



# SCIENCE FAIR

## BACHELOR THESIS

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# SCIENCE FAIR

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## Abstract

In this Bachelor thesis, our aim is to design a multifunctional research participants management platform. The goals of the systems are: to assure participants are eligible, reduce the workload of recruitment, aid in retaining participants, and increase participant engagement. First, a theoretical framework was constructed to guide the design process and assure the needs of all stakeholders assessed. Throughout the process, multiple design iterations have been evaluated, ultimately leading to the high-fi prototype. This prototype has received very positive feedback in the user evaluation. The next steps in bringing Science Fair to fruition, will be the development of the back-end. With the recommendation to be tested in a large scale pilot.

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## Chapter One 'Introduction'

Scientific research; according to the Cambridge Dictionary it is '*a detailed study of a subject, using organised methods, in order to discover new information or reach a new understanding*'.

Employing scientific research to answer the bigger questions regarding human societies is a well established concept. For example; the observation of a tribe living deep in the Amazon Forest to gain insight into the human way of life during prehistoric times. Or the separation of identical twins during the 1960s to gain a better understanding of the age-old nature versus nurture question. These studies have a history of studying humans as subjects seen from the perspective of the researcher, without considering the actual experiences of the humans they study. But in recent years scientists in several disciplines are increasingly trying to involve the human experience of the people they study, the citizens, in their research projects and studies.

With this approach, referred to as citizen science, the citizens become scientists themselves (Follett & Strezov, 2015). They volunteer to collect and/or process the data of a scientific experiment (Silvertown, 2009). Sometimes the citizen even helps with formulating the research questions and assists in guiding the direction of the research. Citizen science is not the only endeavour in trying to increase intensive participant involvement. Others are: Action Research (Oberschmidt et al., 2022), Participatory Design (Zhang & Zurlo, 2020), and Co-Design Sessions (O'Hare et al., 2016). Here, we will group these research and design approaches, and refer to them as 'community-based research'.

To successfully conduct community-based research, the scientists or research institutions have to keep in contact with their new 'citizen colleagues'. They need to interact with them and keep them engaged. Currently, many tools are in use trying to accomplish this. For instance, Google forms is being used to create and distribute surveys to collect data from the participants. Online meeting platforms such as Microsoft Teams, Skype and Zoom are where researchers conduct interviews and host focus groups. E-mailing lists are employed to update participants on the findings of the study, or to send out reminders. The benefit of these programs over simple email is that the researcher is able to track the number of readers. Another tool in use is, of course, social media. Twitter, Facebook, Instagram, etc. are being utilised to share research results, advertise recruitment, or approach (potential) participants. Summarised; a wide variety of platforms or tools limited to a single or few functions are being used in the attempt to accomplish interaction and

engagement with citizen scientists. One might say that the upswing of community-based research has given rise to the need for a multifunctional participant management tool.

The need and possibility of combining several features of the digital tools currently in use, into one, will be assessed in this thesis. It comprises two parts; the theoretical framework will be established through research, and then a design phase will follow.

There are always several challenges when studying human subjects. Not just the communication issues reviewed in the general introduction of this thesis. Three others have been defined by Blatch-Jones and colleagues. The first is Eligibility: is the participant suited to partake in the study? The second challenge identified is Recruitment. A process that takes a lot of time, and comes with a great number of administrative tasks. Thirdly, there is Retention; how do you keep participants interested throughout the study? (Blatch-Jones et al., 2020) The fourth challenge brought forward by Wong and colleagues is Participant Engagement. Keeping participants invested in their participation until the study is completed can present great difficulty, especially in the context of citizen science, where the participants may not have a professional or personal stake in the research (Wong et al., 2021). The research conducted in part one needs to explore the challenges of Eligibility, Recruitment, Retention, and Engagement. What makes these components challenging? What are the best ways to circumvent these challenges, or deal with them?

For the development of a multifunctional participant management system that addresses all these challenges of community based research, it is important to understand the needs of all stakeholders involved. In addition to scientists and research participants, there may be other relevant stakeholders. It is important to identify and involve them in the project. Existing strategies that researchers use to keep participants engaged and motivated need to be identified. And it needs to be explored how these strategies could be incorporated into the design. Lastly, there is a need to explore current systems used in community-based research, that ensure that participants are eligible and that they are recruited in an effective and efficient way.

The identification of these challenges and needs has brought forth the following research question that will be answered in part one:

*"How can existing digital features be combined into one multifunctional research participant management system to tackle challenges of eligibility, recruitment, retention, and participant engagement in the context of community-based research?"*

Our main research question will be answered through the following sub-research questions:



Sub-research question I: *What kind of systems that manage research participation are already in place?*

Sub-research question II: *What recruitment systems that also assure participant eligibility are currently in use by researchers, and do they possess features that could be adopted and adapted for this project?*

Sub-research question III: *What kind of strategies are currently used by researchers to keep participants engaged in a study, and how can these benefit the design of this project?*

Sub-research question IV: *Which stakeholders can be identified beside scientists and research participants, and what are the needs of these target groups?*

The first sub research question will be answered through a state-of-the-art analysis. Systems that resemble our participant management concept will be reviewed, and their pros and cons will be identified. Secondly, expert interviews will be conducted to determine the needs of the obvious stakeholders involved. They will be questioned about the systems they currently use to manage their participants, and which features they consider useful. Sub-research question III will be answered in chapter three, using a literature review. Much research into the challenge of participant engagement has been conducted. And the results can be analysed for the development of our tool. Finally, more interviews will be conducted to identify other stakeholders, and their needs. This all is of course followed by a conclusion.

## Chapter Two 'Background Research'

### 2.1: 'State of the Art'

Sub-research question I: *What kind of systems that manage research participation are already in place?*

Various platforms and solutions have been developed attempting to manage research participants. These platforms aim to facilitate recruitment of suitable participants. Some institutions have created their own databases of potential research participants. This information is usually carefully collected over the years. In this chapter, we will explore some of the known participant recruitment or management platforms. Their pros and cons will be reviewed to facilitate further improvement of our own multifunctional research participant management tool during the design phase.

**ResearchMatch** is a recruitment platform primarily focused on medical research in the United States. It is a centralised database that connects researchers with potential participants. Researchers can advertise their studies, and match with individuals who meet the eligibility criteria. While ResearchMatch is a valuable recruitment research in its particular context, it is quite limited. Regarding both its exclusive field and location. Serving only the United States leaves out a large group of researchers as well as potential participants. The same goes for limiting the database to medical studies only. We can learn from these limitations, and those to roll our project out globally across all fields. Secondly, we can learn from the elements ResearchMatch got right. They use a database in which people can create profiles to register themselves as potential research participants. Matches with studies can be made on the basis of the information given in these profiles.

**RRD (Roesingh Research & Development)** is an institution that has developed its own database of potential research participants. Over the years, they have carefully collected a pool of individuals who may be interested in participating in research projects. This database enables researchers associated with RRD to identify and recruit suitable participants for their studies. While this solution is specific to RRD and its affiliated researchers, it showcases the effectiveness of creating and maintaining dedicated participant databases within research institutions. Their ethical way of handling personal information can be regarded as an example in this project.

**Tingit Platform (8ting.nl)** is a platform that focuses on making digital contact feel personal. Researchers are able to contact already established groups that meet certain

research criteria. The messages can be personalised, and the platform offers the ability for one on one contact between researcher and participant. This limits the effort and time that the researcher needs to put in, while making the participant feel useful. It also allows for a more free flow of information, than for example a questionnaire does. The Tingit Platform represents a versatile solution that can be utilised across various research domains, including scientific research.

**EU-Citizen.Science** is an online platform specifically designed to facilitate citizen science projects across Europe. It is a hub for researchers and citizens interested in collaborative scientific endeavours. The platform offers tools and resources for project initiation, participant recruitment, data management, and communication. By providing a centralised platform dedicated to citizen science, EU-Citizen.Science contributes to the growth and advancement of community-based research within the European context.

**Kennispunt Twente** is a local organisation that focuses on data collection through surveys. It has a database of contact information to share questionnaires with potential research participants. Scientists can request to have certain questionnaires shared. Or Kennispunt Twente can provide them with already existing datasets. Although it is a classic and proven method to gather data, it does have several downsides. While its local focus might provide the potential participants with a sense of trust and purpose, it does limit the quantity of the data. It can also be viewed as a negative that much of the gathered data won't be useful because there is no regard for participant eligibility beforehand.

**Curious** is a platform that aims to engage citizens from the northern region of the Netherlands in citizen science projects. The platform offers various avenues for participation. They offer talks to provide the potential participants with information about the studies featured on the platform. They manage the distribution of measurement equipment to participants. Who can then report the results back to the study. All to make the participant feel involved to improve engagement. The aim is a symbiotic relationship between the curious citizen learning about the subject of the study and the research process, who in turn provides the scientist with the required data.

**Iedereen Wetenschapper** is a platform that aims to involve individuals in scientific research in Belgium. The platform provides opportunities for citizens to actively contribute to research projects across various disciplines. Through Iedereen Wetenschapper, individuals can participate in data collection, analysis, and even project design, fostering a sense of ownership and collaboration. By engaging citizens in science, the platform promotes a greater understanding of scientific processes and encourages lifelong learning. Iedereen

Wetenschapper serves as a bridge between researchers and the public, enabling a more inclusive and participatory approach to scientific research in Belgium.

**University of Twente** offers opportunities for individuals to participate in research projects through their "Meedoen aan onderzoek" (Participate in Research) initiative. This platform serves as a gateway for citizens to engage in various research studies conducted by the university. Depending on the specific projects available, participants can contribute to research through activities such as surveys, interviews, experiments, and field studies. By actively involving citizens in research, the University of Twente promotes collaboration between researchers and the public, fostering a better understanding of scientific processes and encouraging community engagement in scientific endeavours. The "Meedoen aan onderzoek" initiative provides a valuable avenue for individuals to contribute to research while gaining insights and knowledge in their respective fields. But just like many of the other platforms, it has geographical limitations.

**In conclusion**, each of the solutions mentioned brings valuable contributions to the field. Many bringing forth elements that could be integrated in our design of a multifunctional participant research management tool. While many more platforms could be examined, the conclusion would remain the same. While each solution has its strengths, none of them currently combine all necessary features into a single platform that fully supports all stakeholders involved in the quadruple helix; researchers, citizens, government, and industry. There remains a need for a multifunctional participant management system that integrates the best aspects of these existing solutions, addressing the challenges of community-based research comprehensively. Such a platform would enable efficient participant recruitment, effective communication, collaborative project design, data management, and knowledge dissemination.

By developing a comprehensive platform that supports all stakeholders and incorporates features like recruitment tools, participant databases, project initiation, data management, and communication functionalities, researchers can enhance participant engagement, streamline administrative tasks, foster collaboration, and ensure eligibility criteria are met. This integration would empower citizens to actively contribute to scientific research while providing researchers with a useful tool to facilitate community-based research.

## 2.2: 'A Stakeholder Analysis through Expert Interviews'

Sub-research question II: *What recruitment systems that also assure participant eligibility are currently in use by researchers, and do they possess features that could be adopted and adapted for this project?*

The success of any project heavily relies on identifying and understanding the needs and perspectives of all stakeholders involved. In the case of a participant management system, this includes both researchers and participants, and other relevant stakeholders. To kickstart this project, a series of expert interviews were conducted to explore some fundamental questions: "What is important for the stakeholders?", "What are the needs of the target groups?", "Are there any other stakeholders beside the main two groups?", and "What kind of systems are already in place, and what is your opinion about these systems?". These questions were carefully designed to provide a comprehensive understanding of the project's scope, objectives, and challenges. The insights gained from the expert interviews will be used to evaluate the current landscape of participant management platforms, identify gaps and opportunities, and cater to the needs and expectations of all stakeholders involved. This chapter will present and analyse the key findings from the expert interviews.

### § 2.2.1 Methodology

Experts for this study will be selected from the stakeholder group of researchers, who have experience in conducting research involving human subjects. They will be selected based on their availability, willingness to participate, and their level of involvement, or interest in using a research participant management platform. Semi-structured interviews will be conducted to collect data from the participants. The interviews will be conducted using a pre-designed interview script that includes open-ended questions related to the research questions of the study. The interviews will be conducted in person or via video conferencing, depending on the interviewee's preferences and availability.

Prior to the interview, they will be provided with an informed consent form outlining the purpose and nature of the study and their rights. The interviewee's will be given the opportunity to ask any questions they may have about the study before providing written consent to participate.

During the interviews, open-ended questions assessing the need for a research participant management platform will be asked. Such as: "Who are all the stakeholders

involved in research?", "What are the current challenges faced in managing research participants?", and "What features would be important for a research participant management platform?" Most important was during the interview to let the participant talk as much as possible and let side-tracks happen. This might lead to problem statements or needs that wouldn't be revealed by the questions presented in the interview script.

During the interview, important details are noted down. Directly after the interview is conducted, it is transcribed and presented to the interviewee for review. The data collected from the interviews will be analysed to gain an understanding of the stakeholders involved in research. What their current needs and challenges are, and how they can be fulfilled or resolved by a digital platform.

### § 2.2.2 Analysis of the Interviews

The first interview was with dr. Maya van den Berg, the program manager of citizen science at the Design Lab, a public design space at the University of Twente. She is a former researcher now providing support to the researchers there. This makes her very suitable for the first interview. She is able to give a broad perspective of the challenges in research with human participants. Also, her network might lead to other experts willing to be interviewed.

According to dr. v.d. Berg, the stakeholders in research make up the quadruple helix, formed by business, government, research sector, and society. This is explained in a paper she recommended; 'Requirements and motivations of quadruple helix stakeholders for active engagement in Citizen Science' (Psaltoglou et al., 2021).

During the interview, dr. v.d. Berg revealed much about managing research participants, and the challenges that arise in that job. When asked about her experience in recruiting research participants, she mentioned that finding people who are interested, eligible, and can offer something to the study, is difficult. Especially when trying to involve ordinary citizens. She also discussed the importance of personalised information to ensure participants are adequately informed about the study. It should be concise and clear about what is expected of participants. This includes the required abilities to participate in a study, and the invested time that is expected. Also, the goals and benefits of participating in the study ought to be communicated clearly in language that is understandable to ordinary citizens. Otherwise, misunderstandings can lead to poor participation or dropping out of the study completely.

A clear gap in the market for a design like ours became established during the interview. The importance of ensuring that the participants are accurately representing the population being studied, was highlighted. To the best of dr. v.d. Berg's knowledge there is no public database available with data on population samples. And the program manager noted that it is difficult to align the goals of the researchers and the interests of the target group. Time constraints, differences in knowledge and skill levels are some of the main challenges in managing research participants. Additionally, recruiting and identifying participants and maintaining the project can be time-consuming. All of these challenges will be addressed in the design of our multifunctional research participant management tool.

Dr. v.d. Berg stated that personalised access, broad applicability and customisability, are important features for a research participant management platform. One of the most notable benefits, according to her, is the elongated use. At this time, a lot of participant platforms are created on a project basis. It is common that once a project is completed, the dashboard or platform is discontinued. Therefore, it is essential to develop a sustainable solution for a research platform with customisable dashboards, and a large user base that can be maintained over the long term. This requires technical expertise, and commitment to ongoing support and maintenance of the tools included.

Most importantly, dr. v.d. Berg stated that there should be value in long-term engagement with the possible research participants. Maintaining relationships with useful participants should eventually be less time-consuming than repeated recruitment. She did warn that a research platform where participants can sign up to join experiments will most likely encounter a lot of scepticism from the public. Thus, the platform should be given room to slowly develop and earn the trust of the citizen science community.

The expectation that dr. v.d. Berg could introduce more experts to this interviewing phase turned out to be correct. Quite early on in the conversation, she mentioned a similar project in the works. Dr. Renske van Wijk, a knowledge transfer officer at the University of Twente, is currently developing a newsletter for research participants. Prospective participants can sign up for this newsletter, and be informed about research projects at the University searching for participants. This project aligns with her role at the University. It is her job to transfer knowledge, or research findings, to society.

Although dr. van Wijk's project is far more contained than our multifunctional research participant management tool aims to be, she can still offer valuable insights. Therefore, an interview was scheduled. Her previously conducted research makes her the perfect expert to give insights into questions like; Why are current platforms failing in retaining their user

base? And what are the current barriers for researchers to engage with participants? Regarding the first question, her insights were quite similar to those of Dr. v.d. Berg. Participants are difficult to retain due to a lack of alignment between their goals, and those of the researchers. People often participate in research projects because it benefits them in one way or another. When this benefit is reaped, it holds no value for them to keep engaging with the platform. Therefore, it should become one of this project's primary goals to stimulate a continuing symbiotic relationship between researchers and participants.

Dr. van Wijk stated that a problem with achieving that could be the willingness of the researchers to put in the time and effort. She encountered few researchers willing to go the extra mile to make participation in their projects beneficial for both parties. Most researchers are merely focussed on gathering the needed data, and have difficulties seeing the benefit in a platform like ours. This is something that definitely needs to be kept in mind during the design of our participant management tool. We need to prioritise informing researchers about the benefits of elongated relationships. Yes, they might need to put in more effort in the beginning. Including explaining their project in great detail, yet in a language the average citizen can understand. But eventually time will be saved during the active recruitment phase. Far fewer prospective participants will need to be approached. As the platform grows, more and more participants will come to them. It is of great importance that our platform states these benefits clearly, and doesn't leave the researcher under the impression that it will just be extra work. Aside from explaining the benefits of this symbiosis, we can also remind the researcher that dissemination to the public is part of their job.

This importance of symbiosis was again mentioned by the third expert interviewee, Sefora Tunc. The PhD candidate at the University of Twente stated early on: 'the participants don't need us, we need them'. She discovered this during her involvement in a study on healthy ageing and reducing loneliness, where they follow over a hundred elderly participants for a year. In the recruitment process, they had to deal with very limited inclusion criteria. Especially in community-based research, where research participants may not have formal scientific training, it is important to ensure that participants meet certain eligibility criteria. The study required certain skills of the participants that very few possessed naturally. The elderly participants needed to be able to handle themselves with a computer. Sefora Tunc stated that sometimes successful recruitment and retention can be based on something as simple as teaching your participants a skill. This again underlines the importance of symbiosis; the participant can now provide the researcher with the needed data, while having gained a new skill themselves.



