner, J. L. (2016). *Web Performance in Action: Building Fast Web Pages*. Manning Publications.

Wheeler, A. (2012). *Designing Brand Identity: An Essential Guide for the Whole Branding Team*. John Wiley & Sons.