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INFORMATION ARCHITECTURE FOR SCHOOL HOMEWORK WEBSITE

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ABSTRACT

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The thesis explores the subject how the information architecture is applied to design a school homework website. The development of an example website started in an Information Systems Commission -course in Oulu University of Applied Sciences in the spring of 2020. The project was aimed to develop a web-based system that will be utilized in Grades 7-9 of the elementary school for teaching mathematics. The core purpose of the project was to use new technology and provide a more stable, complete website for teachers to organize homework and exams for students. The said project was technology driven. The subject of the thesis is chosen from the personal interest of the author in web design, with a focus on putting information architecture theories and principles into practice designing information architecture for school homework website.

The present thesis focuses to find out what information architecture is and what problems it solves for designing website. A deep dive into information architecture components such as organization systems, labeling systems, navigation systems and search systems are presented. Based on the theories of information architecture and its components, the visual sitemap and wireframe for school homework website are designed. The sitemap and wireframe are the two most common types of information architecture diagrams. The theoretical part of the thesis was established by two books. The material was used to create the main theory structure for thesis.

The most important result was to understand information architecture and apply theories, design principles, and guidelines to website designing practice. To use it to organize website content so that it can be found, to design website interaction so that it is user friendly, and to build interface that is easy to understand. The purpose of the visual sitemap and wireframe as a website information architecture implementation is to serve as a good basis for building the future homework website of the school. The chosen design practice emphasizes user-friendliness and design first-principle, which leads to the creation of a solution suitable for real work.

Keywords: information architecture, sitemap, wireframe

TIIVISTELMÄ

Oulun ammattikorkeakoulu
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Opinnäytetyössä tarkastellaan informaatio-arkkitehtuuri ajattelun soveltamista koulun kotitehtävät verkkosovelluksen suunnittelussa. Esimerkkisovelluksen kehitystyö alkoi Tietojärjestelmän toimeksiantoprojekti -kurssilla Oulun ammattikorkeakoulussa keväällä 2020. Projektin tavoitteena oli kehittää web-sovellus peruskoulun luokkien 7-9 matematiikan opetukseen. Projektin keskeinen tavoite oli kehittää uudella teknologialla monipuolinen ja vakaa työkalu opettajille oppilaiden harjoitustehtävien ja kokeiden järjestämiseen ja hallintaan. Kyseinen projekti eteni teknologiapainotteisesti. Opinnäytetyön aihe valikoitui tekijän henkilökohtaisesta kiinnostuksesta web-suunnitteluun keskittyen informaatioarkkitehtuuri-teorioiden ja -periaatteiden toteuttamiseen käytännössä koulujen kotitehtävien verkkosivustojen tietoarkkitehtuurin suunnittelussa.

Opinnäytetyössä keskitytään selvittämään, mikä on informaatioarkkitehtuuri ja mitä ongelmia se ratkaisee verkkosivuston suunnittelussa. Työssä esitetään informaatioarkkitehtuurin peruselementit ja informaationarkkitehtuurin komponentit, kuten organisaatiojärjestelmä, merkintäjärjestelmä, navigointijärjestelmä ja hakujärjestelmä. Informaatioarkkitehtuurin ja sen komponenttien teorioiden perusteella suunnitellaan koulujen kotitehtävien verkkosivuston visuaalinen sivukartta ja rautalankamalli. Sivukartta ja rautalankamalli ovat kaksi yleisintä informaatioarkkitehtuurikaavion tyyppiä. Opinnäytetyön teoreettinen osa perustuu pääosin kahteen kirjaan, joiden aineistoa käytettiin luomaan opinnäytetyön pääteoriarakenne.

Opinnäytetyön tärkein tulos oli ymmärtää sovellusalueen informaationarkkitehtuuri sekä teorioiden, suunnittelun periaatteiden ja ohjeiden soveltaminen verkkosivujen suunnittelukäytäntöihin. Informaatioarkkitehtuuri lähestymistavalla verkkosivuston sisältö voidaan organisoida niin, että tarvittava informaatio on löydettävissä ja käytettävissä. Verkkosivujen vuorovaikutus voidaan suunnitella niin, että se vastaa läpinäkyvästi käyttäjän vaatimuksiin, on käyttäjäystävällinen, ja omaa käyttöliittymän, joka on helppo ymmärtää. Valittu suunnittelukäytäntö korostaa käyttäjäläheisyyttä ja suunnittelu ensin periaatetta, mikä johtaa reallityöhön soveltuvan ratkaisun syntymiseen.

Asiasanat: informaatioarkkitehtuuri, www-sivustot, verkko-ohjelmointi

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1 INTRODUCTION

Today developing a website to publish information is normal, fast, and efficient. Over time, the website will change enormous and the amount of information is abundant. This introduces new challenges for the website designer, with so much information needed to place in website. How can the designer design an information product that is perceived by the user as place to use, create, and store information. How these information environments can be organized for optimum findability and understandability.

The two main principles are often overlooked in developing web applications and websites: 1) See the big picture and 2) Keep it simple. Sometimes the development methodologies used tend to push developers to quickly create something real to show. Some people may hurry up with technology and forget to design first. Once developers have started to work with technology aspects the original goal starts gradually to diminish, and the result will be inadequate and complicated application which no one wanted. In addition to information architecture design the user experience design has huge importance in creating website users like.

The thesis explores the subject from the view of the sample website and explores how the information architecture is applied to website. The development of an example website started in an Information Systems Commission -course in Oulu University of Applied Sciences in the spring of 2020. The project was aimed to develop a web-based system that will be utilized in Grades 7-9 of the elementary school for teaching mathematics. There was an existing old website and the core purpose of the project was to use new technology and provide a more stable, complete website for teachers to organize homework and exams for students. The project design tool was design thinking, design sprint lasted a week after which, together with the client, we went through the requirements of the project and the implementation technology. The next three sprints progressed to implementation. The system was developed by using Laravel for backend, React for frontend, and Bootstrap, and MySQL database. The client did not specify the need of Non-disclosure agreement (NDA) to be signed by the project members.

The school homework information system is used as an example in practical part of the thesis. In this thesis, the focus is expanded to the information architecture analysis and uses the features

from the original website information system. The term “information architecture” is diversified and it takes time to understand the whole idea. The research questions of the thesis include:

- 1) What is information architecture?
- 2) Why we need information architecture?
- 3) What problems can the information architecture solve?
- 4) How to build an information architecture for a website?

Two books are main used for the primary source. The first book is “Information Architecture: For the Web and Beyond. 4th Edition” by Louis Rosenfeld, Peter Morville and Jorge Arango. The book includes important knowledge on information architecture. This book was used to create the main structure for the thesis. The second book “Information Architecture for the World Wide Web, 3rd Edition” by Peter Morville, Rosenfeld Louis, teaching the skills of information architecture swiftly and clearly. It includes good methods on how to get stuff done in real case.

2 INFORMATION ARCHITECTURE

2.1 What is information

Information has existed so long as people has been communicating with each other. Information can be discovered everywhere in the modern life. Nature, books, radio, TV, internet, phone, car, home appliances, wearables, even doorknobs today etc. all are dealing with information.

Merriam-Webster dictionary defines information as "knowledge obtained from investigation, study, or instruction" (Merriam-Webster 2020. Cited 26.03.2020). Oxford Learner's Dictionaries define information as "facts or details about somebody/something" (Oxford Learner's Dictionaries 2020.Cite 26.03.2020). If we want to see the big picture, not just humans are dealing with information, but also other beings, like e.g. ants (Reznikova, Zh. & Ryabko, B. 1989).

When information started to go digital, it also was being detached from its containers. This has had two important effects in our time: information is more abundant than ever before, and we have more ways of interacting with it than ever before. (Arango, J., Morville, P. & Rosenfeld, L. 2015) And that is why the information architecture comes to a large role when designers create new product, applications and services.

2.2 What is information architecture

Information architecture deals with structuring the information in the way the users can benefit from it. The authors (Arango, J., Morville, P & Rosenfeld, L.) use four phrases in their book to describe what information architecture is:

1. The structural design of shared information environments.
2. The synthesis of organization, labelling, search, and navigation systems within digital, physical, and cross-channel ecosystems.
3. The art and science of shaping information products and experiences to support usability, findability, and understanding.
4. An emerging discipline and community of practice focused on bringing principles of design and architecture to the digital landscape. (Arango et al., 2015)

Information architecture is a discipline that helps people understand their environment in the real world and the Internet to find what they are looking for. In other words, information architecture is

the structural creation of a website, application, or other project that allows us to understand where we are and where we want the information. Information architecture thus extends the process of creating sitemaps, architecture levels, classification, navigation, and metadata. When a content planner begins to split and categorize content, she is doing information architecture. When a designer outlines a top-level menu to help users understand where they are on the site, he is doing the information architecture.

The term “information” to distinguish information architecture from data and knowledge management. Data is figures and truth. It is hard to use and to understand by people. Knowledge is the thing that is in the heads of human. Knowledge managers are creating tools, processes, and opportunities for motivating people to share their information. Information is in the messy center between data and knowledge (Arango et al., 2015).

Structuring, organizing, and labeling

Structuring is finding the right information levels of detail in the context and deciding how to connect them to each another. Organizing involves arranging those elements into meaningful and distinctive categories. Labeling means naming those categories and the set of navigation links that lead to them. (Arango et al., 2015)

Finding and managing

Fast and easy finding of information is crucial for successful product or service. Users can find what they need, by integrated browsing, searching, and asking. Website owners can manage content efficiently, also policies and procedures are clear. (Arango et al., 2015)

Art and science

Information architects use scientific methods to analyze of users’ needs and information-seeking behaviors. Architects must be willing to take risks and trust on intuition. This is the “art” of information architecture. (Arango et al., 2015)

2.3 The concept of information architecture

In practice, Context, Content, Users form the concept of information architecture. Information architect should be familiar with the information of these three fields to design a useful information

architecture. The Venn diagram (see Figure 1) helps people visualize and understand the relationship between these three fields. The three circles illustrate the interdependent nature of users, content, and context within a complex, adaptive information ecology. Should technology have its own circle? No, it belongs in context.