To further provide a worthwhile experience for the participants, a help desk was set up within the study. As the participants lived all over the Netherlands, and not many of the elderly are still mobile, simple things such as facilitating transportation can be the determinant that allows someone to participate. Through this help desk, participants are allowed to communicate their needs to the project. It might take extra time from the researcher, but also saves them from trying to predict these needs ahead of time. Of course not every request can be honoured, but giving the participants a voice is beneficial to the retention. Sefora Tunc also mentioned that the study she is a part of, sometimes offers outings to the participants. They enjoy a day of fun, while completing small tasks like questionnaires for the researchers. Something that results in a quicker and more complete reception of data. Finally, she highlighted the importance of using appropriate language as a researcher to communicate with your target group. As this prevents misunderstandings that might negatively influence the research along the line.

While most of these benefits need to be realised by the researchers themselves, our platform can aid in the facilitation. We can for example offer researchers the opportunity to promote outings they organise. Or provide an interface where every project can easily set up their own helpdesk. Formats for skills videos can be made available. As well as providing researchers with information on the benefits of these efforts. This train of thought will be elaborated on in the second part of this thesis, the design phase.

### § 2.2.3 Conclusion

In this chapter, we aimed to answer the following sub-research question:

*What recruitment systems that also assure participant eligibility are currently in use by researchers, and do they possess features that could be adopted and adapted for this project?*

Although the focus of the interviews have not been on the systems currently in use by researchers, they did provide a lot of valuable information. Primarily, the needs of the stakeholders became established. It is very useful to be informed about certain barriers, such as the potential reluctance of researchers. So this can be taken into account during the development of our project.

Furthermore, the experience our experts have can aid in the improvement of our project. Instead of talking about features of existing recruitment systems, they provided information about recruitment tactics they have encountered that worked properly. It is a core

requirement that the prospective participant is honestly informed about the benefits participating has for them. So a true symbiosis can come to life, where untrue expectations or a misalignment of goals is prevented. The reciprocity between researcher and participant was deemed important by all interviewees. Promoting and facilitating this symbiosis and reciprocity will become a primary goal during the design phase of this project. Lastly, it is worth adding that the overall enthusiasm about this project underlined the need for a multifunctional research participant management tool like ours.

## § 2.3 A Literature Review

*Sub-research question III: What kind of strategies are currently used by researchers to keep participants engaged in a study, and how can these benefit the design of this project?*

In this chapter, we conduct a comprehensive literature review to provide an overview of the existing research on strategies of participants engagement. This review aims to identify effective strategies regarding participant engagement that can inform the design of a multifunctional research participant management system, in the context of community-based research. The increasing digitisation of research has led to the development of various tools for managing and interacting with research participants. However, participant engagement remains a critical challenge for researchers, as it affects both the recruitment and retention. To address this challenge, researchers have employed various strategies focussed at keeping participants engaged and invested in the study.

Through this literature review, we aim to identify the different approaches, techniques, and tools used by researchers to enhance participant engagement, as well as the factors that contribute to their success. We will also examine the challenges associated with participant engagement, and the strategies employed to overcome them. Ultimately, this review will inform the design and development of a multifunctional research participant management system that can effectively address the challenges of participant engagement in citizen science.

Participant engagement (PE) is an essential aspect of research that involves actively involving participants in various stages of the research process. PE can improve the quality and relevance of research outcomes, enhance research participants' experience, and promote research dissemination and implementation (Tse et al. 2015). Here we aim to examine the strategies, obstacles, and outcomes of participant engagement across different research studies.

### § 2.3.1 Methodology of the literature review

A qualitative literature review will be conducted to answer Sub-research question III, which focuses on the strategies currently used by researchers to keep participants engaged in a study. The review will follow a systematic approach to ensure that all relevant literature is identified and analysed. The studies included in this review were selected based on their relevance to the topic of participant engagement. They were evaluated based on the role of the participant in the study, the method of communication, the types of engagement, the specific strategies used to increase participant engagement, and the obstacles to participant engagement that the researchers identified.

The search will be strategically conducted via electronic databases such as PubMed, Scopus, and Web of Science. Search terms are made up of keywords related to participant engagement, retention, and strategies. Examples are: "participant engagement strategies," "participant engagement," and "study participation." Studies that meet the following criteria will be included in the review: Peer-reviewed journal articles or conference papers published in the English language that focuses on strategies for participant engagement and retention in research on human subjects.

Data will be extracted from the selected studies using a pre-defined data extraction form based on sub-question III. Expected to be extracted are strategies used by researchers to keep participants engaged during a study, and the effectiveness of those strategies. Following the extraction, the data will be analysed using a synthesis matrix to identify common themes and patterns in the selected literature.

A limitation of this literature review could include the potential for publication bias. As studies that report positive results, may be more likely to be published. Additionally, the generalisability of the findings may be limited to the specific context and population of the studies included in the review.

A qualitative literature review will provide valuable insights into the strategies currently used by researchers to keep participants engaged in a study and how these strategies could benefit the design of this project. The findings will inform the development of a multifunctional research participant management system to address challenges related to participant engagement in the context of community-based research methods.

### § 2.3.2 Findings of the Literature Review <sup>1</sup>

A common denominator found during the course of this literature review is the positive effect of actual participant involvement on PE. One way a participant can be involved in research is through community-based participatory research (CBPR). CBPR is a type of research that aims to actively involve community members in all stages of the research process. An extreme example of this is the yearly bird count; where the participants are entrusted with the collection of data. The main benefit of CBPR regarding PE is that it results in a more invested participant. When the participants themselves are entrusted with a role in the research, they show more engagement than when merely being the subject of a study. This assumption is supported by the research of Tse, Blaskova and Harrison.

Tse and colleagues found that when expectations of the community were taken into account when setting the research parameters, and the results had an actual impact on the community, the engagement of the participants was higher. The study also showed that reciprocity between the academic partner and the community is essential in establishing a successful CBPR process (Tse et al. 2015). The researcher needs to engage with the participant if they expect engagement from the participant. Another CBPR-related study was conducted by Blaskova and colleagues. They regarded children as experienced experts and invited teachers to be co-researchers. The participants became more invested and therefore showed more engagement when having such a direct role in the study (Blaskova et al., 2020). In a study conducted by Harrison and colleagues, it became clear that PE was improved when a bidirectional dialogue between patient partners and researchers was established. This involves ongoing communication and collaboration throughout the research process, with a focus on mutual learning and understanding, shared decision-making, and the co-creation of research questions, methods, and outcomes. By adopting these principles and best practices, researchers can work with patient stakeholders to ensure that health research is more patient-centred, relevant, and impactful. The researchers asked the patients for their input and regarded them as the experts on their disease instead of scientists (Harrison et al., 2019).

The second observation during the literature review is the positive effect on PE when the participant is understood and represented. This is among others shown in the previously discussed work of Blaskova and Harrison. The children and teachers in Blaskova's research were given a voice in the project. An effort was made to understand and represent them (Blaskova et al., 2020). And the patients researched by Harrison were representing their disease, and their opinions were taken into account (Harrison et al., 2019). Another piece of

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<sup>1</sup> See Appendix B for synthesis matrix

research supporting the influence of understanding and representation of the participant on PE is given by Cruz and colleagues. In an obesity prevention study spanning different communities, they found that building on previous relationships, working with community leaders, forming partnerships with mutual benefits and having a member on the research team who serves as the primary point of contact with the community were effective strategies for increasing PE (Cruz et al., 2014).

Thirdly, the influence of open communication and information on PE was noted. Several studies show the correlation between interacting with the participants and providing them with information about the study, and their level of engagement. Shieh and colleagues conducted a study on pregnancy and infant health via social media and found that regularly sending study participants videos, infographics, messages, photos, blogs, discussion forums, chat rooms, Q&A, and virtual one-on-one or group discussions were effective strategies for increasing PE. However, the study also identified some barriers to PE, such as; falsified eligibility information provided by social media users, competition with others advertising on the same free social media platforms, and difficulty obtaining permission to access certain social media groups (Shieh et al., 2020). Edirisingha and colleagues utilised social media as well. They found that adopting Facebook as a platform to strengthen "friendships" with the participants helped overcome the challenges inherent to ethnographic research: gaining access and immersion and capturing multiple perspectives (Edirisingha et al., 2017).

Another study supporting the premise that interaction and information have an influence on PE was provided by Nkyekyer and colleagues. The study identified various strategies for enhancing PE, including visual and personalised feedback, goal setting, digital push interventions, parental financial incentives or rewards, mental health apps, intensive guidance and digital text notifications. They also suggest that more interactive methods of delivery, such as videos and regular e-therapist contact, improve adherence and completion rates (Nkyekyer et al., 2021). Research conducted by Moses and colleagues focused more on the personal, rather than the digital side, and found that in-person focus groups have a positive effect on PE. The focus groups led to more relevant and applicable research findings (Moses et al., 2020).

Aside from these deeper seeded motivators in PE, engagement can also be positively influenced simply because a study is interesting and entertaining to the participant. Interest among others of course derives from a personal stake in the research. What can the participant gain from the research? The previously discussed research of Blaskova and colleagues showed that engagement increased with 'Play-Research' (Blaskova et al., 2020).

Another study supporting that more entertaining research projects increase PE comes from Morris and Paris. They highlight the importance of art-based research as an important participatory factor. In art-based research, the researcher analyses the artistic output of the participant. The iterative and participatory nature of art-based research supported a longitudinal dialogue between researcher and participant (Morris & Paris, 2022).

Finally, there will be a review of selected literature from Browne, Wong and Supplee; that do not clearly fit within the discussed categories of participatory factors, but still provide information regarding PE that is essential to this project. Browne and colleagues identified factors that influenced PE that for the remainder of this paper will be referred to as 'the abstract concepts'. Browne found that active engagement came largely from promoting the following abstract concepts: trust, honesty, transparency and authenticity. The study was conducted during the COVID-19 pandemic. But it found that despite the lockdown situations, moving all research activities to a virtual environment had no negative influence on participant engagement. (Browne et al., 2022).

Wong and colleagues identified four main forms of participant engagement strategies: changing attitudes by appealing to social motivators, changing attitudes by targeting individual psychology, reducing barriers and cognitive burdens, and providing incentives. These interventions were tested in randomised controlled trials. The results showed that the strategies had a statistically significant positive effect on 31% of the research participants, while 51% of the participants showed no improvements in engagement (Wong, et al., 2021).

Another piece of research regarded as important that this literature review has brought forward came from Supplee and colleagues. Their study showed that the higher the adaptability of the researcher, the higher the engagement of the participants. It is beneficial to constantly keep observing if a certain intervention is showing the required results. And if not, that said intervention is adapted to have more effect on the participants of the study (Supplee et al., 2018)

### § 2.3.3 Conclusion

From this extensive literature review, we can derive the importance of several categories of participatory factors. It is important to involve the participant in the research, possibly through CBPR (Tse et al., 2015; Blaskova et al., 2020; Harrison et al., 2019). The participant also showed more engagement when he or she was understood and then

represented in the study (Blaskova et al., 2020; Harrison et al., 2019; Cruz et al. 2014). Also identified was the participatory influence of open communication with your participant and keeping them informed of the study and its results (Shieh et al., 2020; Edirsingha et al., 2017; Nkyekyer et al., 2021; Moses et al., 2020). It was also noted that having a stake in research and participating in an entertaining form of research has a positive influence on engagement (Morris & Paris, 2022; Blaskova et al., 2020). Furthermore, the importance of the adaptability of the researcher was highlighted by Supplee. The final pieces brought forward by this literature review can be referred to as Wong's four strategies of PE, and the abstract concepts.

During the course of the design of the multifunctional participant engagement tool, the participatory factors identified in this literature review will be taken into account. It has brought forward two streams of interventions that need to be implemented in the design. First, there are the practical interventions, such as; involving the participant, understanding and representing them, providing information, and open communication. This can be done by adopting and adapting the large variety of tools already in use, identified by this extensive review. The second stream involves the abstract concepts; trust, honesty, transparency and authenticity. These are concepts not simply defined, and there are no clear interventions that can be immediately implemented to facilitate these abstract concepts. Therefore, the abstract concepts will need further investigation, which will be conducted through interviews, to gain more defined definitions. By defining the abstract concepts, more clear parameters can be set to take the importance of trust, honesty, transparency and authenticity into account when designing the multipurpose participant engagement tool.

## § 2.4 'Exploring Different Perspectives'

*Sub-research question IV: Which stakeholders can be identified beside scientists and research participants, and what are the needs of these target groups?*

Chapter four will aim to identify other stakeholders and their needs. Thus providing an answer for sub-research question IV. Secondly, it will further investigate the abstract concepts of trust, honesty, transparency and authenticity through different perspectives. In order to gain a deeper understanding of these concepts and how they can be practically implemented in participant management platforms, structured interviews were conducted with students and graduates of diverse academic backgrounds. The chapter begins by discussing the methodology used in conducting the interviews, followed by a presentation of the results. By examining the perspectives of a diverse group of individuals, this chapter aims to provide valuable insights for the development and improvement of our participant management tool.

### § 2.4.1 Methodology

In this phase, a structured interview approach will be employed. The selection of participants has been based on their diverse academic backgrounds, and the different perspectives they will bring. Recruitment was managed through convenience sampling. The interviews were conducted in person. And each interviewee was asked the same set of questions about trust, reciprocity, authenticity, honesty and transparency. Other topics of focus were equitable relationships, participant privacy and confidentiality, power dynamics, and communication in participant management platforms. The interviews were transcribed and analysed using a thematic analysis approach to identify recurring themes and patterns in the participants' responses.

One limitation of this study is the small sample size. Only seven people were interviewed due to time constraints. Which may not properly represent the broad population of individuals with different perspectives on these concepts. Therefore, the findings may not be generalisable to a larger population. However, given the breadth of academic backgrounds represented, the findings still provide valuable insights into the opinions and experiences of a diverse group of individuals.

The use of structured interviews may have limited the participants' ability to fully express their thoughts and opinions on the topic. There is not as much room for side track conversation as there was during the expert interviews. Still, structured interviews were



chosen because the aim is to gather different opinions on set concepts. This way the responses can be more conclusively analysed and compared. It is also important to acknowledge that the responses provided by the interviewee's may have been influenced by social desirability bias. As they may have felt compelled to provide responses that they believed were socially expected of them.

Despite these limitations, the study provides valuable insights into among others: trust, reciprocity, authenticity, honesty and transparency. The findings of this study can be used to inform the development and improvement of our research participant management tool.

### § 2.4.2 Structured interviews with students from diverse backgrounds

This paragraph starts off with a little background information about the interviewee's. As this is the main objective of this research phase, it is important to know what brings forth a certain student's view. This is then followed by the overview of the set questions asked during the structured interviews. Finally, the results will be presented and analysed.

Seven participants were interviewed. Including (1) a Philosophy master student, (2) a fourth year in a bachelor level art programme, (3) a Sociology master student, (4) a third year student enrolled in the Creative Technology bachelor, (5) a recent graduate of a bachelor of law, (6) a Clinical Psychology student, and finally (7) a conservatory graduate. The broad spectrum of views was chosen for the evaluation of the abstract concepts brought forth in the previous chapter.

The questions of the structured interview are:

1a. *In your opinion, what is the importance of trust in participant management platforms?*

1b. *Can you give an example of how trust can be fostered in such platforms?*

2a. *How do you define reciprocity in research participation?*

2b. *Can you give an example of how a participant management platform can ensure reciprocity between researchers and participants?*

3a. *What does authenticity mean to you in the context of research participant management?*

3b. *How can a platform ensure authenticity in its interactions with participants?*

- 4a. *How do you think honesty and transparency can be achieved in research participant management platforms?*
- 4b. *Can you give an example of a platform that has implemented these concepts effectively?*
- 5a. *How important do you think equitable relationships are in research participant management?*
- 5b. *What strategies do you think a platform can use to ensure equitable relationships with participants from diverse backgrounds?*
- 6a. *Can you describe a time when you felt uncomfortable with the way your personal information was handled during a research study?*
- 6b. *What measures do you think can be put in place to protect participant privacy and confidentiality in a participant management platform?*
7. *How can a participant management platform address issues related to power dynamics between researchers and participants?*
8. *Can you suggest any ways in which a participant management platform can facilitate open communication between researchers and participants?*
9. *How can a participant management platform encourage and support participant feedback and input throughout the research process?*
10. *What features or functions would you like to see in a participant management platform to ensure the best possible experience for participants?*

### § 2.4.3 Results

The results of the interviews conducted will now be presented and analysed. A short summary of each interview is given, highlighting their views on trust, reciprocity, authenticity, honesty, transparency, equitable relationships, privacy, power dynamics and open communication.

#### The Perspective of a Philosophy Student

From the perspective of a philosophy student, trust is defined in the context of reciprocity. Knowing that the other party “will do right by me” is very important to the philosopher. Reciprocity is seen as an obligation of the researchers to compensate participants fairly for their time and efforts. Authenticity is defined as the genuine interaction between the researchers and the participants, without any hidden agendas or data manipulations. Honesty and transparency are deemed crucial for ethical research by the

philosopher. Platforms should be urged to ensure that the participants are informed about the research process, and what their role in it will be. Equitable relationships are seen as important for building trust. And platforms should provide equal opportunities for all participants to participate in research studies.

### The Perspective of an Art Student

The art student notes that trust can be achieved by having a coherent design that “looks professional”. How this professional look can be achieved, and what makes a design feel trustworthy, needs further investigation. Reciprocity is seen as a way to create a positive relationship between the participants and the researchers, by acknowledging and recognising the contributions of participants to the research process. Authenticity is defined as being genuine and transparent in interactions with participants. According to the arts student, honesty and transparency are crucial for maintaining the credibility of the research. Providing accurate information to participants will lead to empirically achieved trust. Equitable relationships are seen as a way to ensure that all participants are treated fairly and provided equal opportunities to participate in research studies.

### The Perspective of a Sociology Student

The results of the interview emphasise the importance of prioritising inclusion and diversity in participant management platforms. The sociology student suggests that targeted outreach, and participant compensation, can help to address barriers to participation. And it can help to ensure that all participants have equal access to research opportunities. Additionally, the interview highlights the crucial role of trust, reciprocity, authenticity, honesty, transparency, and equitable relationships in participant management. The student emphasises the need for participant management platforms to ensure clear and accurate communication, to establish guidelines for decision-making and communication. They need to provide opportunities for participants to give feedback and their input. The ethical treatment and well-being of participants needs to be prioritised. Overall, the interview provides valuable insights into how participant management platforms can promote equitable, inclusive, and ethical research practices that benefit both researchers and participants.

