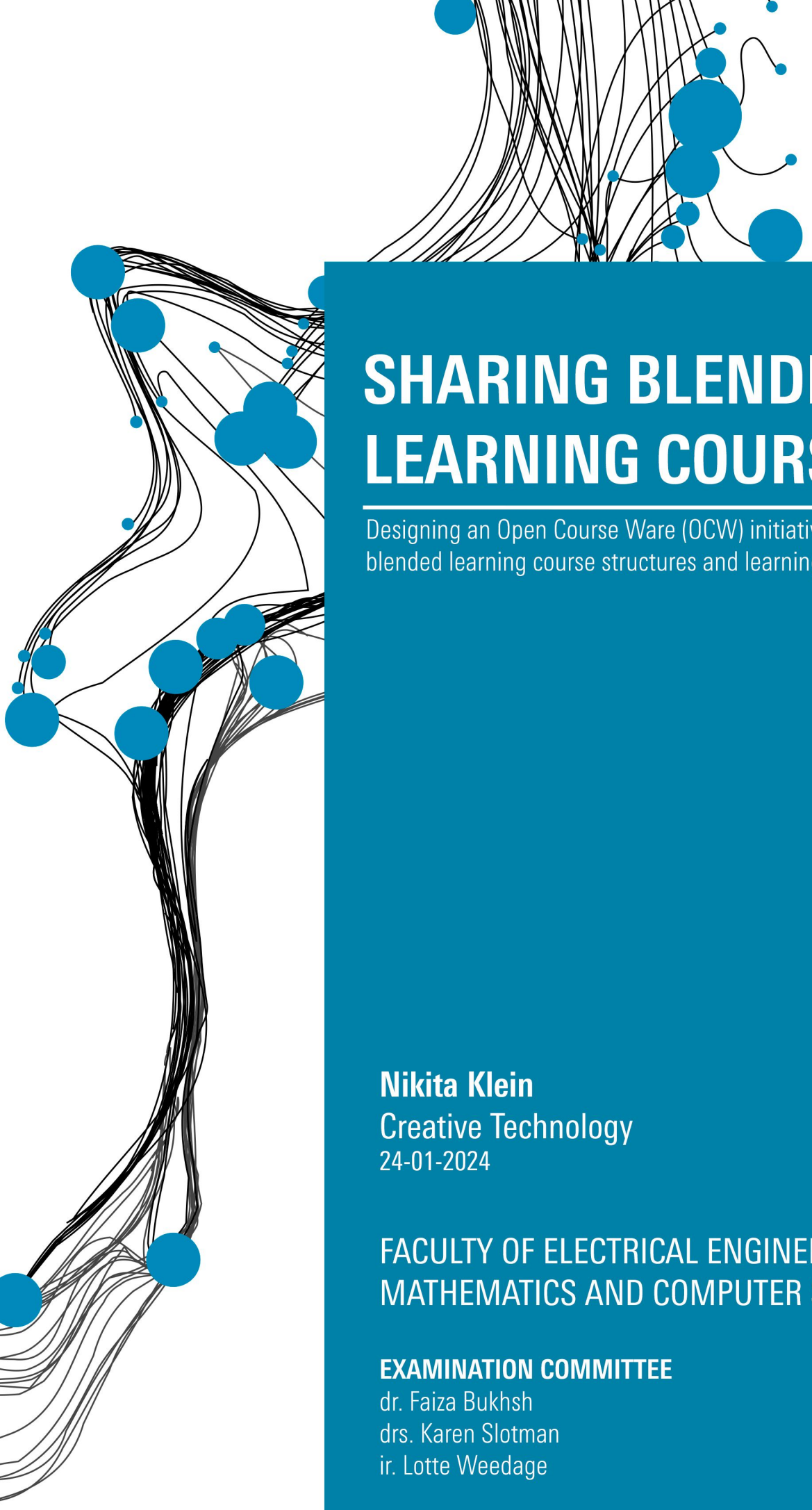

SHARING BLENDED LEARNING COURSE WARE

Designing an Open Course Ware (OCW) initiative for sharing blended learning course structures and learning materials.

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ABSTRACT

During the Covid-19 pandemic, many educational institutions had to switch to online education and online learning materials. This caused the development of many online learning material repositories. This thesis discusses the sharing of the blended learning course structure, Linear Structures. The Open Course Ware (OCW) initiative and its alignment with the Open Educational Resources (OER) form the basis of a platform to share this blended course. Five evaluation frameworks are assessed to evaluate these OCW initiatives, which are used in this thesis to evaluate the developed platform.

A stakeholder mapping was done to identify key stakeholders, who were interviewed to lay down the first factors for the design requirements. An additional survey with educational professionals was done to create the final design requirements. These were translated to an interface design which was developed with the Figma Design program. This design was evaluated based on the OCW evaluation frameworks with a usability user test and a digital accessibility evaluation. The results of the usability test were positive, the usability experience of the design was perceived as 'excellent'. The results of the accessibility evaluation were more varying, several elements adhered to the WCAG accessibility guidelines, however, there was room for improvement in the accessibility of the prototype.

To share blended learning courses we need an OCW initiative which is evaluated through a fitting framework. In the case of this thesis, this framework combined accessibility and usability evaluation. To make the interface of this OCW initiative intuitive, several elements were included. These are clear website organization, understandable structures, (design) consistency and a variety of navigational elements. To ensure that the shared materials can be adapted, the structure of the learning materials was based on several items. The materials need to be based on a consistent element like a book, and the topics of the materials represent the work for a week but include a clear overview of all the different activities.

To further develop this platform, the suggested improvements by the user test, need to be included. Which are changing several names, and increasing the clarity of the activity explanations. After that, the change from Figma Design to a suitable development platform needs to be made. This thesis provides the initial design towards a platform that can share blended learning courses.

ACKNOWLEDGEMENT

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I would also like to thank all my participants during the user evaluations. Without you, many positive elements as well as points of improvement were not identified in the prototype. Specifically, I would like to thank Nelly Litvak, who was still willing to provide input and feedback on ideas for this project, after working on it for so many years.

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1 INTRODUCTION

Since the uprising of the internet, education has also been greatly influenced by new developments and initiatives. A teaching method that has been developed and researched over the past years is 'Blended learning'. Blended learning courses include a mixture of online and offline materials. Developing blended learning materials is a time-consuming process, and requires a considerable amount of effort from the teacher of such a course.

Already back in 2001, the Massachusetts Institute of Technology (MIT) started a pilot in sharing their course structures and course materials, which they called their Open Course Ware (OCW) platform [10]. The purpose of this platform was to provide freely accessible courses to the rest of the world. In the past 23 years, many other universities have followed the initiative of MIT. Nowadays, a lot of different ways to share materials can be found on the internet. However, if someone wants to share a course that includes blended learning materials, it is very difficult to find a platform that supports these learning materials, and that allows to structure the materials logically.

In 2016, the University of Amsterdam (UvA), issued a working group to incorporate blended learning more into their education. The idea for a UvA-wide blended learning platform was proposed to 'Jointly develop and share course material, tools and designs.' [11, p.5]. The intention is clear: if educational professionals can share their blended learning courses, they could share their knowledge and the positive and negative results of the courses. Sharing already developed blended courses could speed up the process of implementing blended courses, enabling more teachers and students to experience different learning methods.

A solution for sharing blended learning courses and course material would need a digital initiative that is focused on sharing blended learning course structures and learning materials. This initiative needs to be easy to navigate, so that an educational professional can implement the course rapidly, without having to invest time in adapting to a new online tool. Therefore the main goal of this research is to investigate what such a shareable online interface should include, and how it will adhere to the current initiatives of Open Course Ware (OCW). This leads to the following research questions (RQ):

- **RQ1:** What is the purpose of the OCW initiative, and how is it connected with the distribution of digital educational materials?
- **RQ2:** Which frameworks are present in the assessment and development of current OCW initiatives and how can they be used for user evaluation?
- **RQ3:** How can the user interface of the online platform be designed to ensure ease of navigation for educational professionals?
- **RQ4:** How can a platform support easy adaptation of shared materials to suit the needs of different educational contexts?

The first research question is established on an initial exploration of the topic and objective of this project. How can we share these blended learning courses? While investigating existing e-learning platforms, a gap emerged, specifically in the context of blended learning. This directed the focus toward Open Educational Resources (OER), emphasizing openness and accessibility. The first research question helps to understand the foundational principles behind the OER, and the OCW initiatives to align the platform with the overarching goals of open education.

The second research question was based on the idea that a design or platform needs to be evaluated in some way, especially when the platform should be user-centered. By exploring existing frameworks, specifically focused on OCW initiatives and other e-learning initiatives, this project can learn from the experience of those already existing platforms and frameworks. The aim is to provide a solid foundation for the evaluation of this project.

The third research question was developed after an initial conversation with the course authors on what current tools are available. Something that was mentioned is that these tools are often not functional, have limited accessibility to learning materials, and are not easy to navigate. A user interface is an important component in the success of any online platform. This question addresses the user experience and usability aspects of this project.

The fourth research question became evident during an interview with the course authors as well. Often courses online are presented with a fixed structure, or without a structure. It is important to realise that every university has a different educational context. The University of Twente works with modules of ten weeks. The platform needs to facilitate easy adaptation of the shared materials to accommodate different educational settings.

To answer these research questions, Chapter 2 gives an overview of the results of the literature review about Open Educational Resources (OER), Massive Open Online Course (MOOC) and Open Course Ware (OCW). This literature review identifies methods to evaluate online educational materials. After that, research is conducted into the current existing initiatives and platforms surrounding this topic. The methods and techniques are discussed in Chapter 3. Chapter 4, describes the ideation phase, in which expert interviews and a survey are held to discuss the current situation and reveal some wishes and needs for the final design. All of this information assists in forming a list of requirements is set up that is categorised with the MoSCow method. This is described in Chapter 5. Based on those requirements a design is created for the interface, with Figma Design. The development of the design is described in Chapter 6. This design is evaluated and recommendations are provided based on the evaluation methods found in the literature review. Chapter 7, describes the user evaluation and feedback on the design prototype.

2 BACKGROUND RESEARCH

This section consists of two parts. First, the literature research focuses on the current Open Educational Resources (OER) guidelines and their relation to two different types of Course Ware as proposed by [1]; Massive Open Online Courses (MOOC) and Open Course Ware (OCW) initiatives. We show what type of Course Ware aligns best with the vision of the project. Secondly, we show the different evaluation frameworks and methods for the Course Ware, and online educational platforms.

2.1 Literature review

2.1.1 What is the relation between the OER, MOOC and OCW?

Sharing educational resources has become significantly more important in our current digital age: this development is supported by initiatives such as the OER, MOOC, and OCW. UNESCO [12] created the Internet Universality principles to describe 'an open Internet that is accessible to all, in which human rights are respected, and where the multi-stakeholder governance structure is preserved'. This Internet Universality is defined by four principles, but the main focus is on the openness of the Internet to promote access to universal knowledge [13]. This aim has an impact on the development of new and better online learning initiatives. The OER supports this goal and is defined by Rodríguez and Pérez [14, p.1] as 'Educational materials of high quality, open license, online that offer an extraordinary opportunity to share, use, and reuse the knowledge by people from all over the world'. In another paper by Rodríguez et al. [1], the same definition of the OER is supported. Piedra et al. [15] continue to describe the OER with a focus on the term 'openness'. This research puts the definition of openness in light of the geographical and financial barriers between educational professionals and institutes.

To help classify the OER, Rodríguez et al.[1], present the elaborate information from Camilleri et al. [16] in a compact flowchart to show the relation of the OER, OCW's and MOOC's. Figure 2.1 presents the content of the OER in such a way that it is either a learning objective or Course Ware. Course Ware initiatives are split up into MOOC's and OCW's.

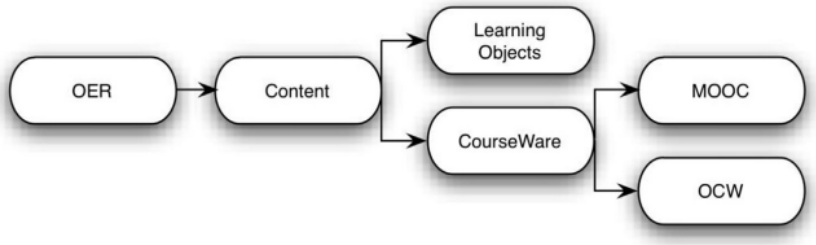


Figure 2.1: Classification of OER [1]

The OER for higher education is supported by OCW initiatives. An OCW is a free and open-accessible publication of educational materials, organized as courses [14]. Both the paper of Rodríguez and Pérez [14] and the study of Rodríguez et al. [1] highlight the benefits of the OCW initiatives described by Pollak [17, p.36]. The latter describes that the impact of the OCW has led to 'web-published course syllabus, reading lists to open access articles, course and lecture notes, video/audio lectures and audio synched slideshows, together with essay assignments, problem sets, past exam papers and full-text readings that are now being used by self-learners, students and young entrepreneurs worldwide.' Sharing these materials has allowed many educators to access a variety of materials, helping them to unlock new knowledge[14]. All these materials are improved and evaluated by fellow educators, resulting in the fact that the OCW initiatives help schools improve their education. An OCW allows more learning materials for regular students, and individual learners can enrich their knowledge [1]. The OCW allows for open access to educational materials and courses at all times and therefore aligns with the vision of UNESCO on the Internet.

Table 2.1 identifies another initiative that supports the OER, which is the MOOC. The MOOC has helped in spreading the concept of openness of course materials, but differently than how an OCW considers openness. A MOOC is a large-scale online course where thousands of participants can take part in the course [15]. A MOOC initiative focuses on the quantity of access instead of the access to educational materials that can be (re-)used and adapted. MOOC's are courses that often charge a participation fee, and their access is restricted to the participants of the course. Sometimes this participation fee is required if the participant wants to receive accreditation for their participation, however, some MOOC's offer free access to their materials but without accreditation. The materials in the MOOC's are protected by a copyright which does not allow for reusing the learning materials of the MOOC[16]. Rodríguez et al.[1] present Table 2.1 that compares the OCW's and MOOC's on copyright provider, creation, and usage rights. Table 2.1 specifically mentions that MOOC's often have companies as authors or suppliers. Several universities provide MOOC courses as well, this was not included in the research of Rodríguez et al. but is important to keep in mind.

Factor	OCW	MOOC
Author/supplier	Universities	Companies
Copyrights	Belong to author	Transferred to the company
Rights of use	Belong to the user	Restricted user
Accessibility	All the time	Duration of the course
Accreditation	There is no accreditation	It grants accreditation
Evaluation	Without evaluation	With evaluation
Work-oriented	Individual	Collaborative
License	Open	Closed
Content type	Static	Dynamic

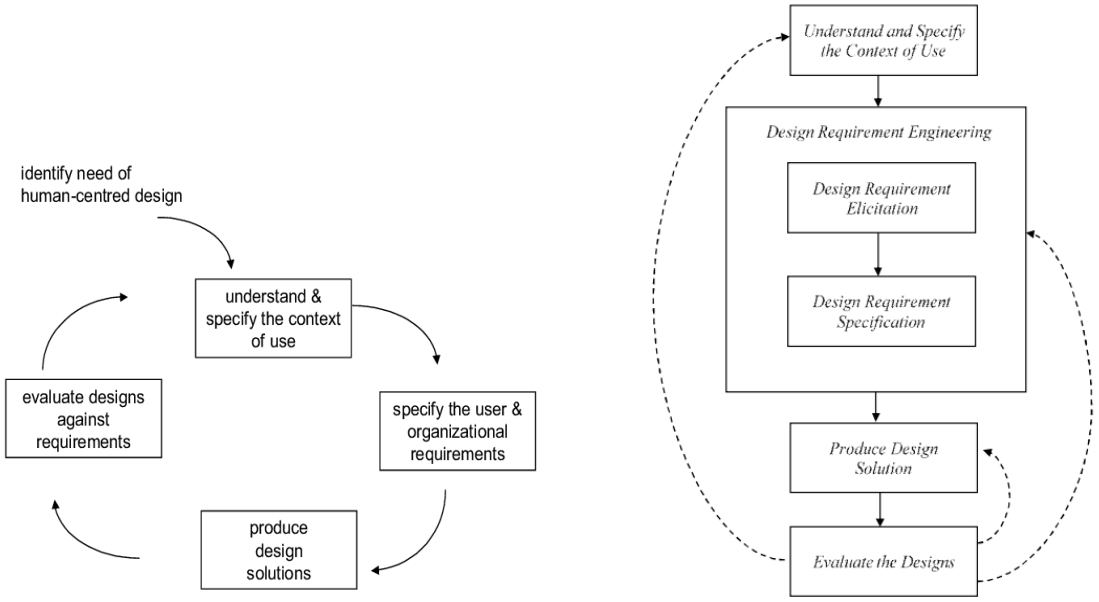
Table 2.1: Comparison of OCW and MOOC [1]

This thesis aims to create a platform or design that allows for the ability to openly share the course and the course materials. The comparison between OCW and MOOCs, as presented in Table 2.1, shows the alignment of OCW with the vision of this assignment. The open and user-centric ideas behind the OCW, together with the emphasis on unrestricted access, align more with the objective of this project. Therefore, further research and development are focused on the exploration and evaluation of OCW initiatives.

2.1.2 Evaluation of the OCW and OER

An important factor in developing new online platforms is the usability of the users. This can be evaluated with a variety of methods that focus on factors like usability, accessibility, and inclusivity. MIT was the first to publicly share all its courses in an OCW environment, intending to make high-quality learning materials widely available [10]. MIT, together with many other OCW pioneers, decided that a 'gold standard' was needed to 'asses and improve the quality of OCW'. [18, p.73]

Several evaluation frameworks have been developed to evaluate digital learning material platforms, specifically OCW initiatives. User-centered design (UCD) is one of the design evaluation methods that focuses on the active involvement of users to improve the understanding of user and task requirements, and the iteration of design and evaluation [19]. Using UCD is a logical solution for evaluating the usability of an OCW initiative since it centres around the users, and that is precisely what is important in building an intuitive platform. One of the reviewed evaluation frameworks proposed by Aulia and Kusuma [20] is an adapted UCD method that combines both the focus on user needs, and product functionality. The proposed method adds the Requirement Engineering method to the normal UCD cycle. The Requirement Engineering method is the process of gathering the requirements and needs of stakeholders and developing them into detailed and agreed requirements, documented and determined [21]. Figure 2.2a shows the normal UCD method, and the adapted version is shown in Figure 2.2b. In Figure 2.2b the steps of elicitation and specification are added. In the 'Design elicitation' phase, the goal is to collect data based on system requirements. This can be done with the System Usability Scale (SUS), which is a user test method that provides 'quick and dirty' measuring devices [22]. In the 'Design requirement' phase, a list of requirements based on the results of initial interviews is made. The process then continues with the development of initial product designs.



(a) General UCD method from [23] (b) Adapted UCD method from [20]

Figure 2.2: General and adapted UCD methods

Usable E-learning web pages require two aspects: technical usability and pedagogical usability. Technical usability is focused on how and if a product functions. Pedagogical usability is concentrated on the learning process of a user [24]. These two factors depend on each other to a great extent, and both require user-centered input to improve either of them. These factors are of great importance to the success of an E-learning website. Therefore these two factors are taken into account in the framework of Aulia and Kusuma [20]. Aulia and Kusuma define usability as 'an assessment of an extent to which a product can be used by the user to achieve effective and efficient system goals so that user would be satisfied' [20]. Faraweh and Al-Bardeen [24] agree with Aulia and Kusuma on the importance of usability and propose an evaluation method centered around usability evaluation. The method of Aulia and Kusuma includes five evaluation categories:

- **Ease of learning:** How quickly can someone learn to navigate the interface and find what they need?
- **Efficiency of use:** Once someone knows the interface, how fast can tasks be finished?
- **Memorability:** If a user has used the interface before, does the interface allow for immediate use again? Or does a user first need to learn the functionality of the interface again?
- **Error regularity and severity:** How often are mistakes being made by the user, and how do they recover?
- **Subjective satisfaction:** Does the user like the system/interface?