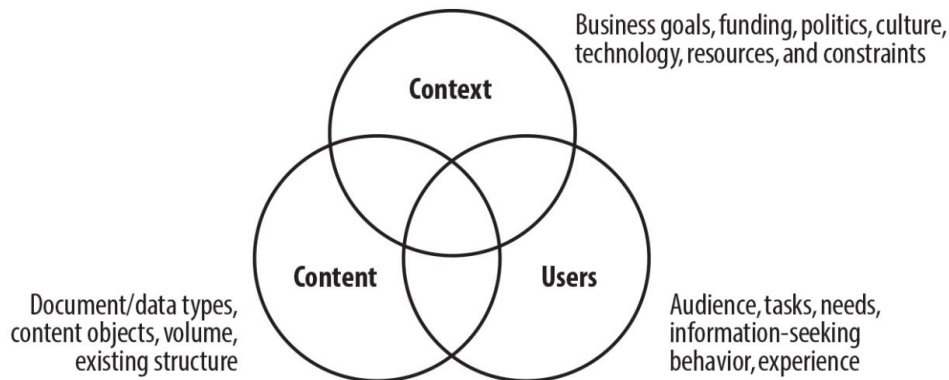


Figure 1 The three circles of information architecture (Arango et al., 2015)

Context is understanding the business goals behind the website and the resources available for design and implementation. Content is aware of the nature and volume of content that exists today and how that might change a year from now. Users are learning about the needs and information-seeking behaviors of our major audiences. (Arango et al., 2015)

2.4 Information architecture components

Information architecture is generally divided into a top-down architecture and a bottom-up architecture. In many cases, these two approaches are occurring. Top-down architecture focuses on the context of the content and the user needs. It explains the "big picture" of the site such as the breadth and depth of the site. It addresses the question: knowing the needs and interests of the audiences, how should information be organized, grouped, and presented? Bottom-up structure focuses on creating building blocks that are the components of the web page, web project, or web site. This content objects are organized for easy storage and access. (Annette Lamb & Larry Johnson 2020. Cited 30.03.2020) Organization systems, labeling systems, navigation systems, and search systems are the components that make up an information architecture.

2.4.1 Organization systems

Organization systems are used to organize information so that people can easily understand and use it. Information is organized, so that people can find the answers to questions, and scenarios are provided to understand those answers. Organization systems also support casual browsing and directed search. Organization systems are composed of an organization scheme and an organization structure. An organization scheme defines the shared characteristics of content items and influences the logical grouping of those items. An organization structure defines the types of relationships between content items and groups. Both organization schemes and structures have an important impact on the way information is found and understood. (Arango et al., 2015)

Organization schemes include alphabetical schemes, audience-specific schemes, topical organization schemes, etc. An alphabetical scheme is the scheme for encyclopedias and dictionaries. Information can be organized alphabetically by last name, by product or service, by department, and by format. (Arango et al., 2015)

When there are two or more clearly definable audiences for a product or service, an audience-specific organization scheme may make sense. Normally you must get some added value in customizing the content for each audience. Audience-oriented schemes result in audience-specific mini-sites, thereby allowing understandable pages for that special audience. (Arango et al., 2015)

Topical organization scheme is organizing information by subject or topic. It is one of the most useful and challenging approaches. Newspapers are organized topically, so if you are interested in e.g. sport, you know to turn to the sports section. Academic courses and departments, and the chapters of most nonfiction books, are all organized along topical lines. Many people assume that these topical groupings are fixed, when in fact they are cultural constructs that can vary over time. (Arango et al., 2015)

Organization structures include the hierarchy, the database-oriented model, and hypertext. Each organization structure possesses unique strengths and weaknesses. In some situations, it is good to use one or the other. In many cases, it makes sense to use all three in a complementary manner. (Arango et al., 2015)

The Hierarchy is a common way to organize information features as tree structures, hub-and-spoke structures. Hierarchy structure uses the simple and familiar approach to group every pieces of information, that is top down approach or parent/child relationships. Users begin to observe broad categories of information (parent) and dig deeper down into next level to find the narrower scope information (child). Family trees are hierarchical. Organization charts are usually hierarchical. Hierarchy is everywhere in our lives and informs our understanding of the world in meaningful way.

Figure 2 shows examples of hierarchical models. When designing hierarchies, it is important to not make hierarchical categories mutually exclusive. You should have to equal the exclusivity with inclusivity. An object can often belong in more than one category. However, if too many objects are cross-listing, the hierarchy loses its value. Balancing between breadth and depth is also important. Breadth refers to the number of options at each hierarchical level. Depth refers to the number of Hierarchy levels. If a hierarchy is too narrow and deep, users need to travel number of levels to find the answer. In a broad and shallow hierarchy, users are faced with too many options on the main menu and lack of content when selectting an option. In considering breadth, the scanning abilities of people and the cognitive limits of the human mind must be obeyed, do not overload too many options to the user. Lean into a deep and shallow hierarchy for new web pages. That allows for new content to be added. Be careful to add more depth levels, as you need to prevent users from making too many clicks. (Arango et al., 2015)

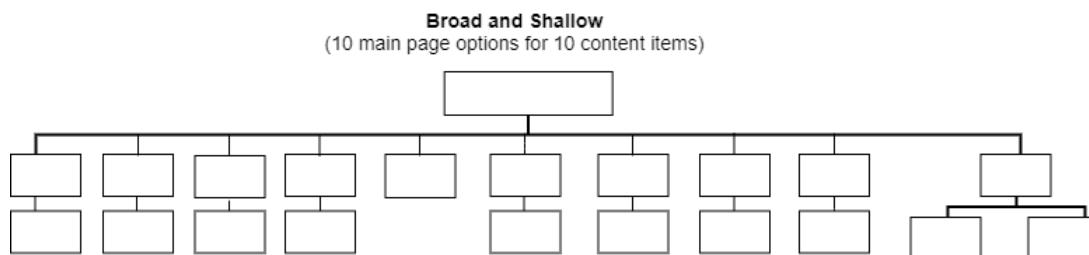
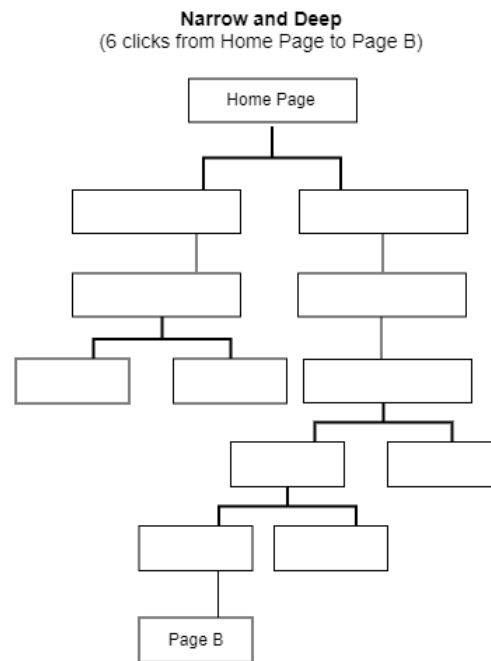


Figure 2 Examples of hierarchy types (Morville, P. & Rosenfeld, L. 2006)

The Database Model is a Bottom-up structure. A database is defined as “a collection of data arranged for ease and speed of search and retrieval.” Most of databases are built upon the relational database model. In relational database structures, data is stored within a set of relations or tables. Rows in the tables represent records, and columns represent fields. Data in different tables may be linked through a series of keys. (Arango et al., 2015)

Hypertext is a highly nonlinear way of structuring information. A hypertext system involves two primary types of components: the items or chunks of information that will be linked, and the links between those chunks. Hypertext can include text, tables, images, and other presentational content formats with integrated hyperlinks. (Arango et al., 2015)

2.4.2 Labeling systems

Labels are the way to show the user the organization of information and navigation schemes across multiple systems and contexts. Screen layout may contain different groups of labels, with each group representing a different organization or navigation system. Labels appear in two formats: textual and iconic. (Arango et al., 2015)

Labeling systems must be consistent. Consistency means predictability, and predictable systems are easier to learn. When seeing one or two labels, the others can be expected from the rest. This is important for first-time users, but consistency benefits all users by making labeling easy to learn, easy to use, and therefore invisible. Consistency is affected by many issues: style, presentation, syntax, granularity, comprehensiveness, audience. (Arango et al., 2015)

2.4.3 Navigation systems

Structure and organization are about building rooms. Navigation design is about adding a road map to all the different areas and information contained within the website. The navigation systems are composed of global, local and contextual navigation systems.

Global navigation system is present on every page throughout a site. It is often implemented in the form of a navigation bar at the top of each page. It answers common questions like: Where am I and where can I go. These site-wide navigation systems allow direct access to key areas and functions, no matter where the user travels in the hierarchy of the site. The global navigation systems provide an access to the search function, a link to the main page or information about the logged in user. Usually, the global navigation is in sight always. This major role of the website's navigation has huge impact on usability. In some websites, global navigation can be hard to identify from the main page, because it does not need to be the most distinguishable part of the website.

Local navigation systems enable users to explore the immediate area. Through these navigation systems, user accesses the content on a specific page of the web site. Local navigation is usually placed on the left side of a page. Some tightly controlled sites integrate global and local navigation into a consistent, unified system.

Contextual navigation links are to a specific page, document, or object. The creation of contextual navigation can be “know more” links that point users to related products and services or may point to similar articles or related topics. (Arango et al., 2015)

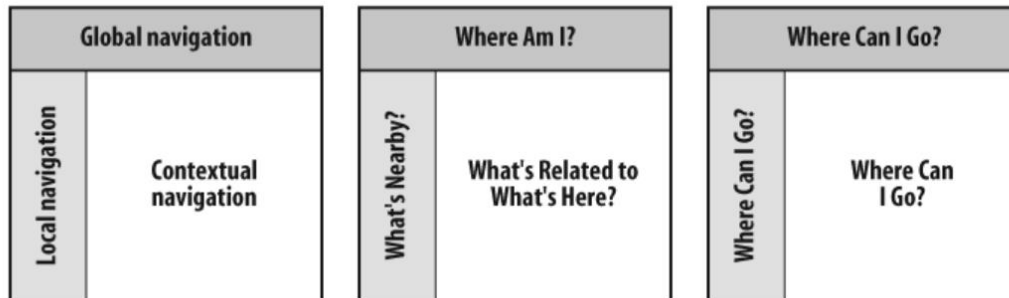


Figure 3 Global, local and contextual embedded navigation systems (Morville et al., 2006)

Supplemental navigation systems are used when embedded navigation systems fail and the user wants to try to find information in an alternative way, and may include: HTML sitemaps, indexes, and guides. HTML sitemaps provide a bird’s-eye view of the information environment. A-to-Z indexes allow direct access to content. And guides feature linear navigation customized to a specific audience, task, or topic. (Arango et al., 2015)

2.4.4 Search systems

Search systems help user to search the data when the user is lost in the website. The search system is composed of search engine, filters, tools and technologies. It is not only a search box in the interface. The search box is just a very small one of the elements. When the user enters the query and clicks the "Search" button, the search process is obvious started from the interface. There is a search engine behind the interface which is making things happen. The search engine generates a query from the user input and then uses the algorithm to locate correspondence objects from the content. Finally, the search engine sends back the objects to the browser where the user can see the results. This whole cycle is shown in Figure 4. (Morville et al., 2006)

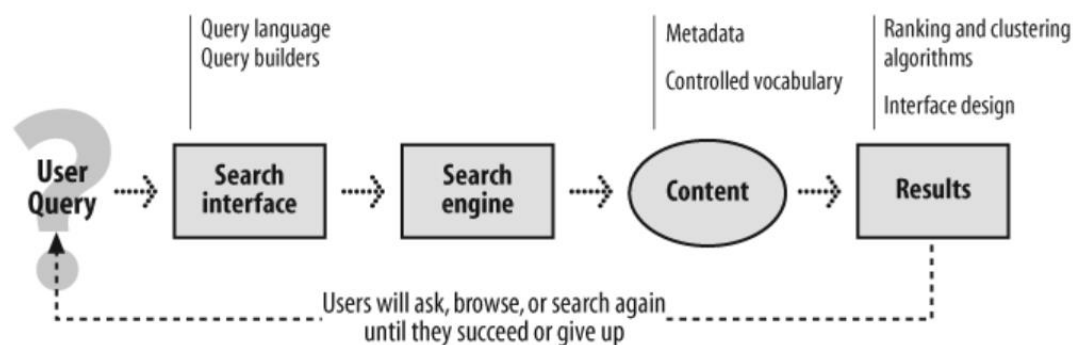


Figure 4 The basic anatomy of a search system (Morville et al., 2006)

There are different kinds of retrieval algorithms that can be used to build search engines. However, I am not going to discuss these algorithms, just telling a good search algorithm maintains the balance between the number of the results and the precision of the results. The search cycle will not stop until the retrieval algorithm and query builder have done their jobs and sent results to the users. The last thing is presenting result in the interface so the user can easily understand what information he or she gets. The interface must serve to users in understandable way. The results can be shown in lists and sorted by alphabetical, chronological, appropriate, common or some other way. Based on what kind of information you are providing and what users want to search. (Morville et al., 2006)

2.5 User research

Users are one of the three fields in the concept of information architecture. User research focuses on understanding user roles, preferences, behaviors, desires, and intentions through a systematic approach to surveys. Then use this result make sure your decisions about product design favor the user. There are at least four types of questions discussed when you decide to start making a user research:

- Who are the users?
- What do the users need?
- What do the users want?
- Can the users use it?

