Practical Placement
Final Report

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1. Introduction

This final report is part of the completion of the International Practical Placement by Linus Andrzejczak and Mats Thiele from 17 January 2022 to 25 March 2022 as part of the ISGC99 course at Karlstad University. It was part of the practical placement to deal with the universities web application Ozlab, which allows users to conduct usability tests with prototypes of GUIs using the Wizard-Of-Oz method. Ozlab was tested for bugs and new features using an extensive prototype of a banking application that exhausted all Ozlab functions. Then the manual, which was last updated in 2019, was revised. As a main task of the practical placement, a usability test was conducted with a website of the Baden-Wuerttemberg Cooperative State University Stuttgart (Duale Hochschule Baden-Wuerttemberg Stuttgart, DHBW Stuttgart), for which an extensive report was also prepared. Finally, the use of Ozlab and video conferencing on mobile devices as well as Ozlab alternatives were considered. This report shows how the authors have applied the "theories from the field of information systems" during this time and that they are able to "analyse a business or a system in terms of the theoretical frameworks of Information Systems" as well as their recognized "need of further knowledge and skills in the Information Systems field". Furthermore, this report includes the tasks and general experiences of the authors during this practical placement.

2. Placement

Weekly Report – Calendar Week 3

The first week of our practical placement started with a lunch on Tuesday. We met John Sören Petersson, Malin Vik, Elin Nilsson and Seemaa al-abdali, with whom we will be working in the upcoming weeks. First we will get to know the software "Ozlab", which was designed by Karlstad University itself. We will revise its user manual, before we will support Elin in the lab and receive other tasks from Malin.

After lunch, John Sören took us on a tour to the usability test lab, which was continued by Elin on Wednesday. The lab includes the "Grupprum" (group room), "Testrum" (test room) and "Kontrollrum" (control room). The group room includes seven seats around a round table and two TVs to conduct meetings and presentations. It could also be used as a wating area to receive several test persons. The test room includes two computers. One of them is the test participant's computer equipped with a webcam, eye tracking and a connection to a screen in the control room so that it can be closely monitored. Furthermore, this room has also a camera, a microphone, speakers and a tinted and mirrored glass window to the control room as possibilities for observation and interaction. From the control room the test room can be observed unnoticed through this window, provided the control room itself has been darkened and the light has been switched off. Communication with the test participant in the test room is also possible via microphone and speakers. In the control room, besides the test leader's computer and the screen that mirrors the test computer, there are also two other computers that can be used for testing, working or supporting tasks such as video recording.

After Elin gave us a short introduction on how to access the Ozlab installations of KAU, we started by reading the manual, which was last updated almost 2 years ago, and checked it for first formal errors. Afterwards we started to implement an exemplary shell (term for a unit consisting of several screens, which is used for testing) in Ozlab. With this shell we will be able to practice the usage of Ozlab and the testing with a test participant. For this we thought about an online banking application, because we both have experience with such applications and they are very different in our home country Germany. Depending on the bank, some of them are very easy to use, others are very complicated and therefore provide an interesting example for us when we perform a usability test with a test participant.

To keep a written record of all our findings, we have created a shared OneNote notebook in which we have created various lists. In "Manual Changes" we note down suggested changes and possible additions to the user manual. Minor adjustments that are obviously needed are made directly into a Word copy of the manual. "Software Changes" contains suggested changes to the software that we have noticed during use due to bugs or non-intuitive behaviour. "Feature Requests" contains features that we are still missing in the software, but would like to see. Furthermore, we created a note "Ozlab Demo Draft" where we created draft drawings of the example shell.

At the end of the week we have already checked half of the manual for errors and found some points for the mentioned lists. We will continue this work in the following week. Furthermore, we have completed a basic online banking application consisting of various objects provided by Ozlab, which we will test with a test participant after submitting this report.

Weekly Report – Calendar Week 4

Our second week was characterized by Covid. At the beginning of the week we were still together at the university to finish our Ozlab prototype and to revise the manual. From the middle of the week we could not go to the university anymore due to a Covid infection, so we had to work remotely. Here we mainly finished the previous tasks and started to work through the scientific papers that John Sören provided us with.

In the meantime, we finished the manual and uploaded it to the shared box folder. The revision of the manual consisted of two parts. On the one hand, we reviewed and revised the instructions for completeness and correctness of content. This included checking for consistent naming. On the other hand, we used the manual to familiarize ourselves with Ozlab and were able to directly test the user friendliness of the application.

Our prototype contains an online banking application. Based on the template with the side navigation menu and first subareas (Accounts, Cards) from the previous week, we completed further subareas (Transactions, Profile) and added the associated notifications to the shell. For these we used the object "label" and wrote the source code itself as html to be able to use objects not available in Ozlab like sliders. Furthermore, we used snap points to fix them at certain positions on the screen. To get to know Ozlab better and to find possible bugs, we then each took the test leader/test participant roles and conducted test sessions.