Aulia and Al-Bardeen evaluated an E-learning website design based on the above categories via questionnaires and personal interviews. The results from their case study show very specific results in the different categories, this could be beneficial for future designs. This method allows designers to identify where usability problems are, and categorizes them into specific categories, making it potentially easier for a design process to adapt to the problems identified in both technical usability and pedagogical usability. Not only usability plays a role in an application or website. Rodríguez, Pérez, Cueva and Torres [1] argue that accessibility should be taken into account. Accessibility is defined by the ISO standards as: 'The use of a product, service, framework or resource in an efficient, effective and satisfying by people with different abilities' [1, p.199]. To evaluate accessibility, the Web Accessibility Initiative (WAI) has developed a set of Web Content Accessibility Guidelines (WCAG) [9]. The WCAG discusses a wide range of accessibility recommendations, structured in three layers.

- **1st level - Principles:** Defining the foundations of web accessibility, perceivable, operable, understandable, and robust.
- **2nd level - Guidelines:** Twelve guidelines that help set up the basics and are in line with the principles.
- **3rd level - Succes Criteria:** For all of the twelve guidelines, success criteria have been set up. These are evaluated on a scale from a low to a high score. 'A' is the lowest, and 'AAA' is the highest.

The WCAG is very elaborate and has numerous tools to help adjust the accessibility of a design, including a tool to automatically check your designs. Regarding usability, Rodríguez et al. [1] created an evaluation method based on three usability measures:

- **Effectiveness:** How well do users reach their goals?
- **Efficiency:** How many resources did users use before reaching their goals?
- **Satisfaction:** How do users feel about the product?

These three measures differ a little bit from the previous frameworks of Aulia and Kusuma, and Faraweh and Al-Bardeen. In the above-proposed measures, there is a big emphasis on the satisfaction of the user. In other methods there is more attention to several factors, of which one is satisfaction, in this method, satisfaction is one of the three larger ones, causing there to be more emphasis on it. Rodríguez et al. propose a complete framework including both accessibility and usability. The framework combines the WCAG for accessibility and the three usability measures. Because of the combination of the WCAG and usability measures, the framework focuses on more than one element of website and application design, allowing it to include and accommodate a wide variety of users. Next to accessibility and usability, a third factor can be involved in the evaluation of online course ware, this is inclusivity. Chatterjee et al. [25] propose a method for the evaluation of gender inclusivity, this method is called the GenderMag tool. The method is built upon an Automatic Inclusivity Detector (AID) tool. The GenderMag tool is an AID tool designed to have different personas, walking through the functionality of an online environment. These different personas have different genders and a variety of learning styles. This is done to Simulate different and contrasting users. By doing this gender inclusivity bugs can be detected. Chatterjee [25] evaluated the GenderMag walkthrough with an online computer science course. It identified bugs in six categories, found by the different personas. These categories are:

1. **This is a dead end:** e.g. links going to the wrong places, no way to create or upload an assignment.
2. **Not enough guidance on where to focus:** e.g. step order not motivated, high workload.
3. **Newcomer-unfriendly:** e.g. lack of reminders, lack of refreshers about concepts.
4. **Missing information:** e.g wrong labels, unclear resources
5. **Failure to guide a student to benefit and away from pitfall:** e.g. not pointing out beneficial resources, order of tasks.
6. **Student blocked by having to deal with info:** e.g. too much information at once, too many options.

The WCAG guidelines as mentioned by Rodríguez [1] also have automatic ways like the GenderMag personas, however, Chatterjee et al. [25] argue that many of those methods fail to include gender inclusivity. We show a summary of all the different evaluation methods in Table 2.2.

Type Of Evaluation	Proposed Evaluation Framework	Reasoning
Adapted User-Centered Design (UCD) [20]	Include requirement engineering steps into the process	Include user needs and product functionality.
Usability evaluation [24]	5 factor evaluation	Focus on technical usability and pedagogical usability .
Accessibility evaluation [1]	WCAG guidelines	Accommodate and evaluate for every user, include every different type of user.
Accessibility and Usability evaluation [1]	3 factor evaluation + WCAG guidelines	Combine accessibility and usability, evaluate on both fronts to get a broader evaluation.
Inclusivity evaluation [25]	GenderMag walkthrough	Include different (digital) personas in testing to identify gender inclusivity errors.

Table 2.2: Summary of the reviewed evaluation frameworks

2.1.3 Conclusion

The purpose of this literature review was to investigate what type of platform could be used for sharing blended learning course materials and to investigate how a design for such an interface can be designed and evaluated. Based on the first section of this literature review, the conclusion can be made that Open Cours Ware (OCW) initiatives fit better with the purpose of this assignment, rather than the MOOC. The conclusion is based on the differences pointed out in Table 2.1. The basic requirements for the shareable blended learning course are open access and free access to the materials. With an OCW this is the case, MOOC's on the contrary focus on restricted users and a closed license type. Another factor is the type of author. Currently, the motivation for the assignment came forth through the University of Twente. With MOOC's the author or supplier is often a company. Because of this, any further research is focused on OCW initiatives.

The research into different evaluation frameworks has led to a variety of frameworks that can be applied to the design and evaluation phase of a potential OCW initiative. Something that can be noticed throughout the different frameworks is the addition of extra evaluation factors. The adapted UCD framework adds requirement engineering and combines it with the normal UCD process. Rodríguez et al. [1] propose a framework that combines both usability evaluation and accessibility evaluation. On top of usability and accessibility, inclusivity can be added by using the GenderMag walkthrough. To say which method is the best, extra research and practical implementation testing would be needed. The proposed frameworks, all conclude that the specific newly proposed framework works better than the framework that was being used. The studied research does not provide sufficient information on the pros and cons of the separate methods to conclude on the best evaluation framework. What would be interesting for the continuation of this study is the combination of accessibility, usability, and inclusivity, since it combines four of the five frameworks. Given the time limit of the project, the best option is to focus on the accessibility and usability evaluation. Both accessibility and usability were repeatedly mentioned in different framework proposals, these are for example Rodríguez et al. [1], and Faraweh and Al-Bardeen [24]. Focussing on these two foundational elements of evaluation, will help with building and designing a platform that is user-friendly and easy to use. Both evaluations can be done without the need for too many resources, therefore it can be conducted within the period of this project.

2.2 Currently existing systems and tools

To get more insight into the currently existing options for OCW initiatives, research into several platforms and initiatives was conducted. This research analyses the functionalities and (visual) design choices of several OCW initiatives, as well as other open-access web pages that share learning materials or courses. As mentioned in the conclusion of the literature research, the focus of this project is continued with a focus on OCW initiatives.

2.2.1 OCW initiatives

Since the first OCW initiative of MIT in 2001 [10], many new initiatives have been developed. An example of this is Moodle.net [2]. Moodle.net is an open platform for sharing and finding educational resources. Moodle, as the overarching organisation, offers an open-access learning management system, and other paid platforms or solutions that can be used by educational institutions, which are on a subscription-based license and can be tailored to an institution's needs. These other services provided by Moodle, are interesting to look at but are not open source and cannot be accessed easily. The Moodle services are not meant for sharing educational materials, but rather to help educational organizations with their education. Moodle.net on the other hand is open source and easy to use, you can sign up within a few steps and then immediately access free learning resources. Figure 2.3 shows the home page of moodle.net, it has an easy and clean design. There are limited buttons that a user can click on, this limits the amount of different actions that a user can do. This can help guide the user to the main purpose of the website since there are no other options for the user.

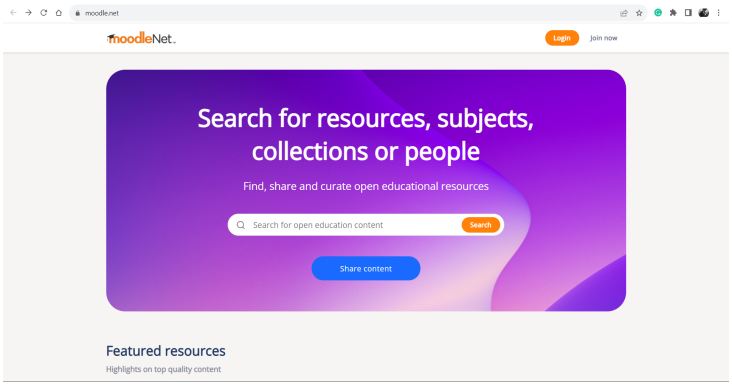


Figure 2.3: Moodle.net home page [2]

The user can use the search bar to find any interesting courses, below the search bar are a few highlighted courses. Besides that, the design is minimal. Once you select a course you see a similar page as shown in Figure 2.4. The page has the same minimal style as the home page. This page includes the title of a course and a short description. The page has information on the author and the publication date. On the top right, the resources can be downloaded. The functionality of this web page is limited, if a user clicks on the resources, the user gets redirected to another website such as YouTube or Grasple, which are not necessarily always open access. The web page is limited to only downloading files and sharing links to other websites.

Figure 2.4: Moodle.net course page [2]

Another website that provides a lot of free and open online course ware is Khan Academy [3]. Khan Academy provides a handful of courses in different languages. The courses are structured based on education that is often provided in primary, secondary, or high school. Some topics align with the subjects of universities. Khan Academy is mostly focused on mathematics courses but provides courses for computing, economics, reading and language arts, life skills, science, and test prepping. Khan Academy aims to provide for learners, teachers, and even parents. Sign-up can be done with many different existing accounts like Google and Microsoft.

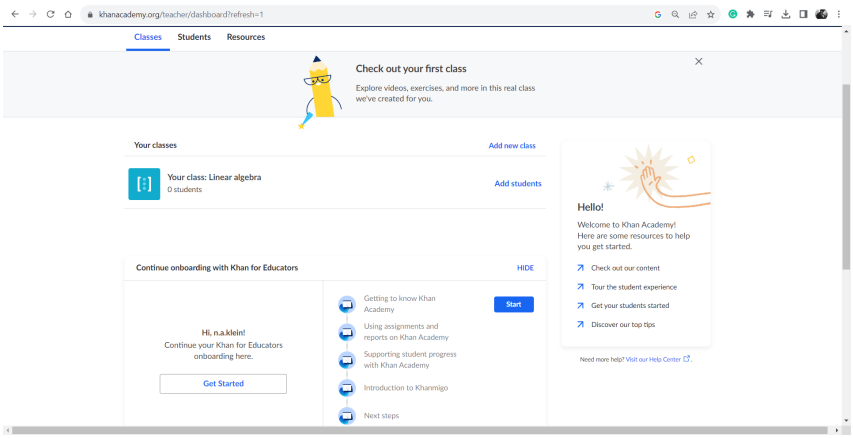


Figure 2.5: Khan Academy new user support [3]

In Figure 2.5, the personal dashboard can be seen, which is adjusted for first-time users. The dashboard shows a lot of support options for getting to know the material, and how the course works. The courses, students, and resources can all be found on this dashboard. The site can track the progress of every student, and the progress of all the exercises. To show to visual interface of the actual course, the student view has been included in Figure 2.6. A course is structured in units, and every unit is divided into smaller topics. Every topic has videos, explanatory texts, and exercises or tests. A unit is concluded with a short test.

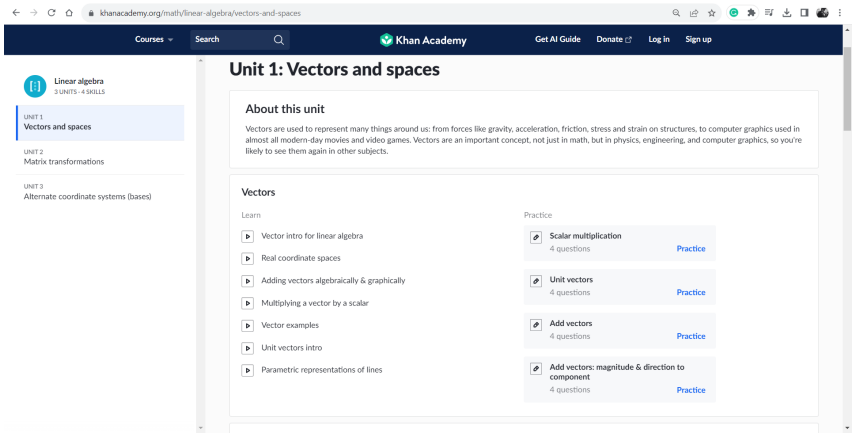


Figure 2.6: Khan Academy student course view [3]

Khan Academy looks visually intuitive but is more complex than Moodle. This web page includes a fully online learning environment and has support for new users. However, the user must take some time to understand all the functionalities. For the user, the information is well structured into units and topics, which gives a comprehensive overview of a larger course.

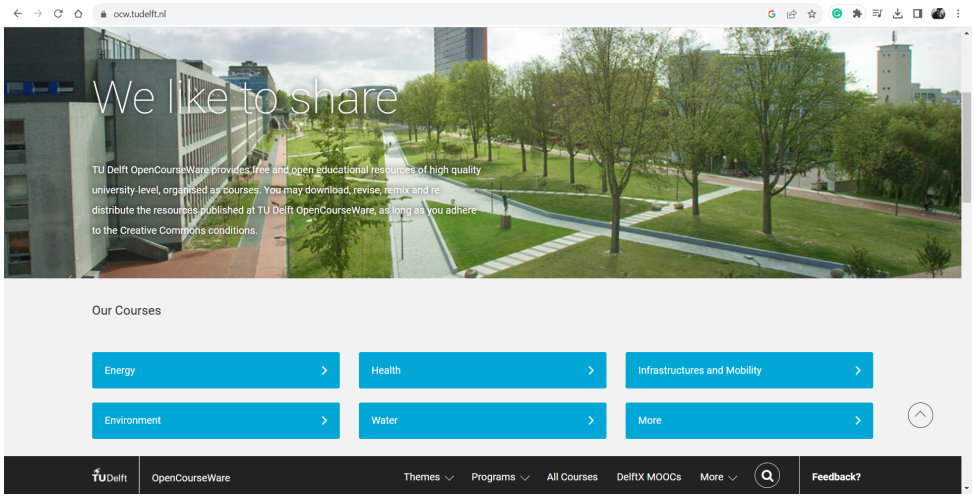


Figure 2.7: OCW TU Delft home page [4]

The Delft University of Technology (TU Delft) has an OCW initiative to promote its courses [4]. The website reuses the modules taught at the university. If a student wants to have feedback on assignments and/or receive a degree, they can sign up for the equivalent MOOC's or bachelor/master degrees. In Figure 2.7 the home page of the OCW can be seen. The quote 'We like to share', grabs quite the attention of the user. The whole feel and style of the website seem to promote their paid courses and the image of TU Delft.

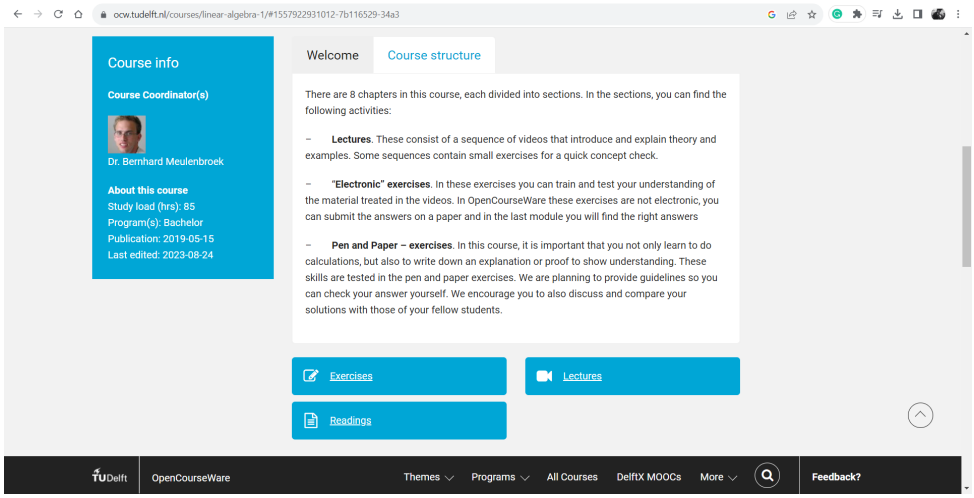


Figure 2.8: OCW TU Delft course page [4]

In Figure 2.8, the course overview and welcome message are shown, in addition, this page explains the structure of the website and the course briefly. Figure 2.9 shows the actual course structure itself. It is divided into modules with subsections. In the subsections video lectures and exercises can be found. What was interesting is that many of these links and exercises do not work. These links send the user to a website that seems to be hosted by the services of Moodle. To access this, the user needs to have a TU Delft account. The fact that the exercises are not accessible takes away from the functionality and openness of the website.

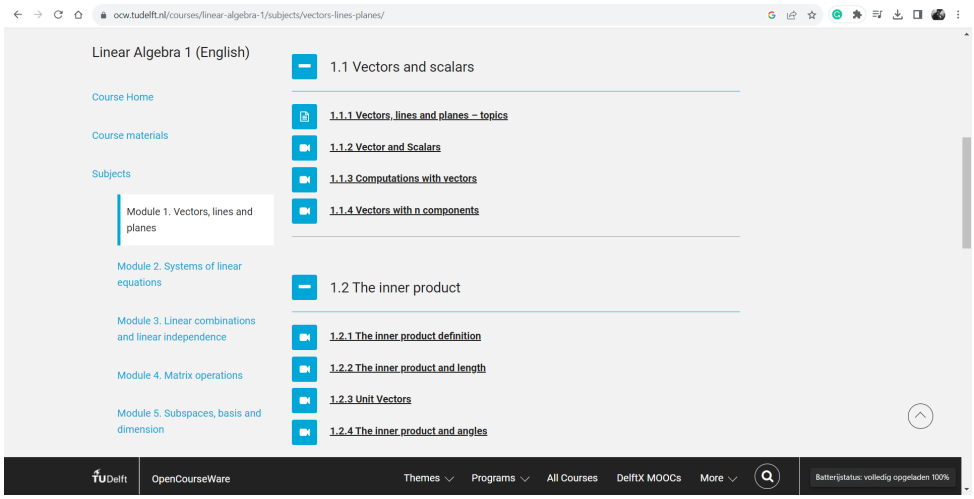


Figure 2.9: OCW TU Delft course structure [4]

2.2.2 Course ware University of Twente

Currently, the University of Twente (UT) offers Open Course Ware in the form of a MOOC [26]. These courses are shared through the 'Future Learn' platform. This platform is used by many universities and educational institutions. In the case of this MOOC, the user needs to pay for participation in a course. Currently, the UT offers six different courses through this platform. The course structure can be seen in Figure 2.10. The structure presented in this Figure structures the course per week and includes subtopics.

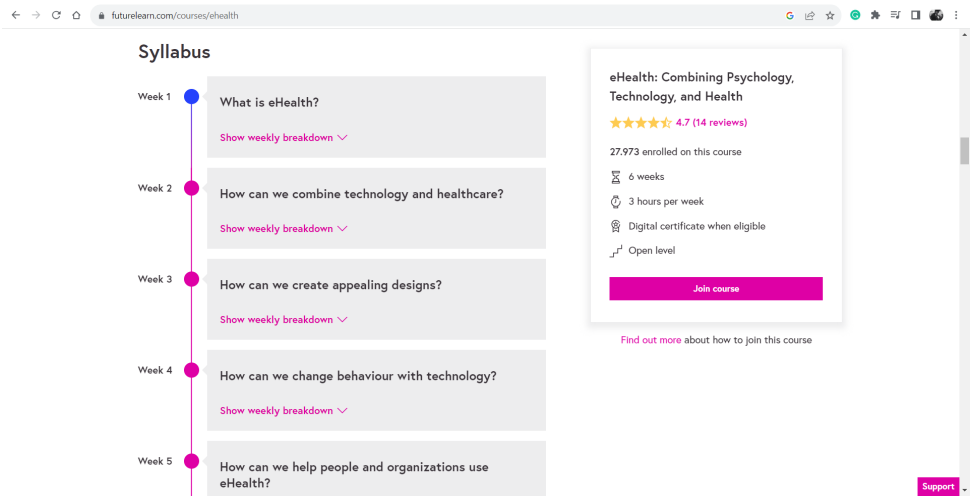


Figure 2.10: Future Learn UT MOOC Course

2.2.3 Conclusion existing systems and tools

Investigating currently existing OCW initiatives and other platforms provided insights into the functionalities and design choices in the realm of open educational resources. Moodle.net provides a minimal design, which helps with the simplicity of the web page. However, the functionality is minimised to downloading files and sharing links to external websites. Khan Academy, on the other hand, offers a more complex learning environment. It provides support for new users and has a variety of complete courses. Khan Academy has integrated all the exercises, so there is no need to leave the website. The complexity can make it harder to use than Moodle.net. Another OCW initiative is the one from TU Delft. Which offers a wide variety of courses, with a clear overview and course structure. Functionality is minimized since some links only work with a TU Delft account. The current courses that the UT offers are hosted on Future Learn, these are all paid courses. However, the design with the weekly breakdown provides a clear overview of what the course entails. To conclude, the insights highlight the importance of balancing simplicity and functionality. A future platform should provide an intuitive interface while offering diverse and interactive learning experiences to meet the goals of open educational resource sharing.