### The Perspective of a Creative Technology Student

From the perspective of a creative designer, trust is seen as crucial in participant management platforms. Trust can be fostered by providing clear and concise information, showing transparency, and ensuring participant privacy. Reciprocity is defined as providing

participants with valuable and meaningful experiences that would encourage their continued participation. Authenticity is emphasised as being honest and transparent in interactions with participants. Strategies such as personalised building of connections, and offering incentives were suggested to ensure equitable relationships with participants from diverse backgrounds. From the perspective of a creative designer, accessibility, usability, and user experience are critical factors in participant management platforms. The design of the platform should be intuitive and user-friendly, making it easy for participants to navigate. The instructions for participating in a study should be clear and concise, ensuring that participants can understand the requirements easily. These design considerations can enhance participant engagement and satisfaction, leading to a better overall experience for both the researchers and the participants.

### The Perspective of a Law Student

According to the law student, participant privacy, confidentiality, open communication, and participant feedback are critical factors in participant management platforms. Researchers must ensure that participants have a clear understanding of the study's purpose and objectives. And that their data is used lawfully and ethically. Preferably clearly set out in a contract signed by both parties. Incentives such as gift cards or discounts can be offered to foster reciprocity. But it shouldn't become plainly transactional, as that can be viewed as unethical. Authenticity can be achieved by maintaining open and honest communication with participants. Equitable relationships are essential to ensure that all participants have equal opportunities to participate in research studies. Power dynamics must be addressed, and the "weaker party" should be given a voice. Providing clear and accessible communication channels, and opportunities for participant feedback and input throughout the research process, can facilitate open communication. Strict data security measures, and compliance with data protection laws, are necessary to protect participant privacy and confidentiality. A user-friendly interface, and clear procedures for handling complaints, can ensure the best possible experience for participants. By doing so, researchers can promote a fair and respectful research process that protects the rights and interests of all involved parties.

### The Perspective of a Clinical Psychology Student

From the perspective of a clinical psychology student, trust is seen as crucial for successful participant management. The platforms must provide participants with a secure and confidential environment to share their personal information while participating in research studies. Reciprocity is defined as providing participants with meaningful and

valuable experiences in return for their time and efforts. Authenticity is seen as a way to build trust. And platforms should be honest and transparent in their interactions with participants. Honesty and transparency are deemed crucial for maintaining the credibility of the research. And platforms should provide participants with accurate and timely information about the research process. The psychology student stated that from their perspective, it is important to prioritise the mental health and well-being of research participants. Informed consent and debriefing can help participants understand the potential risks and benefits of their participation. It is important to address any emotional needs that arise during the study. Participant management platforms should also consider providing resources for participants who may require additional support.

### The Perspective of a Conservatory Graduate

The musician emphasised that mutual respect, and accountability between researchers and participants are critical in establishing trust. This can be achieved through clear and consistent communication, transparent policies, and addressing participant concerns. Reciprocity, defined as fair compensation, can also foster trust. Authenticity can be ensured by being transparent and actively engaging participants in the research process. To address power dynamics, clear guidelines and expectations for researchers and participants can be established. Open communication and regularly seeking participant feedback can also facilitate equitable relationships. The interviewee also advocated for creativity in the design, and using research for social change and activism. Overall, a participant management platform should prioritise user-friendly and accessible features, clear instructions, and appropriate incentives to ensure the best possible experience for participants.

### § 2.4.4 Conclusion

Each interviewee was asked the same set of questions about trust, reciprocity, authenticity, honesty and transparency. Other topics of focus were equitable relationships, participant privacy and confidentiality, power dynamics, and communication in participant management platforms. Looking at the abstract concepts from the perspectives of these diverse educational backgrounds, led to many different interesting views. Ranging from the importance of certain moral values to concrete suggestions that can be brought to the design phase.

Reciprocity was defined in a few different ways. The philosophy student saw it as an obligation of the researcher to compensate the participant for their time and effort. The creative technology, and clinical psychology students thought it mostly important to offer meaningful experiences to achieve reciprocity. While financial based compensation was suggested by the law student, they also warned against the unethical side of it. The musician simply defined reciprocity as being fairly compensated.

The clinical psychology student talked about the connection between the abstract concept. How honesty and transparency make for an authentic interaction, which in turn will build trust. Honesty was defined by most as the truthful supply of information. The art student noted that a continuing supply of truthful information empirically leads to trust. They also pressed the importance of a coherent and 'professional looking design' to achieve trust. These responses could be processed and implemented in the form of prioritising participant autonomy and informed consent. Additionally, there is a need to address power imbalances and promote social justice in the research process. The need for open communication was also highlighted. And platforms were urged to offer multiple communication channels and respond promptly to participant inquiries.

Inclusivity, and diversity, were deemed important by several students. The conservatory graduate also advertised using research for social change and activism. The sociology student suggested clear boundaries or guidelines for decision-making regarding participation. The importance of mental health of the participant was brought up by the psychology student. Providing additional support on as needed basis guarantee

Ethical implications were also brought up by several interviewees. There should be a clear agreement between participant and researcher. The law student suggested making use of a contract. The law student also highlighted the importance of lawful conduct, among others regarding privacy. In terms of protecting participant privacy and confidentiality, the clinical psychologist suggested that participant management platforms should implement measures such as secure data storage and clear communication about data use.

Overall, the interviews highlighted the complex and multifaceted nature of participant management platforms. Trust, authenticity, honesty, transparency, and equitable relationships among others, were given a less abstract definition. These findings will be brought to the design phase, with the goal of establishing ethical and effective research practices.

## Chapter Three 'Methodology'

Now that the research is concluded, we will commence with the design of our multifunctional research participant management tool. All the insights gained in part one will be merged. This second part will begin with an elucidation on the methodology employed. Followed by several chapters detailing the design process.

This thesis will be structured according to Mader & Eggink's '*A Design Process for Creative Technology*'. It will form the basis for the methodology of the design process. This design process is specifically tailored for creating innovative, and engaging digital experiences. So it is ideal for projects like these, that involve creative technology. Before the design begins, an outline of the steps of the process and an explanation of how they will guide the project, will be given.

The methodology for this project will involve a four-phase process, starting with the ideation phase. During this phase, potential product ideas or user needs will be identified through brainstorming sessions, or examination of existing products. The focus will be on identifying potential applications of technology to merge into a unique and innovative solution. Related work in the field will also be examined to identify approaches or ideas that could be incorporated into the design. Contrary to the research phase, which was far more theoretical, we will now be taking a more practical approach. The output of the ideation phase will be a more elaborated version of this project's general idea. A clear set of problem requirements is listed, that include ideas on the user experience, and interaction, as well as a service and business model.

Once a clear project idea has taken shape, and the problem requirements have been established, the specification phase will begin. In this phase, the design space will be explored using prototypes. Several rounds of design and evaluation will be iterated through. A series of prototypes will be created to explore different aspects of the user experience, functionality, and technology. These prototypes will then be evaluated, and the feedback will be used to refine the design. This iterative process will continue until a final design has arisen that meets the project requirements and user needs. The output of this phase will be a detailed product specification that includes a set of functional requirements, user requirements, and a final design that integrates all the components (Mader & Eggink, 2014).

Next, the realisation phase will begin. Now the prototype will be developed. Complementary to Mader & Eggink's design process for creative technology, participatory design is used. It is an approach that seeks to engage the end-users in the design process.

The design will come to life in close collaboration with the stakeholders. (Frauenberger, et al., 2015). Chapter six will mainly consist of a visual overview of our multifunctional participant management prototype. The development of the prototype will be detailed. And an explanation of the available functions will be given. During this phase, a true picture of the final product will be painted.

Finally, the evaluation phase will take place. It consists of evaluating the final product to ensure that it meets all the project requirements and user needs. This could involve user testing, feedback from stakeholders, or other methods of evaluation. Based on the results, further iterations may need to be made to the design. Or changes may need to be made to the final product before it is released to the market (Mader & Eggink, 2014).

Data collection in the design phase of this project is conducted through various participatory design activities. Such as; workshops, interviews, and surveys. The activities will be designed to capture the needs and preferences of the end-users, as well as to elicit feedback on the proposed design solutions. Data analysis will be conducted using a thematic analysis approach. This involves identifying patterns, themes, and categories within the data. It allows for a comprehensive understanding of the end-user's needs and preferences. The results of the data analysis will inform the development and refinement of the design solutions.

Lastly, this project will follow the ethical guidelines as outlined by the Ethics Committee of Computer and Information Science (EC-CIS). Informed consent will be obtained from all participants before collecting data. Participants will also be informed of their right to withdraw from the study at any time. Data collected will be kept confidential and anonymous, and will only be used for research purposes.

Overall, the methodology for this project will involve a flexible and iterative approach to design that emphasises creativity, user needs, and technology. By following this process, a unique and innovative product can be created that meets the needs of both the target group and stakeholders.



## Chapter Four 'Ideation'

*The ideation phase is a critical part of the design process, where the focus is on generating ideas for the design of a new product or service.*

The ideation phase is characterised by an open and exploratory approach, where creativity and innovation are key. In order to be successful, this phase requires a combination of structured and unstructured activities that allow for the exploration of different ideas and perspectives. According to Mader and Eggink (2014), there are three main activities that should be considered in the ideation phase: problem framing, ideation techniques, and idea selection. Problem framing involves defining the problem or needs that the design aims to address. Ideation techniques are methods used to generate a wide range of ideas. They include exercises like brainstorming, mind mapping and focus groups. Idea selection involves identifying the most promising ideas and evaluating their feasibility and potential impact.

In this chapter, the ideation phase of the design process is described detailed. A thorough report is given regarding the methodology, execution and results of all three rounds of ideation.

### § 4.1 Ideation session one

As stated before, it is important to take the needs of all stakeholders into account during this design phase. To do this, many different perspectives will be included during the first round of ideation. Inspired by the work of Jesse Schell *'The art of Game Design: A Book of lenses'*, we have developed our own set of lenses to guide the ideation process. These lenses are designed to help us think outside our own perspective, from different angles. Considering not only the technical aspects but also the ethical, social, and legal implications. By looking through these lenses, we can identify potential issues and opportunities and brainstorm ways to address them. The lenses have been distilled from the interviews with the students of diverse backgrounds analysed in chapter five.

### **Lens of Philosophy**

*"Emphasises the importance of ethical principles. The need for participant autonomy, and informed consent. Highlights the need for clear communication and transparency in the research process."*

### **Lens of Arts**

*"Focuses on the creative potential of research, and making the research more engaging and accessible to participants. Advocates for participant-centred research, and for the use of visual and artistic elements to make the process more engaging."*

### **Lens of Social Responsibility**

*"Emphasises the need for research to be socially responsible. And address power imbalances. Advocates for equitable relationships between researchers and participants. And for the need for researchers to recognise their own biases."*

### **Lens of Creative Design**

*"Focuses on the user experience by designing user-friendly platforms that are visually appealing. Advocates for the utilisation of gamification, and other interactive elements, to make research more engaging."*

### **Lens of Law and Justice**

*"Emphasises the need for legal compliance and the importance of protecting participant privacy and confidentiality. Advocates for the use of clear and accessible language in consent forms and other research documents"*

### **Lens of Wellbeing**

*"Focuses on the importance of building trust with participants to ensure their comfort and willingness to participate. Advocates for the use of clear communication, and support for participants who may experience discomfort or distress during the research process."*

### **Lens of Activism**

*"Focuses on the need for creativity and collaboration in the research process. On the importance of social justice, and addressing power imbalances in research. Advocates for the use of research as a means of promoting social change and activism."*

To kick off the ideation phase, a brainstorming session was conducted with five Creative Technology students. Its aim was to identify the key functions a research participant management tool should have. The lenses, with background information coming from the interviews laid out in chapter five, were used as the input. Their unique perspectives and insights were valuable in identifying key considerations and themes that should be prioritised

during development. Creative technology students were chosen because of their general ability to take on different perspectives, and think outside the box.

A safe and inclusive environment was created to enable all participants to share their ideas freely without fear of criticism or judgment. Active listening and respectful dialogue were emphasised, and everyone was encouraged to build on each other's ideas. The creative technology students were given a short summary of the perspectives of the students from diverse backgrounds, as well as a list of functions or concepts that they deemed important. They were asked to come up with functions, form factors, or concepts for the participant management platform that specifically addressed the statements of the students from diverse backgrounds.

The script of the brainstorming session: Starting the brainstorming-leader welcomes everybody, and thanks them for their participation, and willingness to invest time, and acknowledges the importance of their input for this project. After this, the brainstorming leader will read the following rules of the brainstorming session out loud:

1. *Focus on quantity over quality: The goal of a brainstorming session is to generate as many ideas as possible. Don't worry about the quality of the ideas at this stage - you can evaluate and refine them later.*
2. *Encourage all ideas: Everyone's ideas are valuable in a brainstorming session, so encourage all participants to contribute their ideas. Avoid criticising or dismissing ideas, as this can stifle creativity.*
3. *Build on each other's ideas: One idea can spark another, so encourage participants to build on each other's ideas. This can help generate more innovative and creative solutions.*
4. *Stay on topic: Make sure the brainstorming session stays focused on the topic or problem at hand. This can help keep the ideas relevant and useful.*
5. *Use visual aids: Using visual aids such as a whiteboard or post-its can help participants visualise and organise their ideas. This can make it easier to build on each other's ideas and generate more creative solutions.*
6. *Set a time limit: Setting a time limit can help keep the brainstorming session focused, and prevent it from dragging on too long. You can always schedule additional sessions if needed.*
7. *Evaluate and refine: Once the brainstorming session is over, evaluate and refine the ideas generated. Identify the most promising ideas and develop a plan to implement them.*

After the formalities are finished the brainstorming session will start, the brainstorming session will consist of the following phases: (1) The Creative technology students read the different perspectives that are to be considered in the ideation. (2) They are asked to find ideas or solutions by looking at the problems through the different lenses. (3) They can ask questions regarding the perspectives and other questions that they have at this point. (4) They are asked to do a brain-writing exercise where they have to write down ideas for 10 minutes in silence. (5) The generated ideas are discussed in the form of a group conversation. (6) Then all the generated ideas are grouped by their corresponding perspective.

From the brainstorming session came a list of key functions that should be prioritised in a research participant management platform. These functions take into account the different perspectives and recommendations of the diverse group of students and aim to create a platform that is ethical, responsible, engaging and effective in managing research participants. Overall, prioritising themes such as building trust, clear communication, protecting participant privacy and confidentiality, participant well-being and autonomy, were brought forward. They can create a safe and supportive environment for participants.



Figure 1: screenshot MIRO session sorted by participant input

Figure one shows the outcomes of the brainstorming on sticky notes in the MIRO session used. The colours represent the different lenses that the input belongs to, each block is the input by one of the CreaTe students.



Figure 2: screenshot MIRO session sorted by the different lenses

After the brain-writing exercise, all the results were sorted according to the lens the input belongs to. Duplicates or very similar inputs were deleted, resulting in the layout

represented in figure two.

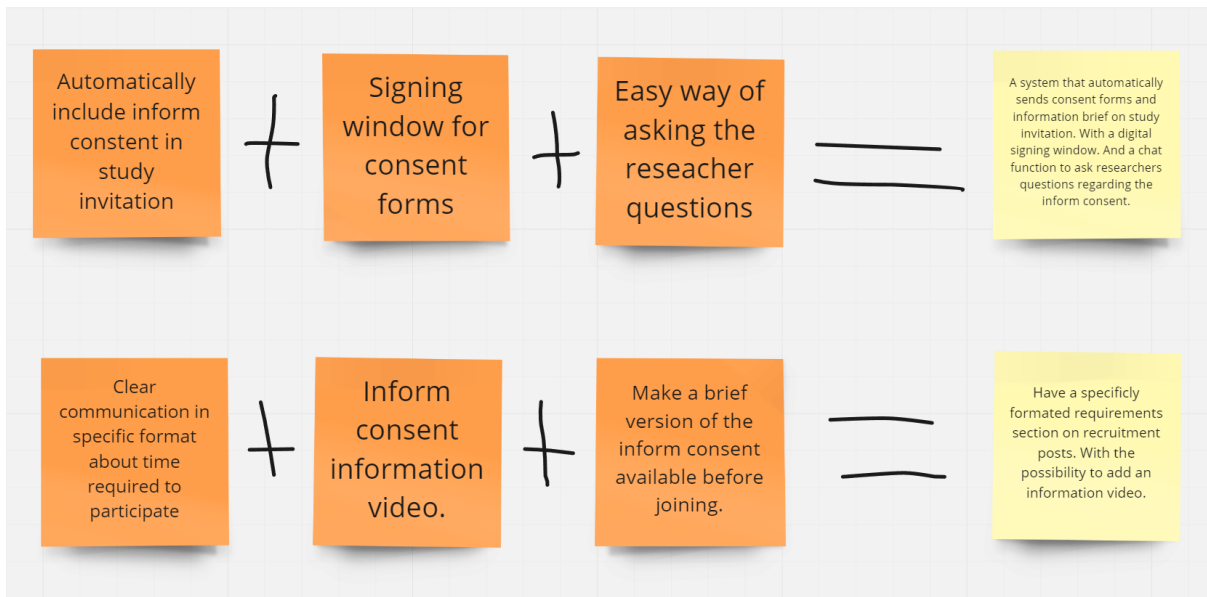


Figure 3: screenshot MIRO combining multiple ideas

During the brainstorm session, a crucial step was taken to further refine and solidify the initial ideas generated. This involved initiating a second round of brainstorming, where we actively combined and interwove the individual ideas to create more concrete concepts. By mixing and matching the various suggestions and requirements put forward by the participants, we aimed to synthesise a cohesive set of ideas. This process facilitated a more holistic and robust understanding of the essential features and functionalities that should be incorporated into the participant management system. By this iterative approach, we were able to leverage the collective expertise and creativity of the brainstorming participants. Figure three shows how this was structured in the MIRO session. Table one, displayed below, shows the final results of the brainstorm session.