Towards the end of the week, we started reading the papers provided by John Sören. In doing so, we were able to establish a better understanding of their use and purpose. We began to look more critically at our own Ozlab demo and adjusted our plans for it based on that. So far we had only created one scene per page of an application, now we want to implement different variants of some pages to be able to offer them as alternatives in the tests.

In the coming week, as soon as we can both return to the university, we would like to use the new demo to conduct further usability test sessions with real test persons under real conditions in the lab. Furthermore, we will work through the remaining scientific papers.

Weekly Report – Calendar Week 5

The third week consisted of the first full test runs with Ozlab and the eye-tracking technology. Based on the feedback and results, we further finalised our application.

At the beginning of the week, we added another version of the scene “Accounts” to our application in Ozlab and have now realised final adjustments to the entire application. This included the addition of three individual scenes, each of them representing the menu for a single credit card. When customising the address in the profile, we also discovered the function that buttons can reload their own scene via the “Object Behaviour” and update the displayed values from hidden fields this way.

Under real test conditions, Elin was our first test participant. Here, we immediately noticed the first problems, which became apparent through a longer search for the desired functions. The new findings were incorporated into the following prototype. Elin also showed us how we can use proximity or borders to make the affiliation of buttons in the form of icons more understandable to the user. The scene for accounts includes the possibility to assign credit cards to the corresponding accounts via drag-and-drop and to directly add accounts and savings goals. Both functions have been made clearer in the end. The final adjustments to increase user-friendliness were the visual presentation of the transaction list with red expanses and green incomes, the adjustment of the transaction function and messages for successful actions. After the test execution, Elin was also able to provide us with general comments and feedback. Ozlab also has great potential in the use of screenshots in combination with invisible squares. This way, meaningful tests can be performed even faster. In addition, Elin recommended that we should prepare concrete tasks including values of the user inputs, so that the test participant can focus on the tasks and the following scenes or movable objects can be prepared accordingly by the test leader. Finally, Elin explained the hardware and software of the Tobii eyetracker to us and performed a first run, so that we could start preparing it for further test cases.

In preparation for further testing, we designed a protocol with tasks for our test subjects to complete. Then we conducted tests with two subjects, one of them with eye tracking activated. We experimented with eye tracking and there were interesting observations, however, we could not gain any real insights from this one test case. But there were surprises, such as the eye jumping over all the transactions on the “Transaction” page and not even looking at the menu bar in this time. One test subject found the four-column "Transactions" page a bit cluttered and would rather see all transactions in a chronologically sorted list. However, she suggested a separate categorization of expenses with analytics about them, such as pie charts. This showed the different preferences of the test subjects and that perhaps offering different views would also be a good choice. Both test subjects were also able to perform the task of assigning a credit card to a different account on their own, without asking by trying out drag and drop of the card images.

When writing a message in the chat with the customer service, a test person entered the recipient's email and not their own email in the "email" field, so we subsequently changed the field to "Your email". We also implemented other feedback, like using our alternative offered account page as a new home page. In the meantime we also found some bugs. To complete the list, we implemented the untested functions on a blank scene. In the upcoming week, we would like to write down the bug list, change suggestions and feature requests in a clean and explained way so that they can be used in the future. Furthermore we can read more papers, because we haven't read all of them yet.

Weekly Report – Calendar Week 6

As planned, we have combined the notes we made on Ozlab into a detailed document with software changes and explained them in detail. The list includes three categories, firstly "software bugs", which represent unintended and incorrect behaviour of the software, secondly the category "software renewals", which contains suggested updates to working components, and the category "software additions", which includes ideas on how Ozlab could be usefully extended. After creating the document, we also replicated the bugs again on Windows and Mac with Chrome, as well as discussing the Renewals and Additions. The document was uploaded to the shared box folder.

We continued to read the papers. Our progress was slow, as we also encountered language and comprehension barriers. However, we were able to learn more about how Ozlab and the Wizard-of-Oz method in general can be used and what findings have been made in economic research as a result. Among them were the advantages of Ozlab and how it has already been successfully used in practice, as well as the GUI-ii method, which can be used to test and develop prototypes - even remotely. It was also interesting to learn about the effects of early user testing. There, we were particularly convinced by the argument that a good requirements analysis and specification of a software using the WOZ method before the actual development is a better basis for the subsequent software development. The fact that this has an impact on the structure of the developed software and the personnel costs was something we had not considered before. We were less able to comprehend the relevance and the procedure of the case study on AR city tours, as the prototype left out the essential aspect of fixing the objects in space and thus the actual insight was mainly on the design and frequency of the notifications and not directly in the area of AR. Nevertheless, the papers - as well as our experiences with our own tests - were able to convey to us that early user testing in the context of software development is important for later usability and that future users will act more differently than we would have expected.

Next week we will finish reading and discussing the papers until Tuesday when we will have lunch together with John Sören and Elin is going to give us an introduction to usability test report design.