Different types of questions can be investigated using different methods. We can use the following methods to study the user in the information architecture.

Situation investigation also known as observation or site visits, situational investigations involve studying the situations of users in their daily lives or tasks. Make a note of what they are doing, the difficulties they face and your own ideas. You want to try to understand their needs and expectations in depth, but do not try to interrupt them. Try to observe as often as possible what they will do to accomplish their task.

Interviews, in user interviews, users are usually met and asked questions about the project. This process is usually done very early in the process, and it can be used to review product's goals. To get a good answer, the question should have to be asked in the right way, we should have to know when to follow up and dig into the answer, keep a record. We need to answer specific questions first and work out our own ideas in advance.

Interview topics may recall that the product worked particularly well or badly in certain situations, and often can provide more vivid details about these events. You can use it to help you to understand the pros and cons of the product when helping users complete their tasks. You can also use interviews to help you to identify questions to ask in a broader questionnaire or survey. On the other hand, you can use interviews after seeing the results of the questionnaire and want to explore some of them in more depth.

Questionnaire surveys can provide us with answers close to user interviews. The disadvantage is that we can not get answers to these questions in more depth because there is no direct interaction with the user. On the bright side, they allow you to get more feedback, which can provide opportunities for more quantitative analysis. In the form of questionnaires, we must have clear thinking to write questions.

Card sorting, writing down all the heading from categories, subcategories and content within your website in cards. Invite user to sort all cards into different meaning groups with label. User can tell what they are thinking while they work. Designer takes good note. (Arango et al., 2015)

User test, you ask a user to sit in front of a device and try to find information or complete a task. Every task will last three minutes. During the mission, user can talk loudly what he/she feels in every step. Take a good note, you need to count click and time in each session. (Arango et al., 2015)

Market Study, when introducing a new product, the market study is important. Competition in the market must be investigated. SWOT (strengths, weaknesses, opportunities, threats) analysis is a good tool to get strategic understanding of the situation.

Behaviour Observation, have your senses in the market, observe people's behaviour to know to what the direction the market goes. Listen to weak signals and collect data to find out what people will need.

2.6 Visual Sitemap

When we talk about sitemap, people immediately think of HTML sitemap and XML sitemap. An HTML sitemap is an HTML page which lists all subpages of a website. It is normally linked in a site's footer. User can get an overview of the structure of website and click on each link to get to the subpages.

An XML sitemap is a list of all URLs of a web site's pages, information about character encoding, metadata such as when the specific pages were last updated. Compares with HTML sitemaps, an XML sitemap is typically not visible for users of website and serves primarily as search engines information.

XML sitemaps are specifically created for Google and other search engine and help them to find all content on your website. An HTML sitemap is mainly for the users of your website which lets them navigate through your site.

However, sitemap in information architecture is a visual sitemap, which is a hierarchical diagram representing a website's information architecture. Sitemaps show the relationships between information elements and website, subsite, or other collection of content. This gives you a visual image of the structure of the web and how the different parts are linked together. Information architectures use sitemaps to define where content will be placed and display the relationship between different pages.

Two commonly used sitemaps are high-level architecture sitemap and detailed sitemap. High-level sitemaps are generated as part of a top-down information architecture process. On the high-level

sitemap, you can see pages, components within pages, page groups, and relationships between pages. Using simple and fast tools to produce high-level sitemaps can facilitate product-level discussions. When the "decoration" gradually goes into details and the internal page relationships of the columns are refined, a detailed sitemap is the result. It describes the detailed information hierarchy of the internal pages or the sections of the website. It also details the labelling and navigation systems. The clearly described detailed sitemap will help to smooth the connection with development colleagues. (Arango et al., 2015)

Why do you need to create sitemap? Many different individuals, front-end designers, back-end developers, project manager would be involved in a web build project. A visual sitemap will help us to understand the aims and purposes of the site when creating a website. In a sitemap, the hierarchical information allows team members identify and delete pages that are not specifically related to the function of the web. Switch off duplicated content.

2.7 Wireframe

Wireframe is a two-dimensional illustration of the interface, focusing on space allocation and prioritization of content, available features, and expected behavior. It is the layout of a page or screen that demonstrates what elements will be present on the page or screen. Wireframe is primarily concerned with understanding features, the location of key elements, and how users will interact with them. (Arango et al., 2015)

As an early part of the user experience design process, wireframes not only allow team members to keep abreast of product understanding, but also advance user testing and collect feedback as early as possible before diving into visual design. We can focus on the layout and function of each element on the page during the wireframe stage. Wireframes must be constrained in size. What is right percentage of space for components of the architecture and actual content. Typically, wireframes are created for the most important or complicated pages, not for every page. (Arango et al., 2015)

A low-fidelity wireframe focuses on layout of content and visual elements over content accuracy. A medium-fidelity wireframe has higher degree of detail. This wireframe is intended to introduce several aspects of content, layout, and navigation into the discussion, and often used to

communicate the information architecture to managers, graphic designers, and programmers. A high-fidelity wireframe provides a near approximation of what the page would look like in practice. The content and color bring the page to life, helping to capture the attention of your clients or colleagues. (Arango et al., 2015)

3 VISUAL SITEMAP AND WIREFRAME OF SCHOOL HOMEWORK WEBSITE

I had the following expectations when I began designing this school homework website. It can only be used on a computer. Parents are not included in users. Users use it for around two hours a day. The interface is simple, and clear. On the mobile Internet era, people are easily receiving all kinds of messages quickly on limited device as mobile phone or iPad. They may not have patience for deep reading and learning knowledge. The purpose of this homework web page is to get the user back to the writing desk and sit down for two hours in silence. The teacher can calmly teach the knowledge, the learners can concentrate on understanding the knowledge. On the market most school homework websites will include parents as users, I do not want to place pressure on students on my designing homework page, because parents also log in to check their children's credit on this website.

3.1 User research

In this project, the user research methods were Depth- interview and user testing. The Depth-interview was conducted in a company meeting room. It began by introducing developing team members and the study subject. It is important to establish good rapport with the user and put him or her at ease. During interview, developing team members asked user questions in a relatively unstructured conversation. Interviewers' main responsibility was to listen and observe the user through the conversation until all the six questions were explored. The interviewers took detailed notes on user answers. The six questions clearly stated the subject and the query, and as short as they can:

Do you like the old version of homework website?

Which part you do not like?

Why you do not like it?

When you use the website?

What kind of device you use to log in the website?

Which function you mostly use?

The key findings are that teachers mainly use functions focused on organization of homework, exam, and class. Most of the time, teachers use this website when they work with computer at

school. Why teachers do not like this website, because this website has not been completely developed, there are many functions are not supported the normal teaching activities. Based on user research, an information architecture schema has been created (see Figure 5).

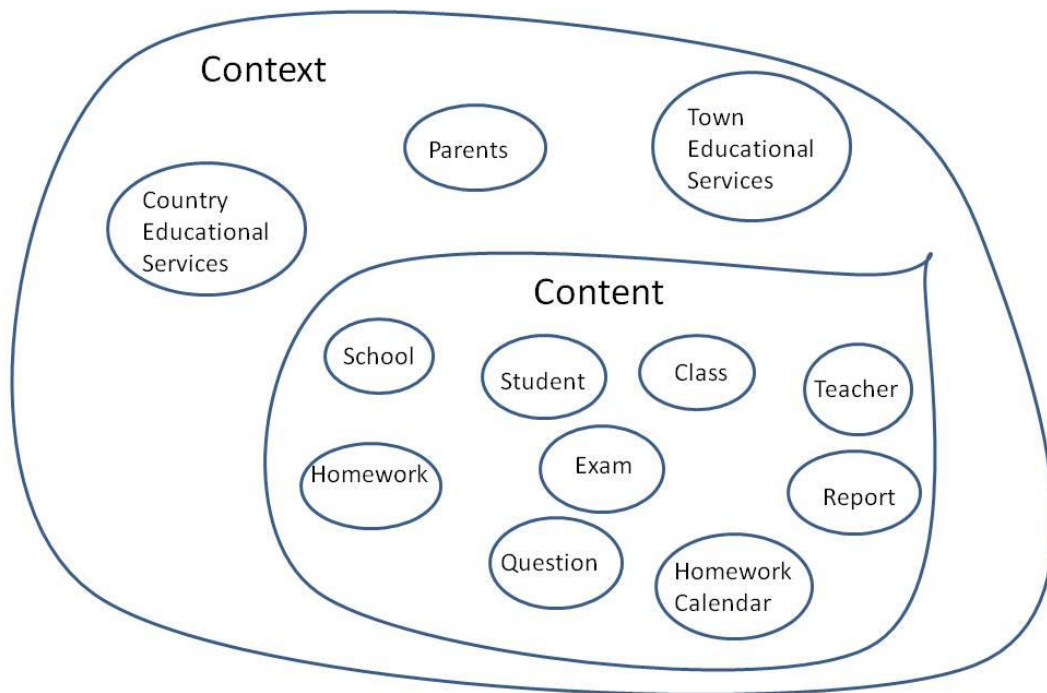


Figure 5 Identified concepts in School Homework website

In user testing, user was observed while he completed a series of tasks with the old version website. He finished creating assignment and assigning it to student group, viewing student finish assignment status. The conclusion is that current solution is outdated and does not fill the user needs identified so far. We need to develop the function of the new website to carry out homework and exams online and get better control over them.

After finishing Depth- interview and user testing, the development team began a one-week workshop on design thinking. We based on user research and created use cases, storyline for teacher and user persona (see Figure 6). User is a mathematics and chemistry teacher. He lives in Finland with wife and three school-age children. The school where he works in a small town. His school has no school website. He has some skill to develop website. He also is the project creator and owner. Teacher persona promotes empathy in project and encourage designers to think from the user's viewpoint.