Automatically include informed consent in study invitation	+	Signing window for consent form	+	Easy way of asking the researcher questions	=	A system that automatically sends consent forms and information on the participation invitation. With a digital signing window, and a chat function to ask the researcher questions regarding the consent form
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Clear communication in specific format about time required to participate	+	Informed consent information video	+	Make a brief version of the informed consent and requirements available before joining	=	Have a specifically formatted requirements section on the recruitment posts. With the possibility for researchers to add an information video
Before joining a study, show explicitly how the data is gathered	+	Make data retention clear to users	+	Make use of data encryption and safety scanning (SNYK)	=	Have a system for researchers to gather data. The database generated will be encrypted and able to compile a list
A system where participants can vote on the course of action	+	A peer feedback system	+	Have a system for online workshops, focus groups and brainstorms	=	Have a system where participants and other researchers can give feedback on the current state of the project. With the possibility to integrate several communication services like teams. And a polling system where participants can vote on the course of action
Responsive web design	+	Four memorable colours	+	A modern look and subtle animations	=	Have a responsive and scalable web design with four memorable colours. A modern look and subtle animation

Forums for open discussion within the platform	+	A live updating dashboard where the gathered data is presented in an overview	+	A window where participants can view their research input. And retract or edit their data	=	Have a dashboard where a live update of the data is available for the researchers and participants. With the possibility to open a forum thread to discuss the findings. And a clear and easy way to retract or edit your provided data
Reward system for when participants complete tasks	+	Reward system gaining stars (Bronze, Silver, and Gold level)	+	Have a way for researchers to see how serious participants engage in previous projects	=	Have a reward system that gives participants points for completing tasks set by the researchers. These points are added up in a progress bar unlocking the bronze, silver or gold star status on their profile
Input fields for interest on participant profiles, and generate a feed based on the interest.	+	Have a 'like' button for posts on the platform	+	Have a 'follow' function for all account types	=	Have a customised feed with articles based on interest, likes and follows

<p>Have a system where researchers are forced to publish work that is understandable by people from all walks of life</p>	+	<p>Have a system for easy visualisations/ animations for publishing work</p>	+	<p>Provide Easy way of asking the researcher questions</p>	=	<p>Promote multiple styles of publishing work for people from all walks of life. By having easy to understand animation, short explanatory videos, and research explanations. As well as links to the PDF of publication. With the functionality to ask researchers questions about their work</p>
<p>A modular system so researchers can create and share plugins for the platform</p>	+	<p>Make all sorts of participant input available like video, audio, drawings, pictures or poems.</p>	+	<p>awareness for inclusivity through promoting multiple forms of data entry on the platform</p>	=	<p>Have a modular system for data gathering where multiple inputs can be used in parallel, with the possibility to convert all data to one encrypted database.</p>
<p>Inclusive design for people with visual impairments.</p>	+	<p>Colour-blind mode</p>	+	<p>Have a screen reader compliant interface, with image descriptions</p>	=	<p>Have an inclusive design for people with visual impairments. With a screen reader compliant interface and image descriptions. Including a colour-blind mode. This can be verified by several AI UI checking tools</p>



Randomised population sample generator	+	Give researchers insight in their participants demographics	+	Filter on range or online for study participation	=	Have a system where researchers can send out a recruitment to a randomised population sample. With a dashboard on their current population. With on the participant side a filter to search for studies nearby or online.
Have a system where researchers can request a peer review session.	+	Peer review other researchers work	+	Temporary punishment of papers and videos to show to a select group.	=	Have a mode to publish work to be reviewed by selected people, with a feature to add comments.

Table 1: Outcomes of the first ideation session

In conclusion, the brainstorming has highlighted various essential functionalities that a comprehensive participant management system should possess. The system should be designed to automate the process of sending consent forms and information briefs, incorporating a digital signing window and a chat function for communication. Requirements should have a specifically formatted section in the recruitment post. And the platform should allow researchers to include information videos to enhance participant understanding.

Furthermore, the system should enable researchers to gather data efficiently, with an encrypted and compiled database for analysis. It should offer a dashboard for participants and other researchers to provide feedback on project progress. Integrating voice services and polling systems for interactive engagement. The system's web design should be responsive, scalable, and visually appealing. It should incorporate memorable colours, while also ensuring accessibility for users with visual impairments.

The inclusion of a live dashboard with real-time data updates, forum threads for discussion, and options to retract or edit participant-provided data would enhance transparency and collaboration. A reward system based on task completion, with progress bars and profile achievements, would incentivise participant engagement. While also informing researchers about the previous experiences of the potential participants. Customised feeds based on interests, likes, and follows would facilitate personalised content consumption. The system should promote multiple styles of publishing work, including

explanatory animations, videos, and traditional papers. A modular data gathering approach, encompassing various inputs and converging into an encrypted database, would enhance flexibility and data integrity.

Ensuring inclusivity, the system should comply with screen reader standards, provide image descriptions, and offer colour-blind mode. It should also support randomised recruitment of population samples, and supply researchers with a dashboard to track their current participant population. Participants should have the ability to filter and search for studies on the basis of geography or interests. Lastly, the participant management system should incorporate a review mode, enabling researchers to share their work with selected individuals for feedback and comments.

By incorporating these functionalities, the proposed participant management system will provide a comprehensive and user-friendly platform that supports efficient recruitment, secure data management, participant engagement, collaboration, accessibility, and personalised experiences.

## § 4.2 Ideation session two

The brainstorming session came up with a lot of functionalities, based on the different perspectives offered by the lenses. These functionalities will definitely be brought into the next phase, but first the following statements need to be considered in this second ideation session. During our expert interview, Sefora Turn stated “The participants don’t need us, we need them”. And Dr. Renske van Wijk noted the following problem: “Researchers are probably very hesitant to give their carefully built small community over to a large platform”. So for a platform to work it needs to give value to its user base, whether they are researchers or participants. This means creating long term value for the target group of this platform.

This second ideation session consisted of a series of events on MIRO with several stakeholders and designers from CreaTe that are invested in this project. We came up with the MIRO board pictured below, considering the following question “what would create long term value for participants outside of research involvement?” The question be looked at from different angles as they are depicted in the MIRO Board.

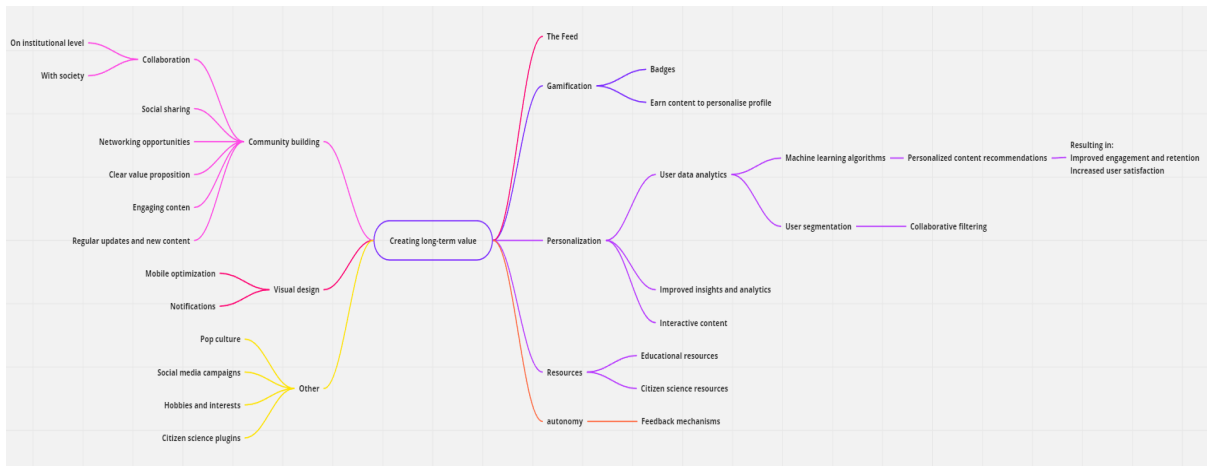


Figure 4: Miro board of the second ideation session

<p><b>Gamification</b></p>	<p>Incorporating game-like elements into the platform can make it more engaging for participants. By adding game-like elements, such as rewards, badges, and points, to tasks related to science projects, we can make them more engaging and motivating for participants.</p>
<p><b>Personalisation</b></p>	<p>People are more likely to engage with content that is tailored to their interests and preferences. Identifying patterns and trends with user data analytics can provide information on user behaviour, preferences, and interests. This can be achieved with machine learning algorithms.</p> <p>Categorised and tagged content is easier to find and recommend based on user preferences. This can increase the relevancy of the content presented to the user. Users will be segregated based on their analysed behaviour, and receive the content for their segment. Users who are interested in biology may receive different content recommendations than users who are interested in physics. Using collaborative filtering to recommend content based on the preferences of similar users can help personalise content at scale, and reduce the need for individual customisation.</p>
<p><b>Improved Engagement and Retention</b></p>	<p>By providing tailored content and experiences, the system can improve user engagement and retention, as users are more likely to stay engaged with content that is relevant and interesting to them. Users are more likely to be satisfied with the system if it provides them with content that meets their needs and preferences, leading to increased user satisfaction and loyalty.</p>

<p><b>Improved Insights and Analytics</b></p>	<p>By collecting data on user behaviour and preferences, the system can generate insights and analytics that can be used to optimise content, improve user experiences, and inform decision-making.</p>
<p><b>Community Building</b></p>	<p>Building on a sense of community among participants by creating discussion forums or chat rooms where they can connect with each other. This can help participants feel more invested in the platform and encourage them to return.</p> <p>Collaboration on the institutional level can be facilitated by a feature that enables researchers to connect with their participants and other professionals in the same field of study. This could include forums, webinars, online or even live meetings. This could help participants build relationships with others in the industry and expand their network. Organising community events, such as online conferences, workshops, or meetups, can bring participants together.</p>
<p><b>Social Sharing</b></p>	<p>Encouraging participants to share their experiences on social media by including social sharing buttons or creating a hashtag for the platform. This can help spread the word about the platform and increase engagement. Social media is a powerful tool for engagement, and creating social media campaigns that are designed to promote science projects can be an effective way to reach a wider audience. By creating engaging and shareable content, such as videos, infographics, and memes, we can raise awareness about science projects and encourage people to participate. The platform should be regularly updated and show opportunities to keep users engaged and coming back.</p>
<p><b>Collaboration</b></p>	<p>Collaboration between scientists, educators, and communicators can help make science more accessible and engaging. Working together, they can create educational materials, events, and activities that are more relevant and engaging to a wider audience.</p>
<p><b>Visuals</b></p>	<p>Science can be complex and difficult to understand, but visuals can help make science more accessible and engaging. Infographics, animations, and videos are all effective ways to present scientific information in a more visually appealing way. By using visually appealing graphics and design elements, the platform will be more engaging and user-friendly.</p>

<b>Mobile Optimisation</b>	If the platform is mobile-friendly, participants can access it on the go. Developing a mobile app or creating a responsive website that adapts to different screen sizes should be considered.
<b>Notifications</b>	Using push notifications or email alerts to remind participants about upcoming studies, surveys, or other activities on the platform can help keep participants engaged, and encourage them to participate more frequently.
<b>Educational Resources</b>	Creating a section on the platform that provides educational resources related to the field of study or research could help participants learn more about the subject and stay engaged. Even when they are not actively participating in studies. This could include articles, videos, podcasts, and webinars.
<b>Feedback Mechanisms</b>	Providing participants with opportunities to provide feedback on the platform and the studies they participate in can help improve the overall user experience and make participants feel more valued.

Table 2: Outcomes of the second ideation session

The last notion made by one of the brainstorming participants doesn't fit any category, but seemed very relevant: *"TV shows like; MythBusters by Discovery have a lot of scientific elements. You actually learn a lot while being entertained. This is achieved by presenting data fast in a fun way, and most of the time they include a lot of pop culture"*. Therefore, the strategy of 'using pop culture' to increase the user's long term use of the platform was added. Pop culture can be a powerful way to engage people with science. By incorporating themes and storylines from popular movies, TV shows, and books into science. This way, science can become more accessible and interesting to a wider audience.

### § 4.3 Third round of ideation

In this last and relatively short ideation session, we looked at several social media platforms. E.G. Facebook, Twitter, Instagram, LinkedIn. We identified the strong points of these social media platforms, and debated how they could be implemented to benefit our platform.

Second, we discussed the structure of several profile forms that need to be available on the research participant management platform. And we compared this with the information that universities and researchers are currently displaying publicly. The three main account forms that are currently being considered for the platform are: participant account, researcher account and an institutional account. The participant account is meant for the general user and citizen scientist. A researcher account will need more functionality when it comes to organisation and data gathering. The last account form is an institutional account, which will have the ability to verify researchers to assure trustworthiness.

The brainstorming session about what should be presented on the different profiles, resulted in a list of possible content for each account type, which are presented in bullet points down below.

### *Participant account*

- Username: A unique username or handle that identifies the participant on the platform.
- Profile picture: A photo or avatar that represents the participant on the platform.
- Bio: A brief description of the participant's background.
- Areas of interest: A list of the participant's areas of interest, such as science topics, hobbies, or career fields.
- Skills and expertise: A list of the participant's skills and expertise, which can be helpful for researchers looking for collaborators.
- Research experience: A summary of the participant's research experience.
- Research interests: A list of the participant's research interests, which can be used to match them with relevant research projects or groups.
- Engagement history: A record of the participant's engagement with research projects on the platform, such as comments, ratings, or contributions.

### *Researcher account*

- Name and title: The researcher's full name and professional title or academic affiliation.
- Profile picture: A photo or avatar that represents the researcher on the platform.
- Areas of research: A list of the researcher's areas of research interest or expertise.
- Publications and research experience: A summary of the researcher's publications and research experience, including grants, awards, and notable collaborations.
- Research projects: A list of the researcher's current and past research projects, including brief descriptions and links to related content.

- Engagement history: A record of the researcher's engagement with participants on the platform, including response rate to comments or questions.
- Contact information: Contact information for the researcher, such as email or social media handles, to facilitate communication and collaboration.
- Research philosophy or mission statement: A brief statement of the researcher's philosophy or mission, outlining their goals and values as a scientist.

### *Institutional account*

- Profile information: The university page would include basic profile information such as the name of the university, location, website URL, and contact information.
- Mission and values: The university page would highlight the institution's mission, values, and priorities, and how they relate to scientific research and innovation.
- Research areas: The page would feature information about the university's research areas, highlighting the different fields of study and the research projects being conducted.
- Researchers and staff: The page would also feature an overview of profiles of individual researchers and staff members. Highlighting their research field and recent publications.
- Partnerships and collaborations: The page would feature information about the university's partnerships and collaborations with other institutions, organisations, and industry partners.
- Events and news: The university page would feature updates on upcoming events, conferences, and talks related to scientific research. As well as news and updates about the university's research projects and findings.
- Opportunities for engagement: The page would provide information about opportunities for engagement: studies to join, scheduled events, and educational materials.

## Chapter Five 'Specification'

*During the specification phase, all the identified requirements will be categorised and prioritised.*

Based on the information obtained from the analysis of the problem domain through literature review, interviews with stakeholders, and examination of existing systems, the requirements were identified. The specification aims to gather a comprehensive understanding of the system's functionality to fulfil the users' needs. Each of the requirements is assigned a label of functional or non-functional. Then they were prioritised using the MoSCoW method.

*Functional Requirements Identification* is the identification of specific actions, tasks, and features that the system should possess to fulfil the intended purpose. Each functional requirement is expressed in a clear and unambiguous manner.

*Non-functional Requirements Identification* describe the qualities and characteristics of the system, such as performance, usability, security, and maintainability. These requirements are crucial for ensuring the overall professionalism and quality of the system.

*MoSCoW Prioritisation* The identified requirements are then prioritised using the MoSCoW method. Each requirement is categorised into one of the following groups: 'Must have requirements' that are critical to the system's success and must be implemented for the system to be considered functional. 'Should have requirements' are important requirements that provide significant value but are not critical that can be compromised or deferred if necessary. 'Could have requirements' are desirable requirements that are considered as nice-to-have features and can be included if time and resources permit. 'Won't have requirements' are explicitly excluded from the project scope, which may be considered for future iterations or not at all.

To ensure the accuracy and completeness of the identified requirements, they were verified and validated in close collaboration with the stakeholders. Throughout the development process, the requirements were continuously refined and adjusted based on stakeholder feedback, emerging needs, and project constraints. The MoSCoW prioritisation is revisited and updated as necessary to reflect changing priorities. This thesis will only show the final iteration of the MoSCoW priority tables.



## § 5.1 Requirements

In this section, we will present the requirements sorted by the MoSCoW method in tables. The requirements that apply to all the pages on the platform are grouped in one table. And for each of the pages or functions that require further specification, a separate table was compiled. By applying this method, we can determine the essential functionality and prioritise the development efforts for each page. These tables will assist us in focusing our resources effectively and determining the crucial features that must be present to meet the users' needs and expectations. It is important to note that these MoSCoW method tables serve as a starting point for the design phase, and they can be further refined and tailored.

By systematically analysing and organising the requirements, we can align the development efforts with the most critical requirements and ensure that our platform provides a robust and user-friendly experience to the users. Secondly, these requirement tables will be used in the evaluation of the high-fi prototype to ensure all the requirements are met.

Table three presents a list of requirements that applies to all pages on the platform. These requirements are essential for ensuring a seamless and user-friendly experience throughout all the pages on the platform. By adhering to these requirements, the platform aims to meet the needs and expectations of its users while providing a consistent and cohesive user interface on all devices.

Requirement	Priority	Functional/ Non-Functional
The platform must have a notable and attractive logo that has the functionality to be used as a link button to return to the platform's home page.	Must-have	Non-Functional
Seamless Content Loading; moving from one page to another on the platform must be achieved in one click. With a loading time shorter than one second.	Must-have	Functional
Trust Indicators (Badges, Certifications): The website of the platform must have all standard certifications, so the lock icon next to the web address appears. And the site should not be flagged by any antivirus or malware system.	Must-have	Functional

Responsive and Adaptive Layout: The content represented on the platform should scale properly on all devices and screen sizes. The normal horizontal layout must facilitate screen sizes from 1024 x 703 pixels (a horizontally orientated iPad Mini) to 3840 x 2160 pixels (4k computer monitor)	Must-have	Functional
Colour contrast: All text elements in the user interface must have a colour contrast of eight or higher	Must-have	Functional
Mobile Responsiveness: The design should have an additional vertically orientated mobile interface that scales well on all modern smartphone screens, from 667 x 375 pixels (iPhone SE) to 2778 x 1284 pixels (iPhone 13 Max)	Should-have	Functional

Table 3: Requirements for all page types

Table four displays the requirements specifically applicable to the home page or landing page.