3 METHODS AND TECHNIQUES

During the continuation of this research, the Design Science Research Method (DSRM) is used. The aim for the creation of the DSRM was to create a commonly accepted framework for design sciences [5]. Therefore the decision is made to use the DSRM process, rather than the Creative Technology design method. This is because the DSRM is more commonly used than the Creative Technology design method. In addition, the DSRM allows for possible extra research entry points as shown in Figure 3.1. This enables the project to build upon established knowledge and encourages further exploration if needed.

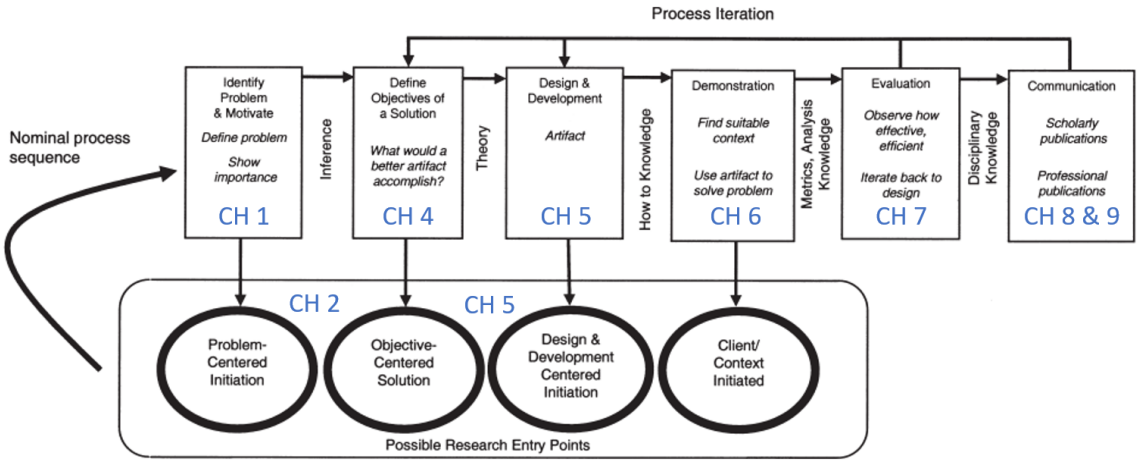


Figure 3.1: Design Science Research Method (DSRM) with Chapters (CH) from [5]

The DSRM process is shown in Figure 3.1. The first activity is problem identification and motivation, this is done in Chapter 1. After the first activity, a research entry was done as described in Chapter 2, which describes the relation between the OER and OCW and explores a variety of evaluation frameworks. The second activity is defining the objectives for a solution. This is discussed in Chapter 4. Chapter 4 starts with stakeholder mapping and next to that it includes an expert interview. Afterwards, we show a potential field of requirements based on the found information.

The third activity of the DSRM process is design and development, which we discuss in Chapter 5. In Chapter 5, a survey is conducted and discussed to identify additional requirements for the design. These new insights together with the insights from Chapter 4 are categorised with the MoSCoW classification method. This method is further elaborated in Chapter 5. This chapter also allows for an additional research entry, to help identify the design requirements. The design is then created based on the requirements and is visualised in a program called Figma Design[27].

In Chapter 6, the creation of the design in Figma Design is explained and discussed. This design is made interactive by the variety of interactions in Figma. Chapter 6 discusses how

and if the requirements are met in the design. Figma is used for activity four of the DSRM process, which is demonstration. The design is demonstrated and used by potential future users, this is then combined with activity five of the DSRM process, evaluation. In Chapter 7, a user product evaluation is done. This is focused on determining how well the product fulfils the users' needs. Evaluation frameworks from the research of Chapter 2 are used to evaluate the prototype. These are focused on the evaluation of usability and accessibility. The usability evaluation is done via user tests, in which users receive a list of tasks that they have to complete. The accessibility evaluation is done with online tools and a WCAG guidelines checklist.

The sixth activity of the DSRM process is about communication of your findings. This is done in both Chapter 8, discussion and future work, as well as in Chapter 9, conclusion.

4 IDEATION

To understand and define the objective of a solution for this project, we need to understand the users and the stakeholders of this project. This is done with a user analysis and stakeholder mapping. Two stakeholders are interviewed to help identify wishes and needs for this project. The idea of using an already existing tool for this project is researched and concluded.

4.1 User Analysis

To understand the needs and requirements for this project, a user analysis is needed. First, the stakeholders are identified, and then the stakeholders are put into a 'stakeholder map'. Such a map categorizes stakeholders based on their 'power' and 'interest'. Several stakeholders are interviewed to determine a list of preliminary requirements. Afterwards, an overview is created of the potential and current features and functions.

4.1.1 Stakeholder Identification

The stakeholders for this project are either centred around the University of Twente (UT) or are more national and globally focused. One of the stakeholders identified at the UT is the teaching staff. Every (educational) staff member could benefit from a platform that shares knowledge and courses. The same applies to the UT students, within Creative Technology it is even encouraged to broaden your knowledge of subjects. Therefore the UT students are considered stakeholders. Another stakeholder that would be relevant to the UT is the course authors of the course in question. They developed and created the course, and wish to make the course shareable, therefore they should be taken into account as stakeholders. The fourth stakeholder within the UT is UT policymakers. These can be policymakers on both education itself and the sharing of education. if we were to develop a platform that shares course materials that are from the UT, it is important to discuss this with the people who have the authority to make decisions on topics like the sharing of education.

Looking more outside of the UT, other universities, both nationally and internationally are considered as stakeholders for this project. They could benefit from this project for their education and help develop the course materials. Similar to the UT, students internationally should be taken into account, since developments like the aim of this project have an impact on their learning development as well. Next to students worldwide, teaching staff worldwide should be taken into account as a stakeholder. This project aims to design a platform that allows for the sharing of courses and materials between teachers worldwide, and not just within universities.

This project includes the following stakeholders:

- UT Teaching staff
- UT students
- Course authors
- UT policymakers

- Other universities (outside of the Netherlands)
- Students worldwide
- Teachers worldwide

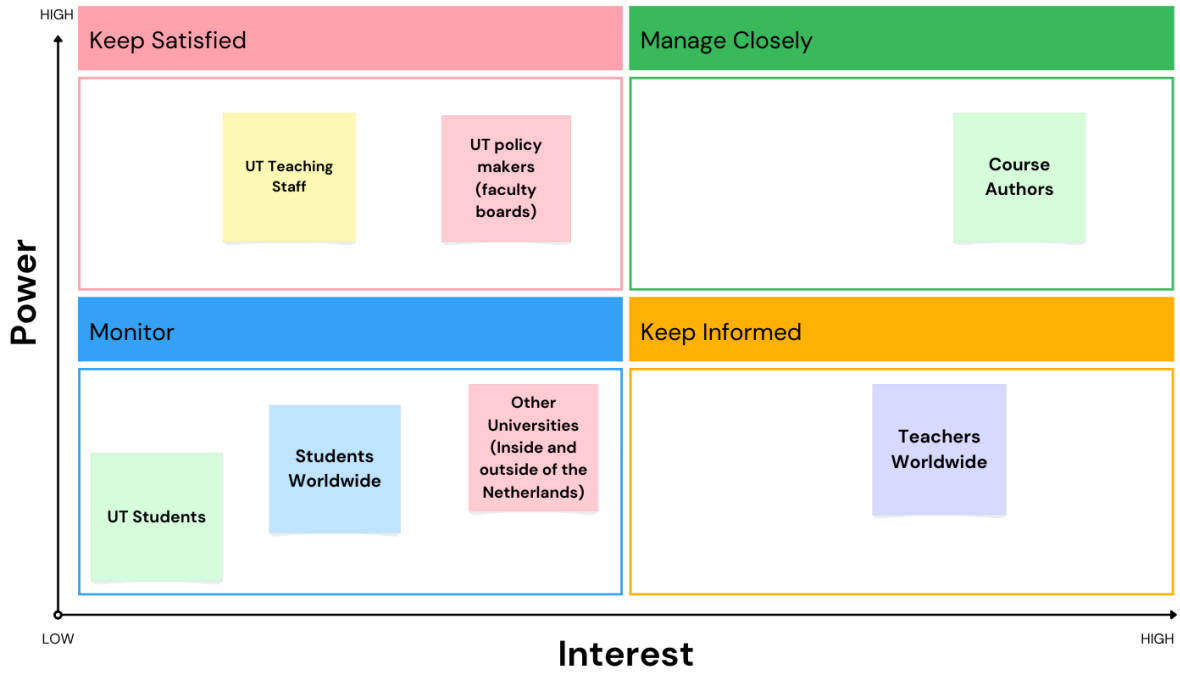


Figure 4.1: Power-Interest Stakeholder Map

4.1.2 Stakeholder Mapping

The stakeholders mentioned above are ‘mapped’ based on two factors, these factors are ‘power’ and ‘interest’. The results of this are presented in Figure 4.1. The x-axis represents the level of interest from the stakeholders, the y-axis represents the power of stakeholders. The course authors are seen as stakeholders that hold a lot of power, and have much interest in this project. Since the starting point for this assignment lies with the course authors, it is therefore important to manage them closely.

Something else worth noticing is the difference between the mapping of UT staff and teachers worldwide. Concerning this project, the UT teaching staff might have less interest in the final product, but the stakeholders do have a lot of power within the UT. Therefore it is mapped as high in power, and lower in interest. Teachers worldwide on the other hand have a higher interest in open accessible course material, but they hold less power. Therefore they are considered in the ’keep informed’ category. The UT policymakers are mapped in the ‘Keep satisfied’ category because they have high power and some interest in the project. However, not as much as the course authors.

The UT students, students worldwide, and other universities are mapped in the ’monitor’ category. This is since both UT students, and students worldwide, will not access the course materials directly, but through a teacher. The universities both nationally and internationally are considered to have some power and some interest, but not much more involvement than that.

4.2 Expert interviews

Based on the stakeholder mapping the decision was made to interview Lotte Weedage and Nelly Litvak. They have researched and developed the course in the past years. Lotte Weedage is currently the coordinator of the linear structures course at the University of Twente. Because of that, the interview with Lotte was mostly focused on understanding the current functionalities of the Canvas page. The course is currently structured per week, Figure 4.2. The course is a total of ten weeks, in every week several activities are happening, or have to be finished. To help the students with an overview of the weeks and the activities, the overview in Figure 4.3 was created. This is an interactive overview leading to the different tasks such as the Grasple exercises. Each colour adheres to a certain activity, and if that button is clicked it leads to a page with more information on those tasks and activities. From this interview, a few key functionalities and some of their problems were identified:

- **General page with course overview:** A general page with a course overview helps structure all the separate elements of the course and shows a clear overview of what is included in the course. This page makes it comprehensible for the user. However, the overview requires a lot of clicking through the Canvas pages to find the page that the user is looking for. Clicking through many pages can lead to situations where the user gets lost in all the different pages.

- **Course structure per week:** The course was designed to fit into ten weeks. This structure helps the user to get a clear overview of what needs to be done per week. Per week the tasks, learning goals etc. are presented, which gives a clear overview of what needs to be done that week. On the other hand, it can cause an overload of information for the user. Once you click on that week, you see many tasks that you have to do. To limit this icons were added to represent tasks, and a dropdown menu was created to prevent showing too much information at once. Since the course is structured per week, this limits its adaptability for other educators. Not everyone has a module that is ten weeks. Therefore a weekly structure might not be the best way to share it with others.

- **Usage of multiple platforms and tools:** Canvas does not support all the functionalities that are required for the course. Because of this multiple platforms/resources are used such as Wooclap and Grasple. To teach the course as it is intended, it is needed to maintain all the activities. The downside of using multiple platforms is that not everything is in one place. Not every platform that is currently being used allows for sharing the materials, this is a challenge for the design of the final product.

The interview with Nelly Litvak focused mostly on the course structure and its activities. During that interview, some of the points above were previously mentioned, however, it gave insight into two new key functionalities. These are the importance of student activities and how to prevent the OCW from becoming a ‘dump’ for the learning materials. During the interview, we discussed the idea of an OCW initiative for this course, the biggest problem with many current OCW initiatives is that it is mainly a place where a lot of materials are uploaded. However, there is no structure present that helps the user to adapt and re-use the materials. It is almost a ‘dump’ of the courses and learning materials. This is something that needs to be prevented in the design of this project. Another important learning lesson is what makes a course successful, is not the teacher, but it is what the students do [28]. Because of this, it is very important to maintain the student activities when the course is shared. There should be a focus on how to keep the functionalities of these activities the same.

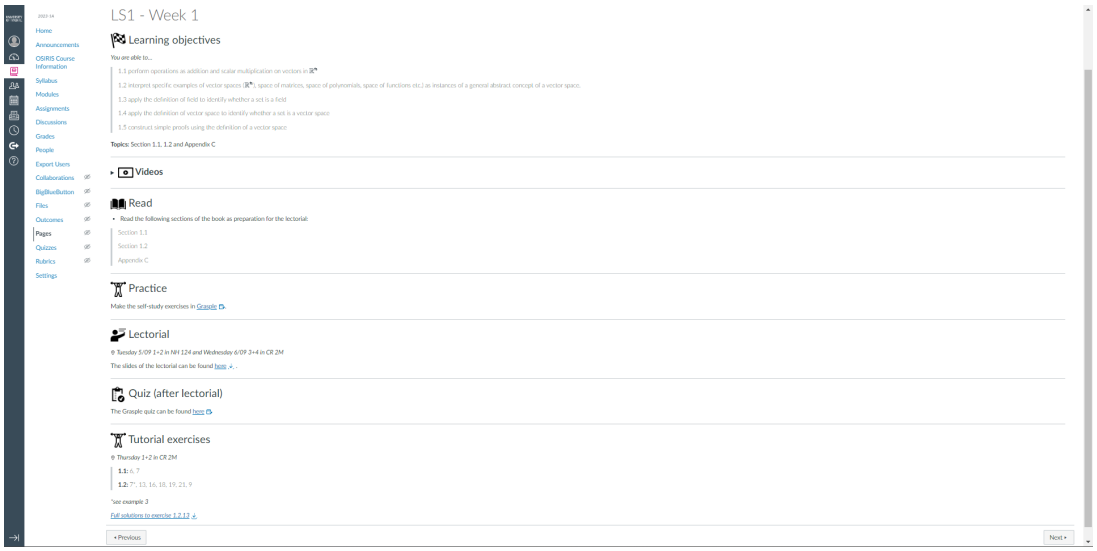


Figure 4.2: Weekly overview of the linear structures course in Canvas

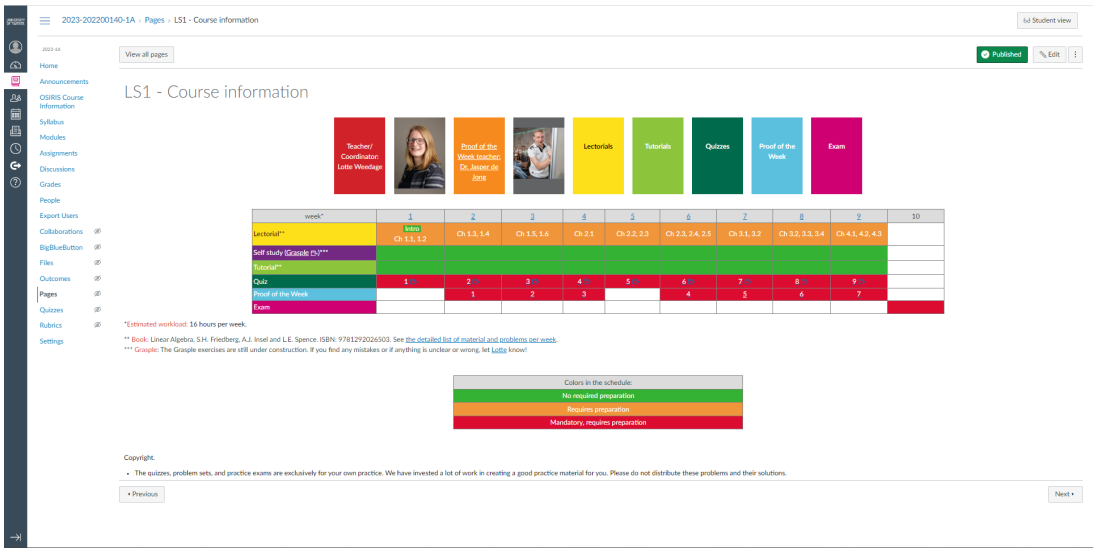


Figure 4.3: Structure overview of the linear structures course in Canvas

Based on these two interviews, a mind map was created to help provide an overview of the identified problems, current functionalities/features and potential functionalities/features. This overview can be found in Figure 4.4. The mindmap shows five ‘main’ identified features, which are shown in five different colours. Each ‘main’ branch splits up into features which are related to the main feature. To further identify the functionalities and features of this project, the decision is made to conduct a survey. The results of this survey are discussed in Chapter 5, to help set the requirements of this project. This survey is conducted to further identify, and obtain insights into the requirements as shown in Figure 4.4. By engaging multiple survey respondents in the field of education, the aim is to collect conclusive input that will assist in shaping the OCW initiative. This is also done to keep involving a user-centric approach in this research.

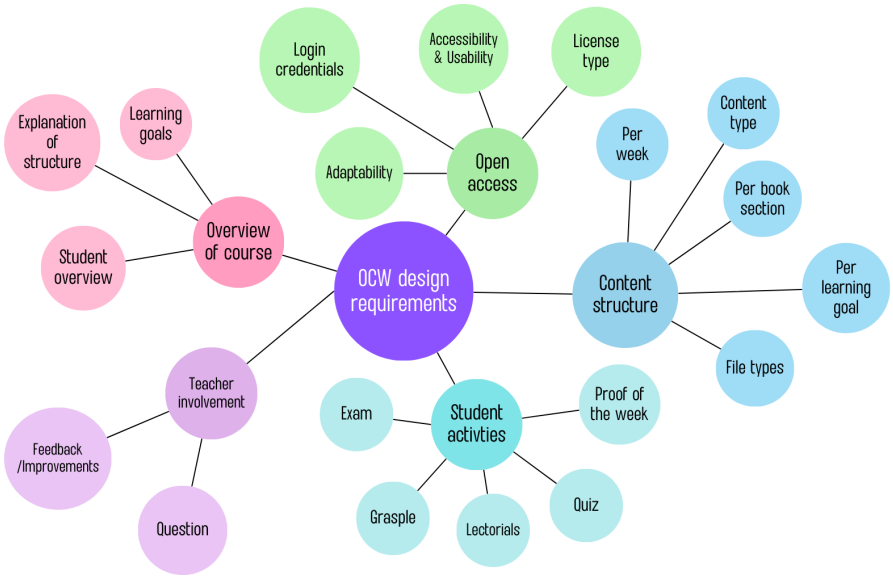


Figure 4.4: Overview of the identified (potential) features/functionalities

4.3 Current online course tools

For this ideation phase, the concept of learning management systems (LMS) and a course creation website have been reviewed. This was done to get an idea of what is possible to develop with the tools and services that are currently available on the market.