PERSONA

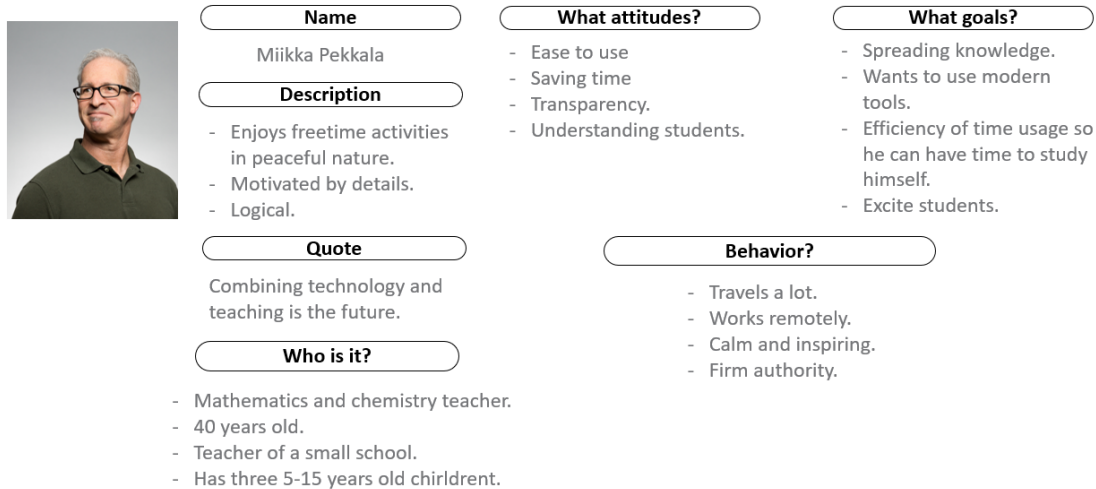


Figure 6 User persona

3.2 The concept of information architecture in school homework website

Context: School homework website initially to support the teaching tasks in the project owner's school. After website gradually develop maturity, will be encouraged to be used in provincial schools, and finally in Finland.

Content: Teacher can create homework and exam. Student can finish homework and exam. Main content will be created in this website by teachers and students. Content format including MS Word, PDF, picture, and video. In future, this website will access to some databases, school website.

Users: There are three target users: teacher, student, administrator. Teachers can use homework website to create and check homework and exams, generate report of students completing assignments and exam. Teachers can reduce tutoring time to improve efficiency, devote more time and energy to the attention and education of students. Students can easily and happily complete homework and exams, allowing students to practice in less time and more effectively, to achieve mastery of knowledge points and the construction of interdisciplinary thinking skills. Administrator can manage website, share important study resources, update important news and events, and create customized reports and analytics.

3.3 Visual sitemap of school homework website

School homework website has two versions of the user interface, for teacher and for student. Starting with the Log In page, I do not even talk about the Log In page here, but to make the reader understand that this homework website needs to log in first before you can use it, so I indicate this on the sitemap. This thesis discusses teacher interface.

As mentioned before, the visual sitemap documents the pages in web site. It tells the relationship of the pages to each other, the interaction between pages. Because homework website depends on user-generated content, how to save new content and archived content, how to design them and put in information organization, also how to concentrate on presenting hierarchy and pages, all are challenge.

The school homework sitemap is designed as high-level sitemap. High-level sitemap is often created as part of a top-down information architecture process. After login, user arrives in Recent page. There are total two levels. The first level is comprised of Recent page, Homework page, Exam page, My Class page, My Colleague page, Resource page, Forum page.

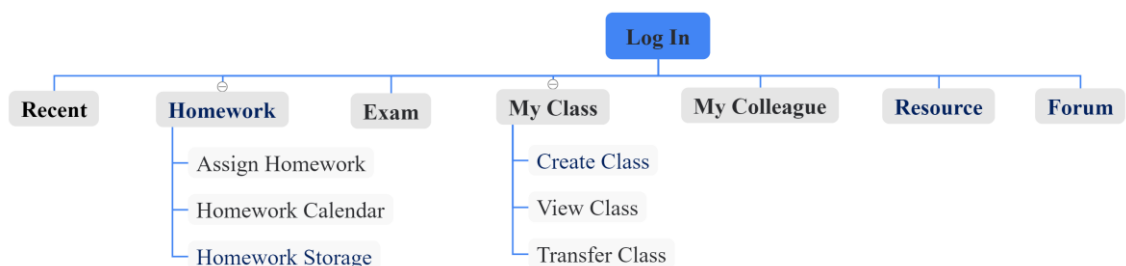


Figure 7 School homework website visual sitemap

Three principles were followed when designing the sitemap: 1) Balance hierarchies between breadth and depth. 2) At any given time, the average human can only hold about seven items in their short-term memory. 3) Lean toward a broad-and-shallow rather than a narrow-and-deep hierarchy for new website which is expected to expand.

- Recent page shows user's homework and exams due today and this week, so the user can easily enter the content to be viewed.
- Homework page provides teacher with the online framework to create, share and reuse homework, also to generate report of students completing homework. There are Assign

Homework, Homework Calendar and Homework Storage under the Homework tab. Teacher creates homework in Assign Homework, checks all assigned homework in Homework Calendar, finds all saved homework in Homework Storage.

- Exam page helps teacher to develop, edit and review online exams. Automatic evaluation can be used in multiple choice or fill-in questions. Teacher can produce reports of students' completing exams.
- My Class page deals on how to create a class, add students to class, manage a class roster, transfer a class to another teacher. There are Create Class, View Class, Transfer Class under the My Class tab. In View class will display classes that are default current. By the end of a school year, the status of all current classes will be adjusted to expire automatically.
- My Colleague page, teacher can find the contact information of his/her colleagues. Teacher can add people to the list of colleagues, organize colleagues by using groups and limit who can use his/her Homework Storage.
- Resource page lists helpful links and resource for a specific topic. Teacher and administrator can publish useful education material in this page.
- Forum page is for teacher and student discuss study issue.

Within this thesis, I concentrate on designing these pages: Recent, Assign Homework, Homework Calendar, Create Class, View Class.

3.4 Wireframe of school homework website

Sitemap will help designer decide where the content will go, and how to access it within a website context. Wireframe serve another role: it represents how an individual page should look from an architectural point of view. During the wireframe level, we can concentrate on the layout and function of each element on the page. Wireframe is usually created for the most complicated or important pages, not for every page. According to the level of fidelity, wireframe can be divided into low-fidelity, medium-fidelity, and high-fidelity. A goal of the low-fidelity wireframe is on content layout and visual elements over content accuracy. A medium-fidelity wireframe is the most widely used, concentrating on content, layout, and navigation. A high-fidelity wireframe shows a near approximation of what the page would look like in practice.

While delving into each webpage's wireframe, let us first understanding some of the main features and symbols. In wireframe three key symbols are used, they are homework document, button, and filling block. Homework document represents the file that has been generated in homework website. Filling block is where the user creates content. Filling block template is a fixed form so that users can quickly recognise as they skim through web pages (see in Figure 8).

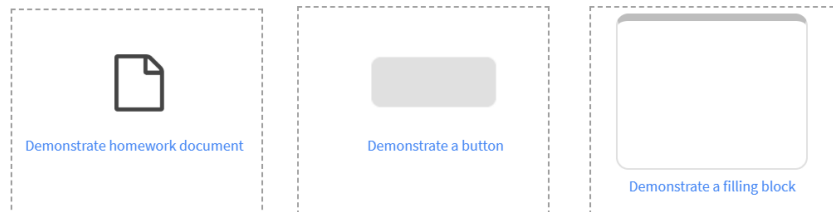


Figure 8 Basic Wireframe Symbols

Navigation bar (see Figure 9) is the main feature that will be most consistently shown on left side of each web page. In this website, global and local navigation are designed into a consistent, unified system. The idea is to let the global navigation system be complemented by one or more local navigation systems that enable users to explore the immediate area. The website provides a global navigation bar that shows local navigation options for each category of names. A user who selects "Homework" sees different local navigation options than a user who selects "Exam," but both sets of options are provided within the same navigational framework. On top of the navigation bar, there are logo and user avatar.

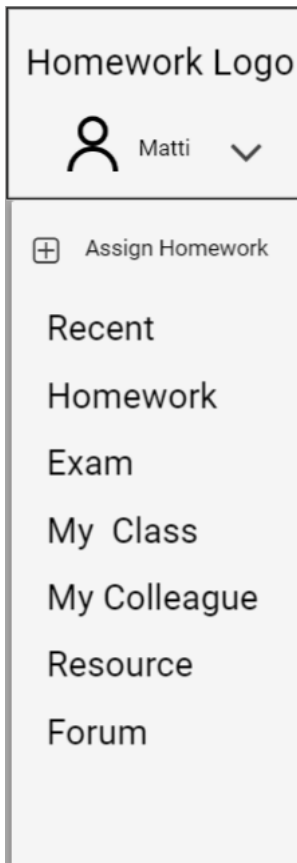


Figure 9 Navigation bar wireframe

3.4.1 Recent page

Figure 10 shows the wireframe of Recent page. After the user logs in, he/she first comes to the recent page. The design of recent page primarily considers the two features that teachers use most on this website: assigning homework, showing today and this week homework and exam. The logo, user profile, and personal settings are at the top left of the web page. There is a quick link to the assigning homework page. The central position of the page is to display the homework and exams due today and this week. It is a topical scheme of organization. The homework and exam file names use contextual navigation. Upon clicking, the user will enter the specific page directly to access homework and exam.

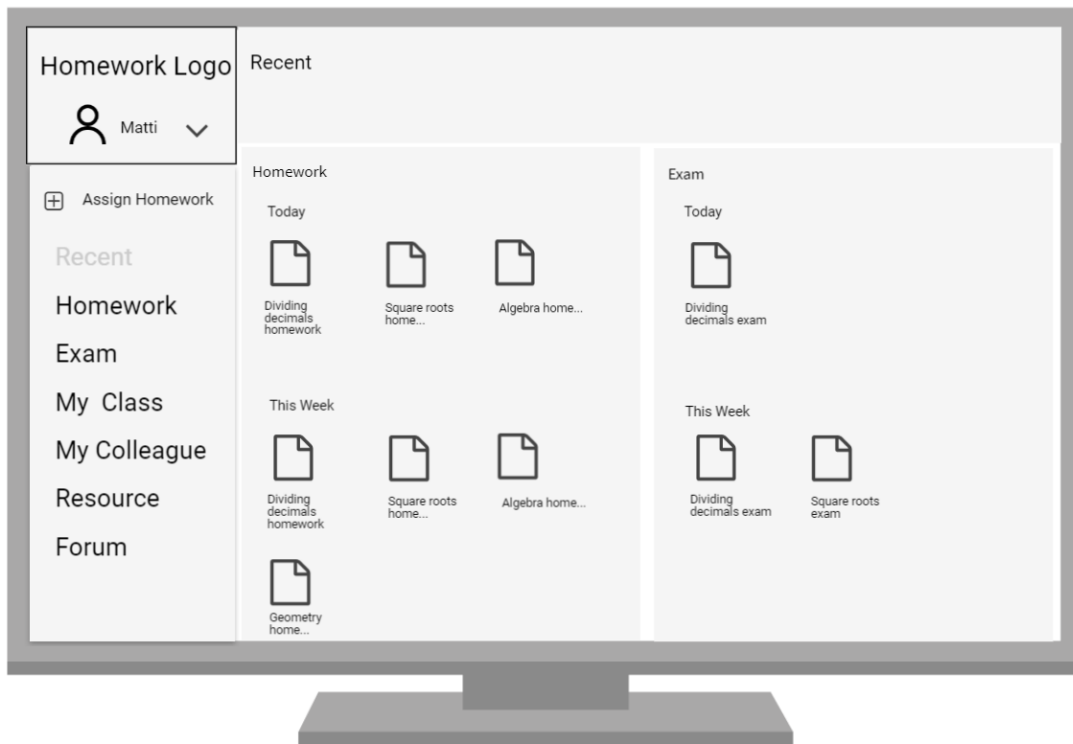


Figure 10 Recent page wireframe

3.4.2 Assign homework page

Assign homework page is an important page. Teacher creates, edits and assigns homework to students, all functions are going to happen in here. At the top right of the page, there are three icons representing custom theme, preview, and settings. In the middle of the top there are two tag bars, Questions and Assign.