Weekly Report – Calendar Week 7

At the beginning of the week, we finished reading and discussing the given papers. Afterwards, we had lunch together with John Sören and Elin on Tuesday. We discussed the rough plan for the coming weeks and then Elin gave us a short introduction to the structure of usability test reports. Elin also recommended the book "Handbook of Usability Testing". In addition to the physical version from the usability test lab, we also borrowed a digital version so that we could read chapters 11 "Analyse Data and Observations" and 12 "Report Findings and Recommendations" together.

In "Analyze Data and Observations" we were able to learn which data should be collected and in which format, how to best summarize it, and which values can be calculated or used to subsequently perform a meaningful evaluation that contains concrete, well-founded statements and recommendations. This chapter provided us with a good basis on which we can create a guideline next week that we can use for further usability tests, which we can then document and evaluate in accordance with these guidelines.

"Report Findings and Recommendations" starts with the definition of findings as conclusions drawn from the data and observations. This chapter then showed us how important a test report is as a clear presentation of the results. The greatest insight from this chapter, is the chapter-by-chapter presentation of the structure of a test report with the individual content requirements, which provide us with the ideal theoretical basis for the coming test phase. Furthermore, we became aware of the relevance of individual solutions and recommendations in combination with considered prioritisation, as this is the only way to achieve an optimal improvement of the product.

We also got in touch with Katerina Svobodova this week. We will help her find her way around the Innovation Park next week. She is studying for her Master's degree at Karlstad University and would like to work with 3D printing technologies.

The week ended with the development of the schedules for the coming weeks. We have arranged to meet Malin for lunch on Tuesday to discuss the time frame of her task and then finalise the plan. Currently we are planning on about two weeks for the test report together with a new test phase including audio/video recordings and the corresponding evaluation in the form of data analysis.

Weekly Report – Calendar Week 8

This week we started with a new test phase for a report. On the one hand we prepared it, on the other hand we conducted three tests. In addition, we had lunch with Malin on Tuesday and specified the schedule for the coming weeks.

On Monday, we finished reading and summarizing chapters 11 and 12 of the book "Handbook of Usability Testing - How to Plan, Design, and Conduct Effective Tests" (ISBN 978-0-470-18548-3). Based on the knowledge gained, we created a test plan and prepared the structure of the report.

On Tuesday we had lunch with Malin and had an interesting exchange about current topics and an outlook on the following task in the internship. We will now need about two more weeks for the usability tests and writing the report and then we will support Malin in comparing different prototyping tools.

For the usability tests and the report, we have chosen the web application "Dualis" of the Baden-Wuerttemberg Cooperative State University which is a system that provides important information like lecture schedules, grades and certificates of study for students. We selected this application because we see potential for improvement from our own experience, our results could possibly really be used for adaptation, and the application is suitable for conducting remote tests with German students. Another point was that the web application is very statically structured and therefore a prototype can be created quickly with the help of screenshots and invisible fields. The implementation of scrollable pages posed a problem. Due to the static structure of "Dualis", however, we were able to easily divide longer pages into sections and enable scrolling using "up" and "down" buttons, which all three test persons quickly realized and found less intuitive, but not disruptive. Furthermore, we had the problem with two of three test persons that the mouse pointer of the test person no longer moved in the view of the wizard and the session had to be restarted. This would have led to the deletion of hidden fields when using hidden fields. The latency of the connection between Sweden and Germany, on the other hand, turned out to be very low; only the reaction time of the wizard caused test persons to click several times and to feel that the application was slow. One test person accidentally left the test session when using a "back" button on the mouse to navigate back on a page. Even after three tests, areas for improvement in "Dualis" have already been noticed. For example, the password reset information is not only well hidden, but also confused the test person and made them click on a link that was only for applicants and not for students. In general, the wording in the menu and the overview on the start page can also be adjusted to show more clearly what information can be found where.

At the beginning of next week we will conduct two more tests with DHBW students and three tests with test persons who have no experience with Dualis. This will be followed by transcription, analysis and evaluation in the form of a report.

Weekly Report – Calendar Week 9

The main goal of this week was to make good progress in the current testing phase. This week we have conducted five more tests with different participants and then started the preparation for the test report. We have also supported two pilot tests. Finally, we were able to write the first chapters for the test report.

This week we chose people from Karlstad University as test participants for the first time in the current testing phase. Consequently, they were not yet familiar with the application (“Dualis” from the Duale Hochschule Baden-Württemberg) and we hoped for more objective results. Furthermore, we were able to work with the eye tracking technology in the lab for the first time. We tested three people with eye tracking and the other equipment in the laboratory under ideal conditions. The fourth test person did the test due to studies from Ireland and therefore we were able to test the quality of remote sessions again. The transmission from Ozlab via the internet also worked well to Ireland. However, it became clear that testing over the internet is more dependent on a skilled test leader than on site. We carried out the last test via the Internet again. This time only within Sweden to have a comparison outside the university network.