A LMS is a system that helps organize and structure e-learning content. It helps to record course users, the courses and the learning process altogether [29]. An example of a LMS that the UT is using is Canvas. Besides Canvas, there are several LMS that allow it to be used as a plug-in in website-building tools like WordPress. WordPress is a website that lets users build a website, from either a template or from scratch. It is relatively easy to learn and does not require programming knowledge or experience [30]. If the user wishes to build a course on WordPress, they can use an LMS plug-in like LearnDash. LearnDash [31] provides the technical functionalities needed to create an online course, such as video support, content management and user management. LearnDash is a paid program that aims to help the user create a course website on which they can sell multiple courses. The tool itself is easy to work with and provides a 'drag and drop' way of designing your courses. The options are somewhat limited since the user does have to stick to a certain type of template. The style of the website can be changed completely to the liking of the user.

LearnDash has many functionalities that align with the idea of a MOOC. It provides a way to teach courses in real-time, and to let students hand in course assignments. It is aimed for the user to use as an e-commerce tool. You can make the courses free, however, the checkout page stays. It provides a variety of ways to promote the courses, to help the author of the course reach a broader audience. Potential students have to enrol in the courses, even if they are free. This is done so that the teacher can see who is participating in the course. The idea of being able to see who is using the learning materials is interesting for the project of this bachelor. It could help with observing and controlling the intellectual rights of the learning materials. However, the LMS plug-ins are too focused on making a profit out of the courses and have a focus on the student management side of the courses instead of a focus on the functionalities of sharing course materials. Keeping the functionalities of the student activities is a feature that is important for the purpose of the project. Using Learn Dash would not align

with the focus and goal of this project, so therefore these plug-ins will not be used in the creation of this project.

Next to the LMS, a review was made on other companies that provide online website-building tools, specifically made for online courses. LearnDash uses WordPress as the tool to build a website, but some companies offer their online website-building tool, and focus that tool on the development of online courses. A few examples are Podia [32], Teachery [33] and Thinkific [34]. These companies all offer the same type of service; an easy way to build and sell your online courses in the format of a website. Podia, Teachery and Thinkific all offer one platform with built-in tools to create your perfect website that helps keep students engaged, and helps sell your courses. The services are often free to try out but require a payment subscription to keep using the tools. The functionalities seem to be mostly the same as with LearnDash, but when developing a website, they feel more restricted. The user can change the style of the website but has even less flexibility in the structure of the website. There are some basic templates to start the website from, the user can edit those, but the user cannot start from scratch. The tools offer you access to sell YouTube seminars or bundles of courses. The focus is very much on selling the courses. Using the tools is very easy, and a website can be developed quickly. However, the focus stays very put on the profit of the courses and student management. For this reason, these tools are not going to be used for the development of this current project.

5 SPECFICATION

In this chapter, the requirements of the final product are discussed. The Design Science Research Method (DSRM) from Chapter 3 allows a researcher to add possible research points at any moment in the beginning steps of a research. Therefore this chapter will include extra research into the design of other OER and e-learning projects. To determine the final requirements for this project, a survey was conducted. The combination of both literature and the survey results will lead to the final requirements. These final requirements will categorized according to the four key design features presented by Sandanayake et al. [35]. Within these four categories, the MoSCoW [6] method will be applied. This is a method to help categorize the requirements. The requirement can be categorized as either a Must, a Should, a Could or a Would. Figure 5.1 shows and explains the prioritization method, taken from [6].

Figure 5.1: MoSCoW method explained [6]

5.1 Design of Functionalities survey

A survey was created to gather insight into how teachers currently view open course ware and what their preferences and needs regarding open course ware are. While the expert interviews provided valuable insights, the survey aims to validate and expand on these findings. By reaching out to (mathematical) educators from diverse backgrounds, including the University of Twente, Eindhoven University of Technology, and Delf University of Technology, the survey ensured a varied perspective. The results of the expert interviews combined with the data from the survey form the basis for informed decisions in shaping the OCW platform's design require-

ments. The questions of the survey can be found in Appendix A. The reasons for including specific questions are discussed below.

The focus of this research is not necessarily to investigate whether or not teachers are willing to reuse online educational materials. However, for the development of the design, it can be interesting to know if the user is likely to use the product, or if the design could be of any assistance to it. Therefore question 2 of the survey discusses the likelihood of reusing learning materials.

Questions 3 and 4 in the survey are focused on how to determine if learning materials are suited for your specific purpose. In question three of the survey, the participants were asked to describe how their 'determination process' works, and what they focus on. This was included to help determine what should be included in a course overview for the Linear Structures design. In question 4 participants were asked to select the elements that provide the most information when trying to get an overview of what a course and its learning materials are about.

In the research on existing platforms and initiatives in Chapter 2, several websites were reviewed that are either a MOOC or an OCW. For this survey, in questions 5 and 6, the OCW web page of the TU Delft was used, as well as a course from the University of Twente's Future Learn page. This was included in the survey to learn more about the opinions on current solutions and designs.

Questions 7 and 8 in the survey discuss the content structure. Since the content structure was one of the key elements surrounding OCW interface design, the participants were asked what their ideal course structure and overview were, to determine design requirements for these two elements.

5.2 Survey Results

The survey was filled in by eight participants, all of whom have a varying experience in teaching. A few participants had 20+ years of teaching experience, others between 4-8. The group of participants that had 20+ years of teaching experience consisted of four participants, the group with 4-8 years of teaching experience consisted of four participants. The results of the survey will be discussed per topic of the question.

Likelihood of reusing course materials

In Figure 5.2 the answers to question 2 of the survey are shown. Five out of eight participants are either very likely to reuse materials from others or are somewhat likely to do so. There was no real relation between the teaching experience and the answer given to this question. It is good to know for the development of the design that people are likely to reuse the learning materials from others, otherwise, part of the design and text on the website should be altered to help people understand why reusing learning materials might be beneficial.

Determining suitability of learning materials

The answers to questions 3 and 4 have several frequently mentioned terms. These terms are quality of content, credibility of the source, content relevance, workload, usage of keywords/learning goals and course structure. The result of question 4, in which participants had to select specific overview elements, can be found in Figure 5.3. The most popular elements are a title, the learning goals, an overview of student activities, an overview of teacher activities, the structure of the course and a short introduction of the course. The results of these two questions conclude that there is a wide variety of preferences, but that it can be narrowed down to a few key elements that should be included in the final design of the course information.

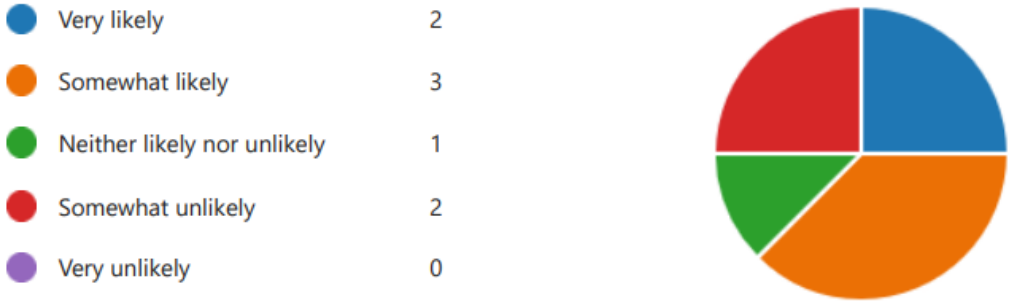


Figure 5.2: Results to question 2 - How likely are you to reuse materials from somebody else for your own courses?

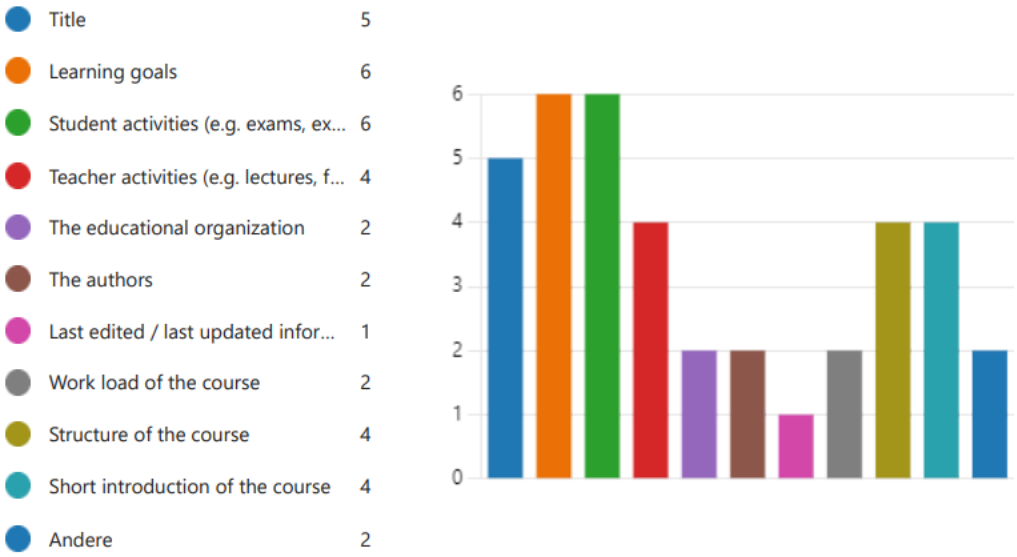


Figure 5.3: Results to question 4 - To understand the course's content, which elements would you like to see to get an overview of what the course is about?

Review of existing platforms

The TU Delft OCW page was presented in question 5, this interface received a lot of comments on how clear the structure was, specifically the material division into modules, and the general 'home page'. The information on the content itself was mostly lacking according to several respondents. The material is well-structured but requires a lot of clicking when wanting to access the materials. Something else that was unclear in this interface is what is expected from students after the course. To conclude, the design was clear and provided a lot of information, but was missing out on a few key points such as learning goals, and content information.

The other interface was the University of Twente MOOC page, which was used for question 6. This design was reviewed negatively by the participants. It looks too commercial, and there is no way to access content and see what the content is about. It provided a worse overview of the course than the TU Delft OCW page. On the other hand, the weekly structure was preferred over the TU Delft OCW platform, since it allowed for a clearer overview of the structure.

Ideal course structure

The results of question 7, discussing a preferred course structure, can be found in Figure 5.4. The majority prefers to structure the content per week. Two out of eight participants prefer to structure content per learning goal, one participant answered that both week and learning goal make sense. The other option that was provided by a participant was per module, which is described as somehow similar to 'a chapter for a good book'. The preferred structure seems to be a combination of organizing materials per week, or per learning goal.

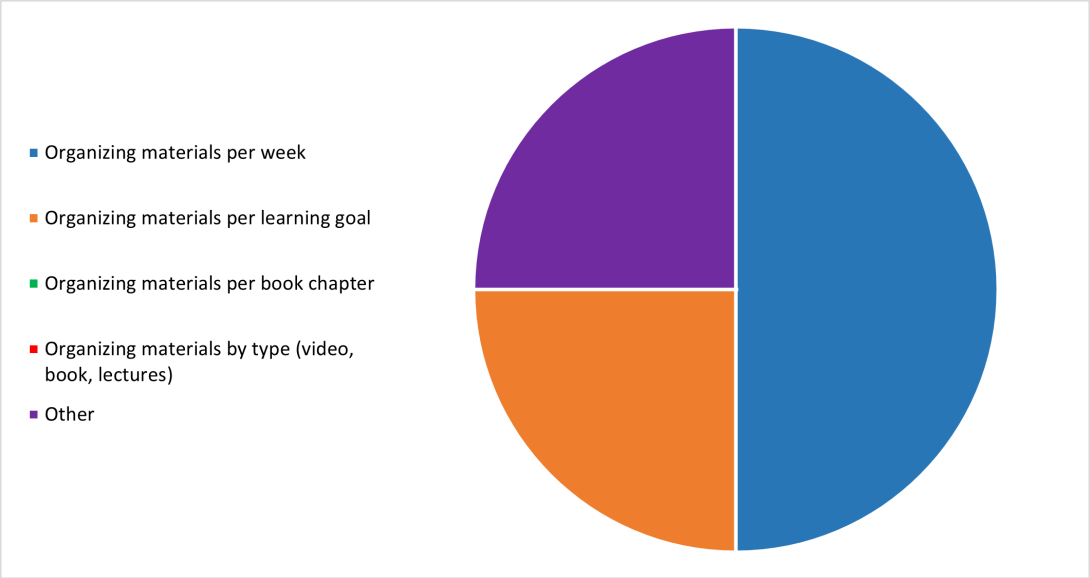


Figure 5.4: Results to question 7 - If you are designing the structure of a course, which design approach would you prefer?

Ideal platform for sharing educational resources

In the last question, participants were asked to describe their ideal platform to share educational resources. There were a few elements that were repeatedly mentioned. One of these is copyright if the materials are going to be shared. It is nice to keep the copyright to the materials as the author of the materials. Next to this, some form of quality control of the materials would be preferred. A contact person on the platform could be nice so that questions can be asked when necessary. Another important element was providing access to actual open source materials, no payments after using it for a month or anything like that, just open source materials. On top of that adaptability plays a large role, how can the materials be presented so that they can easily be adapted? If you want to reuse materials, you have to adapt them to your institute, providing a way to assist with adapting materials is asked for by the survey participants. The survey results will be used in the next section to help determine design requirements and the importance and relevance of certain design requirements.

5.3 Design requirements

The research of Sandanayake et al. [35] proposes four key design principles for OER-integrated online courses. These four design features are information design features, instruction design features, interface design features and interaction design features. Garret et al. [36] review the frequency of certain website design elements. The most used elements defined by Garret et al. are organization, content utility, navigation, graphical representation, purpose and simplicity. Since there is some overlap in the design elements/categories that Sandanayake et al. and Garret et al. state, both views will be used to identify the necessary design requirements, the practical implementation of these features will be supported by the survey results and the research of Tosho et al. [37], which describes usability strategies for designing e-learning websites, specifically for inclusive education systems.

To help keep an overview of all the different requirements and their categories, Table 5.1 was created to provide an overview of all the requirements.

	Information design features	**Instruction design features**	**Interface design features**	**Interaction design features**
Must	Overview page elements Learning Objectives Website organization	Instruction clarity Navigational structure Navigational aids	Avoid visual overload Design consistency	Student activities Applicability of content Student-teacher interactions
Should	Understandable structure Consistency	Control of website Limit clicks	Font/text consistency Colour scheme	Multi-media interactions
Could	Error recovery	Short website introduction Search features	Distinct logos and icons	Up-to-date content
Would	Contact form Feedback mechanisms			

Table 5.1: Overview of design requirements per category

5.3.1 Information design features

Information design features include any features that relate to how information is used in the design. This can include elements like learning objectives, lesson structures, flexibility and comprehensibility [35]. Garret et al. [36] talk about information design features in the sense of the design element of the organization. This includes design features like a logical organization, cognitive mapping of the website, keywords, consistency, meaningful titles/names/headings and systematic information arrangement and categorization. From this information and the survey results the following requirements have been derived.

Must:

- **Overview page elements** The website needs to include a starting page with the following elements: title, a short introduction of the course, Learning goals, student activities, teacher activities, and structure of the course. This is based on the results of survey questions 3 and 4.
- **Clear learning objectives** Display clear learning objectives at the informational page of the course. This is defined as a ‘must’, since it is essential for users to assess the suitability of the course for their needs. It provides a foundation for decision-making and aligns with the findings from question 4. This requirement is supported by the findings of Tosho et al. [37].
- **Clear website organization** The website will have a clear structure and organization of contents described in the start page. Based on the results of the survey the preference for the structure differs a lot. Some answers are ‘both topic/learning goal makes sense’, ‘organize materials per week’, ‘organize per learning goal’ and ‘per module.’ ‘It’s not the

same as learning goals. it's at best similar to per chapter, for a good book.' The answers vary a lot, but the way that the respondents of the survey determine if a course is suited for their purpose is by checking the learning goals. Therefore the structure of the website must be based on something alike. This is also identified as a 'must', since it was driven by responses to the survey, as mentioned above.

Should:

- **Understandable structure** Make sure that the structure is easy to understand and requires little explanation, this is based on the ideas of Garret et al. [36]. To achieve this, we need intuitive navigation, and visual aids to enhance clarity and use logical grouping. This is done with the structural organization of the website. Next to this, we need to ensure that the used structure is communicated clearly. This requirement is put under 'should' since there is some flexibility in how users perceive an understandable structure. However, clarity in the structure is needed to help create an optimal user experience.
- **Consistency** Use consistent naming/terms/titles throughout the website. Garret et al. [36] consistency as a key factor for website design. For this project, we need to set clear names for the student activities, the teacher activities, navigational labels, button names and instructional texts. This should be included to prevent confusing the user. This is put under the 'should' category since a small variation in naming will not hinder an initial release of the prototype.

Could:

- **Error recovery** Make sure that users can recover from their tasks easily. Provide ways to return to the home page, and prevent the user from getting lost by providing a help section. Or a way to see the general information of the course again. This was mentioned in the results of Tosho et al. [37]. This requirement is put in the 'could' category since it is valuable to include for the user experience, but not necessary for an initial release.

Will not:

- **Contact form** Add a contact form to the website to contact the product owner or page owner. Provide information about the response time. This will be left out for now, since it is not critical to the first release of the project. This requirement was derived from a key design factor mentioned by Garret et al. [36].
- **Feedback mechanisms** Implement a feedback mechanism, that can help gather important insights or user feedback. This can be done with a short form or a comment section. For now, this will be left out because it is a nice feature to implement, but not necessary. This requirement was based on the feedback and contact factor of Garret et al. [36].

5.3.2 Instruction design features

Instruction design features discuss elements like guidelines and requirements. Designing in a way that helps the user understand the tools that they are working with is necessary for their usability experience. Instruction design features include elements such as instruction clarity, navigational structure and knowledge construction [35]. Garret et al. have identified the element of navigation as being one of the most important elements in design. This includes everything such as a navigation bar, navigational aids (links), limiting the number of clicks, search features, and ensuring the users have control over the web page [36]. Based on this literature, we have derived the following requirements.

Must:

- **Instruction clarity** Is the purpose of the website clear? Do the users understand the functionalities of the website? This can be assessed through user testing, focusing on usability. Testing with a focus on usability is necessary to focus on since it is key to the fact that users can use the website correctly [36]. The application of this is done through a variety of requirements, like visual aids, structure, context, and concise language. This is a 'must' since it directly impacts the purpose of the website.
- **Navigation structure** Including a salient menu or navigation bar. The best practice is to include a navigation bar at the top of the website and make sure that it always stays in the same place. This helps the user to know where they can find their way back to the page they were before. This is mentioned by both Garret et al. [36] and Tosho et al.[37] as a key factor for ensuring that users know where they are on the website. Because of this it is put in the 'must' category.
- **Navigational aids** Include clickable links leading to other pages. This helps the navigation of the user [36]. At the same time, there should not be too many clicks leading to other pages, because that can allow users to get 'lost' on the web page. This requirement is a 'must' because it helps effective user navigation.

Should:

- **Control of website** The control of the website lies with the user. They understand and can handle the website correctly. This is based on the key factors by Garret et al. [36] regarding simplicity. User control over the website is categorized as 'Should' since it is important for a positive user experience but may have some flexibility. Users understanding and handling the website effectively are recommended for optimal usability.
- **Limit clicks** Limit the number of clicks a user must do before returning to a home page or an overview. This is needed to reduce the time needed to perform certain tasks and to make the navigation more efficient [37]. A certain limit for a certain number of clicks can be introduced. This has been included as a 'should' requirement because it is beneficial to include, but allows for some variation in the number of clicks in an initial release.

Could

- **Short website introduction** Starting page with general instructions of what is where, and what functionalities can be found in the website. This can be in the form of a pop-up or something like that. This was based on the design features of other OCW initiatives. Implementing this 'could' be included since it provides guidance, but is not necessary for the functionalities of the website.
- **Search feature** Allowing the users to search through the content. Giving them a sense of autonomy through quickly finding the right materials. This is an important feature mentioned by both Tosho et al. [37] and Garret et al. [36]. For now, the search feature is categorised as a 'could' because it might offer autonomy for the user, but it is not mandatory for a functional design.