Requirement	Priority	Functional/ Non-Functional
A clear and attractive logo adapted from the normal page logo to be largely displayed on the home/landing page.	Must-have	Non-Functional
An engaging call-to-action. The landing page must attract users to sign up for this platform. Cookie tracking could be used to change the call to action for users who are already registered. Then specifically advertising studies to participate in.	Must-have	Non-Functional/ Functional
Clean and intuitive design with only relevant and high-quality visual elements, with as little text as possible.	Must-have	Non-Functional
Easy navigation is required. The user should be able to navigate through the application with the minimum amount of submenus and window stacking.	Should-have	Non-Functional
Clear and concise copywriting should be clear to all users without taking up too much space, or take the attention away from the content.	Should-have	Functional

Social proof like testimonials and reviews can be given by users and established scientists.	Could-have	Functional
Minimal form fields for the login and sign up screen. Input fields should be kept to a bare minimum. And no more than one or two input fields should be displayed at the same time. Easy reversal of actions should be possible.	Could-have	Functional
Integration with third party analytic tools	Won't have	Functional
Live Chat Support	Won't have	Functional

Table 4: Requirements specifically for the landing Page

The table depicted below shows the requirements specifically for the feed style page.

Requirement	Priority	Functional/ Non-Functional
A clear and user-friendly design is required. The feed must have as few buttons as possible. The feed should display a maximum of two content cards at the same time, while showing part (second or third content card) of the next content card to make clear scrolling is possible.	Must-have	Functional
Seamless content loading. The feed must be able to compile the next section of content off-screen, giving the illusion the feed is endless.	Must-have	Functional
Customisable content preferences: the content presented on the main feed must be customisable. Users will be able to select what type of content you want to see (videos, papers, tutorials, newsletters, etc.) and the fields that they are interested in.	Must-have	Functional
Relevant and personalised content. Based on the content preferences and user behaviour, the system must be able to generate an interesting feed for the user. <sup>2</sup>	Must-have	Non-Functional

<sup>2</sup> This data-driven content recommendation algorithm is further specified in table 8

Filtering and sorting options. The system should accommodate the option to filter and sort the content. The user could for example choose to only view peer reviewed papers.	Should-have	Functional
Social sharing functionality. All items and content cards should be directly shareable on all standard social media platforms (Instagram, Twitter, Facebook, LinkedIn, Discord).	Should-have	Functional
Real-time updates.	Should-have	Functional
Notifications and alerts should be given, e.g. when actions on the platform are still needed, or to inform users on upcoming events.	Should-have	Functional
User engagement metrics (likes, shares). These metrics are not meant for public display with the post. But merely for the owner of the content to see what works with the audience and what doesn't. The likes should also be used in the algorithms that compile the content shown on the user's feed.	Should-have	Functional
The platform could have a comment and discussion feature within a project. Where scientists and participants can engage in conversation about the study.	Could-have	Functional
Recommended content suggestions. Next to the content recommendation algorithm, the platform administrators could have the functionality to feature certain content to be displayed on all main feeds platform wide.	Could-have	Functional
User profile integration. The feed could have the functionality to recommend. These suggestions could be based on the user's interests and behaviour on the platform. Realised by the data driven content recommendation algorithm.	Could-have	Functional
Trending or popular content section. The main feed could have a second tab where all trending or popular items are displayed regardless of your interest profile.	Could-have	Functional
Integration with External Platforms (Social Media): It won't be possible to directly share third party social media articles on the feed.	Won't have	Functional

Table 5: Requirements specifically for the feed style page

The platform will be designed to meet the requirements to satisfy the needs of all the members of the quadruple helix. To achieve this, there is a need for several account types. The institutional account is to be used by universities and research institutes. The researcher account will be obtainable for researchers through their institute. This account can be used to manage projects and publish scientific work. The third account type will be the partner account, suitable for business and governmental branches to engage with research. Lastly, the citizen account is to be used for engagement with the entire content on the platform. The table below shows the requirements specified for each account type.

Requirement	Priority	Functional/ Non-Functional	Account type: Institutional, Partner, Researcher, Citizen
User information; profile picture or avatar (based on the users' preference)	Must-have	Functional	All account types
Bio; a frame for a short text that shows relevant information.	Must-have	Functional	All account types
Contact Information; the profile page must have a contact information container. The contact information is given (e-mail, address, phone number) depends on the account type.	Must-have	Functional	All account types
Connections; the connections section will show the affiliations of each user.	Must-have	Functional	All account types
Social sharing; the profile page must have a form of social sharing that is beneficial for participant engagement.	Must-have	Non-functional	All account types
Areas of Interest; this section on the profile can be used to show the interests of participants.	Must-have	Functional	Citizen account
Skills and Expertise; this section can clarify if somebody is eligible to participate	Should-have	Functional	Citizen and partner account

in research. Or it can be used to find experts.			
Research Interests; this will be the area of interest variant for the researcher account type.	Should-have	Functional	Researcher accounts
Publications and projects; the profiles could have a section dedicated to showcase research.	Could-have	Functional	Institutional, Partner and Researcher accounts
Research philosophy/mission statement; the institutional account could have a banner displaying their research philosophy or mission statement.	Could-have	Functional	Institutional accounts
Social Media Integration; all profile types could have a banner with icons to link their social media profiles.	Could-have	Functional	All account types
Customisable profile; institutes and partners could have the functionality to include their branding and house style on their profile page.	Could-have	Functional	Institutional and Partner accounts
User engagement history; a user's profile must keep track of the user engagement history in previous studies. Although this will not be directly visible on the profile, researchers can use this to assess the quality of participants when recruiting	Could-have	Functional	Citizen account
Public/Private profile; citizen accounts could have the functionality to keep their accounts private. All other account types must be public.	Could-have	Functional	Citizen account
Networking functionality; the platform could have functionalities that facilitate networking. For instance, an event agenda or a tool to book meetings.	Could-have	Functional	Institutional, Partner and Researcher accounts

Research opportunities; these profile types could have a function or content container to show if there are any opportunities for citizens to engage in research projects that this profile is connected to.	Could-have	Functional	Institutional, Partner and Researcher accounts
Personalised study or survey suggestions; the system could be able to send out personalised messages to citizens regarding studies or surveys they might want to participate in.	Could-have	Functional	Citizen account
Metrics and analytics; this could be a functionality for institutes, partners and researchers to see what content is doing well with the public.	Could-have	Functional	Institutional, Partner and Researcher accounts

Table 6: requirements based on profile type

Building upon the outcomes of the second ideation session, we have sorted and prioritised the previously identified requirements to enhance the platform's engagement and user experience by gamification elements.

Requirement	Priority	Type
Rewards; a bronze, silver or gold badge to indicate the engagement and participation with projects on the platform	Must have	Functional
Visual indicators of progress and achievements, including a progress tracker for the next reward.	Should have	Functional
Rewards by researchers; added functionality for researchers to easily reward and send out physical rewards for participation.	Could have	Functional
User-friendly interface for the implementation gamified elements	Could have	Non-functional

Table 7: Requirements specifically for gamification elements

Table eight contains the requirements needed to produce the personalised content. This will be realised via analysis of user data by machine learning algorithms.

Requirement	Priority	Type
Collection of user behaviour and preference data	Should have	Functional
Data analysis to identify user patterns and trends	Should have	Functional
User segmentation based on data analysis	Should have	Functional
Content categorisation and tagging	Could-have	Functional
Collaborative filtering for content recommendations	Could have	Functional
Real-time analytics for user engagement tracking	Could have	Functional
User segmentation based on behaviour	Could have	Functional

Table 8: Requirements for user data analytics by machine learning algorithms for personalised content

Inclusive design aims to create products, services, and experiences that are accessible and usable by a wide range of individuals. Including those with disabilities or impairments. When it comes to user interfaces (UIs), addressing the needs of individuals with visual impairments is of utmost importance. By incorporating inclusive design principles we provide equal opportunities and experiences, so we can ensure that our UIs are accessible for all users. The following table presents a prioritised list of UI requirements, specifically focused on addressing visual impairments. These requirements are categorised using the MoSCoW method.

Must have	Should have	Could have	Won't have
Alternative Text (Alt Text) for Images	High Contrast Mode	Text Size Adjustment	Dark Mode Support



Keyboard Accessibility	Screen Reader Compatibility	Text-to-Speech (TTS) Integration	Braille Support
Clear and Consistent Navigation	Text Resize Option	Magnification Controls	Voice Commands/Assistants Integration
Form Input Validation	Headings Hierarchy	Visual Indicators for Focus and Selection	
	ARIA (Accessible Rich Internet Applications) Roles and Attributes	Dyslexia-friendly Fonts	
	Colour-blindness Support	Subtitles/Captions for Multimedia	

Table 9: UI requirements based on visual impairments

Table ten presents the back-end requirements for the management of all the different account types. And the access management for third party plugins that could be supported by the platform. These are the primary features the backend of the system should support. Although this is outside the scope of this thesis, this table can be useful to ensure the validity of some design choices.

Requirement	Priority	Functional/ Non-Functional
User authentication should provide GDPR-compliant security measures for a system that deals with personal information	Must-have	Functional
User Authorisation; user roles and permissions must be changeable for the different profile types	Must-have	Functional
Database management systems must be up to today's standards of scalability, speed and security	Must-have	Functional

Researcher profile management should be accessible for the system administrator of the institute	Must-have	Functional
CRUD Operations on all profile types must be possible	Must-have	Functional
Data validation and automatic anonymisation	Must-have	Functional
Logging and error handling	Should-have	Functional
Reporting and Analytics	Could-have	Functional
User activity tracking capabilities	Should-have	Functional
API Integration and Web Services	Should-have	Functional
Third-Party Integrations	Could-have	Functional
Infrastructure for notifications and Alerts	Could-have	Functional
Data Import and Export	Could-have	Functional
User Feedback and Support	Could-have	Functional
Real-time Updates	Could-have	Functional

Table 10: Back-end design requirements.

Figure five specifies the dimensions of the design in pixels based on a normal 1920p x 1080p screen. All the sections will scale according to these ratios to the desired screen size. Secondly, this will function as the framework for the design of the platform. The rectangular container represents a full size computer monitor. The light pink container and top bar are designed to easily scale to a horizontally oriented tablet screen. The middle section comprises ten rectangles in two pairs of five. These are the framework for the design and will aid in the placement of content cards. Content cards can span over several rectangles in the framework, allowing for highly customisable pages while preserving the consistency in layout across multiple pages.

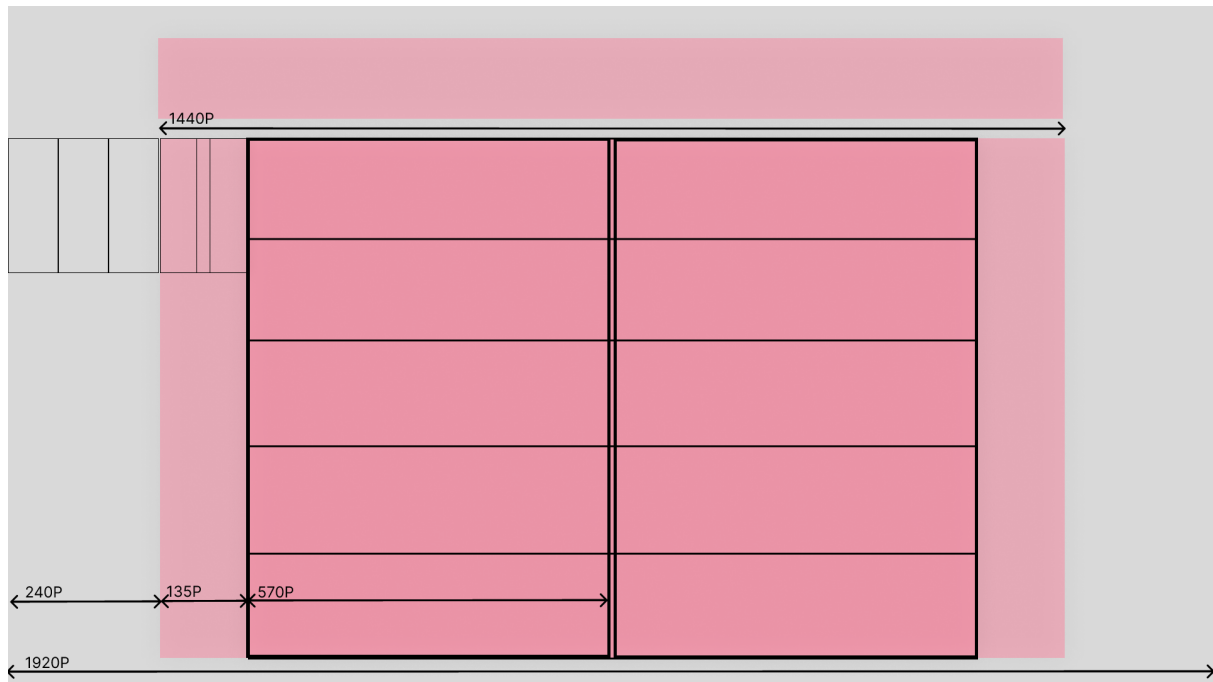


Figure 5: Dimensions of the application based on 1920x1080p

During the research phase described in the previous chapters, requirements for a successful participant management platform were brought forth. In this chapter, these requirements were clarified and prioritised. The specification formed the basis for the prototype that will be revealed in the next chapter.

## Chapter Six 'Realisation'

*During the realisation phase, the design will be brought to life. We will delve into the creative process of bringing the visual elements, outlined in chapter five, to fruition.*

### § 6.1 Designing the low-fi prototype

The realisation phase begins with the utilisation of pen and paper prototyping<sup>3</sup>. This is a fundamental approach that lays the groundwork for the subsequent design iterations. This methodological approach allows us to sketch and refine various design concepts, capturing the essence of our 'vision' and translating them into tangible layouts. The produced drawings play a vital role in visually representing the intended appearance and structure of the system. These drawings serve as a visual communication tool that help convey design concepts, features, and details to stakeholders and collaborators. The pen and paper prototyping stage serves as a crucial starting point in our design process. By this hands-on approach, we focus on establishing the fundamental structure and arrangement of the user interface. It will ensure that the key elements and functions are effectively represented. In the context of this thesis, we have created several design drawings for the main page formats that the platform needs to depict the envisioned user interface.

The paper prototype created adheres closely to the wireframe presented in the specification. This wireframe serves as a blueprint or a 'skeleton' that outlines the general structure and arrangement of the user interface. It defines the placement of key components such as navigation menus, content sections, buttons, and forms. The design drawings take this wireframe as a foundation and build on it by adding visual elements. The wireframe ensures that the overall layout and organisation of the user interface remains consistent throughout all the different page types. By following the wireframe, the design drawings maintain a cohesive and unified design language throughout the prototype.

Through these drawings, we aimed to provide a tangible representation of the intended design direction and gather feedback from stakeholders. This visual approach facilitated discussions and allowed for a better understanding of the design concepts. Following several rounds of iteration, the design drawings acted as a bridge between ideas and implementation, helping to shape the final visual representation of the platform.

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<sup>3</sup> In the context of this thesis, the essence of pen and paper prototyping is the use of a digital pen and drawing pad.

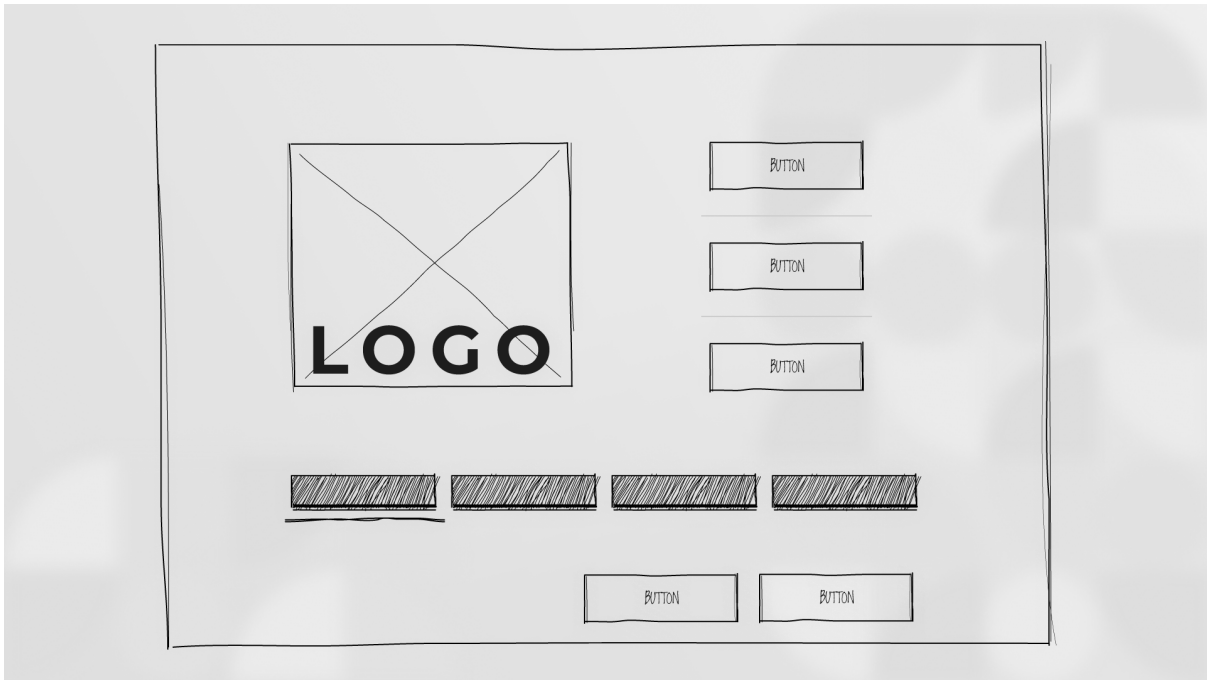


Figure 6: Low-Fi Landing Page Layout

### *Landing Page*

The design for the landing page is depicted in figure six. It incorporates key visual elements derived from requirements table four. A landing page is a web page that serves as the entry point for visitors to a website or online platform, commonly known as a 'home page'. It is specifically designed to capture the attention of users and encourage them to take a specific action. In the case of our platform, we want visitors to sign up for a profile. The placement of the logo is quite prominent, because the landing page must immediately establish the platform's identity. The section next to the logo will have three buttons: 'explore', 'login' and 'sign-up'. To encourage the user onboarding process, the platform can be used without an account by clicking the 'explore' option. This way a visitor can see if the platform will be something they would use, without having to disclose personal information. The second button will be the 'login' button, allowing returning users to access their account straight away. The third button 'sign-up' will open a window overlaying the landing page, with a minimal form field to create an account. Engaging content that call-to-action will be placed directly below the logo and explore, login, sign-up -section. The two buttons below can for instance be assigned to links to the Apple app store and android play store.



Figure 7: Low-Fi Feed Style Page Layout

### *Feed-Style Page*

The 'low-fi pen and paper design' for the 'feed-style page' depicted in Figure seven shows the visual elements derived from requirements table five. The design aims for a clear and user-friendly layout that enhances the overall user experience. This will be achieved by having the minimum amount of content presented on a page at once. To ensure adaptability, the layout is structured to scale properly on different devices and screen sizes. This includes organising the content in a way that maintains readability and usability, regardless of which device the program is running on. Although, for mobile devices, the content cards that are presented on the feed should be converted to a vertical design instead of the broad horizontal design.