We recorded all the tests and the subsequent questions with sound and vision in order to carry out the analysis afterwards. We decided to present all data in a collected workbook in Excel. This way we can achieve a clear tabular presentation of both qualitative and quantitative data. Afterwards, we watched all the videos again and transcribed strong or meaningful statements.

After completing the first tests, we also made the first progress with the test report. In the introduction, we have developed a corresponding knowledge base for the “Dualis” application as an administrative system of the DHBW, so that readers can place the study in context. In the second chapter, we have also presented the methodological procedure. For our usability study, we used the Wizard-Of-Oz method with Ozlab. The Wizard-Of-Oz method allows usability user testing and prototyping of non-programmed interaction designs, where the functionality of the system is manually simulated by a person.

Saliya and Chathuri conducted two pilot tests with us in the lab. Using "JustInMind", we were asked to test the applications with appropriate tasks and were then interviewed based on specific guiding questions. Salyia has been working on a prototype of a mobile application for Karlstad University that will combine the functionalities of Canvas and My KAU in a smartphone app. Chathuri was working on a chat program for My KAU.

Next week we will finish the analysis and evaluation of our test results and formulate the test report. The aim is to finalise the test report by the end of next week and have it reviewed by Elin beforehand.

Weekly Report – Calendar Week 10

This week we continued writing the report and sent a first version to Elin.

We have finished the theoretical part of the report. We explained the Dualis application and the individual pages that were tested. We also explained the method and procedure, for example usability testing, thinking aloud, Wizard-of-Oz, Ozlab and eye tracking. We also completed the paragraphs on test participants, tasks and questions and how these were changed over time.

We have completed most of the results. The evaluation worked very well using the Excel tables with the results, but some places were also identified where the recordings need to be looked at again, because the transcription was not clear or information that is considered important seemed unimportant when transcribing, for example, which of the possible paths the test persons used to complete a task if they completed it without any problems. Accordingly, this part of the report is now almost finished, but some information needs to be looked up again.

Based on the results, we then formulated and described the findings and recommendations. These included, in order of importance as defined by us:

1. Make the information pages for modules accessible via a further path, which many people chose at first
2. Make the information page for modules clearer and more concise, as the test persons interpreted it in different ways
3. Create a dedicated password reset page with a clear structure, as this function is hidden on the contact page and also led test persons to a wrong password reset page, which is not meant for students but for applicants
4. Create a single menu item for news, as test persons found it confusing to find this only under Home and visited many other pages unnecessarily
5. Expand the Home page as a landing page with useful information and promote additional qualifications on it, as the tests showed that students do not realise that you can register for this voluntarily.
6. Introduce sorting/classification by semester in My Documents.

In the coming week we will work on the final touches to the report, also with Elin's feedback, and receive our new tasks from Malin.

Weekly Report – Calendar Week 11

This week we made final steps in writing the test report and received two new tasks from Malin at lunch. We have started the reports for Malin and the final report.

To finalise the test report, we incorporated Elin's comments this week. This mainly affected the source work in the theoretical part of the methodology. Furthermore, we filled in gaps by looking again at the recordings of the tests. Finally, we wrote the executive summary and sent the final version to Elin again.

We mainly worked on the first task set by Malin, which deals with conducting mobile tests including the use of the camera in a video conference. We tested how the apps from different providers (Zoom, Microsoft Teams, Microsoft Skype, Jitsi Meet, Cisco WebEx, GoTo Meeting, BigBlueButton, Google Meet, Google Duo, Apple Facetime, WhatsApp, Telephony) behave when they are run in the background while Ozlab respectively the web browser is run in the foreground. The tests were carried out with different devices (Galaxy Tab 4 and OnePlus 9 Pro with Android, iPhone XS with iOS and iPad Pros 2020 with iPadOS). We collected the results in an Excel spreadsheet. It showed that there are small differences between providers, for example in the use of picture-in-picture overlays when leaving the video conferencing app. Basically, however, the problem was that the camera is disabled as soon as the apps are only running in the background and no overlay is displayed any more. Even when using different browser tabs for video conferencing and Ozlab, instead of native video conferencing apps, access to the camera was blocked as soon as the tab with the video conferencing app was in the background and ozlab in the foreground. For this reason, we developed a small support website that uses the HTML tag <iframe> to embed both Ozlab and a Jitsi video conference (because it's the only video conference that is designed to be embedded in other webistes) on the full screen and uses a button to decide which of the two <iframe> to show and which to hide. This allows the meeting to run in the background of Ozlab, even though it is no longer visible on the test device. Furthermore, this solution works universally on devices with different operating systems. It turned out that the camera continues to work in the background, but the solution does not yet work with Ozlab. Ozlab can only be embedded via HTTP, which is why the support website must also be called up via HTTP. However, the security policies of the mobile browsers block access to the camera and microphone (needed for the video conference) if not accessed via HTTPS. For this reason, this solution should work fine if Ozlab is published over a secure HTTPS connection.

Next week we will finalise the Final Report and Malin's Tasks with the corresponding reports. Furthermore, we have a lunch date with Malin for final arrangements.