Clicking Question tag, user will be in the editing question area. The first filling block is for homework's name and description. The second filling block is for creating questions and responses. On right side, the editing toolbar moves while the cursor runs in the upper and lower filling blocks. The editing toolbar has five functions: add question, import questions, add title and description, add image, add video, add section. The Assign area is where the teacher sets the time for the completion of homework and assigns it to the different class of students.

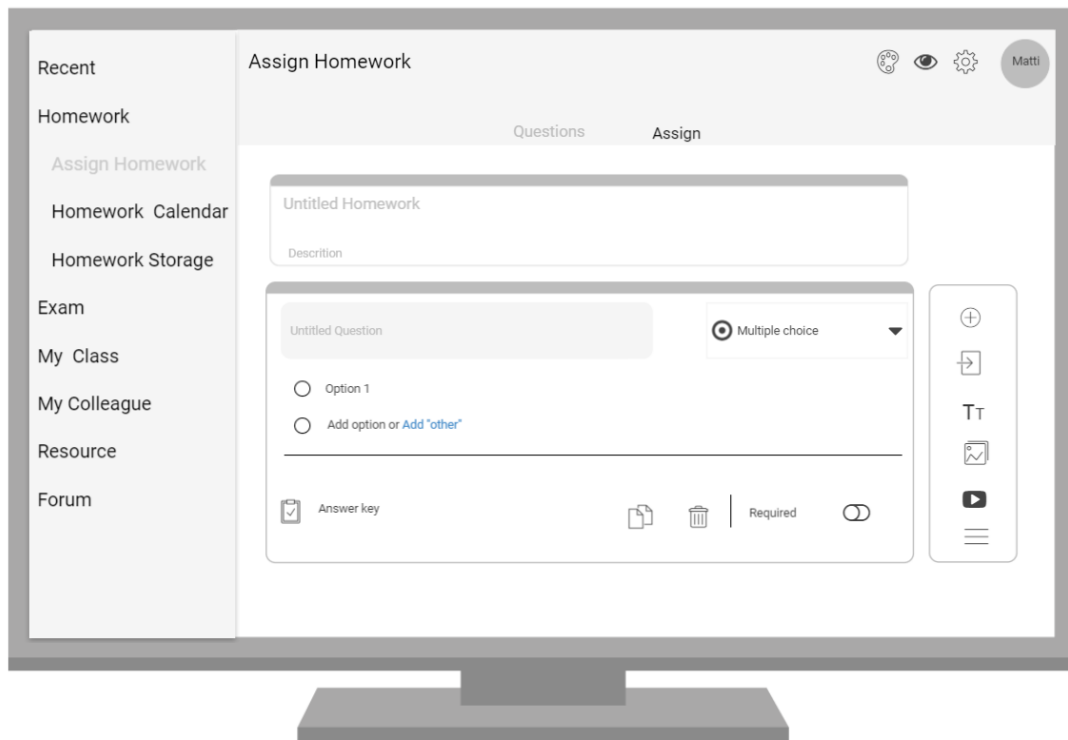


Figure 11 Assign homework page wireframe

3.4.3 Homework calendar page

On the Homework calendar page, you will find all the homework generated by teacher. The search box was originally considered on this page but at this point I do not think the homework website is appropriate for the search system. Since the website does not contain much structured or fragmented information to browse, and the search system is costly to build and is based on different technologies. More important emphasis may be on developing more efficient navigation systems. So, the drop-down menu is designed to allow teacher to pass subject and class by category to find homework. In the calendar, homework is displayed with name, class, number of completed students, and a Report button. To switch to the Report page, press the Report button.

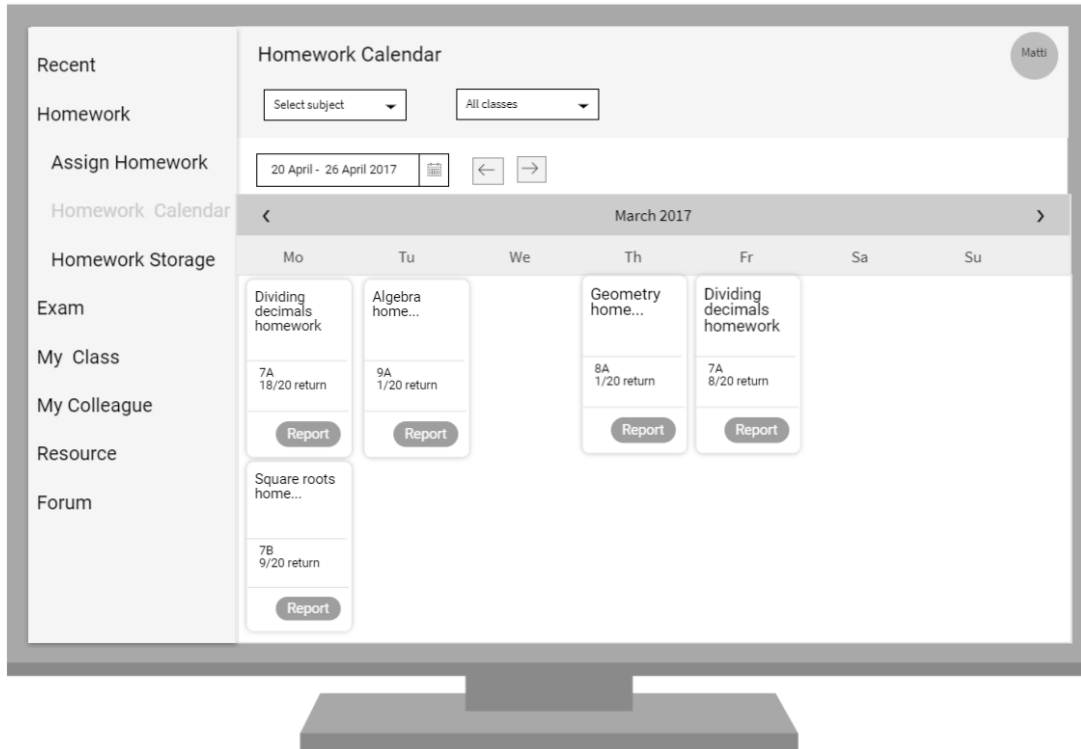


Figure 12 Homework calendar page wireframe

3.4.4 Report page

The Report page displays a report of the class's completed work, including the entire class score, the list of unfinished students, chart of score distribution, and the student's personal score.

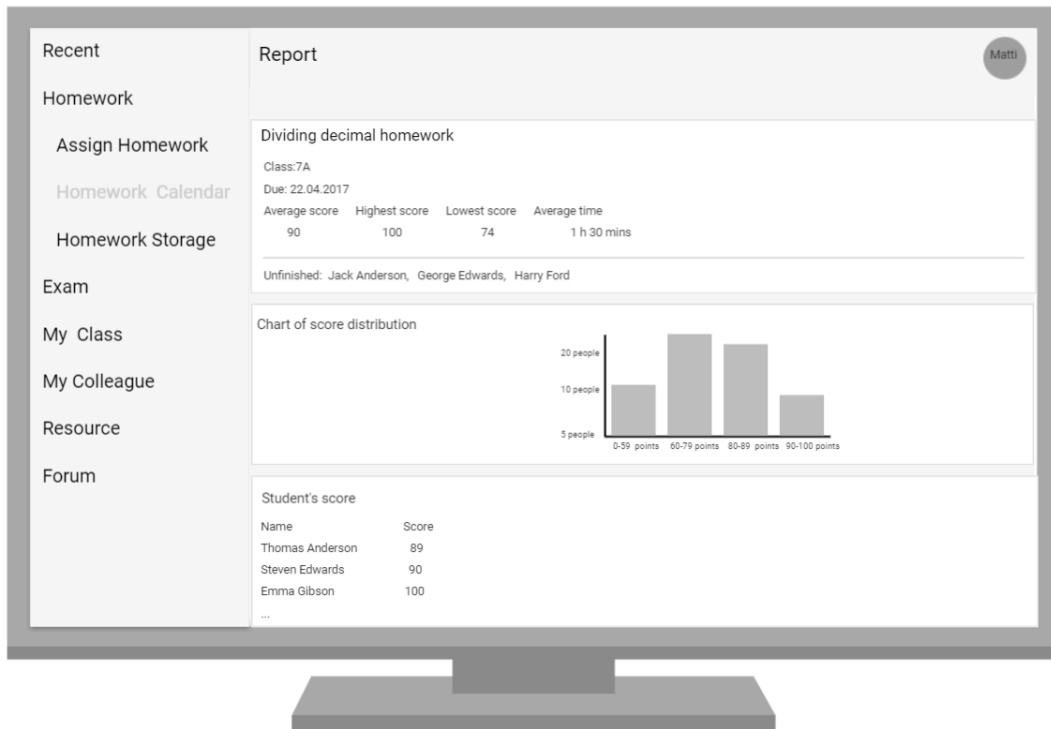


Figure 13 Report page wireframe

3.4.5 Create class page

Create Class is the page for teacher to create a new class. After the class is successfully created, an ID is generated. The ID can be forwarded to student. To enter the class, the student should fill in the ID on student's interface. Teacher can also add students to the class on View Class page.