5.3.3 Interface design features

This feature involves all the visual elements of the design. Design clarity and consistency are two elements that are often discussed with this design principle. According to Sandanayake et al. [35] some other elements are attractiveness, accessibility and readability. Taking these elements into account will help the visual part of the design to support the content that it is portraying. Garret et al. [36] have identified the graphical representation as one of the most important elements of the design. The graphical representation includes elements such as the inclusion of images, multimedia content, font colour and font size, size of text, usage of logos and icons, avoiding visual overload, and colour schemes. Next to this, readability is included in the design. Meaning that text on the web page should be easy to read, and have the appropriate amount of text on a page. Therefore the following requirements have been set up.

Must:

- **Avoid visual overload** Ensure a clean and calm design to prevent a visual overload with the user, therefore it is put in the 'must' category. Preventing visual overload is needed to keep the user on its main task, not distracting the user with too many visual elements. To achieve this, it is important to include enough 'white space' in the design to maintain a balanced design. This is derived from Garret et al [36].
- **Design consistency** Maintain consistency in the design throughout the website [36]. Keep all the buttons the same size/colour. Stick to one style throughout the different pages of the website. Use one style for each of the different categories of activities[37]. This is one of the key requirements for good usability of the website, and because of that a 'must' requirement.

Should:

- **Font consistency** Decide on a style for the font. This includes anything like the font colours, font sizes and font types or font families. Set certain styles for certain purposes on the website. This is mentioned by Garret et al. [36] and Tosho et al. [37] since it is important for the overall consistency of the website. This is a 'should' requirement since is needed to maintain consistency, however, some variations will not affect the user experience to a great extent.
- **Colour scheme** The colour scheme should fit with the identity of the project and align with the visual identity of the organization[36]. The colour scheme is checked for different cases of colour blindness with Coolors [38] and ensures that everything stays readable. Using a fitting colour scheme is a 'Should' to align with the project's identity, but not crucial to the user experience.

Could:

- **Distinct logos and icons** Using logos and icons will help the user to navigate through the website[37]. This can be included in the project, but might not add much to the first iterations of the design. Therefore it is put in the could category.

5.3.4 Interaction design features

The interaction design features focus on the activities between students and teachers, students and peers, and students and the content. This translates mostly to the activities that are included in the design, and how they are presented. This can be translated into the following elements such as multimedia interactions, ways to motivate the user, the applicability of the content, the interaction between peers, student-teacher interaction and student-content interaction [35]. Two elements from Garret et al. [36] that seem to be linked to this are content utility and the purpose of the design. The content utility includes elements for content quality, motivation of the users, user's needs and requirements, up-to-date information and its relevance to the purpose of the website. The purpose of the website discusses the unique identity of the website, the types of interactions possible and the organizational attractiveness. This section mostly focuses on the actual content on the website, therefore the following requirements are needed.

Must:

- **Student activities** All the current existing student activities are shared on the website in a structure so that the teacher can easily re-use them. The teacher should be able to review and restructure the activities based on their teaching approach. This was based on the expert interviews and therefore has been defined as a 'must' requirement.
- **Applicability of content** Ensure that the content is presented in such a way that it can be easily adapted to the user's needs and requirements. It needs to be flexible and easily adaptable to meet the needs of different users. The reason for this requirement is the expert interviews and the results of the survey, and because of that is a 'must' requirement.
- **Student-teacher interactions** Ensure explanation of the activities in which the teacher must present and explain the tasks. To achieve supportive materials, need to be placed on the website. Keeping the course as was originally intended is important, as discovered in the expert interviews, otherwise, the course itself is changed. This makes it a 'must' requirement.

Should:

- **Multimedia interactions** Ensure that the multimedia interactions, such as the interactive videos, keep the same functionalities as they have currently. This is necessary to ensure the same effective learning experiences. This was based on both the expert interviews and the research of Tosho et al [37] and Garret et al. [36]. It is defined as a 'should' requirement because it is not necessary to test the initial design with all the functionalities of the videos.

Could:

- **Up-to-date content** Make sure that the information and resources are up to date so that the quality of the content stays high. Implement a way of keeping the resources updated. Since this is more on the implementation side of this project, it will be seen as a 'could' requirement. This was based on the survey results as well as the interface overview of TU Delft in Figure 2.8. This requirement would be a feature that would add to the design, however, realising this is not needed for the initial release of the design. Because of this, it is a 'could' requirement.

5.4 Concluding design

Based on the input from the ideation phase, the survey results, and the final design requirements several design sketches were made. This process was done by looking at different requirements and coming up with a variety of designs that would satisfy that specific element. In the end, the idea arose to develop an OCW initiative with the University of Twente in mind. So not only designing a website for the Linear Structures course, but taking a look at the bigger picture. How could this be used within the education of the UT?

Figure 5.5 shows the landing page of the website. In this design idea, the landing page contains a salient menu bar, a large header with an image of the UT, a highlighted area with some new courses, and a section with information about the OCW and contact details in the footer area. The general feeling whilst designing these web pages, is to keep them open, clear simple and structured.

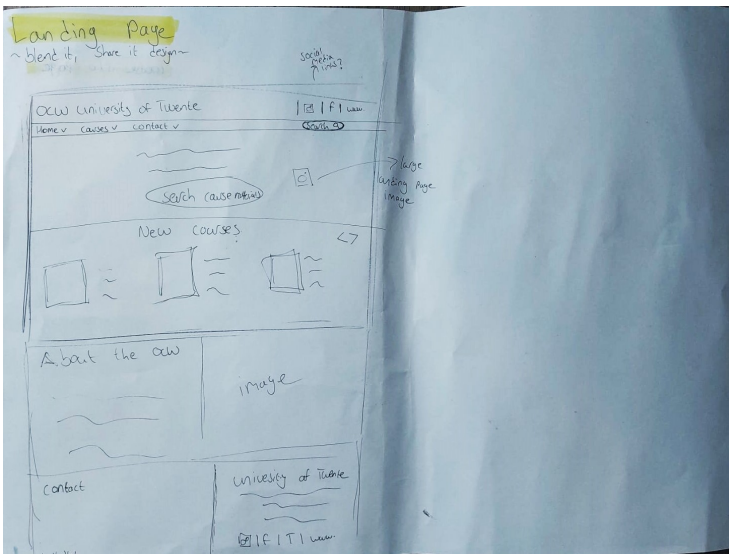


Figure 5.5: Landing page design sketch

For the course page design, the general page layout stayed the same as the landing page. The design has the same header and navigation bar. The footer on this page is the same as on the landing page. What is different about this page is the title header and all the different courses. Each course has its own container, with an image, a title and a little bit of course information. The general page layout can be seen on the left side of Figure 5.6.

On the right side of Figure 5.6, the final idea for the linear structures page itself can be found. This page has the same header, footer and title as the previous pages. To create an overview, several designs were reviewed. These can be seen in Figure 5.7. These sketches are based on the research done on the state of art websites in Chapter 2. A few elements kept reoccurring whilst sketching these designs. Some of these elements that can be seen in the sketches of Figure 5.7 are dropdown menus, a pop-up explaining the course structure, fold-down sections and specific overviews for activities or learning goals. The final sketch for the overview of the Linear Structures page includes an overview that can be navigated through three tabs, one for the course overview, one for course topics and one for structures. On the right of this overview, a list of quick links was placed so that a user can navigate easily to all the materials. The idea for the final placement of the learning materials is drop-down sections below the course overview, that allow a user to open and close the materials per topic, and per type of learning materials. These sketches form the starting point for the actual development of the prototype. The realisation of the prototype will be discussed in the next Chapter 6.

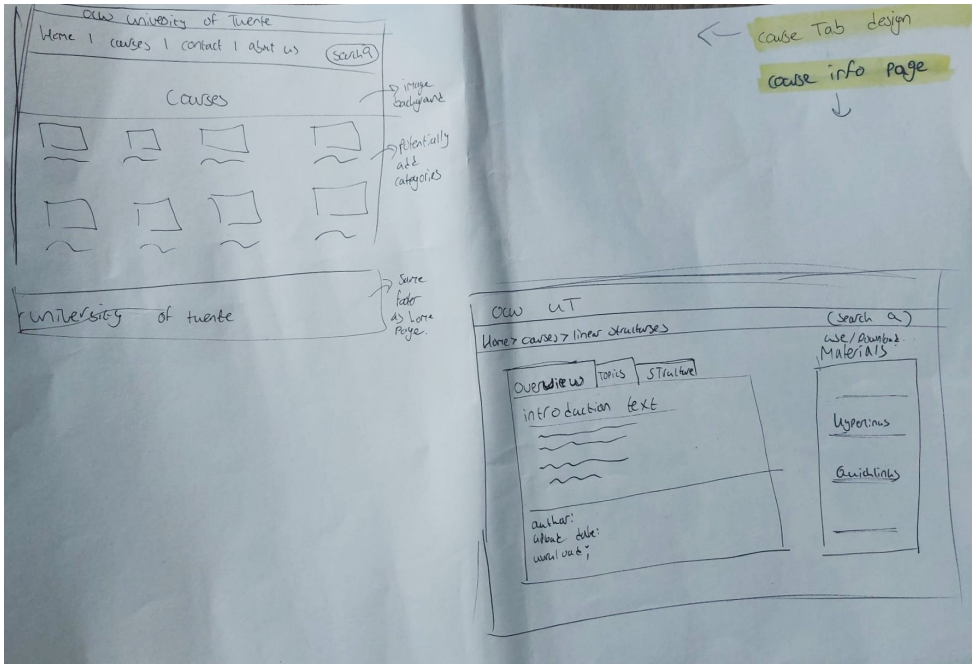


Figure 5.6: Course page design sketches

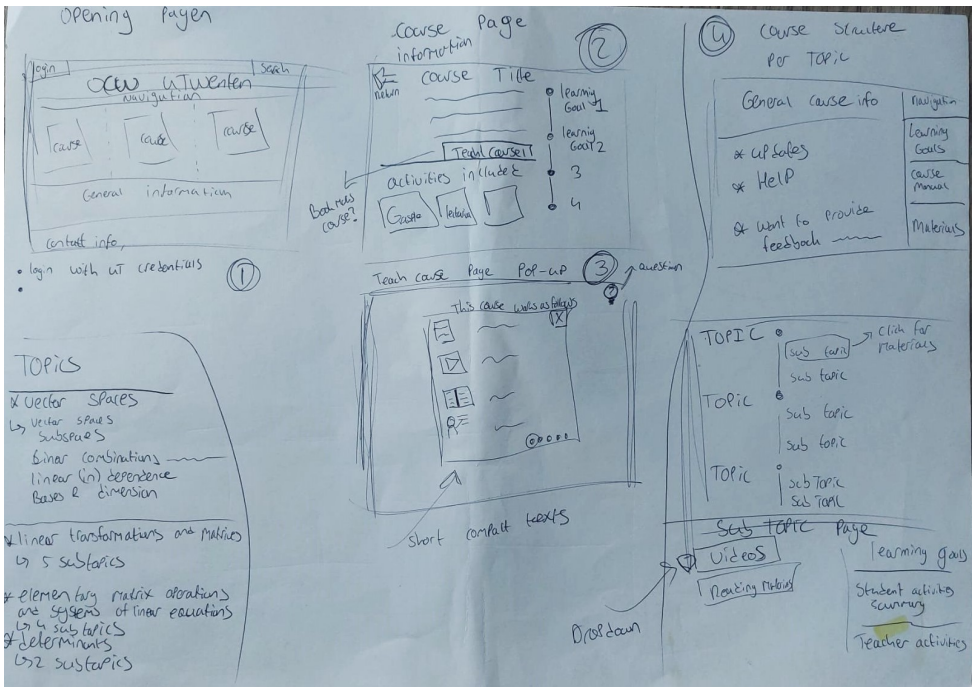


Figure 5.7: Linear Structures design ideation sketches

6 REALISATION

The realisation of this project will be done using Figma Design. Figma Design is a program that can be used to create, share and test any digital design for web pages, apps, mobile phones and so on [27]. Figma can help design early prototypes, but the software offers options to include all the interactions available in a real website or app. Because of this, the tool can be used to create completely functional prototypes. Figma has a lot of options to connect with other tools. It has several plug-ins to help develop the real product based on your Figma designs, such as an export to HTML. This can be helpful in the development phase. Next to this, it is an online program, which means that the designs and prototypes can be accessed from anywhere, this allows for easy sharing between designers, developers or clients.

6.1 Visual design

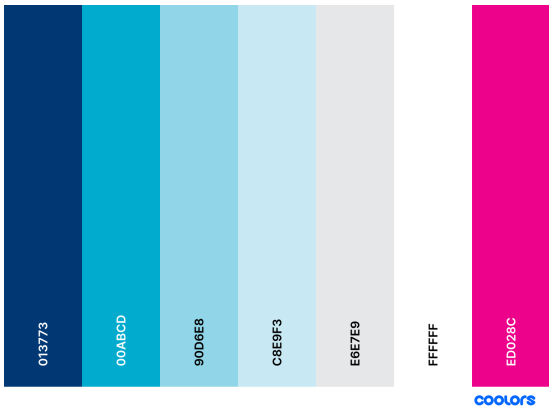
All the pages discussed in the upcoming sections have been designed with a width of 1440 pixels. This is a standard size in web design. During the process, first, the container of 1440 pixels width was created, after which the design sketches from Chapter 5 were used to place all the other containers. These are elements such as the header or navigation bar.

6.1.1 Colour usage

The visual design of the website is inspired by the style of the UT branding. This was done so that it would already fit with the idea of being used for more than just the Linear Structures course. The colour palette was created with Coolors [38]. This palette was based on the larger palette of UT identity colours. The colour palette can be found in Figure 6.1a. The colours are mostly centred around the blue colours, this is done to create a calm and ‘cool’ feeling on the web page. The pink colour was added as an accent colour, to add a bit of contrast between the colours. The Coolors web page allows you to test your colour palette for a variety of colour-blindness-related illnesses. The web page can show you how colours and the contrast between colours are perceived as different colour-blindness-related illnesses. Doing this helped identify how difficult it is to distinguish the lighter colours. This was taken into account when designing, the design tries to use darker colours with lighter shades, and not too many light shades in one element.

6.1.2 Font usage

The font of the UT was used throughout the design. The font family that is used within the UT is Linotype Univers. Different variations of this font are used throughout the design. These can all be found in Figure 6.1b. Next, some images from the UT visual identity were used throughout the design. These are chosen based on the colours of the colour palette.



(a) Colour palette for design

(b) Font family usage

Figure 6.1: Colour palette and font used in design

6.2 Landing Page

The first page that the user encounters is the landing page. The complete landing page is shown in Figure 6.4. The page can be separated into a title section, a navigation section, a hero image, a section highlighting new courses, a section introducing the user to the OCW initiative, and a contact section at the bottom. The prototype is completely interactive, so someone can visit the prototype web page and use it as if it were already a completely developed one.

On the top, the navigation bar has several interactions. A user can click the buttons in the navigation bar to navigate to other sections of the web page. The 'Home' button will lead the user back to the Hero image on the landing page. The 'courses' button will redirect the user to the courses page. The 'about' button will show the user the 'about' section. The 'contact' button will always lead the user to the contact section at the bottom of the page. This navigation bar keeps the same button and the same destinations throughout the different pages of the prototype.

6.2.1 Search fields

The search field is not completely functional, since that is a function that Figma does not support. The user can click on the search field, but it will send them to the courses page. It is mimicking the idea of searching for a course. The buttons in the navigation bar change colours when a user hovers over a button. This was done to help visualize where they are on the page and to show them that the navigation bar changes when interacted with. Figure 6.2 shows the default state on the top and the interacted state on the bottom.

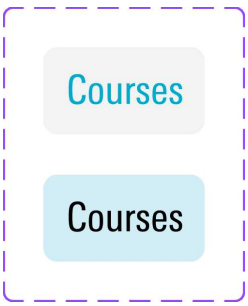


Figure 6.2: Changing navigation bar buttons

6.2.2 Hero image

The Hero image is a large image often with a title to draw attention. In this design the hero image is the large image of the University of Twente, together with the large search bar, the attention is drawn to searching courses. This search bar is not functional but sends the user to the courses page to mimic the search for courses. The image used in this Hero image was taken from the UT website.

6.2.3 New courses

The section for the 'New Courses' was included to help highlight new updates and additions for the OCW initiative. It provides a quick link to these highlighted courses. The user can click on each course and receive a pop-up as shown in Figure 6.3. Every course will show this pop-up, only the Linear Structures course page has been completely developed. The other courses were taken from the UT course catalogue Osiris [39].

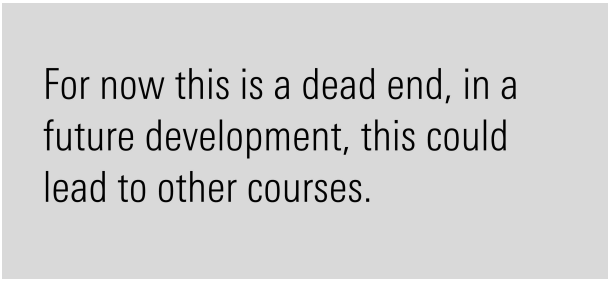


Figure 6.3: Pop up for dummy courses

6.2.4 About the OCW

The 'About the OCW' section provides a little bit of background information about this project and the OCW initiative. This section is not interactive, and purely informational. The image used in this section has been taken from the UT website. Below the 'About the OCW' section, a contact footer has been added. This footer is not functional but could link to the social media channels of the UT. This footer stays the same throughout all the different pages.

Figure 6.4: Landing Page prototype

6.3 Courses Page

The Courses page, Figure 6.6 can be accessed via the navigation bar on each page or the search fields. The general layout is similar to the landing page. On the top, there is a title, navigation bar, hero image, filter buttons, search field, and all the different courses. Below the large 'Courses' hero image, there are a few buttons that represent the idea of a filter for the course categories. The different topics are mathematics, physics, computer science, design, health and sustainability. The filter buttons will lead you to a course that is relevant to that topic because Figma is unable to filter content on the prototype pages. These buttons were developed in the same way as the navigation buttons, they change colour once the user hovers over them. In Figure 6.5, the default state can be found on top, and the hover state can be found on the bottom.

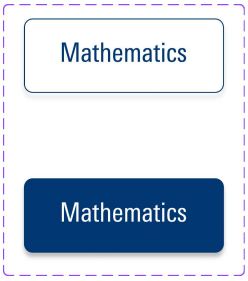


Figure 6.5: Changing filter buttons

6.3.1 Search bar

The search bar on the course page is a non-functional search bar due to the limitations of Figma. By clicking on the search bar the user will be led to the area on the page where the linear structures course is located. This is done to mimic the idea of the user searching for 'linear structures' in the search field.

6.4 Courses

Below the filter buttons and the search bar, all the courses can be found. Each course is clickable, but not functional, just like the courses on the landing page. Each course has a short description of the course and a representing image taken from a stock-free page called Pexels [40]. Below the courses, the footer, with all the contact information, can be found. This is the same as on the landing page.