The design consists of a top bar with enough space for adding function buttons that will be consistent throughout all the pages, except for the landing page. The content section of the page has a container with standard sizing. This framework is specified in figure five of the previous chapter, and will be consistent on every page. Seamless content loading is represented through a simple scrollbar. In the final version of the platform, this should be represented in a more subtle way. The 'feed-style page' must have an endlessly scrollable content section where content is presented based on the user's preferences and behaviour on the platform. This feature relies heavily on a large amount of content.

The page shown in figure eight represents the layout of a 'project page'. A project page will be used by researchers to create an environment to showcase what they are

currently working on. It will be a public page where researchers can post all relevant information about their project. The top left content card will be a dedicated space for the name, and short description of the project. The content card, in the top right section, will be a scrollable list of all the team members involved in this project. It shows a circular frame for profile pictures, and a text field for title, name, and function. It is made clear that interaction is possible when hovering over each of the team participants with a mouse. A button to follow the researcher will appear.

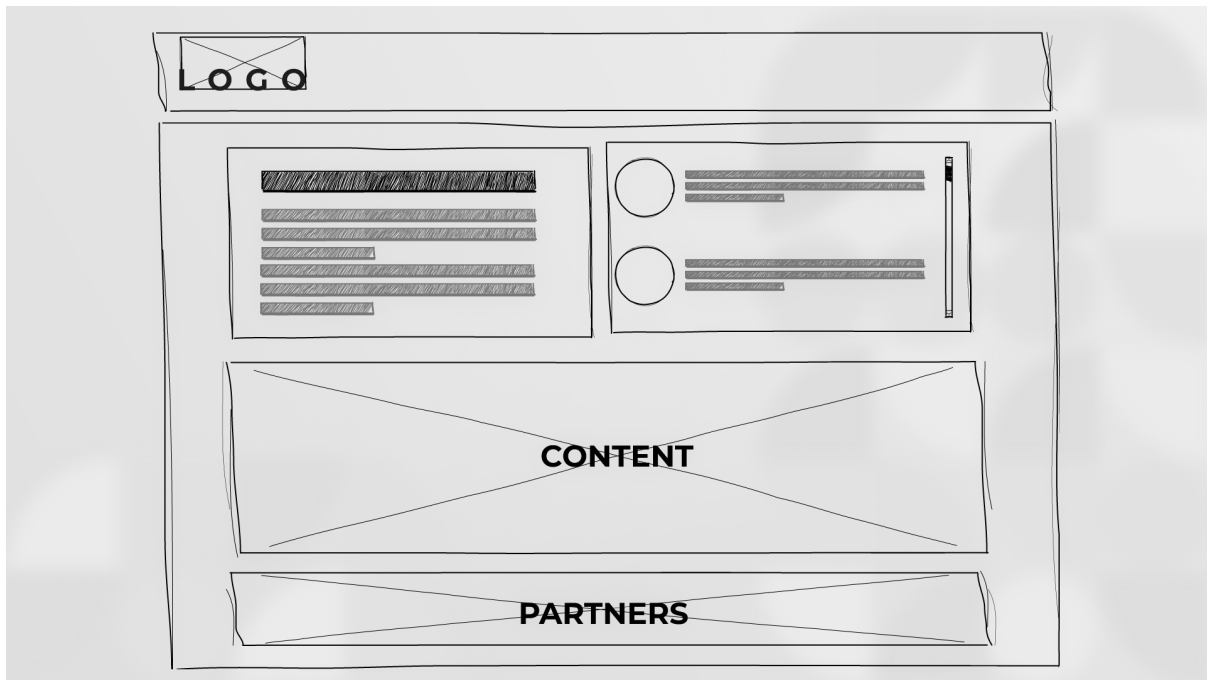


Figure 8: Low-Fi Project Page Layout

The middle section displayed in figure eight will be for presenting content that is relevant for the project at that time. For instance, when a study is recruiting participants, this content box can be dedicated to the recruitment message. Or during the study, this container can be used to display the latest messages or publications, with a link to the project's feed.

### *Profile Page*

The pen and paper prototype for the profile page of the research platform is depicted in figure nine. The profile page serves as a central hub where users can showcase their information, connect with others, and discover relevant opportunities. In the top left content card on the profile page, the layout of the information/bio section is shown. It contains a subtle circular frame for a profile picture or avatar. Next to the picture frame a section is reserved for two lines of larger text that can be used for name, title and function name. Or the name of the institution or business, accompanied by a mission statement or research philosophy. Near the profile picture, is a bio section, providing a place for users to share

relevant information about themselves. For example; their expertise, or their research focus. The black bar in the bottom of the content card represents a banner where social icon buttons can be placed, if the user wants to link their social media profiles.

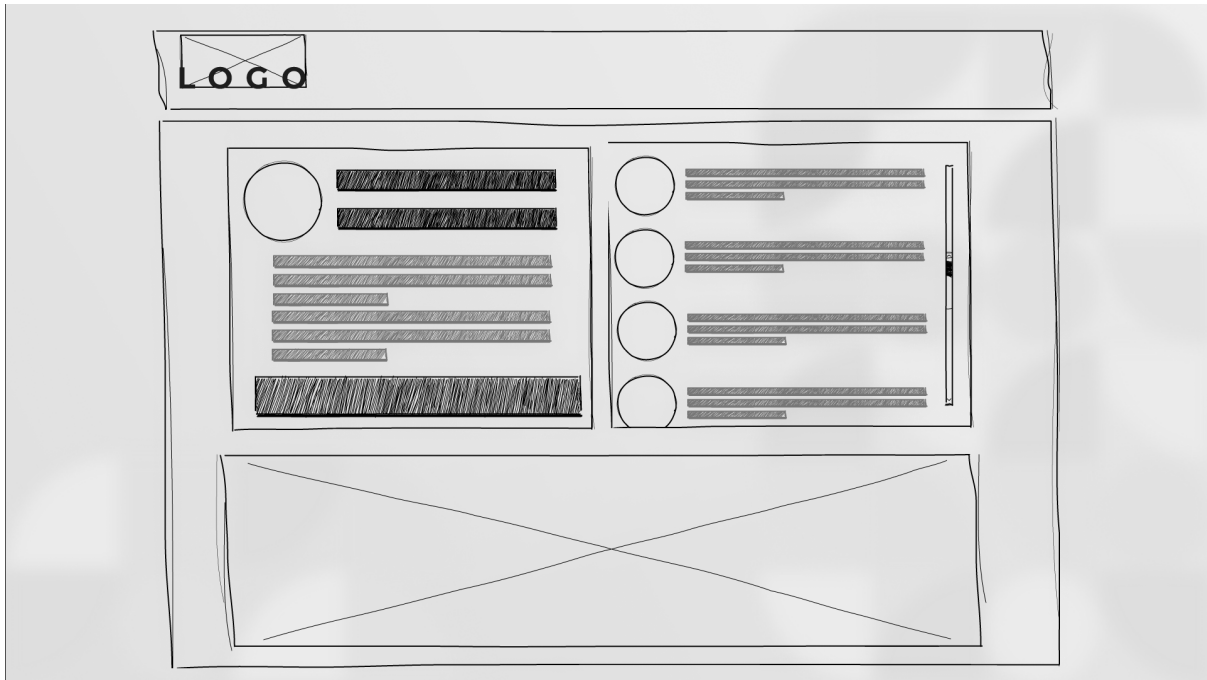


Figure 9: Low-Fi Profile Page Layout

The profile page also includes a contact information container, allowing users to share their preferred means of communication. This container's visibility can be managed for different scenarios, ensuring privacy and control over the displayed contact details. By allowing users to control their accessibility, the prototype emphasises the importance of user agency and privacy.

Another crucial element of the profile page is the connections section, which visualises the user's network. This feature allows users to see their connections within the research platform. It promotes collaboration and networking opportunities across different account types. Additionally, the profile page includes sections that are specific to different account types. For citizen accounts, an 'areas of interest' section showcases participants' interests, enabling researchers to identify potential participants for specific studies. Similarly, citizen and partner accounts feature a 'skills and expertise' section. Which could be an aid for finding experts within the platform. Researcher accounts have a dedicated 'research interests' section that allows them to highlight their areas of focus and expertise. Furthermore, the profile page accommodates customisable features for institutional and partner accounts, allowing them to incorporate their branding and house style.



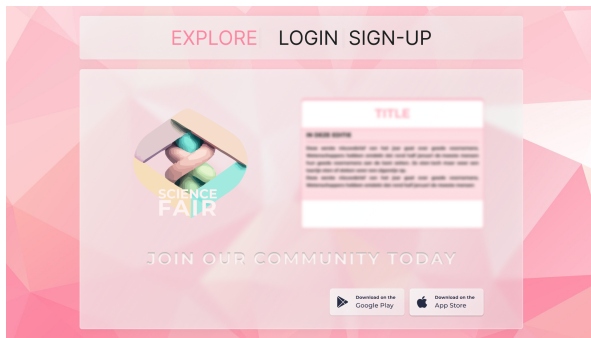


Figure 10: First landing page prototype



Figure 11: First feed style page prototype

The user interface prototypes were developed using the popular prototyping tool Figma. Figma is a powerful vector-based interface prototyping software that has the functionality to quickly set up the navigation between pages. It also supports the creation of an interactive prototype. Where a button is not a mere visual representation, but a functioning animation.

The prototype created in this phase served as an early visual representation of the interface design. It focused on the overall layout and structure rather than intricate details. In this lo-fi prototype, a distinct colour scheme was chosen to create a visually appealing, and playful interface. The colour palette primarily consisted of various shades of pink. Complemented by contrasting white and black for text elements. The use of pink shades added a touch of vibrancy and playfulness to the interface, with the white and black text ensuring optimal readability.

It was along this time in the design phase that the name 'Science Fair' was chosen. A name capturing the essence of the platform and its purpose. The choice 'Science Fair' carries a dual meaning. It is a reference to the traditional concept where individuals showcase their scientific projects and discoveries. However, the name also holds a deeper significance when the words 'science' and 'fair' are considered separately. 'Science' represents the pursuit of knowledge, while 'fair' embodies the values of honesty, integrity, and equity. The name is incorporated in the first iteration of the logo visible in figure ten.

Figure eleven presents the initial prototype of a feed-style page. Showcasing two distinct styles of content cards that have been designed for A/B testing purposes which will be elaborated on in paragraph 6.2. This prototype demonstrates the different visual styles and layouts of the feed-style page.



Figure 12: First prototype's page flow and interaction model

Figure twelve displays a function and page flow model. The model shows a loop, representing how one would navigate through the platform. Most of the arrows are pointing towards the feed, because it is the most important page in the system. As its primary goal is to present the user with interesting content. This example is one single loop, of going from the landing page to the feed. And by clicking the button of the first article on the feed, you navigate to the article's accompanying project page. From here you can move to several pages like: the researchers' profiles, the profiles of partners involved in the project, or the profile page of the institute hosting the research. Having moved through the project page you can scroll through all the posts, or go back to the main feed by clicking the logo. This is only one example, but it could be an endless loop with changing content. If, of course, enough content is present on the platform.

## § 6.2 Testing the low-fidelity prototype

For the development of the prototype, we recognised the importance of obtaining real-world feedback. Engaging with potential users will ensure the effectiveness and usability of our system. To accomplish this, we organised a demonstrative stand at the University of Twente, on one of the days it was open to the public. We displayed the current prototype and actively sought feedback from visitors. During the initial part of the day, we observed visitors' interactions with the prototype as shown in figure ten and eleven. We carefully noted their behaviours, comments, and suggestions. This led to valuable insights

into how users engaged with the system, and identified areas that required improvement or further attention. Additionally, we took the opportunity to answer questions and clarify any doubts that interested parties had regarding the prototype's features and functionality. Several visitors noted that the colour scheme was a bit distracting or 'too pink'. Also, we got comments on the layout of the landing page. Mainly that it was too crowded with content. In addition to this, the top bar containing; the explore, login and sign-up buttons were not the centre of attention.

During the first half of the university's open day a new way of gathering feedback was tried. While visitors were interacting with the platform, they were notified that there might still be major flaws in the system. And that they would be awarded bragging rights if they found one. The main goal was to break the ice, appear humble, show the need for constructive feedback, and show appreciation for the visitors' attention. This approach turned out to be productive. A major flaw was found by several visitors; a search function was lacking. A crucial gap in the functionality of the prototype. The visitors expressed a desire to search for specific information, and the ability to filter their search. Exploring this topic further resulted in a new requirement for the platform: the platform must contain a content search engine that supports content sorting and filtering. Including a separate search engine to be used for searching in the profile database. The second big flaw in the design of the system that was identified by one of the visitors was that there is no way of navigating back to the sign-up option after leaving the landing page. This finding led to the second new requirement: the platform must display the option for account creation and login on every page while in exploration mode. These requirements will be implemented in the design of the hi-fi prototype.



Figure 13: Preferred content card in A/B testing

As the previous paragraph states; figure eleven shows two different options for the content card on the feed-style page. During the first part of the day, visitors were asked about their preference. Would they prefer option A or option B? The majority chose the top card, shown enlarged in figure thirteen. When asked for feedback, they noted it looked more refined and makes the best use of the available space.

During the second half of the day, we introduced the concept of public prototyping. A new testing form where the prototype is designed and improved in public. Visitors were encouraged to actively engage with the prototype and provide real-time feedback. In figure thirteen, a photo of the stand is displayed. The visitors could watch the editing happening live, and immediately see the changes on the big touch screen. This also allowed visitors to interact with a functional prototype. The interactive session allowed users to express their preferences regarding different aspects of the system, such as colour schemes and fonts. By incorporating their input and making on-the-fly adjustments, we collectively fine-tuned the prototype to better align with the expectations and preferences of its potential users.

Public prototyping offers a unique approach to the traditional iterative process of converting user interactions and feedback into labelled natural languages, and then translating these languages back into the next iteration of the prototype. Unlike the conventional method that involves an intermediary step of interpretation by the researcher, public prototyping allows for direct feedback from participants on the changes made. By engaging users in a collaborative and interactive manner, public prototyping bridges the gap between data collection and implementation. Enabling users to provide immediate input on the researcher's understanding and translation of their feedback. This direct feedback loop facilitates more efficient and accurate incorporation of user insights into subsequent iterations of the prototype, ultimately leading to a more refined and user-centric design.

Overall, the stand at the University of Twente's open day proved to be an invaluable opportunity to gather qualitative data, incorporate user feedback, and iteratively improve the prototype. The insights gained from this experience contributed significantly to the refinement and optimisation of the prototype. By the end of the day, the design phase of the low-fi prototype was complete

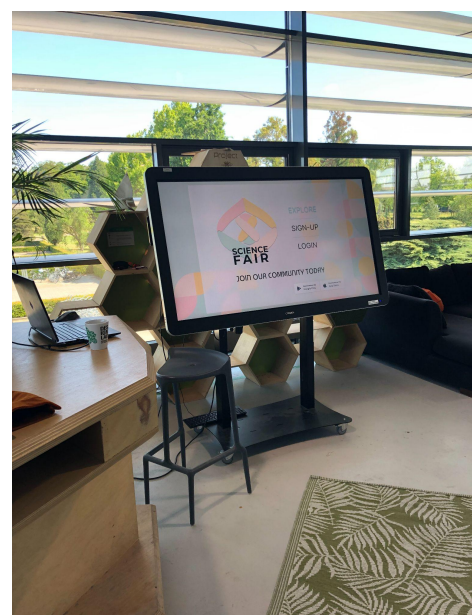


Figure 14: Stand at the UT open day

### § 6.3 Designing a high-fidelity prototype

In the fourth paragraph of this realisation chapter, we present the high-fidelity prototype of our platform. We built upon the insights gained from the low-fidelity prototype, and incorporated the user feedback. The high-fi prototype represents a significant leap forward in terms of visual aesthetics, interactive elements, and overall user experience. This paragraph aims to provide a comprehensive overview of user interface design, highlighting the key features, and the considerations that have shaped its development.

We will examine the user interface elements that make up the foundation of the high-fi prototype, including; content cards, navigation menus, buttons, forms, icons, typography, and colour schemes. Each of these elements has been designed to enhance usability, visual coherence, and brand identity. In addition to the visual aspects, we will also address the interactive elements and transitions incorporated into the high-fidelity prototype. These interactions aim to provide a smooth and intuitive user experience. While also presenting information more efficiently and effectively. By strategically utilising interactive elements, the interface can reduce the visual clutter on the screen while simultaneously providing access to a greater amount of information. Overlays and submenus have been implemented. These interactive elements allow users to access additional options, settings, or contextual information without navigating away from the current screen. By employing overlays and submenus, the prototype ensures a streamlined and unobtrusive user experience while providing access to a wider range of functionalities. To further optimise the user interface and reduce clutter, a PDF viewer has been integrated into the prototype. This feature allows users to view and interact with PDF documents directly within the platform. By eliminating the need to download files or switch between applications, the PDF viewer enhances convenience and efficiency when accessing important documents, research papers, or other relevant materials.

In the high-fidelity prototype, several important functions have been incorporated to enhance the overall user experience and functionality of the platform. These additions cater to the needs of all account types, provide convenient access to relevant information, and facilitate seamless communication between users. Prototypes of all account types will be presented; the institutional-, partner-, researcher-, and citizen account.

Another function presented in the high-fi prototype enables users to access educational resources, tutorials, or training materials related to their fields of interest. By offering courses within the platform, users can enhance their knowledge, skills, and

expertise without the need to seek external sources. This fosters a more immersive user experience that builds on the concept of reciprocity.

Lastly, the prototype incorporates a messaging system to streamline communication between users. Users can exchange messages, share information, collaborate on projects, or seek assistance within the platform's messaging feature. The prototype promotes efficient and effective communication, enabling users to connect and collaborate conveniently without relying on external communication tools.

Throughout this paragraph, screenshots of the high-fidelity prototype will be displayed to showcase the key design elements and the added features will be discussed. And it will be examined if the design meets at least the must-have requirements stated in chapter five.