Weekly Report – Calendar Week 12

This week we did our final presentation, continued to work on Malin's tasks as well as the test report for Dualis and our final report.

On Monday, we met with Malin to discuss some questions and our progress. John Sören was also present and we spontaneously presented our past results from all the tasks we had done during the International Practical Placement. This presentation and discussion of some of the topics then also constituted the presentation and discussion at the end of the course.

For Malin's first task, which deals with the mobile use of Ozlab with video conferencing systems and for which we already did some tests last week, we completed the tests and wrote a detailed report. The report presents the approaches and results that can be used to conduct the mobile tests, showing that different methods and different video conferencing providers are suitable depending on the test setup and test equipment. Surprisingly, however, Google Meet performed best in terms of the range of functions related to videoconferencing. On Android, it offers a very extensive overlay that even has buttons for activating and deactivating the camera and microphone and displays both the image of the test person and the test leader in the overlay. It also offers an overlay on iOS and iPadOS, as well as splitscreen on all operating systems. Depending on the requirements of the test situation, however, the appropriate video conferencing systems differ.

We also worked on Malin's second task. Here Malin had started an exploration in 2019. It was about looking into available prototyping systems and their abilities to allow interactive prototyping. Now we have to check the old systems again and possibly add new systems from the lists of the best prototyping applications. We have to check if redesign is possible during the session, what interaction is possible, if collaboration is allowed and more. This task was very time-consuming. Especially the search for specific information took a long time. We have therefore only been able to check a few applications and update some of the information that has changed.

On Thursday, Elin sent us more comments on the second version of our test report. We worked on these on Thursday, as they were rather minor adjustments.

3. Assignments during the practical placement

The results of the work during the Practical Placement are mainly recorded in separate documents. These and the most important findings are briefly presented below.

3.1 Ozlab manual

At the beginning of the practical placement, we were asked to update the Ozlab manual, which was last revised in 2019. To do this, we read through the instructions completely and tested all Ozlab functions. With the help of Word comments and the "Track Changes" function, we made adjustments and saved notes in the Word document. These were mainly small reformulations, features that no longer worked or only worked insufficiently, as well as updated images and examples. The reviewing function in Word counts 353 insertions, 91 deletions, 2 moves, 337 formatting and 20 comments.

3.2 Suggestions for Ozlab Software Changes

While learning Ozlab and revising the manual, we wrote down bugs and errors found in the software during use, as well as further possibilities for adjustments and additions to improve Ozlab. We have summarised these in a separate document that describes the following improvements:

Software Bugs

- Hover-Options-Overlay is sometimes hidden
- Keyborad shortcuts not working correctly
- Snap Points not visible
- MakeObjectSnap behaviour does not work correctly
- HTML <input> tags values override other input fields

Software Renewals

- Delete vibration behaviour
- Use spelling "Object Behaviours" in the Settings Panel
- Change predefined screen sizes
- Renewal of the start Page

Software Additions

- Let the user select which scenes should be imported
- Allow grouping of objects
- Show an object overview
- Allow the categorization of Snap Points

3.3 Test Report - Usability of DHBW Dualis

To learn how to write a proper usability test report, we have written an extensive report about our usability tests on an Ozlab prototype of the web application Dualis, a student administration system of our home university, the Cooperative State University Baden-Württemberg (DHBW). Dualis is a web application that allows students to view their grades, timetables, important documents and much more in a central system. Since we were explicitly looking for an application that we could ideally test remotely, we mainly looked around in German applications. Since Dualis is an application from our home university, it is perfectly suited for this, as we have easy access to potential test participants. Furthermore, Dualis has some known problems, which is why the usability analysis is intended to classify the application and identify potential for improvement. Through a user-oriented revision of the system, the areas of application, such as appointment and document publication, could be fully used in the long term. The importance of this study is a result of the high relevance of Dualis for students, as the application represents important information. In order to create the optimal conditions for a useful report, we decided to conduct a new test phase with the research question *"What changes could be made to maximise the usability of the DHBW administration system Dualis for students?"*. Tests were carried out with eight German-speaking students as test participants, including three who study at the DHBW and already know the Dualis web application being tested, as well as three students who were tested in the lab, including eye tracking. The test participants were given nine tasks to complete with the help of an Ozlab prototype consisting of screenshots of Dualis. The tests were recorded and evaluated in an Excel spreadsheet and in the report. Six findings and recommendations were found, which are explained in more detail, described and implemented as examples in the report:

- Make Modules clickable in the "Performance Overview"
- Design a clearer "Detailed Module View"
- Add a more intuitive "Password Reset" function
- Add a new section to the menu called "Messages"
- Make "Home" a useful landing page
- Add semester names to documents in "My Documents"

3.4 The Ozlab system, video conferencing systems and image capturing

This report was written to document Malin's first task. It reviews the most popular videoconferencing systems for use with Ozlab and will show which systems are suitable for which devices in which testing scenarios. It also reviews how snapshots/photos can be sent from the test taker's smartphone to the assistant during a test. In addition, an embedding of videoconferencing systems in Ozlab is again being investigated. The report addresses the general question of which video conferencing systems are suitable for mobile usability tests with Ozlab.