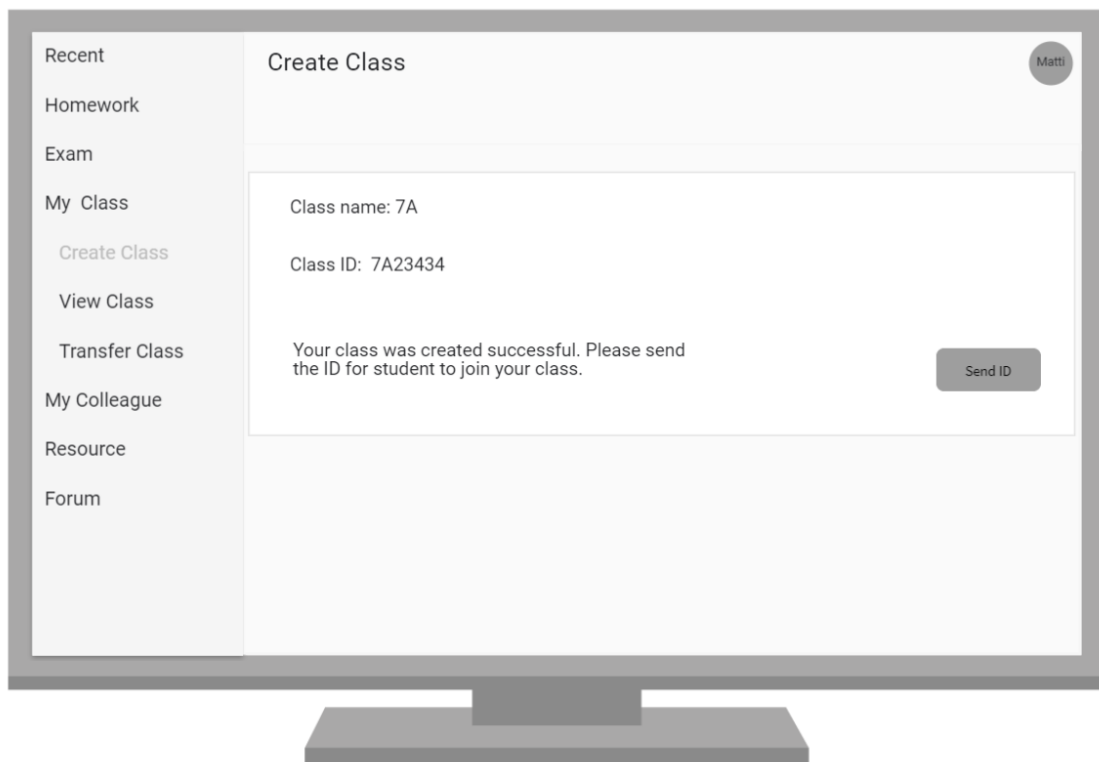
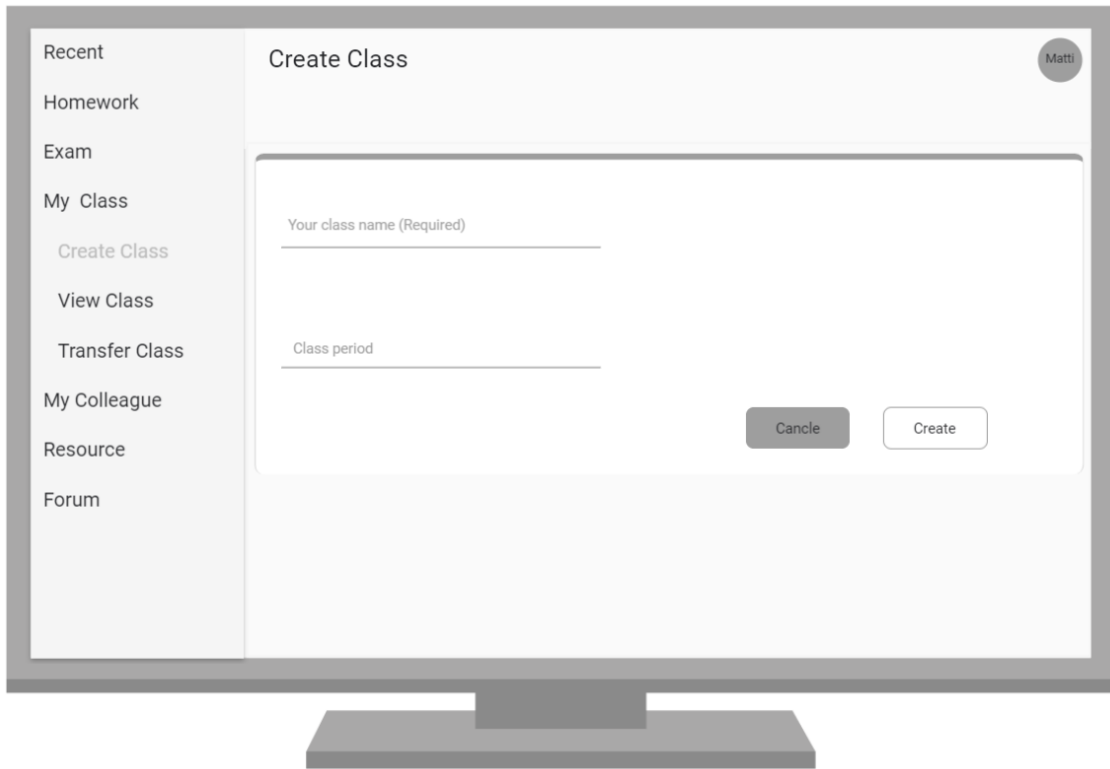


Figure 14 Create class and send class ID page wireframe

3.4.6 View class page

View Class displays the teacher's current class. Selecting the class name, teacher can view the student's list, transcript, kudos. To add, delete, and transfer student, press the Edit button.

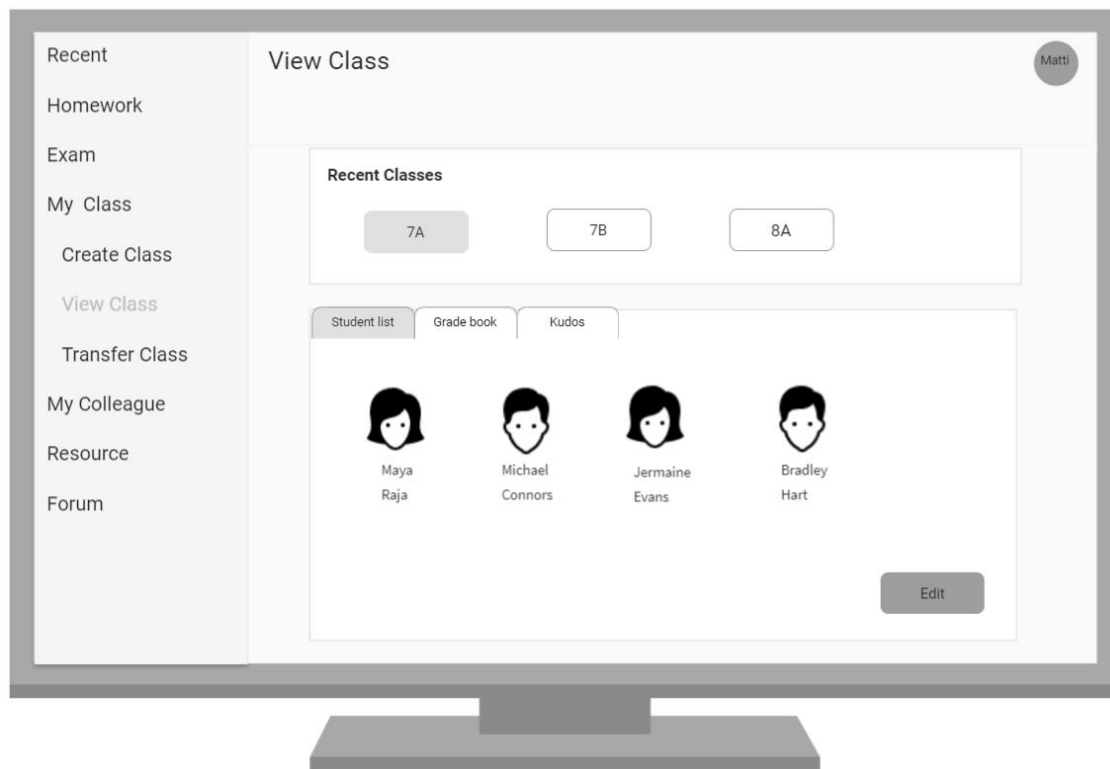


Figure 15 View class page wireframe

3.5 The finished high-fidelity wireframe

3.5.1 Colour

Research on the psychology of color points out that color has an important influence on people's psychological activities, especially with a very close relationship with emotions. Long-wavelength colors (e.g. blue and green) are perceived more positively, are more desirable and more effective than short-wavelength colors (e.g. yellow and red). For example, colour psychological test showed that the color of response sheets given to students sitting in an examination at university influenced the quality of their productions: students provided with blue sheets of paper scored higher marks than those provided with red ones (Soldat, A.S., Sinclair, R.C. & Mark, M.M. 1997).

In homework website, seven colors are used in the project (see Figure 16). Blue color combination (#4285f4, #6fd6f6, #bfd6f6) is primary color, these colors will be used for 70% of website design. Orange color (#f37736) is pop color, it used sparingly to highlight the most important information. Black, grey, white (#292a2d, #e0e0e0, #FFFFFF) are neutral colors, they will most be used for text and background.

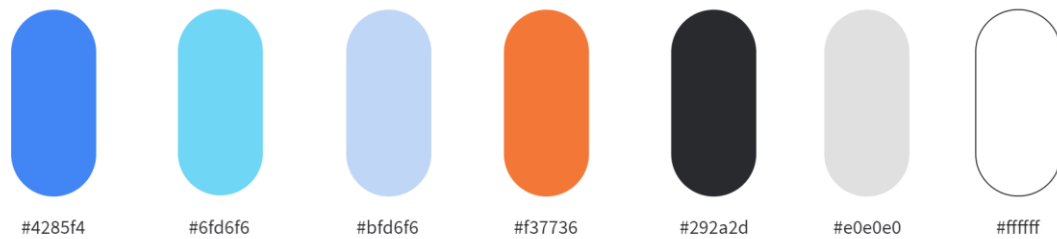


Figure 16 Colour palette of school homework website

3.5.2 Typography

Choosing the right font design has “magical” power of making your website look better, causing your visitors to feel more at ease, thus improving their experiences on your website. This website users are teacher and teenage student. I want this website to represent this personality: comfort, reliable, modern. The font style I used is Roboto. Roboto matches this website personality. Christian Robertson designed Roboto font. Roboto is the recommended font for Google’s visual language, Material Design. "Google developed the font to be ‘modern, yet approachable’ and ‘emotional’" (Wikipedia 2020. Cited 17.04.2020). Roboto font is free and safe to use for websites.