### *The General Design*

The layout and structure of the prototype still adhere to the organisation of content, with the use of grids, as depicted in figure five. Facilitating a responsive design that adapts to different screen sizes and devices, and ensuring that the layout stays consistent on all pages. The content cards are structured on an eight pixels wide grid system, which serves as the underlying framework. By adhering to this grid, the content cards exhibit a sense of order, contributing to a cohesive and professional appearance. The other benefit of the 8px grid system is that the smallest item on the screen can only be eight pixels. This means that in terms of scalability, the user interface can be scaled down eight times without losing content. The whole design makes use of vectors for all the UI elements, so upscaling is infinite without losing quality.

Additionally, the prototype employs a flex box layout for positioning and arranging the content within each card. The flex box layout provides a flexible and efficient way to manage the placement and spacing of elements. Allowing the content cards to adapt and adjust to different screen sizes and orientations. This ensures a responsive design that can accommodate various devices and user preferences.

These functions satisfy the following requirement:

*“Responsive and Adaptive Layout: The content represented on the platform should scale properly on all devices and screen sizes. The normal horizontal layout must facilitate screen sizes from 1024 x 703 pixels (horizontally orientated iPad Mini) to 3840 x 2160 pixels (4k computer monitor)”*

Moreover, the high-fidelity prototype has been carefully crafted with the aim of being easily convertible to real code. The design elements, including the content cards and their layout, have been developed in a way that simplifies the transition from a visual representation to actual implementation using programming languages such as HTML and CSS. The use of standardised design practices and guidelines facilitates the process of translating the prototype into a functional and interactive website or application.

### The Colour Scheme

The colour scheme chosen for the high-fidelity prototype is a four-colour pastel palette, consisting of soft and gentle hues. Namely: light pastel green, light pastel orange, light pastel peach, and light pastel pink. With the addition of an off-black colour for text representation. A selection of four colours was inspired by the concept of the quadruple helix, which represents the collaboration between the four key parties involved in the research.

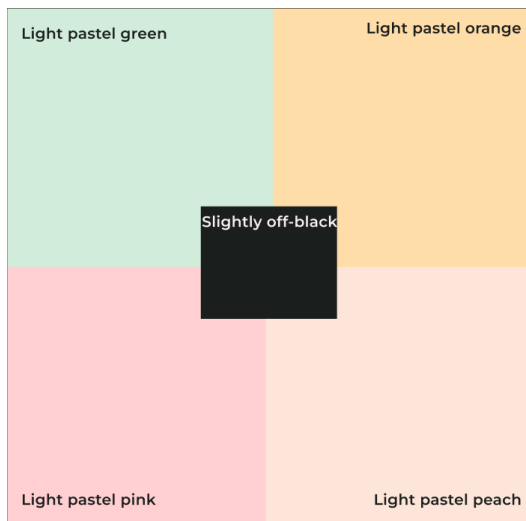


Figure 15: Colour scheme

A slightly off-black was chosen for the text on the platform, because pure black is harder to read. And most non-HDR screens cannot display pure black. The light pastel green was chosen as the main colour for the background from the four brand colours. This was

#### Contrast Checker

[Home](#) > [Resources](#) > Contrast Checker

Foreground Color: #1A1F1E  
 Background Color: #D2ECDB  
 Contrast Ratio: **13.31:1**  
 WCAG AA: **Pass**  
 WCAG AAA: **Pass**

**Normal Text**  
 WCAG AA: **Pass**  
 WCAG AAA: **Pass**  
 The five boxing wizards jump quickly.

**Large Text**  
 WCAG AA: **Pass**  
 WCAG AAA: **Pass**  
 The five boxing wizards jump quickly.

**Graphical Objects and User Interface Components**  
 WCAG AA: **Pass**  
 Text Input ✓

decided on the basis of the feedback gathered on the University of Twente’s open day. The slightly off-black colour, when placed against the light pastel green background, creates a visually striking contrast. The large difference in luminance and hue between these two colours ensures a high contrast ratio, which is essential for optimal readability and visual clarity. This was tested with contrast check, a resource made available by Webaim. The results of the test can be seen in figure sixteen.

Figure 16: Results of the contrast checker  
 From: <https://webaim.org/resources/contrastchecker/>

This satisfies the following requirement:

*“Colour contrast: All text elements in the user interface must have a colour contrast of eight or higher”*

### *The Landing Page*



Figure 17: High-fidelity prototype of the landing page

The design of the landing page is depicted in figure seventeen. Our goal has been to meet at least the must-have requirements. These requirements are primarily focused on creating an appealing and engaging interface for users. All fall under the category of non-functional requirements. This makes it crucial to conduct user testing to evaluate the effectiveness, and gather valuable feedback for further improvements.

The first requirement is to have a clear and attractive logo. The logo used for the landing page is an abstract representation of a quadruple helix, incorporating the four distinct brand colours. It is designed to convey the essence of collaboration and synergy among the four parties involved. The abstract nature of the logo allows for versatile and creative interpretations. An engaging call-to-action is another key requirement for the landing page. We want to provide a clear and enticing invitation for users to sign up and join the platform. The design of the call to action stayed very similar to the low-fi prototype, as the feedback was very positive.



We aim to create a visually pleasing interface with only relevant and high-quality visual elements. The use of minimal text avoids overwhelming the users with unnecessary information, and allows them to focus on the essential content. Therefore, the top bar was removed from the landing page. And the 'explore', 'sign-up' and 'login' buttons were moved to the right side of the landing page, with the container in a vertical orientation.

### The Main Feed

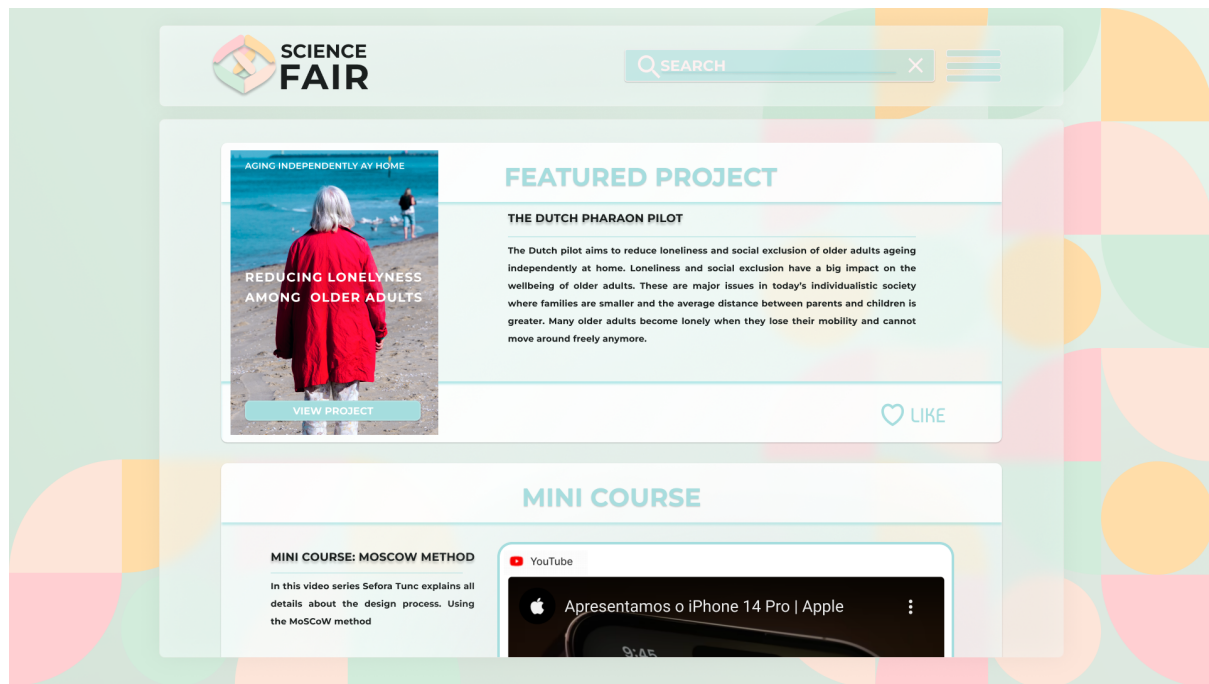


Figure 18: High-fidelity prototype of the main feed

The design of the feed-style page is focused on creating a clear and user-friendly experience. To achieve this, the feed has a minimalist appearance, ensuring that only the essential buttons required for its functionality are present. This streamlined design allows users to focus on the content without unnecessary distractions. One of the key aspects of the feed design is its presentation of content cards. The feed intentionally limits the number of content cards displayed simultaneously to a maximum of two. This deliberate choice ensures that users can easily digest and engage with the content without feeling overwhelmed. The second content card is only partially shown, indicating to users that scrolling is possible and encouraging them to explore further.

The feed also prioritises customisation and personalisation. Users have the ability to tailor the content they see on the main feed according to their preferences. They can select the specific types of content they are interested in, such as; videos, papers, tutorials, or posts. And they can use custom search terms in the search menu included in the top bar.

Furthermore, they can choose fields or topics that align with their interests, ensuring that the content presented is relevant and tailored.

To enhance the user experience, the feed incorporates seamless content loading. By compiling the next section of content off-screen, the feed gives the illusion of being endless. This approach eliminates any disruptive loading times between content sections or having to click the next page every couple of articles. This provides a smooth and uninterrupted experience.

The combination of these design choices regarding the feed style page satisfy the following functional requirements:

*“Clear and user-friendly design: the feed must have the minimal amount of buttons needed to function. And must present a maximum of two content cards on the feed at the same time. While showing part of the next content card to make it clear that scrolling is possible.”*

*“Customisable content preferences: the content presented on the main feed must be customisable. Users will be able to select what type of content you want to see (videos, papers, tutorials, newsletters, etc), and the fields that they are interested in.”*

*“Seamless content loading: The feed must be able to compile the next section of content off-screen, giving the illusion the feed is endless.”*

The effectiveness of these design choices in meeting user expectations and preferences will be evaluated through user testing to ensure optimal usability and satisfaction.

### *The Profiles*

All profile types within the research platform adhere to specific requirements to ensure a consistent and functional user experience. These requirements focus on essential elements that enhance user engagement and facilitate effective communication. For consistency, the content card for user information is always located in the top left corner of the content container. User information is a fundamental component of each profile. Users have the option to upload a profile picture or choose an avatar that reflects their personal preference. This visual representation adds a personal touch, and helps users to establish their identity within the platform. Another key requirement is the inclusion of a bio section in each profile. This designated space allows users to provide a concise and relevant description of themselves or their research interests. The bio serves as a means to share important information and create a connection with other platform users.

To enable effective communication, all profile pages are equipped with a contact information container. This container provides users with the ability to display their preferred methods of contact, such as email addresses or social media handles. The links to the contact information will be displayed by the accompanying standardised icons. Additionally, the visibility of this contact information can be managed, allowing users to control its accessibility based on different scenarios. The social sharing functionality is integrated into all profile pages. This feature allows users to share relevant content, research findings, interesting articles, or even a whole profile with their network within the research platform. By enabling social sharing, the platform fosters collaboration and the exchange of knowledge among its users.

While the aforementioned requirements primarily focus on functional aspects, it is important to note that the non-functional requirement of social sharing also contributes to the overall user experience. By promoting social sharing, the platform aims to facilitate the dissemination of valuable research content, foster engagement, and encourage active participation within the research community. This heavily relies on the quality of the content and active participation of the users in the research community. With the application of these functions to the prototype the following must-have requirements are met:

*“User information: profile picture or avatar (based on the user's preference)”*

*“Bio: a frame for a short text that shows relevant information.”*

*“Contact Information: the profile page must have a contact information container. The visibility of the information in this container can be managed for different scenarios.”*

*“Social sharing: the profile page must have a form of social sharing that is beneficial for this research platform.”*

By adhering to these requirements across all profile types, the research platform ensures consistency and usability, enabling users to effectively showcase their information, engage with others, and participate in meaningful research collaborations.

## The Citizen Profile

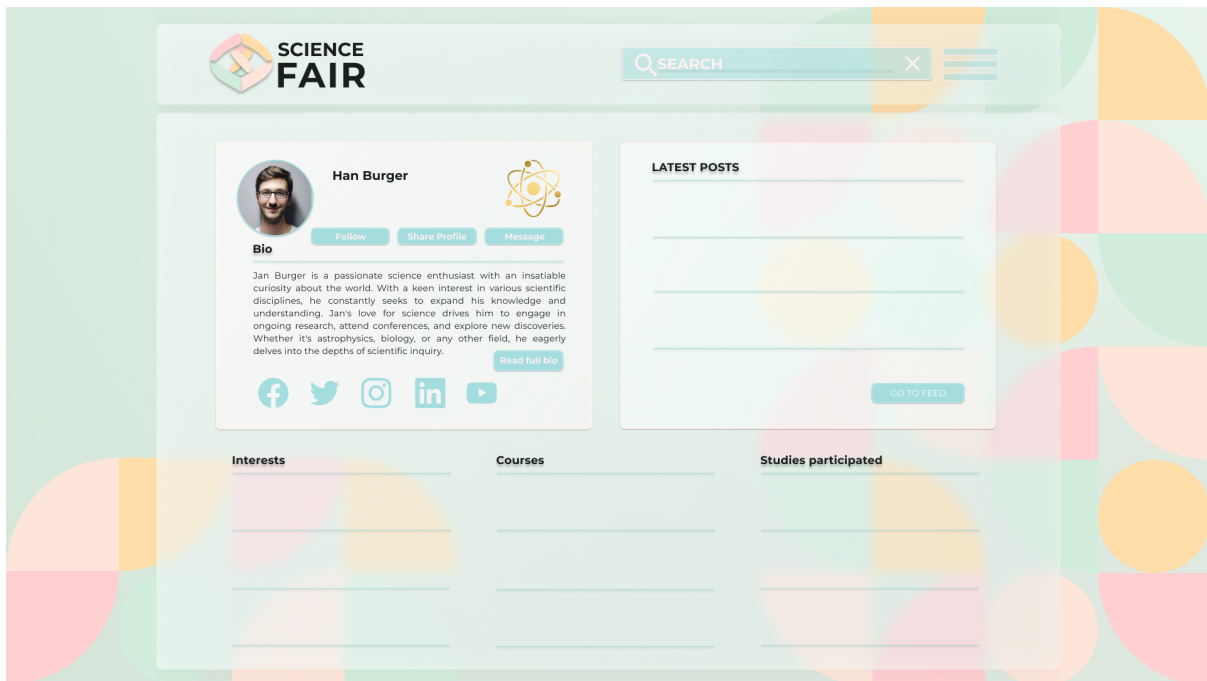


Figure 19: High-fidelity prototype of a citizen profile page

The design of the citizen profile page incorporates specific elements that aim to meet the broad spectrum of needs this target group presents. These features are designed to enhance the user experience, while also promoting active participation by citizen scientists. The following features and functionality that will be discussed are exclusive to the citizen profile page.

The first feature that is solely available for the citizen account is a gamification element in the form of rewards. These rewards are neutron-shaped badges in bronze, silver, or gold. These badges serve as a visual representation of a citizen's level of engagement and participation in projects on the platform. By earning these badges, users are recognised for their contributions and achievements. The aim is to give them a sense of accomplishment, and to motivate further engagement with research projects.

The citizen profile page also prominently features an 'areas of interest' section. This section provides a platform for users to showcase their specific areas of interest, which allows them to connect with others that share similar passions or research focus. By displaying their interests, citizens can actively seek collaboration opportunities and engage in relevant discussions within the research community.

Furthermore, the citizen profile page offers the option to showcase the courses a user is currently following, or has successfully completed. This feature emphasises the

importance of continuous learning and professional development. By displaying their course progress or completed certifications, citizens can showcase their dedication to expanding their knowledge and expertise. By implementing these features, the following must-have requirements are satisfied:

*“Areas of Interest: This section on the profile can be used to show the interests of participants”*

*“Rewards: A bronze, silver or gold badge to indicate the engagement and participation with projects on the platform”*

Overall, the design of the citizen profile page integrates rewards, areas of interest, etc. to provide a comprehensive overview of a citizen's engagement and interests. These design elements not only recognise and incentivise active participation but also facilitate networking, collaboration, and continuous learning within the research platform.

### *Institutional and partner profile pages*

Figures twenty and twenty-one show the profiles of institutions and partners. These profile types share a lot of similarities in their design. But there are distinct differences in the functions and features. First, the similarities in the design of these profile types will be discussed. Secondly, the extra capabilities of the institutional account will be highlighted. The bio section of the institutional and partner profiles includes a dedicated container specifically designed to showcase their respective logos. This feature sets them apart as professional entities within the research platform. It is important to note that institutional and partner accounts are exclusively available to verified parties, ensuring their credibility and authenticity.

In contrast to the other pages, the institutional and partner profiles feature a carousel that highlights key content directly on the profile itself. This carousel showcases important updates, news, publications, or projects.