First, providers were selected, then their functions were tested using four test devices (iPhone, iPad, Android tablet and smartphone). The behaviour of the apps in the background was checked, i.e. when the browser with Ozlab is running in the foreground. Video conferencing apps behave differently in terms of floating picture-in-picture overlays and the use of the camera in the background. They also differ in terms of the chat function and whether it allows media or even direct camera access. Recommendations for video conferencing providers depend on operating system, device format and test setup.

Since the use in the background is sometimes difficult due to current restrictions of the operating systems, a solution using screen sharing and remote control from the mobile test device to a computer was also evaluated, and a separate support website was developed that embeds Ozlab and the video conferencing service Jitsi Meet. This way, only one tab needs to be open for both, Ozlab and Jitsi Meet. Therefore, while Ozlab is in use, the videoconference can continue to access the camera. This works with the help of an HTML tag called <iframe>. Unfortunately, the described way does not work correctly with Ozlab until it is accessible via HTTPS and not only HTTP. The HTML code of the support website / embedded version is attached to the report.

3.5 Prototyping systems and interactive prototyping

This task was about revising an old exploration from 2019 that Malin had started. The topic was related to finding alternatives to Karlstad University's own Ozlab application. There are many available design/use experience prototyping systems on the market. Based on lists from several blogs with the best prototyping tools, which are most popular in the UI/UX community, Malin made a first overview. We should then check whether the same systems have been extended or discontinued. Furthermore, we should check whether the market contains new systems that should be considered in further exploration. Basically we should check if and how the application allows re-design during the test session, what interaction is allowed during the session, what interactivity and export possibilities exist and if collaboration work is available. Unfortunately, the research for specific information took a lot of time and we have therefore only been able to check a few applications and update some of the information that has changed.

4. Relation to earlier studies

4.1 Business Information Systems – Data Science (Linus Andrzejczak)

During the practical placement in the Usability Test Lab, we mainly dealt with the conduction of usability tests and especially with the Ozlab web application. My studies at my home university have the goal of forming an intersection between computer science and economics, but in my study programme with a special focus on data science. Accordingly, it has less to do with the process of software planning, development and usage, to which I would classify the usability tests. Nevertheless, there are some aspects that relate my studies and the practical placement.

I had some relations to the practical placement in the lecture "Introduction to Business Information Systems", we were shown how **relevant functioning IT** systems have become in everyday life and what effects failures of these systems can have nowadays. In "Technology Assessment" we were also taught what **impact technologies** can have on the future of the society. As a result, we took away that such systems should function as securely as possible and have a great responsibility nowadays, as they are used by so many people. Of course, this also implies that the operation of these systems must be as clear as possible for the users, which is also in line with my personal experience, as we all use a lot of mobile apps, websites and programmes nowadays. Although usability testing was not explicitly mentioned here, the lectures gave me a fundamental understanding of the relevance of usability testing.

In the course "Systems Analysis and Design" we learned how to carry out a **requirements analysis** in software development and how to write down requirements for the software developers. Here we learned how to describe how a website should be implemented, but there was no consideration of how, for example, usability tests could be carried out and thus how an optimal design could be iteratively approached. Only control-flow oriented test procedures were presented to test functionally correct behaviour.

During my studies I already had some practical experience in **software development**. In the lecture "Case Study on Project Management", we developed a web application as a team of five students for our lecturers, who represented the customers. We demonstrated the website live to the lecturers, our customers, twice during a weekly meeting and commented on it. We then received feedback from them on what else they would like to see. Part of my studies are also the internships at my company Hewlett Packard Enterprise (HPE). In my first internship, I helped develop an internal CRM system, and in my third internship, a web app for booking technology demos. For the CRM application, we first did surveys to find out what the future users' requirements were. We used PowerPoint to design a UI, presented it and let the people surveyed comment on it. In the case of the WebApp for reservations, no evaluation was carried out at all. In all cases, a usability test in the form of a survey or even with prototypes that users could try out, such as in Ozlab, Justinmind or Figma, would certainly have been useful. This is because the website of the case study was only improved from the point of view of the simulated customers - the salesperson's point of view - and not from the end user's point of view. Furthermore, the CRM application in the first internship offers relatively complex functions, which might not be self-explanatory for some employees and could therefore be optimised with knowledge about the users' behaviour. However, neither I knew what a usability test is at that time, nor did the other students or supervisors in the teams mention this topic. With this in mind, a usability test would have made sense several times, but the option was

not considered. Here, during the internship, it became clear to me retrospectively how important it is to carry out usability tests, at least on a simple scale. During the pilot tests with Saliya and Chathuri, I realised how much valuable feedback you can get even by the use of simple prototypes.