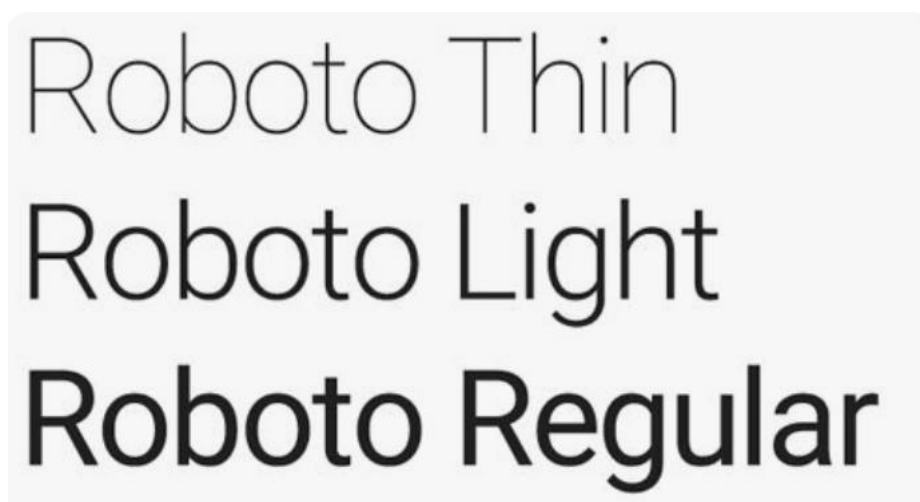


Figure 17 Roboto font styles

3.5.3 High-fidelity wireframe

A high-fidelity wireframe has the following advantages: content and color make the page come alive, helping to catch the developing team's attention. The wireframe allows people to understand the constraints of an HTML page by simulating real page width and font size. Some drawbacks are: Constructing such a complex wireframe takes a lot of time. This can slow down the process and heighten costs. The emphasis may change prematurely from information architecture to interface and graphic design as you incorporate visual elements and content into a structured layout.