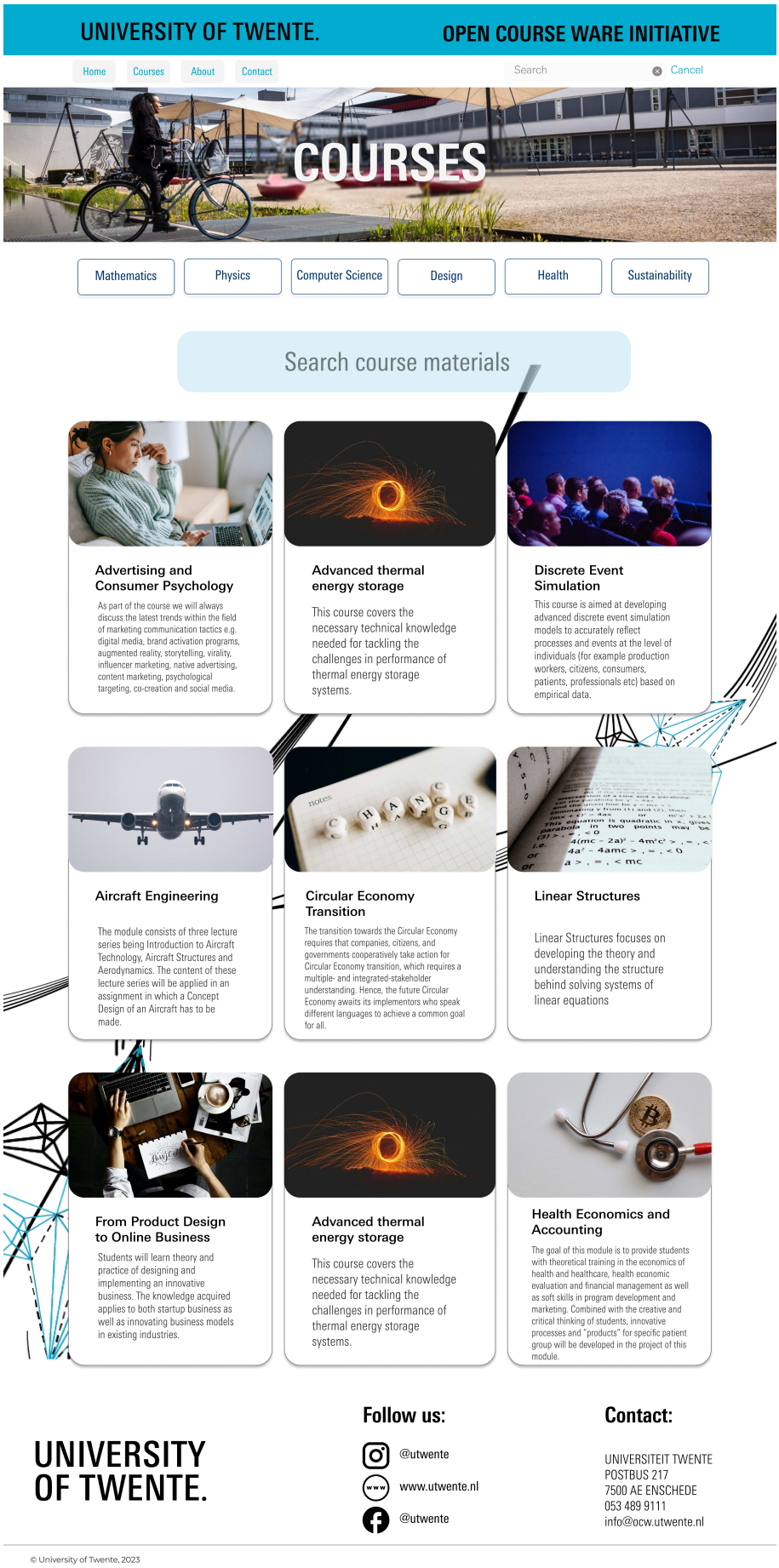


Figure 6.6: Course Page prototype

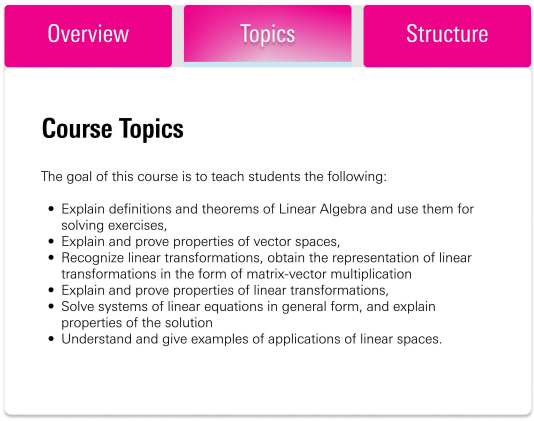
6.5 Linear Structures

The user will end up at the Linear Structures page by navigating through the other pages. The top part is similar to the courses page, and the navigation bar still allows the user to travel to the same pages. the only difference here is the 'Return to other pages' button. This was created to help the user return easily to other courses.

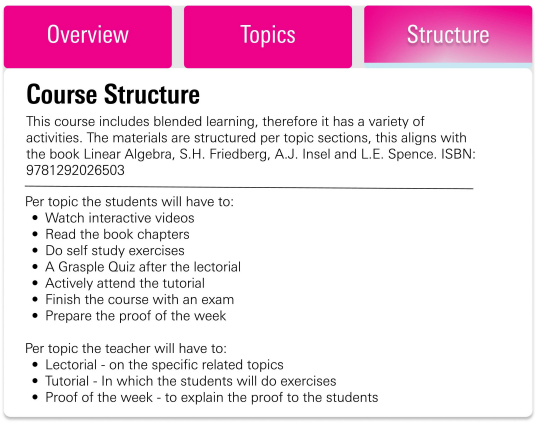
6.5.1 Tabs

One of the most challenging parts of this project was creating an overview that included sufficient information on the course. The decision was made to create three tabs. Each of the tabs contains general information about the course. When a user hovers over the button of the tab, the tab lights up white. When a user has clicked the tab and is present on that tab, a blue line appears under the button. This can be seen in Figure 6.8 or in Figure 6.7. The first tab is 'overview'. This tab includes the title of the course and a small informational text that describes what the course entails. Below that the estimated study load per week is given, as well as the original program that the course is used for. It states a publication date and a 'last updated' date. This was included based on the results of the survey in Chapter 5.

The second tab can be seen in Figure 6.7a, this tab discusses the topics of the course. It states the general learning goals of the linear structures course. The tab' Course Structure' can be viewed in Figure 6.7b. This tab informs the user that the course is based on a certain book. It provides an overview of all the student activities, as well as the teacher activities. The three tabs together are meant to provide a complete impression of the course to the user. Next to the three tabs, a section with some 'Quick Links' has been added. The user can click each of the 'Topics', leading the user to the learning materials of that specific topic.



(a) Information of the tab 'Topics'



(b) Information of the tab 'Course Structure'

Figure 6.7: Tabs 'Topics' and 'Course Structure'

6.5.2 Learning materials

Below the tabs and the quick links, the learning materials are presented per topic. An example of Topic 1 - Vector spaces can be seen in Figure 6.8. A topic is equivalent to about 2 or 3 sections in the book. Every topic was given a title that describes the topics from the relevant book section. Within the topic, all the learning materials are divided based on what type of learning material it is. This was inspired by how the course is currently structured on Canvas. Each of the boxes drops down, showing the user information on what the activity is. For some of the activities, a download button has been included. In Figma, this download button shows the user a pop-up similar to Figure 6.3. The text has been altered to fit with what their action was. So if they press 'Download Slides', it will show a pop-up saying: 'You downloaded the slides, click outside of this box to continue using the web page'.

In Figure 6.9 the drop-down boxes of each of the activities can be seen. All of the 9 topics have been added in the prototype. The topics in the prototype contain all the information shown on the Canvas page of the linear structures course. A tenth topic was added with 'General Information'. On Canvas this could be the week in which the exams are given. In this prototype, it includes download buttons for some sample exams. In the future, it could include a document that explains the Proof of the Week or something similar.

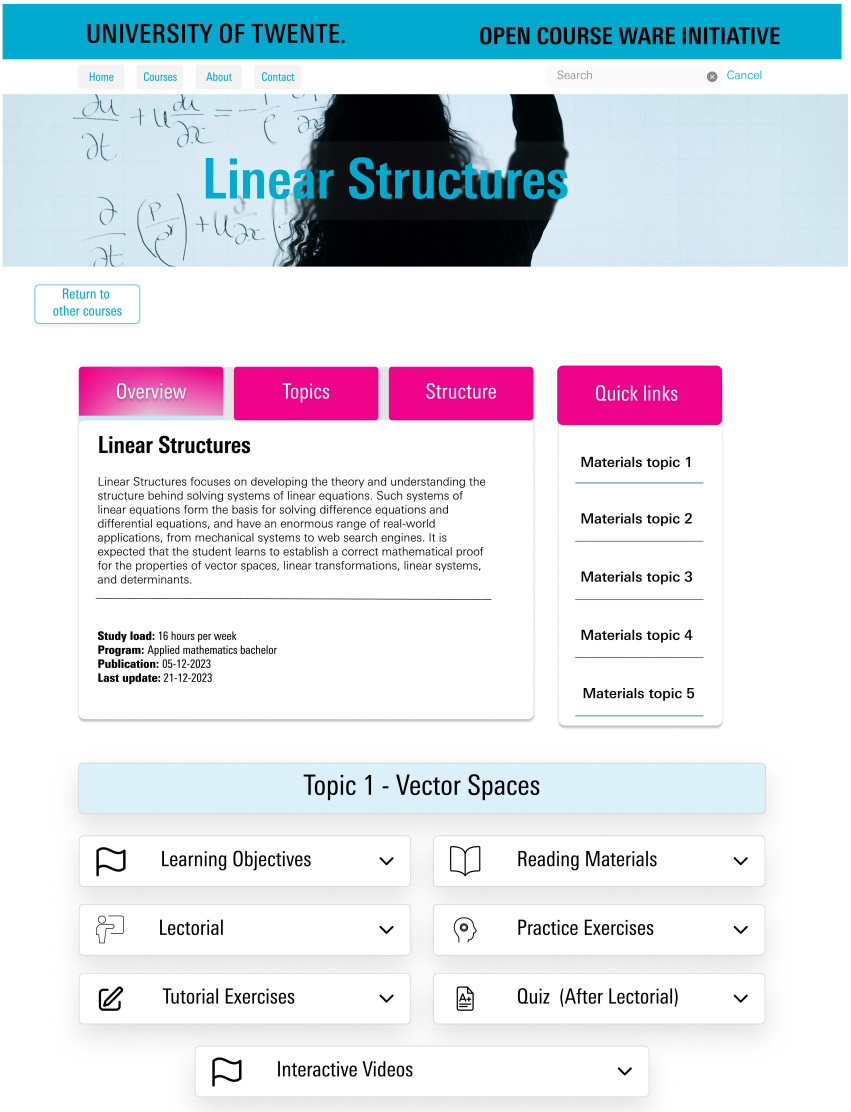


Figure 6.8: Top part of the Linear Structures page

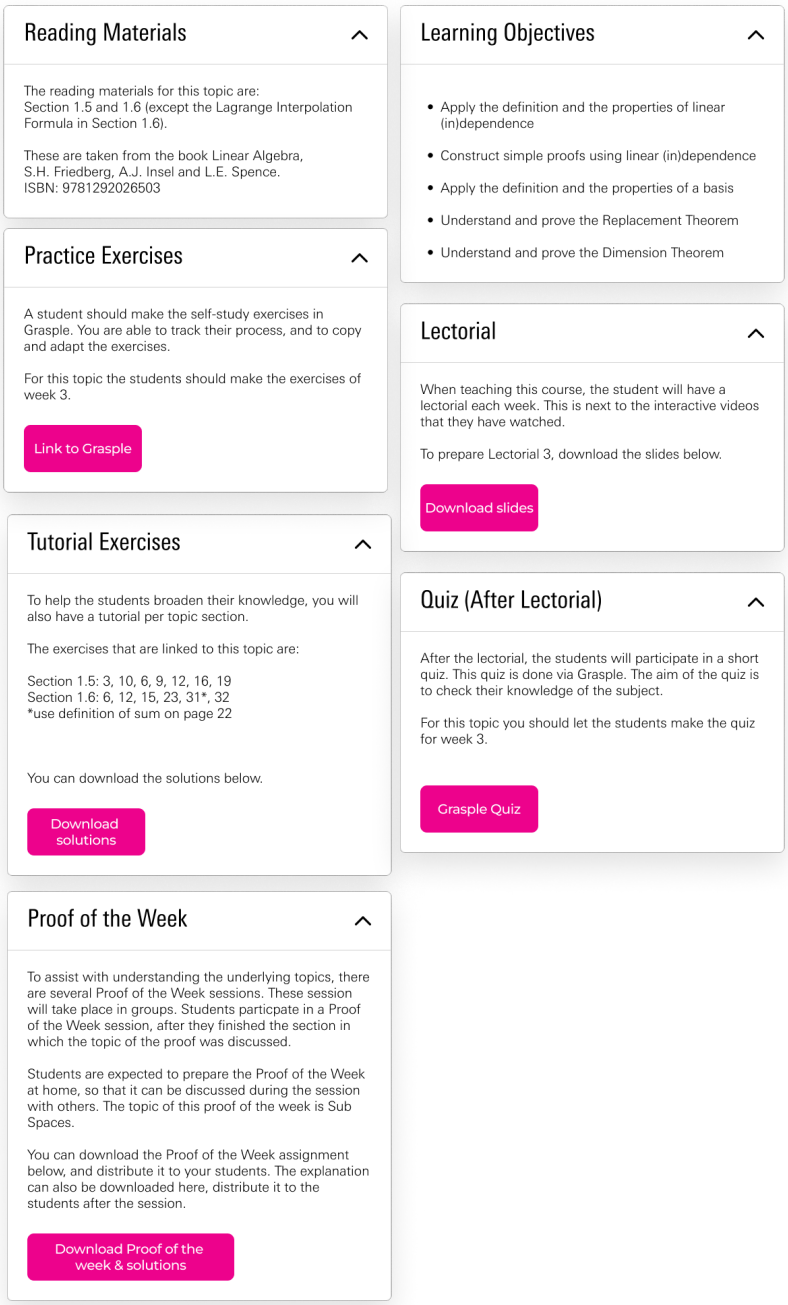


Figure 6.9: Drop down activities in topics

6.6 Compliance with design requirements

In Chapter 5, the design requirements for this project are discussed. In Tables 6.10 - 6.13 we show how the chosen design requirements are met in the final version of the product. Some of the requirements can not be fully evaluated, since the design should first be user-tested. This is often marked with a 'partial yes'.

	Information design features	Included in design	How is it included? / why is it not included?
Must	Overview page elements	Yes	The overview at the linear structures page has a variety of elements such as the title, general overview, study load etc. This was based on literature and the survey results.
	Learning objectives	Yes	Both per topic, and the course as a whole includes learning objectives
	Clear Website organization	Yes	The decision was made to structure the content per topic. The topics refer to sections of the book. This structured is used for the entire linear structures course.
Should	Understandable structure	Partial yes	The structure that was chosen, requires little explanation. The user tests will provide more information on if it is really understandble.
	Consistency	Yes	During the realisation the focus was put on using the same titles, and names for activities. The design for similar items has been supported with similiar colours and design features, such as one specfic style for buttons etc.
Could	Error recovery	Partial yes	Some options for error recovery have been added to the design. Such as the 'return to other courses' button, and the salient navigation bar. A 'help' section, was not added into the design.

Figure 6.10: Compliance with information design requirements

	Instruction design features	Included in design	How is it included? / why is it not included?
Must	Instruction clarity	Partial yes	User testing will provide more insight into whether the website is clear. The design was made to be clean and clear, to make sure the user would understand where to navigate to.
	Navigation structure	Yes	A salient navigation bar has been included. It stays the same throughout the different pages.
	Navigational aids	Yes	Several navigational aids where included, such as the clickable links leading to the different topics.
Should	Control of website	Partial yes	User testing will provide more insight into if the control really lies with the user. Right now it feels like it does, but it needs to be proven via user testing.
	Limit clicks	Yes	The salient navigation bar limits the amount of clicks to return to the landing page. Several other navigational aids also help limit the amount of clicks.
Could	Short website introduction	Partial yes	The focus was mostly put on explaining the course page itself. The website introduction has been reduced to some background information on the OCW.
	Search features	Yes	Several search fields were included in the design.

Figure 6.11: Compliance with instruction design requirements

	Interface design features	Included in design	How is it included? / why is it not included?
Must	Avoid visual overload	Yes	The design is very 'clean' with large spaces of one colour, or a white background. There are no moving images or illustrations.
	Design consistency	Yes	The style for certain elements was created and then applied to all the elements. The buttons all have the same form, and the same effects when hovering over them. The same goes for all the topics on the linear structures pages.
Should	Font consistency	Yes	The font sizes and types were set before writing and editing all the text. The scheme in Figure 5.1b was used throughout the entire website.
	Colour scheme	Yes	A distinct colour scheme was set for the project. These colours, and adaptation of the colors are used in the design.
Could	Distinct logos and icons	Yes	Every activitiy in the linear structures page has a corresponding icon to help distinguish the different activities even more. The logos and images of the UT were used to help represent the visual identity of the UT.

Figure 6.12: Compliance with interface design requirements

	Interaction design features	Included in design	How is it included? / why is it not included?
Must	Student activities	Yes	All the activities are included and explained in the design. The real access to them of course is limited by the functionality of Figma.
	Applicability of content	Partial yes	The user testing will provide more insight into if it is easy to adapt the content. For now the topics allow to re-use materials selected on book chapters and on the type of activities.
	Student-teacher interactions	Yes	These are all explained and included in the design. Topic 1 - 9 includes all the instructions and download buttons.
Should	Multi-media interactions	No	The interactive videos are not possible to be used within Figma. This is therefore more on the implementation side of this project, and therefore was not included. Ideas for the multi-media interactions will be shared later in the project.
Could	up-to-date content	No	A publication date, and a 'last edited' date were added to provide some information regarding this topic. However, there is way to check or keep resources up-to-date.

Figure 6.13: Compliance with interaction design requirements

7 EVALUATION

To get more insight into how and if the design requirements from Chapter 5 are being met, a user test is conducted. In Chapter 2 several frameworks were presented based on previous literature. For the evaluation of this project, the decision was made to evaluate both the usability and accessibility of the design. The usability of the design is evaluated with participants who receive a list of tasks that they have to perform within the prototype. Afterwards, these participants are presented with the System Usability Scale (SUS), and some additional questions. This was inspired by the evaluation framework based on the adapted user-centred design method [20]. For the accessibility evaluation, the WCAG guidelines are be used. This was taken from the research by Rodríguez et al.[1].

7.1 Usability evaluation

The group of participants for this study consists of seven participants, who are all related to either teaching, mathematics or interface design. The user evaluation is conducted one-on-one and can be either online or in person. First of all the participants receive some information on the project and what the purpose of the project as well as the evaluation is. This is done, so that all participants can sign an informed consent form. The consent form can be found in Appendix B. This research with human participants has been approved by the Computer and Information Sciences (CIS) ethics committee.

To get the participants in the right mindset, they are introduced to the idea of looking online for educational materials. In addition, they are provided with the knowledge that they are teachers in the field of mathematics and that they will teach a course that involves the topic of linear structures. They are not instructed on how the prototype works. The interface of Figma is explained to the participants since it is not relevant to how the prototype works. This is mostly information on how to exit or enlarge the prototype [41].

The participants are motivated to think out loud, these remarks will be written down by the observer. This can help identify what the user thinks about the prototype at that moment. Participants can ask questions if they get stuck. or are wondering about something. These questions will be answered in a way that does not affect the outcome. If participants need a hint, a hint might be given, and it will be noted that the participant needed a hint.

After these instructions, the participant receives a task list. They will have about 10 to 15 minutes to complete these tasks. The observer will write down if and how they finish their tasks. The tasks are set to help explore the prototype, each task is based on the task before so that the difficulty of the tasks somewhat increases over time. The task list consists of the following tasks:

- **Task 1.** Find a course that fits and aligns with your subject.
- **Task 2.** The university that you teach at, requires you to introduce the students to the definition of a vector space. Can you figure out if that is included in the course?
- **Task 3.** You are curious about how the course is structured, and if you can adapt it to your time schedule. Does the web page tell you anything about this?

- **Task 4.** You like to teach courses that let students do a variety of different activities, so not only reading and some exercises. Does the web page tell you anything about what student activities this course includes?
- **Task 5.** You are wondering what activities you as a teacher are involved in. Is it just lectures or is there more? Try to find out what the web page tells you about this.

After the time for these tasks has passed, or the tasks are all completed, the participant receives a survey that helps identify how the prototype performs. This survey consists of the System Usability Scale (SUS). The SUS is a Likert scale, which is a scale that forces the participant to make a certain choice [22]. In this case, it is a five-point scale on which the user agrees or disagrees with the statement. The complete SUS consists of ten statements discussing several topics regarding usability. The SUS can be found in Appendix C. The SUS was created in Microsoft Forms so that the results could be gathered digitally. After the SUS, the participants were posed with several questions regarding what they liked or disliked about the prototype. This also allows for some discussion on how the participant's experience with the prototype was. These questions are also included in Appendix C.