In the course "Programming II (Java)" we learned how to **implement a GUI** with Java. We only learned the technical aspects and did not look at the concepts of a good GUI. Nevertheless, we got to know the different design possibilities (e.g. headings, text, input fields, dropdowns, checkboxes, tabs, accordions, etc.) and thought about how to arrange the elements properly and how to link them to different windows and window areas. In the lecture "Web-programming" we learned how to **create websites** with HTML, CSS and JavaScript as well as with SpringBoot. Unfortunately, this lecture did not teach us anything about general web UI design (e.g. headers, footers, sidebars, etc.) and good web UI design in particular, only the basic understanding of how to use it.

In the lecture "Data Visualization" we learned how to **present data visually**, and among other things we covered the "three phases of understanding" (perception, interpretation & understanding) as well as Dieter Rams' ten principles of good design. In my opinion, the basics of data visualisation can also be applied to the conception of GUIs. However, much of my knowledge in **building an application** comes from my own experience, as I often try out different applications. Also, the experience of having worked on websites in several larger teams, for example in my former school or a local church, and having had discussions about layout, scope and presentation styles.

The lecture "Fundamentals of Academic Writing" taught how **academic writing** works and how to prepare a practice report. In the second internship, a project assignment with 25 pages was written. I was able to use this knowledge as a basis for the reports we wrote during the practical placement. With the practice of writing the test reports "Test Report - Usability of DHBW Dualis " and "The Ozlab system, video conferencing systems and image capturing", I think I was able to improve in this area and I think that this will also help me with my second project assignment in the upcoming internship at HPE.

I had **little to no connection** between my studies and the practical placements in the modules Fundamentals of Business Administration, Principles of Financial Accounting, Law, Fundamentals of IT, Programming I (Python), Mathematics (I & II), Big Data, Data Analysis and Optimization and Machine Learning Fundamentals, which were only related to business, very technical or very data science.

4.2 Business Information Systems – Application Management (Mats Thiele)

My studies in business information systems combine economics and computer science with a focus on the management of an application field in companies. On the technical side, the aim is to develop IT systems in a structured way using current technologies and methods of software engineering, to introduce them systematically and to operate them reliably. On the economic side, it is about the basics with the specialist terminology and the central concepts of business administration. In addition, my studies relate to the financial sector with selected aspects of banking management. The internship was mainly concerned with usability studies with a focus on Ozlab, an application of the Karlstad University, as a system for interactive prototyping. As a minor part of the overall software development process, usability tests only occupy a very small part of my studies and are therefore only mentioned or dealt with in marginal terms. The grouped modules with the respective overlaps are shown below.

The biggest overlap with this internship was in my previous studies in the case study in Methods in Business Information Systems II and Selected Aspects of Business Administration and Business Information Systems for Banks. In a group of eight people, we had to realise the entire process of **application development** on our own. We had to develop an application based on a list of requirements. In order to minimise the later adaptation and correction effort, there were presentations to the client at regular intervals. My project group began to optimise the application for the user or client. Similar to the internship, there was a lot of internal consultation on usability.

In Fundamentals of Business Administration, we learned the general basics as well as the key concepts of **marketing**. Here we also dealt with market research and product development. Via the definition of marketing, we came to the analysis of customer behaviour. The overlap with the internship then came in the area of market research with qualitative research. The goal is to find out how people see an issue, what meaning it has for them and what motives for action arise. We got to know **usability tests** as a special form of observation. Here we also learned about the basics of a usability lab and the process of a test. I was able to optimally apply and expand this theoretical knowledge during the internship. In addition, we also learned how **Thinking Aloud** can be used to understand the participant's subjective evaluation of the situation as well as the participant's decision-making process. As a final extension of the usability studies, we also looked at **eye tracking**, which was consequently also used in our own studies due to the special equipment of the laboratory here.

In the Methods in Business Information Systems I module, in addition to a general introduction to the types of applications, we mainly learned about the aspects of object-oriented **system analysis and system design**. This overlaps in the central argument with the experiences in the internship. Indeed, it is worth to carry out early tests and consultations with the client due to the connection between the development of errors and the discovery of errors. Iterative and evolutionary development minimise the errors in the final product. It was exactly this experience of testing and prototyping that we experienced ourselves during the internship.

In the module distributed system development we got an overview of **web programming**. Logical structures with HTML, layout/design with CSS and dynamic behaviour from Java script served as technical foundations for our first own website. We also tested quick demos and **prototyping** through interactive web applications. This semester my course has Software Ergonomics lectures.

The learning content of this module is largely congruent with the internship, so I was able to cover this content here very well through self-study. Topics included the relevance of user friendliness in **usability** and the process of **user-centred design**. Design thinking, prototyping, usability tests and mockup tests play a central role in this.

In the technical modules Fundamentals of IT, Programming I and II, we dealt with the introduction of JAVA programming and then relatively quickly arrived at the first **user interactions**. The technical side of user interaction became clear, especially with our first own graphical user interfaces. This is where the first thoughts about user interaction came up, which played a central role in this internship. However, the aspects of computer architecture, algorithms and data structures were not applied in the internship.