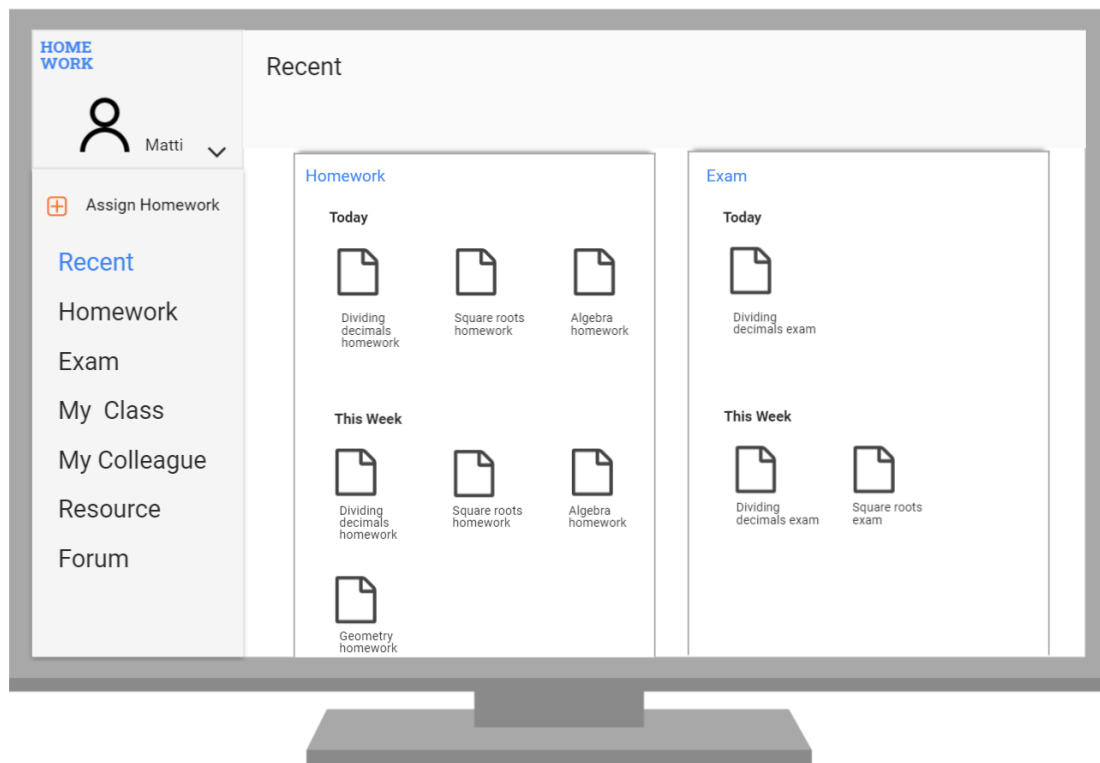


Figure 18 Recent page

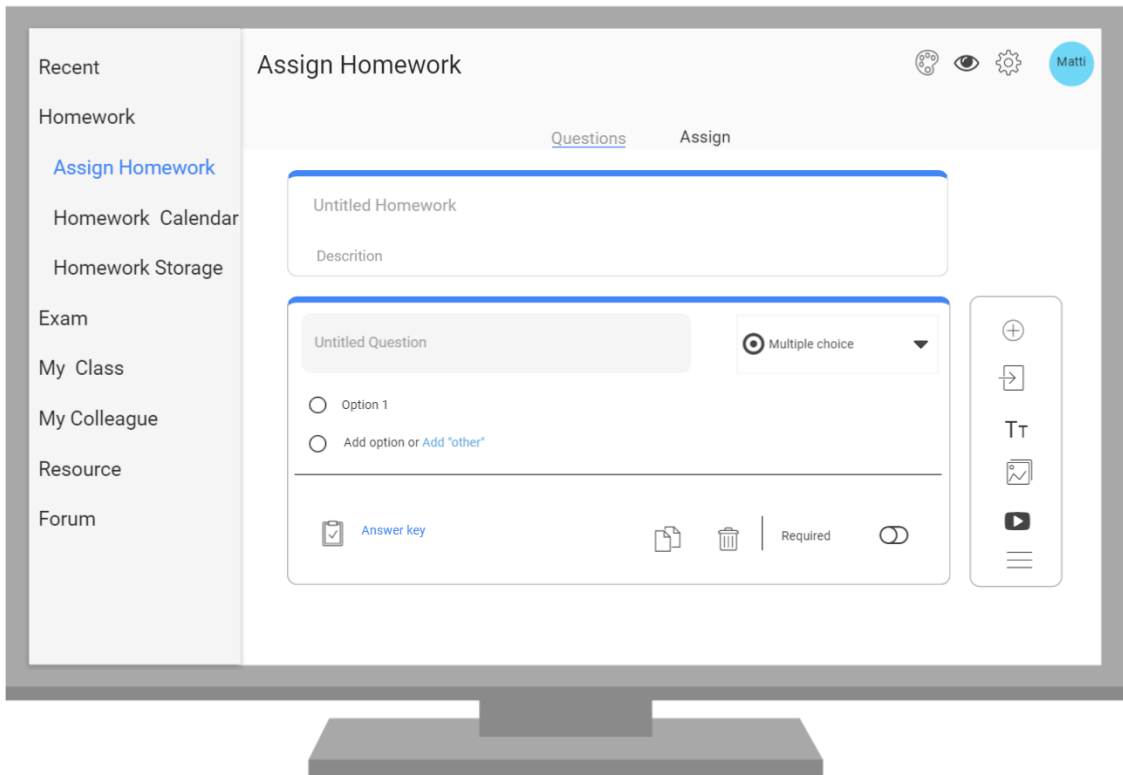


Figure 19 Assign homework page

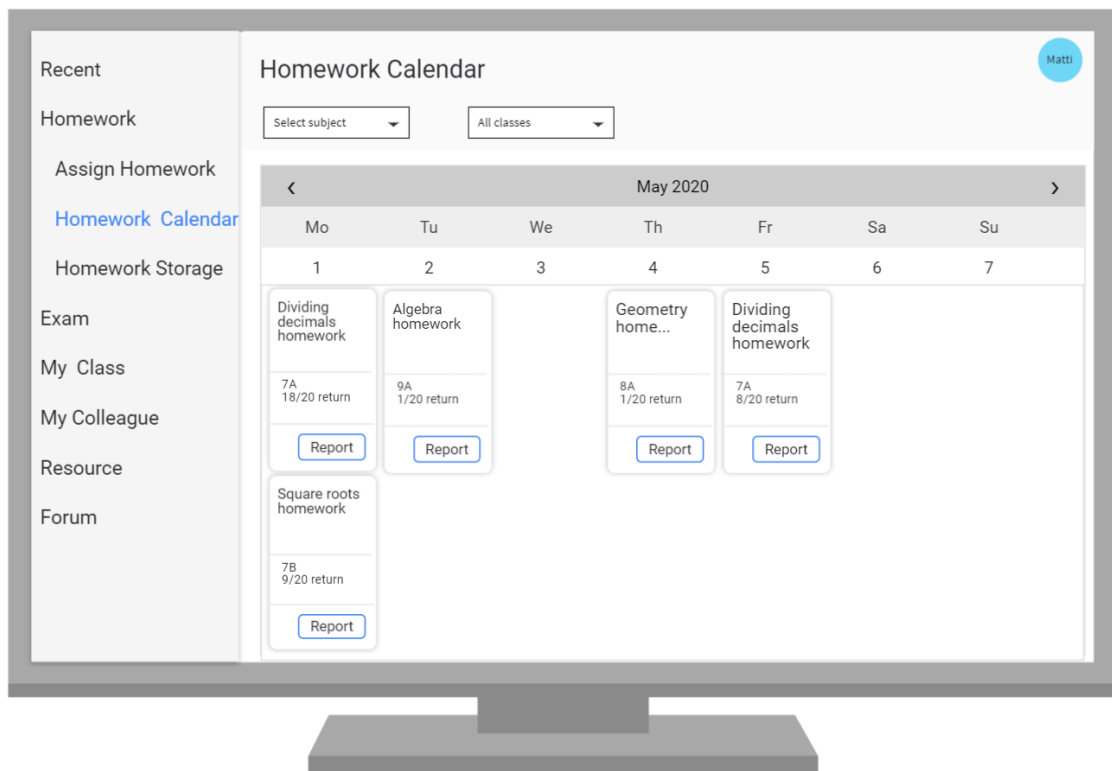


Figure 20 Homework calendar page

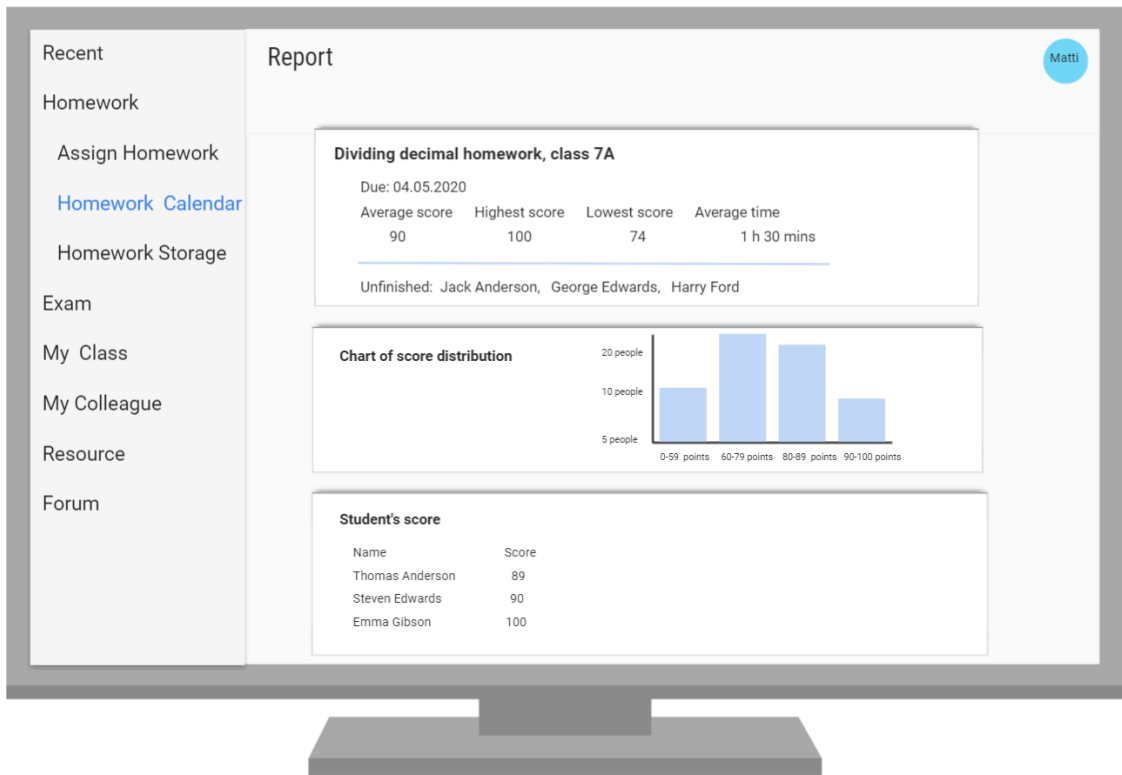


Figure 21 Report page

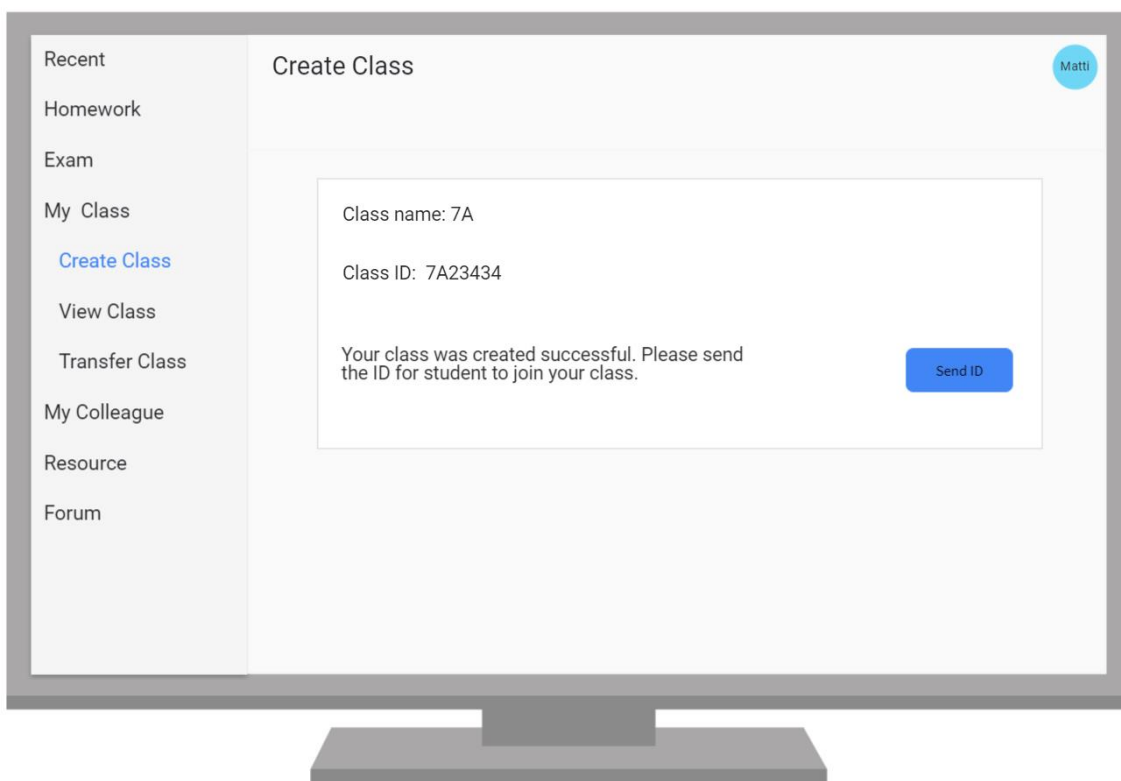
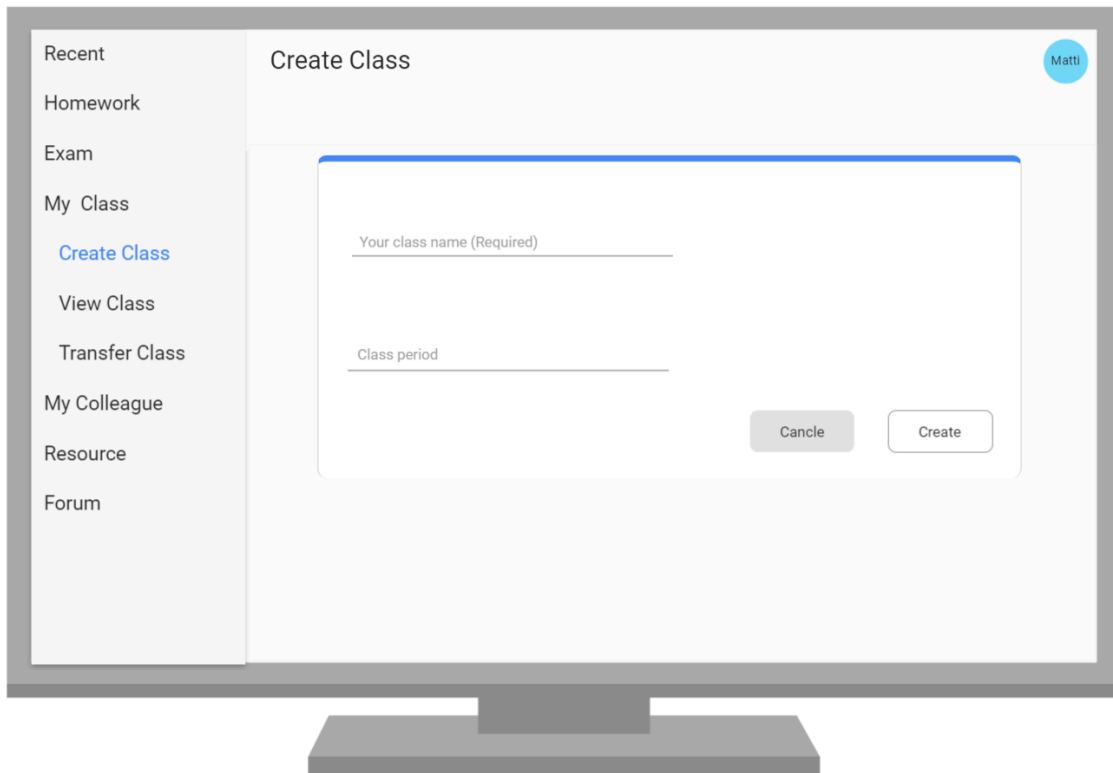


Figure 22 Create class, Send class ID page

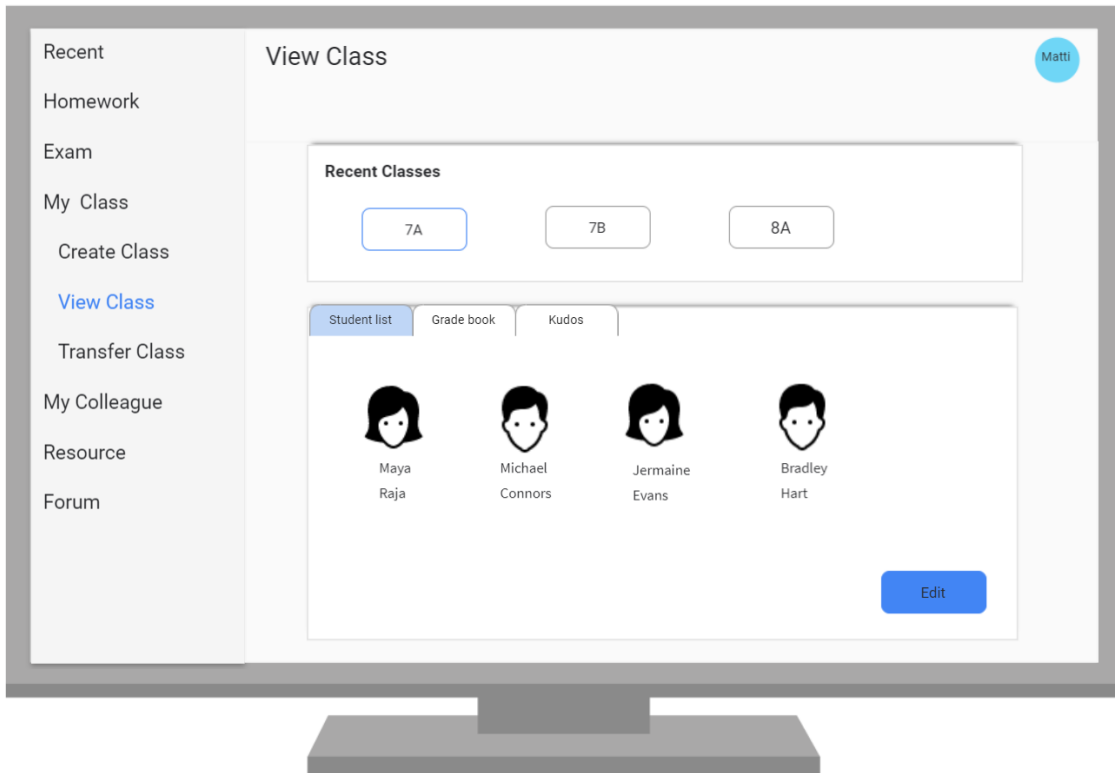


Figure 23 View class page

4 CONCLUSION

The purpose of writing this thesis is learning of information architecture and applying it to the design of website for school homework. This way was used to check if information architecture is useful for website development. Facts have proved that information architecture is very useful. Information architecture helps designer to create the structure of the website. After that, the content, visual elements, functions, interaction and navigation are all based on information architecture.

Designing information architecture should be carried out in the early stage of developing website. During the developing time, a complete information architecture design can guide the progress of interaction design, interface design, database design, back-end development, and front-end development in the project globally. Without information architecture as a guide, it is like a building without a solid foundation.

Since it is important to design information architecture whose duty is to design information architecture? It takes time to create a clear and logical information architecture. If you just have three to five people in a team, maybe all members must join to work. Whoever is responsible for this work, it is necessary to have a very strong logical thinking ability and a very complete overall thinking ability. Generally, large organizations have teams of information architecture, they will deeply study the information architecture problem and rely on user research and data analysis to optimize the overall architecture for developing large-scale websites.

At the end of my thesis, I finally figured out what information architecture is. I thought my research came to an end. Not yet. I found that information architecture is part of the user experience, and then I began to think about the relationship between it and the user experience. Diving down that it is part of the third level of the five elements of the user experience, I wondered the relationship between this level and other levels, and want to learn about the contents of the other four levels except the structural layer, which would be the next new subject to research.

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