7.2 Results of usability evaluation

Every participant filled in the evaluation form shown in Appendix C. The first element in this form is the SUS. With the results of the SUS, a calculation can be made on how the usability experience of the participant was during the experiment. In the SUS there are five possible answers, every answer corresponds to a number ranging from 0-4. 'Strongly disagree' is 0, and 'Strongly agree' is 4. Based on the participant's answers we get a number for every statement. Statements 1,3,5,7,9 are calculated by: the participant's answer - 1, so x-1. Statements 2,4,6,8,10 are calculated b: 5 - the participant's answer, so 5-x. The ten statements are then summed up and multiplied by 2,5. This provides a score ranging from 0 - 100. This number represents the usability experience. The calculation is taken from the original SUS document by Brooke [22]. In Figure 7.1 the acceptability, or interpretation of the final SUS scores can be found. This Figure is based on additional research on the SUS scores by Bangor [7].

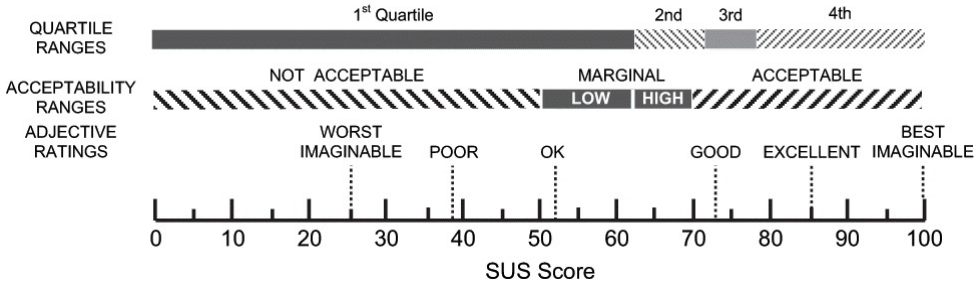


Figure 7.1: Interpretation of SUS scores from [7]

7.2.1 SUS results

The results of the SUS scores are displayed in Figure 7.2. Six out of seven scores are 85 or higher, When we look at Figure 7.1, we can interpret these scores as an excellent user experience in terms of usability. There was one user who had a much lower user experience score compared to the other participants. This user has a score of 57,5 which can be seen as an 'OK' user experience. It is important to identify why this user had such a different user experience so that we can learn from their difficulties and adapt the design to it. After reviewing the notes of this user test, it became clear that the focus of this user was on the design, and looking very closely at design details. Therefore, the user lost track of what the tasks were and how the user would be able to complete them. This impacted the user experience negatively. In a future user test, it might be needed to emphasise on using and exploring the website, rather than get focused on minor design choices. All the other users were also asked if they were able to perform the tasks easily. None of them had any trouble with the tasks, which aligns with the SUS scores.

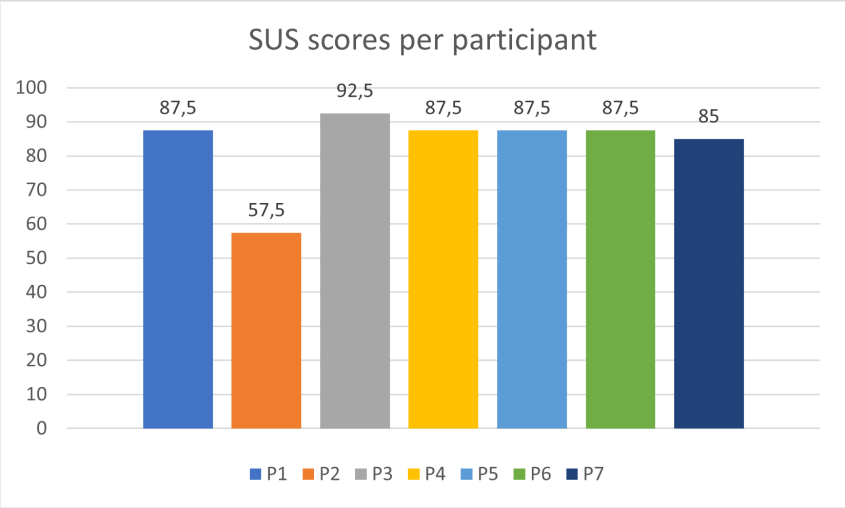


Figure 7.2: SUS results of user testing participants

7.2.2 Additional questions

After the SUS, the participants were asked to fill in a few additional questions to highlight what they did and did not like about the prototype. First some of the positive reactions to the prototype. There were several comments related to the structure of the Linear Structures course, and the appearance of the prototype. Users responded to the prototype with the following statements:

- 'Clear overview of the contents each week.
- 'Handy quick links to all the materials per topic, the website fits well with the visual identity of the UT'
- 'Clear structure, professional appearance.'
- 'Clean design, good emphasis on activities.'
- 'Clear overview of the ingredients of the system.'
- 'Good clarity and structure, there was a clear overview.'
- 'Clear layout, nice environment (visuals), clear links to the courses and topic and so on.'

These statements align with the positive SUS results, underscoring users' appreciation for the organized structure and effective presentation of course materials in the prototype.

Points of improvements

Users provided several points of improvement as well. In the survey, the following statements were given:

- 'More quick links.'
- 'Some things can be made to be more user friendly.'
- 'At this point some it wasn't clear what the activities entail exactly (like proof of the week and lectorial). this should be made clear and specific per activity.'
- 'Lacking explanations of some of the components of the system.'
- 'The quick link box, there were some topics missing and including the title per topic would be helpful.'

This feedback can be summarized in two general areas of improvement: explanation of activities, and quick links or navigation. Not only after the user test feedback was provided, but also during the user testing. As a researcher, it is interesting to compare the areas of improvement from during the user test, and after the user test to see if they touch on similar topics.

Explanation of activities

A frequently mentioned feedback point was the need for more explicit explanations of activities. In the design, topic 10 was included to provide general information, this could include things like exams, or explanations of how the proof of the week works. During the user testing, it became clear that many users did not understand what was expected from them with the proof of the week, or the lectorial. This feedback was provided by users both during the user testing and after the user testing.

To improve this in the design, in the tab 'Overview', see Figure 6.7, a button could be added as a quick link to the general information topic. In this general information section, the various activities could then be explained. For example, an explanation of what teachers need to do for the proof of the week and what students should expect can be provided. This can be done for every activity. Additionally, for the proof of the week, it was unclear that the proof was not present every week. This information could be added to the general information about the proof of the week. Another proposed addition is to add the information that the self-study exercises are also from the book used in the course. This was proposed to add more clarity as well.

One of the users mentioned that 'reading mathematics, is not just as simple as normal reading', adding an explanation about how to read a mathematical book would be beneficial for the course. Another suggested improvement regarding the activities, is the order of activities. Users asked if the order of the activities is the order of how the course works. This is somewhat the workflow of the course but could be highlighted more by explaining the order of the activities per topic or per week. This information can be provided in the general overview, aiding the user in the navigation through the course.

Quick links

In the survey, feedback was given regarding the quick links and navigational structure of the Linear Structures page. This became evident during user testing as well. The naming and content of the tabs in Figure 6.7 can be changed to improve the usability experience of the user, and the clarity of the course. The tab 'Topics', can be changed to 'Course Content'. Instead of the overarching learning goals, several users suggested that it would be better to list all the course topics and the corresponding book sections. This would provide more information about the course topics than the general learning goals of the course. An additional improvement would be to change the 'Structure' tab, to the 'Course Organization' tab. According to a user, this aligns better with the contents provided in that tab than 'Course Structure'. In this tab, an additional improvement can be made, this would be adding the number of contact hours per topic, to provide more information on what it would be like to teach this course. Some other changes were proposed by users to change the wording of a few elements. For example, change 'Students will have to', to 'Students will', to make it sound less 'mandatory'. The idea was also proposed to change the name of the activity 'Practice Exercises' to 'Self Study exercises'. Changing the wording could help with showing which activities are done by the students and what is meant for you as a teacher.

In the 'Overview' tab, a user mentioned that it would be handy to provide information on the course's prerequisites. Is it also possible to use this course for a study like Mechanical Engineering or something similar? Osiris often provides this information, so the user mentioned it would be beneficial to provide it in this tab as well. Providing some context in which the course is given within the UT could also help identify users if the course aligns with their purpose or wishes. Besides this, there are also several comments on the naming of the 'Quick Links'. According to several users during both the user test and after the survey, it would be clearer if the quick links had their respective topic names instead of numbers ranging from 1-5. This was overlooked during the realisation process, and would be an adaption that is easy to carry out, but would help the usability to a great extent according to the users. There was another remark regarding the font size of some of the text. One user had difficulty with reading the text. All the text sizes used in the prototype are 12pt. or larger, so to conclude if the text in the prototype is too small to read, maybe more user tests are needed. It was now only one of seven participants that mentioned this problem.

Realisation of prototype

Users provided some suggested improvements that are more related to the realisation of the prototype but are worth mentioning. One of the ideas for an improvement by a user was the option of a contact form so that the user could get in contact with the author of the course. In case there are questions, they would be able to ask the questions. This idea is something that would need to be discussed with the authors of a course; are they open to the idea of a contact option? Another user asked how courses and course materials would be uploaded. Designing that part of the interface was excluded during this project because it is more related to how this project is realised. However, it is something important to consider once the prototype is ready to be developed. The last remark regarding the realisation of the prototype was the download buttons. Once the prototype is developed, would the user download a lot of separate documents? Or would the user download a ZIP file with for example both exercises and explanations of the exercises? This would also depend on what the software will be able to support.

Visual design

To end with, the users were asked to say something about the visual design of the website. The responses overall were very positive. Many users said that the design is clean and calm to look at. One user disliked the colour pink but mentioned he was not a big fan of the UT colours in general. A user mentioned that the prototype seemed calm due to the simplicity of all the buttons. The user liked the fact that there were not unnecessary many buttons or options to click on. Regarding the visual design, there was one suggested improvement by a user. This is to highlight the different sections between the tabs and the topics below. The user felt that the two sections should be distinguished more.

7.3 Accessibility evaluation

Since the prototype is not a finished website, it is not possible to use an online WCAG guideline checker such as TAW [42]. TAW is an online website accessibility checker that was proposed and used in the paper of Rodríguez et al. [1] to check webpages according to the frameworks of the WCAG 1.0 and 2.0. However, the Web Accessibility Initiative (WAI) has a list of 'easy checks' to do a first review of web accessibility. This list consists of the following elements [43]:

- Page title
- Image text alternatives
- Text: headings, contrast ratio, resizing text
- Interaction: keyboard access, visual focus, forms, labels and errors
- General: moving, flashing or blinking content, multimedia alternatives and basic structure check

Page titles

Regarding the page titles, it is important by looking at the tabs in your browser, that the page that you are on has a title. This helps with orientation and moving between pages according to the WAI. If you currently open the prototype, the name 'Page 1 - Bachelor assignment' will be shown. As seen in Figure 7.3. If you navigate through the pages, this name will not change. This is probably because the prototype is hosted within Figma. For the realisation of the prototype, the accessibility can be improved by adding page titles such as: 'Home | UT OCW', 'Courses | UT OCW', and 'Linear Structures | UT OCW'. The title should briefly describe the contents of that specific page.

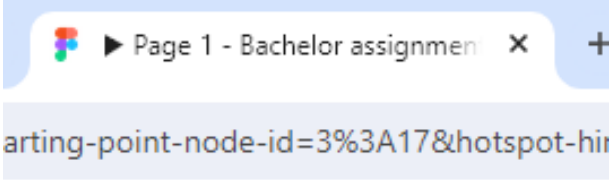


Figure 7.3: Web browser page title of the prototype

Alternative text

The second accessibility check is about alternative text, which is used to describe the contents of an image, illustration or video. This is often used by people who are blind or have limited visibility. The alternative text is a substitution of what is portrayed on the webpage, it should keep the same user experience. WAI [9] gives the example of a magnifying glass, which is used to annotate a search field, and not necessarily the magnifying glass. In the current prototype, there is limited use of images, however, they do not include alternative text. The images in the design are mostly decorative, which can be excluded from the alternative text. The best option would be to have alternative text, informing the user that the image is decorative. After some additional research into this topic, it became evident that Figma has a plugin called Stark [8], that allows the design to include alternative text in the design. This plugin could be used to improve the prototype in terms of accessibility. Figma does include an option for screen reading so that it can also be evaluated by users who use screen reading. Figure 7.4 portrays this option.

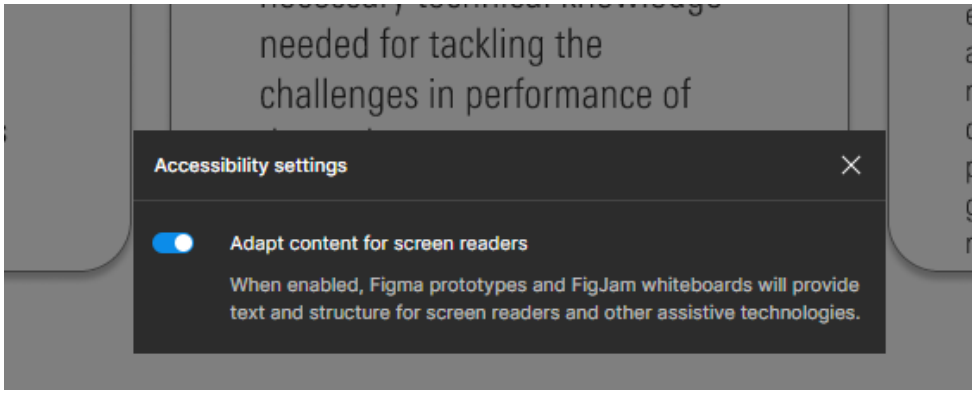


Figure 7.4: Figma screen reading option

Text

The next item on the checklist is text, which consists of headings, contrast ratio and being able to resize text. Firstly headings, these should have a meaningful hierarchy to help separate certain different sections of text. So, a title should be larger and could be bold, whilst the text of some content will be smaller. For this check, every page has to have a header on the page, and the hierarchy of the text needs to be marked up, ranging from large titles to smaller background information. In the prototype, every page has a header, and based on this the hierarchy was continued. This is shown in Figure 6.1b. The next check is about the contrast ratio, not everyone can read text well if the contract between the background and the text itself is not large enough. This is often the case for people with visual impairments. Other people with reading disabilities might prefer a contrast with low luminance. A web browser should be able to adjust to this. The minimal contrast as described by the WAI, is checked with the Figma plugin Stark. The prototype only contains two colours of text, which are black and white. All the other used colours were tested against these colours of the text. White text only passed the contrast test against the dark blue colour in the colour palette 6.1a. Luckily white text was mostly used on the dark blue colour. On the Linear Structures pages, the white colour is also used on pink. To improve the contrast it would be better to change the text colour to black on pink. The black text passed all the colours, except for the dark blue colour. An example of the test can be seen in Figure 7.5. Something else that should be checked regarding the text, is the ability to resize text. This was unable to be checked since the Figma interface can only resize the entire screen and not small sections for text. If you currently resize text, it will most definitely overlap with other sections,

or disappear from the screen. This is also because Figma is not responsive in resizing the text. This is something that needs to be checked once the prototype has been developed into an actual web page. One of the user participants specifically said that the website was easy to read, this user was colour-blind, this was explained after the user test, but it was positive to hear that the website was still easy to read.

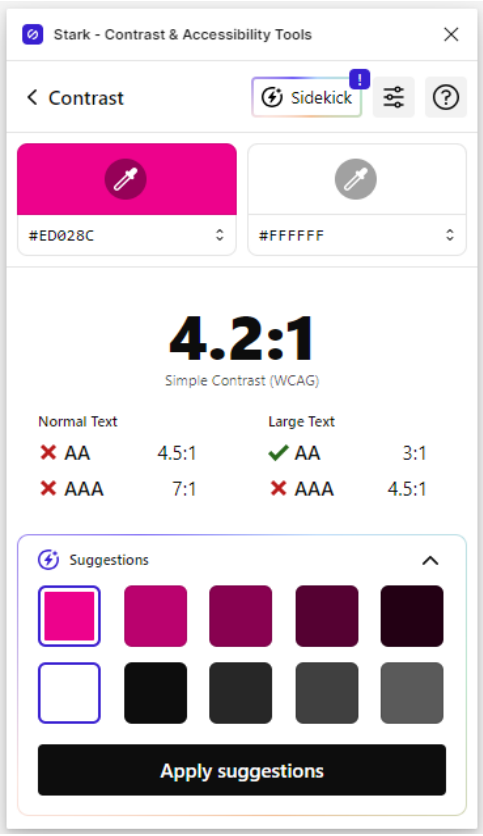


Figure 7.5: Contrast check between white and pink with Stark[8]

Interaction

The checklist for interaction consists of keyboard access and visual focus, and forms, labels and errors. The keyboard access and visual focus are checked since a lot of people cannot use a mouse to interact with web pages. Visual focus is used to help guide people using only a keyboard to the fields that they can interact with. Currently, the prototype does not score high in this category, already during the user test it was discovered that scrolling on the web page is only possible with a mouse. All other interactions are currently also set to 'mouse down' or 'mouse up'. This was done to limit the amount of interactions that were to be set within Figma. For future development, it would be necessary to also accommodate navigation per keyboard on the website. The visual aids are optional in Figma but are used as hot spots to help users through the prototype. This was disabled for user testing since the question was whether or not users would be able to understand the website themselves. The forms, labels and errors check, mostly focuses on if these elements are labelled and have clear instructions when needed. The only fields that are used within the prototype are the various search fields. These all have a field with 'search for...' to provide more information on what action can be taken there. Since the website does not include any other forms and therefore errors in forms, this element will be excluded from the accessibility test.

General

The general checks are moving, flashing or blinking content, multimedia alternatives, and basic structure checks. With moving, flashing or blinking content two problems can arise: understanding the moving content, and distraction from moving content [9]. If elements start moving some people find it harder to process, content may move too quickly before it can be processed. The distraction from moving content is problematic with people who already have difficulty focusing. It could also be problematic for people who are prone to having seizures, such as people with epilepsy. In the prototype moving contact is mostly used on the Linear Structures page, in the section with all the topics. The guideline of WAI is that this is problematic if it lasts more than 5 seconds and starts automatically. Or if it contains auto-updated information, or flashes/blinks more than three times in one second. The movements in the prototype are unable to do either of these, therefore the movements that are present in the prototype adhere to the accessibility guidelines.

The Multimedia alternatives check is regarding audio and video alternatives, similar to how images have alternative text. Since Figma was unable to support the interactive videos, only images of the videos have been included. Because of this, it is unnecessary to check the videos and audio for accessibility. This check will need to be conducted as soon as the videos are included and functional within the design. The basic structure check focuses on the design of a web page as a whole. What is the flow of the website? If users make use of screen readers, it is easy if the entire website can be restructured into one column. An example of this can be found in Figure 7.6. To perform this check, we need to turn off all images, and style sheets and adjust them so that everything is in one column as shown in Figure 7.6. Figma is unable to do this, but the two areas of improvement are indicated by hand. The prototype was mostly designed to be read from top to bottom, however, an element like the navigation bar breaks this flow. The same applies to the Linear Structures page. the tabs section is sideways, and the topics go from top to bottom. This element of accessibility should also be further evaluated once finished with the realisation of this project.

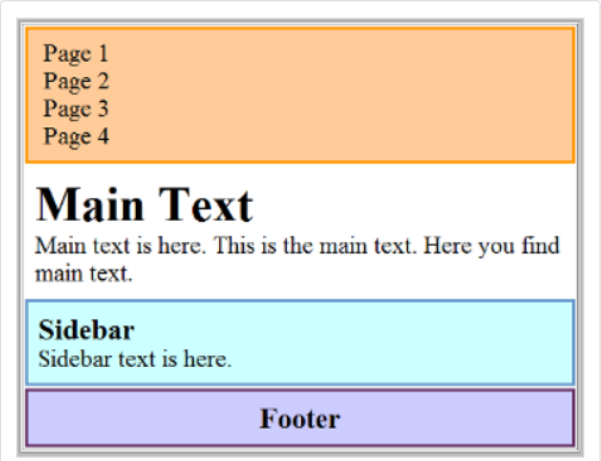


Figure 7.6: Basic one column page structure from [9]

7.4 Conclusion of evaluation

The evaluation of the prototype aimed to determine the levels of usability and accessibility. This involved user tests for usability and applying the WCAG guidelines for the accessibility evaluation.