In Mathematics II, we learned the basics of **statistics**, for example. The focus here was on statistical calculations, where, among other things, calculations of individual fictitious studies were carried out. In the internship, we had to carry out the statistical calculation of the median and the mean value as part of the evaluation of our own usability study.

In Key Qualifications I and II, we learned the basics of **academic writing**. Especially the practised use of Word in Writing Projects made working with the reports much easier. The Presentation and Rhetoric Workshops also made it much easier for me to quickly present the results of the project and to discuss the assignments. This was further supported by Presentation and Communication Skills in English, which we also had in the form of a lecture.

In the Work Integrated Learning module, the practical internships are summarised as part of the study programme. In my last practical assignments, I worked in different areas of the project management process in the bank. This included the capital market environment, the investment business and internal processes. I also worked on the internal resource management process as part of my first project assignment. Since I only experienced the customising and purchasing process during my last assignment in the software development process, I was not able to gain any knowledge that was applicable in this internship.

Furthermore, we also had many aspects of economics and information technology that go too deep into detail and consequently almost no overlap with the internship. In information technology, it was mainly advanced programming, databases, operating and communication systems. In economics, too detailed were mainly topics around Financing, Investment, Accounting and Law. This was part of the modules Fundamentals of IT, Databases, Business Information Management, Fundamentals of Financial Accounting, Fundamentals of Bank Management, Economics, Selected Aspects of Business Administration and Business Information Systems for Banks, Law and Mathematics I.

5. The difference between theory and practice

In the following, we look at the theory we know and critically question it on the basis of the new practical experiences from the internship. It should be mentioned here that the subsequent text only reflects the subjective opinion of the authors.

Basics of user interface design: During our internship we observed that users behave very differently and there are different ways to make something stand out. One example from our experience was the custom-made prototype of the online banking application, where Elin gave us the tip that elements that belong together should be displayed close to each other. Certainly, such rules apply in part, but since UIs are often structured very differently, we think it is better to conduct individual interviews and observations, for example through surveys with users or in usability tests.

Improvement through usability tests: We have not yet covered usability tests in lectures dealing with software and web development. Furthermore, feedback was taken into account in two projects in practical internships, but not actively planned into the projects. Although there is research and findings in science (theory), they are often not taken into consideration or implemented in practice. In addition, many websites, programmes and apps are very unintuitive and confusing. Probably for various reasons such as effort, costs or lack of know-how, they have not been usability tested and revised accordingly.

Development process: In the lectures at our home university, we are usually only taught fixed process models and conservative methods of software development and project management. Through the new experience from the internship, it became clear that iterative and evolutionary procedures lead to increased product quality, especially in the IT environment. In this way, the quality of the product is repeatedly evaluated and the further procedure can be aligned with the requirements. The minimisation of errors can be optimised through usability testing and early user testing.

Statistics: In the lecture Statistics in the module Mathematics II, we addressed the theoretical foundations and the basic calculations of statistics. In contrast to this knowledge base, the results of the usability studies were unclear and offered a lot of room for differentiated interpretation. In a few cases, the studies even produced conflicting results. Consequently, we had to adapt our way of thinking and accept usability studies as a basis for interpretation.

Prototyping: In the previous applications that had to be developed during our study programme, we used a type of prototyping. Here, only a functionless GUI was created with an interactive application that subsequently generated code. In contrast to the practical placement, however, no tests could be carried out there. Furthermore, the actual application was developed based on this. In the practical placement it became clear that an independent prototype can be useful, especially for user-centred design.

6. Final reflections

Up to now, usability testing was not an explicit part of our studies, so we were able to learn a lot of new things in our International Practical Placement. We were able to learn practically by making mistakes ourselves and learning from them. For example, in the UI design of our banking application, we quickly reached our limits of knowledge on how to create a user-friendly UI. EyeTracking was able to offer us interesting insights here and Elin then gave us valuable tips from current research. Among other things, we also began to question our previous approach to application development in our studies and internships in our companies and to understand the relevance of usability testing. We also became more aware of this relevance when thinking about the applications we use on a daily basis - such as bank and university - as these often offer potential for improvement from an end-user perspective. We also gained this different perspective by participating as test subjects in Saliya and Chathuri's pilot tests, which showed us how much feedback can be gathered at the very beginning. We were also able to reinforce this impression by reading the papers and, moreover, get an insight into how scientific work is practised in research at KAU. By writing our own reports, we were also able to improve our skills in scientific work and writing. We were surprised that we had no contact with usability testing before, because it is relevant both for maximising customer satisfaction for project managers and for better planning of development for developers. Consequently, this subject area affects all areas of business information systems and is therefore highly relevant. From our Practical Placement, we particularly took away a new perspective on developing and improving applications, which will help us to question existing structures in application development more strongly.