The usability evaluation included tasks regarding the prototype performed by seven participants which were related to the field of teaching, mathematics or interface design. The participants explored the prototype and provided feedback using the SUS survey. The SUS results were positive, rating six out of seven participants with a usability score of 'excellent'. One participant struggled with the interface due to a focus on design details rather than task completion. After the SUS participants were asked several questions to help them express their opinion about the prototype. The main takeaway from these results was positive results on the prototype's structure and clean design. The negative feedback was centered around the explanation of several activities. Other feedback was mostly related to re-phrasing several words or activities to enhance the clarity of the prototype.

The accessibility evaluation was somewhat limited due to the prototype not being a finished web page. However, the accessibility evaluation was able to check several aspects like page titles, alternative text, text readability, keyboard accessibility and visual focus. The prototype has room for improvement in the area of alternative text and keyboard navigation. There is certainly room for improvement in the area of accessibility. However, some areas already score well on the accessibility checks. Such as the text contrast, text hierarchy and moving content. Several checks were not possible to check entirely, these checks need to be included in future design and design evaluation.

Positive feedback on the prototype's visual design mentioned the clean and calm appearance. Some suggested improvements were including a contact form, designing the interface of how to upload material and refining download options. In conclusion, the usability evaluation indicates positive feedback with some suggestions for improvement. The accessibility evaluation helped highlight areas that need improvement to adhere better to the WCAG guidelines.

In Chapter 6, the compliance with design requirements is discussed. Several requirements were labelled with a partial yes. The following requirements were able to be tested during the user tests:

- **Information design - Understandable structure** There were no noteworthy problems regarding the structure of the prototype. Most users were able to complete the tasks without setbacks. The structure of the course materials became evident during task 3 of the user test, users were all able to explain the structure of the materials as well. This requirement can be marked with a yes.
- **instruction design - Instruction clarity** The users had to navigate to the Linear Structures course in task 1 of the user test. They all had varying ways of doing so, but all users were able to find and navigate the course easily. This requirement can be marked with a yes as well.
- **instruction design - Control of website** One user showed trouble with the website, this also became evident in the SUS score. Other users were able to use the prototype well and had no trouble performing the tasks. This requirement is marked with a yes after the user tests.
- **Interaction design - Applicability of content** Task 3 of the user test asked users to figure out how they would need to adapt the materials to their schedule. During the test, the user was able to explain how they would restructure the content to their schedule. The users understood that the course was based on a book and that the topics were based on book sections. The adaptability was clear to users, therefore this requirement is marked with a yes.

8 DISCUSSION AND FUTURE WORK

Based on the design requirements in Chapter 5, a prototype was developed. This prototype has been evaluated with a user evaluation as described in Chapter 7, showing insight into usability and the accessibility of the developed prototype. The prototype was generally perceived as positive, and several users were excited about the idea of using this platform in the future. However, throughout the process of this thesis, several points of discussion and limitations have been identified.

OCW initiative and the design process

The conclusion of the literature review led to using the idea of an OCW initiative for this project. The idea of an open accessible platform that is free to use aligns well with the vision for this project. In the section of the literature review information was provided about the OER and OCW and how OCW can be evaluated using evaluation frameworks. Reviewing the design phase the focus drifted away from the OCW, to how to design a platform. The prototype was developed and evaluated with the idea of an OCW in mind throughout the process. However, it cannot be clearly explained to what extent it currently adheres to the ideas and regulations of an OCW. Future research and further development might have to look into what specific elements should be included to adhere to the standards of the OCW. This research lays the groundwork for the idea of developing an OCW and creating an initial design, it is not a developed, functioning OCW platform. The next step would be to incorporate the user feedback, and start checking the standards of an OCW, and how this can be implemented.

Figma Design for development

This leads to the next point of discussion, the choice of using Figma Design [27]. The choice for Figma Design was extensively discussed in Chapter 6, however, resisting the realisation process, it might have been better to realise earlier what the limitations of Figma were. The task for this thesis was to make the design for a platform, and not to develop it. However, during the user testing, it became evident how much more insight users were giving by being able to click around in the prototype. In hindsight, the problem with Figma is that it does not support all the interactions that would be needed for the final product of this project. It might have been better to develop initial designs in Figma, and then develop an interactive website using an easy web-building tool like Wix [44] or WordPress [30], to help with creating all the interactions. During the creation of the prototype the limitations of Figma became clear. It would have been better to look into the limitations of Figma, and if it was the best tool to develop the prototype with interactions in. For future development, it is better to move to a new tool that supports all of the functions required for this project. Shifting to another tool during this thesis was outside the scope of this research. The aim was to create a design for a platform, which was decided to be done in Figma

Course activities

The user testing identified several unclarities surrounding the activities of the Linear Structures course. These unclarities were mostly caused due to the assumption that the activities would 'speak for themselves'. During the realisation process, it would have been important to participate in some activities of the course, to ensure understanding of the activities. This understanding of the activities could then be used in the design and the realisation of this project. Some of the activities were much more complex for others to understand than was expected beforehand. It would have been better to experience the activities and to read more into the details of every activity. For the future improvement of the explanation of the activities, it is necessary to use the course manual more, and meet with the course authors to improve the explanation of the activities.

Iterative user testing

User testing is often an iterative process, users provide feedback, and then the prototype is updated until the product is good enough for further development. In Chapter 7, a lot of suggestions were provided by the users for improvement of the prototype. In this thesis, only one round of user testing has been finished. This is mostly due to time constraints since updating the prototype and organising new user sessions would take a significant amount of time. An example of what could have been concluded is that one of the users had a lower SUS score, it would be interesting to improve the prototype and do a second round of user testing to conclude if there is a real usability problem, or if it was an outlier result. For future development, the advice is to implement the feedback as described in Chapter 7, and then do another round of user testing with a prototype or early development of a website, to conclude if the improvements helped the design. After that, the product can be developed.

Uploading materials, and copyright

Something that was pointed out during the user tests, is how learning materials and courses will be uploaded. This was not taken into account during this research. In addition, it could be important to have an intuitive interface for the uploading side of the prototype as well. Taking this into account in the future is important since there need to be educators who are willing to upload to this website. Next to this, it is important for future development to address the copyright license of the learning materials on the website. A potential approach is adopting licenses such as the Creative Commons CC BY-NC-SA 4.0 DEED [45] license. This license allows for sharing and adaptation of the materials, as long as the author is referenced and it is used for non-commercial purposes. Copyright is a difficult topic, and will probably be one of the reasons why people are not keen on sharing their materials freely. In future research, more focus should be put on the copyright of the to-be-shared materials. During this research, the topic of copyright was not investigated since it did not directly affect the design of the prototype, it will, however, affect the final development and publication of the product. For the future development of this project, in addition to being able to upload the materials, it is necessary to investigate how to ensure the quality of materials that are uploaded to the platform. In Chapter 2 we discussed that the early pioneers wanted to ensure high-quality learning materials, if the name of a University like the UT is connected to an OCW initiative, it is important to determine a method that can ensure the quality of learning materials. Maybe not everyone should be able to upload materials randomly, or the materials should be checked by a sort of admin first. To continue the development of this project, a strategy needs to be created regarding the quality of materials.

Concluding recommendations

In summary, this thesis realised the initial step towards the development of a blended learning platform. In both this Chapter 8 and Chapter 7 several recommendations are made on how to move forward with this project. The next step is incorporating the user testing remarks into the prototype. This should be followed by improving the functionalities of the design by developing it in an appropriate development program. This process needs a focus on addressing copyright, quality and OCW standards. After these improvements, user testing can be done to conclude the improvements of the project. If the prototype satisfies the needs of the users, and the authors of the course, the main objective will be to gather support for further development of the platform.

9 CONCLUSION

The main question throughout this thesis was: How to share blended learning course structures and course materials? This was discovered throughout this thesis, starting with a literature review and ending with a prototype. This process was guided by four research questions which provided insight into how to share blended course structures.

RQ1: What is the purpose of the OCW initiative, and how is it connected with the distribution of digital educational materials?

In the research on Open Educational Resources (OER) in Chapter 1, we delved into Course Ware concepts such as MOOCs and OCWs. The primary goal of the OCW initiative is to provide free and open access to educational materials, organized as courses. Rodriguez et al. [1], provided insights into how the OCW aligns with the vision of the OER: sharing educational materials to provide an opportunity to share, use and reuse educational materials. The vision of both the OER and the OCW align with the vision for sharing blended learning materials, we wish to share a course and provide free and open access to it.

RQ2: Which frameworks are present in the assessment and development of current OCW initiatives and how can they be used for user evaluation?

Section 2.1.2 discusses five frameworks used to evaluate OCW initiatives, which are presented in Table 2.2. These frameworks are: an adapted User-Centered Design method including requirement engineering steps, five-factor usability evaluation, accessibility evaluation using WCAG guidelines, accessibility evaluation with WCAG guidelines + three-factor usability evaluation, and an inclusivity evaluation using Gendermag. For the user evaluation in Chapter 7, these frameworks were used as a foundation to determine what and how to evaluate the prototype. The System Usability Scale (SUS) from the adapted UCD [20] was used to evaluate the usability of the prototype. The accessibility evaluation with the WCAG guidelines by Rodriguez et al. [1] was used to evaluate the accessibility of the prototype.

RQ3: How can the user interface of the online platform be designed to ensure ease of navigation for educational professionals?

To make sure that the interface of the prototype would ensure ease of navigation, research into currently existing OCW initiatives was done. This research was combined with a survey which was sent out to different (mathematical) educational professionals. The results of the survey in Chapter 5 are focused on the overview of a course, and on two platforms as a whole. The feedback on questions 5 and 6 provides insights into what elements could be improved based on existing OCW initiatives. Positive feedback was provided on a clear, and minimalised design, which was mostly achieved through the clear organization of materials. The points of improvement were focused on lacking information or access to information which hindered the navigation through materials specifically. This feedback together with research from Tosho et

al. [37], and Garret et al. [36] formed requirements which led to the following implementations in the prototype to ensure ease of navigation:

- Clear website organization - The materials are structured according to a book. This helps the ease of navigation between the learning materials specifically.
- Understandable structure - The structure of every web page is continuous in the design of the same header and footer information, The structure always moves from top to bottom. The user test in Chapter 7 has shown that 6 out of 7 participants were able to perform their tasks easily and did not need explanation for how the website is structured.
- Consistency - Ease of navigation was achieved through consistency in using the same titles, colours, similar button styles and design styles throughout the web page.
- Navigation - A salient navigation bar, quick links and navigation aids were added to help navigation of the website. In the user tests it became evident that users were prone to using the quick links, which helped the users to finish their tasks.

RQ4: How can a platform support easy adaptation of shared materials to suit the needs of different educational contexts?

Questions 7 and 8 of the survey in Chapter 5 helped identify ideal structures for the learning materials. Figure 5.4 shows the diversity in answers of how a course should be structured. The answers to question 8 provided even more diverse wishes and needs for an ideal platform. This shows the need for the possibility to adapt the shared materials. The answers in Figure 5.4, identified the preference for a structure per week, and per learning goal. To ensure adaptability, both structures were used in the design. The concept of weeks was changed to ‘topics’, a topic is based on certain sections of the book. In these topics the materials are split up per type of material, it also includes the learning goals per these topics. This allows for several options to adapt the materials. The user evaluation of Chapter 7, included task 3 in which the user has to figure out how to adapt the materials. This task was performed by all the users and was perceived by the users as easy.

Conluding remarks

In conclusion, this thesis has provided an exploration of sharing blended learning course structures and materials. From understanding the purpose of OCW initiatives to designing a user-friendly interface and supporting adaptability, it all contributes to the overarching goal of collaborative and accessible educational resources.

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A FUNCTIONALITIES SURVEY

Blend it, Share it - Functionalities questionnaire

Dear Sir/Madam,

For my bachelor assignment, I am developing a digital platform aimed at sharing educational courses and learning materials, focusing on the Linear Structures course at the University of Twente. This questionnaire aims to gather insights for the platform's design, with a specific focus on functionalities, aesthetics, and the relationship to education.

The questionnaire will be anonymous, so I will not save any personal data.
If there is anything unclear about the questions, or you want to reach out to me, please send an email to n.a.klein@student.utwente.nl

Thanks in advance for filling in this questionnaire!

Kind regards,
Nikita Klein

* Vereist

1

How many years have you been in teaching? *

2

On the internet, a lot of educational materials can be found. These can be online textbooks or exercises, but also complete courses, with a course manual, exam, course structure and so on.

How likely are you to reuse materials from somebody else for your own courses? *

- ◯ Very likely
- ◯ Somewhat likely
- ◯ Neither likely nor unlikely
- ◯ Somewhat unlikely
- ◯ Very unlikely

3

How do you determine if online educational materials align with your courses?

Please specify the criteria, such as the relevance of the content, source credibility etc.

If you are not likely to use online materials, please explain your reasons for this choice. *

4

To understand the course's content, which elements would you like to see to get an overview of what the course is about?

Please select the ones that are most important to you. *

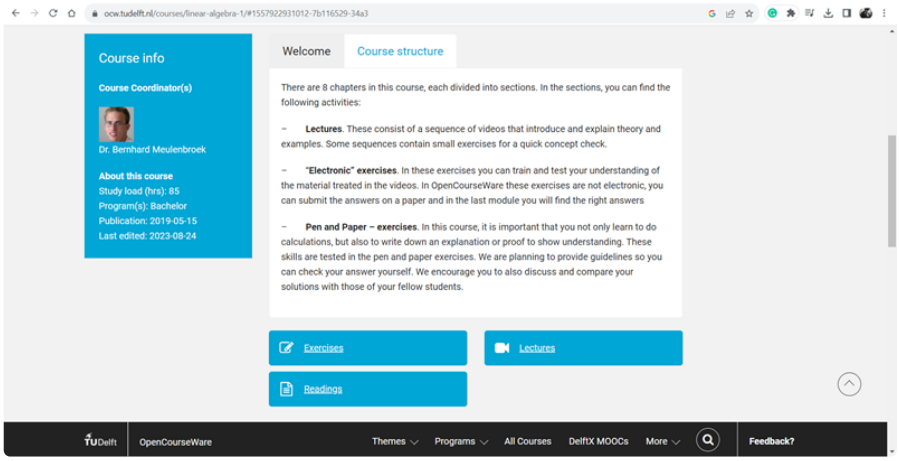
- [ ] Title
- [ ] Learning goals
- [ ] Student activities (e.g. exams, exercises, reading papers)
- [ ] Teacher activities (e.g. lectures, feedback sessions)
- [ ] The educational organization
- [ ] The authors
- [ ] Last edited / last updated information
- [ ] Work load of the course
- [ ] Structure of the course
- [ ] Short introduction of the course
- [ ] Andere

5

This is the interface of the open courseware of TU Delft, they share a selection of their courses via this website. Link: https://ocw.tudelft.nl/courses/linear-algebra-1/

Would the interface provide sufficient information for you to determine if the course is suitable to use for your own course?

Please explain what elements in the interface help you determine this. Such as the overview of activities (lectures, exercises), the information on the course author, the information of the study load etc.
*



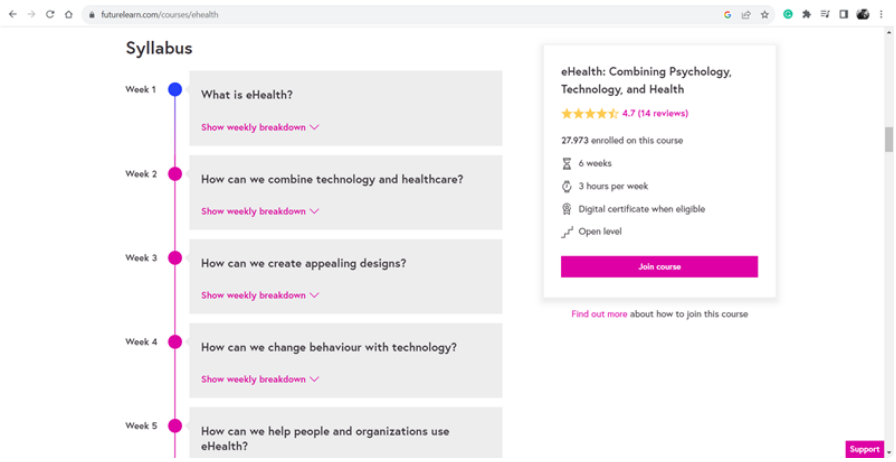
6

This is the interface of FutureLearn, the website on which the UT has a few course that people can follow.
Link: https://www.futurelearn.com/courses/ehealth

Would the interface provide sufficient information for you to determine if the course is suitable to use for your own course?

Please explain what elements in the interface help you determine this. Such as the overview of activities, the structure per week, and so on.

*



7

If you are designing the structure of a course, which design approach would you prefer?
*

- ◯ Organizing materials per week
- ◯ Organizing materials per learning goal
- ◯ Organizing materials per book chapter
- ◯ Organizing materials by type (video, book, lectures)
- ◯ Andere

8

If you were to create an ideal platform to share educational resources, how would you envision this?

Here are some elements that you could include in your ideal platform:
- **Sharing content:** Using simple documents or multimedia, such as videos & exercises
- **Adaptability to your own institutional educational platform**
- **Quality control of the resources:** Making sure the content is of a certain quality
- **Forum:** Community engagement and discussions
- **Copyright:** Respecting intellectual rights
*

B INFORMED CONSENT FORM

Consent form template for research with human participants

Consent Form for Blend it, Share it!

YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM

Please tick the appropriate boxes	Yes	No
Taking part in the study		
I have read and understood the study information dated 21-12-2023, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	○	○
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	○	○
I understand that taking part in the study involves using the newly developed platform for sharing educational resources. I understand that afterwards there will be a list of questions and a short interview.	○	○
Use of the information in the study		
I understand that information I provide will be used for the research into the development of this platform. This will be published as a bachelor thesis.	○	○
I understand that personal information collected about me that can identify me, such as [e.g. my name or where I live], will not be shared beyond the study team.	○	○
Future use and reuse of the information by others		
I give permission for the user review results that I provide to be archived in anonymous results so it can be used for future research and learning.	○	○

Signatures

_____	_____	_____
Name of participant	Signature	Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____	_____	_____
Researcher name	Signature	Date

Study contact details for further information: Nikita Klein, n.a.klein@student.utwente.nl

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee Information & Computer Science: ethicscommittee-CIS@utwente.nl

UNIVERSITY OF TWENTE.

C USER EVALUATION SURVEY

1. For the following ten statements, please indicate what fits most with your experience *

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1. I think that I would like to use this system frequently	◯	◯	◯	◯	◯
2. I found the system unnecessarily complex	◯	◯	◯	◯	◯
3. I thought the system was easy to use	◯	◯	◯	◯	◯
4. I think that I would need the support of a technical person to be able to use this system	◯	◯	◯	◯	◯
5. I found the various functions in this system were well integrated	◯	◯	◯	◯	◯
6. I thought there was too much inconsistency in this system	◯	◯	◯	◯	◯
7. I would imagine that most people would learn to use this system very quickly	◯	◯	◯	◯	◯
8. I found the system very difficult to use	◯	◯	◯	◯	◯

9. I felt very confident using the system	◯	◯	◯	◯	◯
10. I needed to learn a lot of things before I could get going	◯	◯	◯	◯	◯

2. What did you like the most about the website?
   This can be anything visually or functionally *

3. What did you like the least about the website?
   This can be anything visually or functionally *

4. What did you think specifically about the visual appeal of the website?
   *

5. Where you able to perform the tasks easily? *

6. What can be improved about the website? *

7. What is missing or lacking in the website?
*

8. Do you have any other questions or remarks?