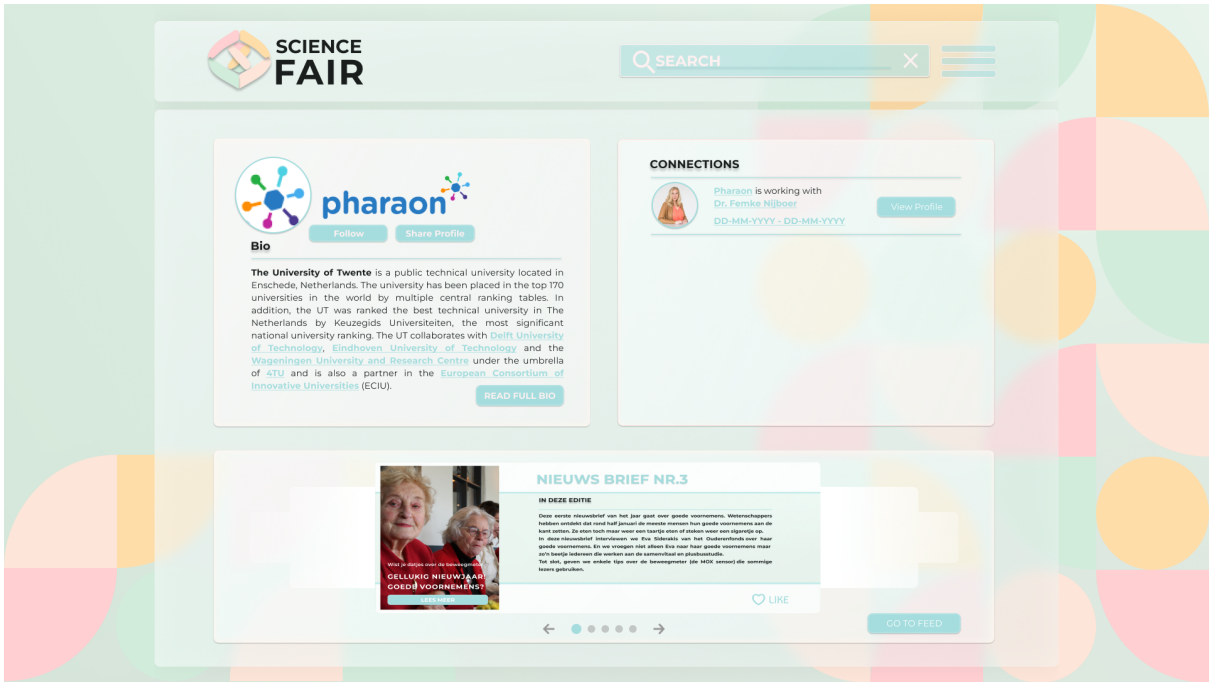


Figure 20: High-fidelity prototype of a partner's profile page

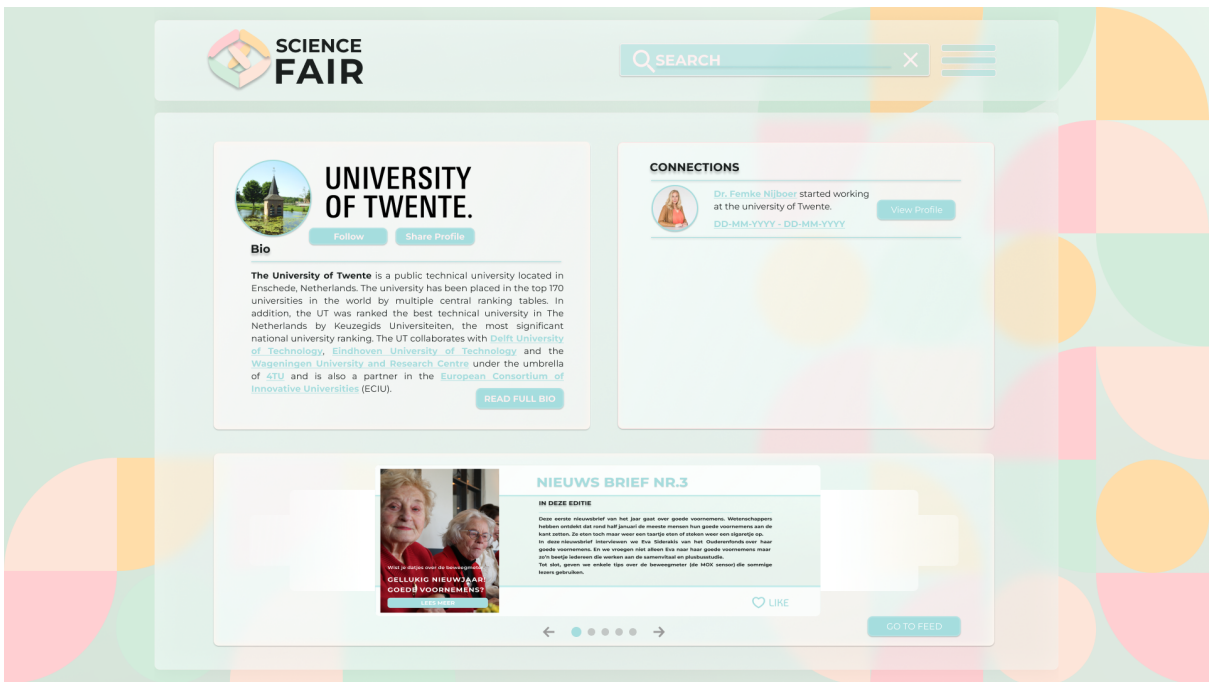


Figure 21: High-fidelity prototype of an institute's profile page

Additionally, these pages include a dedicated connections section. In this section, institutions have the opportunity to show a select few profiles that are of particular importance or relevance to their organisation. This allows them to promote collaborations, partnerships, or key personnel within their network.

Institutional accounts also have the unique capability to grant researcher accounts to their staff members. This administrative authority sets them apart from other profiles within the platform.

### The Researcher Profile

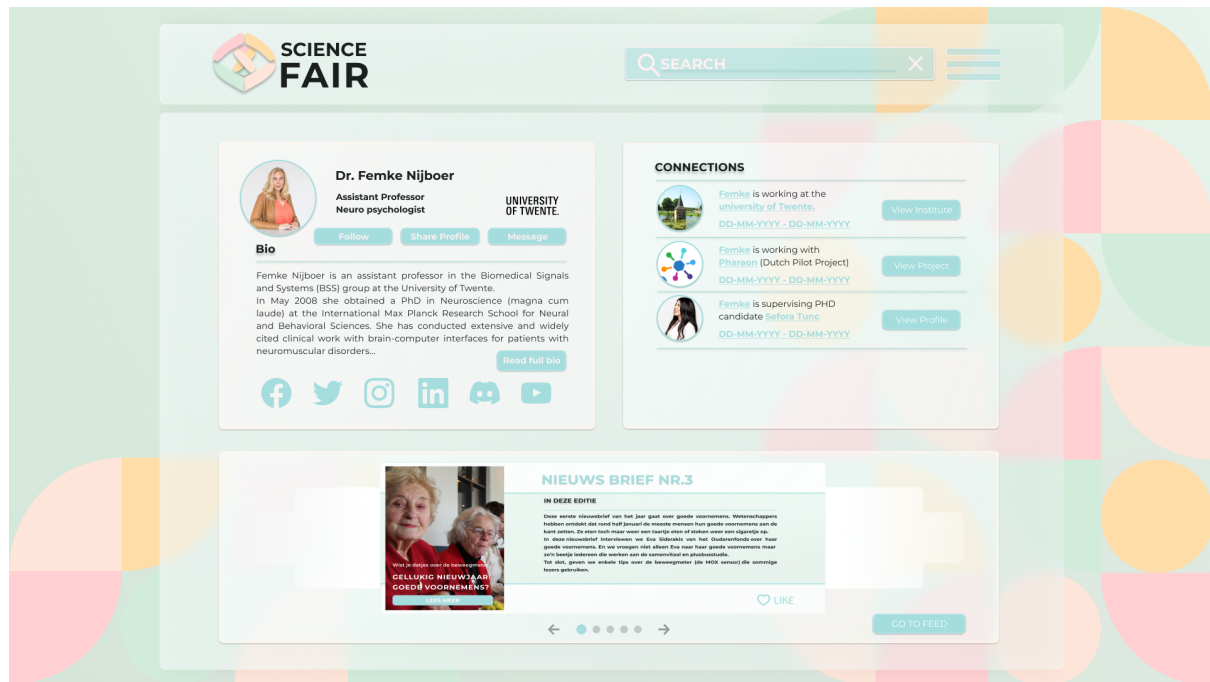


Figure 22: High-fidelity prototype of a researcher profile page

Figure twenty-two shows the prototype of the researcher profile page, this profile type is only available to professional research personnel who are verified by their institution. Researcher accounts are equipped with functionalities that allow them to create and manage projects within the platform. So they can efficiently organise their studies, collaborate with team members, recruit participants and track their progress. These features should make researchers see the platform as a centralised hub for their research activities.

## The Project Profile

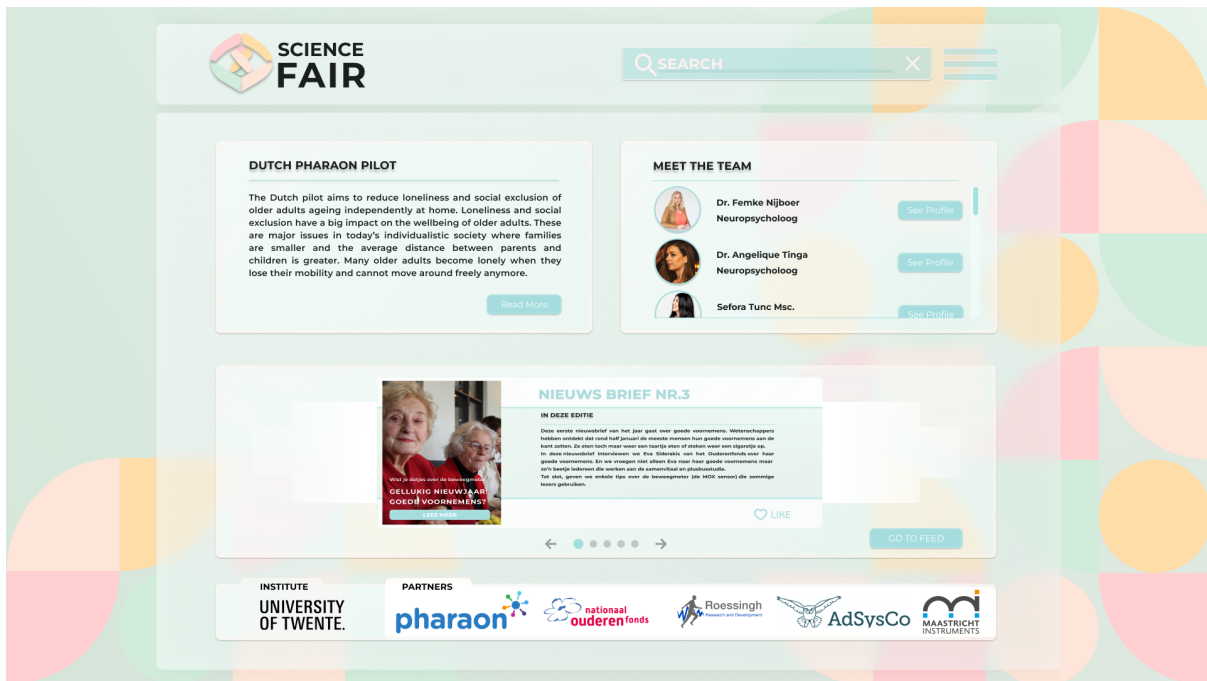


Figure 23: High-fidelity prototype of a project page

The project bio provides a concise overview of the study, offering essential information to interested participants. This section also contains a button to open an overlay where a longer text can be presented, explaining the study in more detail. Additionally, the 'meet the team' section introduces the researchers involved in the project. Intended to foster a sense of transparency and connection.

The carousel is a dynamic feature that allows for the presentation of various materials such as videos, papers, tutorials, and newsletters related to the study. Users can conveniently navigate through the carousel to access the content that was highlighted. The content carousel contains a button in its bottom right corner for navigating to the project's main feed. Furthermore, the research project pages prominently display a banner featuring clickable logos. These logos represent the institutes hosting the research, and the study's partner organisations. By clicking on these logos, users can navigate directly to the respective profiles.

In figure twenty-four, a content card is presented. These cards can be displayed on a feed style page or in a content carousel. There will be many forms and presets of content cards available for different purposes. In this example, a content card for promoting a paper or newsletter was chosen.





Figure 24: High-fidelity prototype of a content card for text

The card has two buttons for interaction with the content. On the bottom right there is a clickable 'like' button. This is to track the interest of users to train the algorithm in personalising their feed. The button in the picture frame can be customised by the author of the post. In this example, it's a read more button, with a link to the platform's internal PDF viewer. The platform's internal PDF viewer can be seen in figure twenty-five. In this example, it's the PDF that opens when the "Lees meer" (read more) button is activated. The PDF viewer has all the standard functionality that is required to properly represent PDF files, while still maintaining the same style as the rest of the platform. A file can be made publicly available on the platform, or only be shared in a network or project.

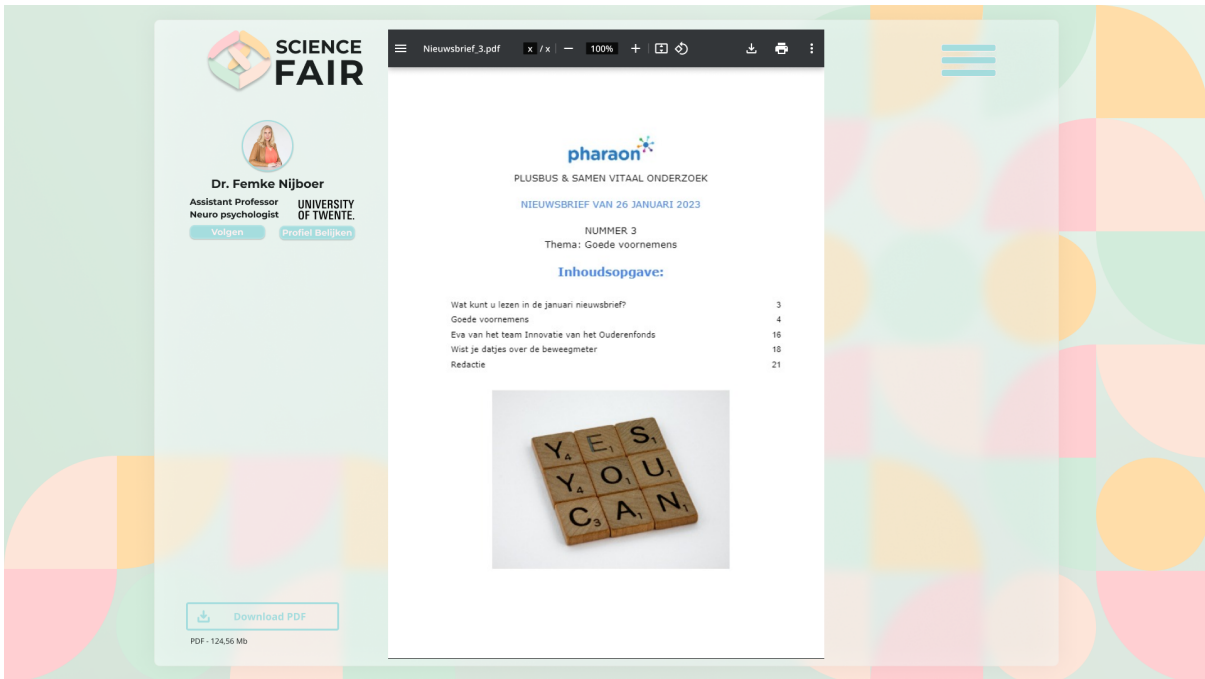


Figure 25: High-fidelity prototype of an institute's profile page

Left of the PDF-viewer, a section is reserved for the authors' information. In this case the document has only one author, but it can have multiple. The author's name, title, function and the logo of their institution are displayed. Underneath this information, a follow and view profile button are available. A download button, with information regarding the file size, is present on the bottom left of the screen. To go back to the feed, the user can close this window or click on the Science Fair logo.

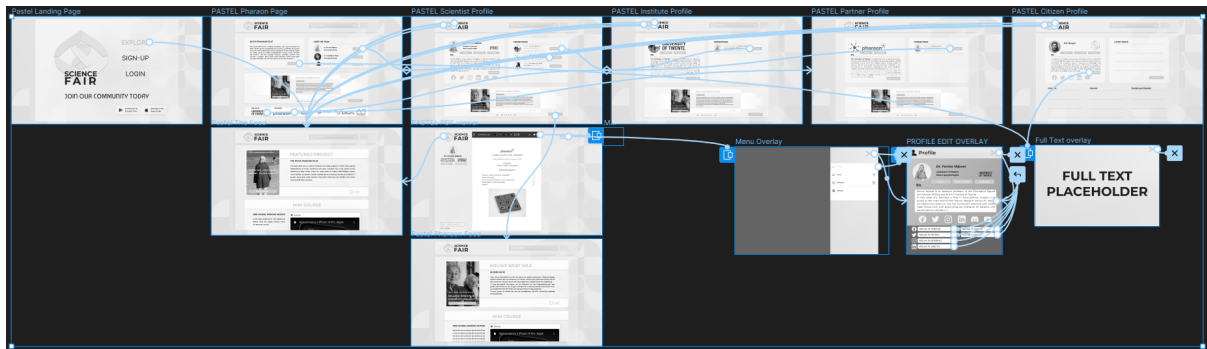


Figure 26: The page flow model of the high-fidelity

Figure twenty-six illustrates a page flow model that demonstrates the connections between the various pages within the platform. The page flow is designed to scale effectively, accommodating an increasing amount of content. While still maintaining a clear and intuitive user experience, as more content is added. It can be seen that the page flow expands seamlessly when comparing this figure to the first page flow model in figure twelve. Importantly, every page within the model has a designated pathway back to the feed, allowing users to easily return to the main content hub. This flow model also shows which buttons on the interface can enable an overlay. Some overlays can be enabled from any page on the platform, like the main menu, while other overlays are page or profile type specific.

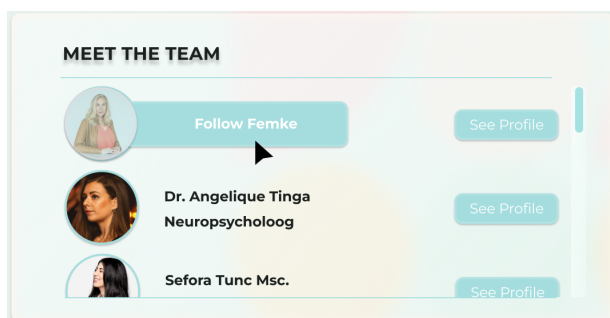
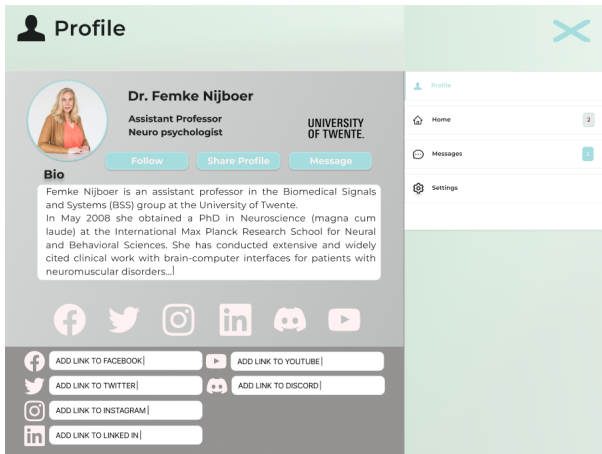


Figure 27: Hover effect.

One of the important overlay elements is the hover effect displayed in figure twenty-seven. It allows users to directly follow a user from the 'meet the team' or 'connections' sections.

The menu overlay for the platform is presented in figure twenty-eight. It offers users convenient access to their various profiles, particularly beneficial for researchers who may have multiple project pages. For example, a researcher could have their researcher profile,



two project pages, and a citizen profile as well. In the menu, messages are easily accessed. And users can conveniently edit their profile information through the settings option. The menu overlay includes an option to link and various social media platforms. By integrating these elements, the menu overlay aims to provide an efficient and user-friendly experience.

Figure 28: Menu overlay

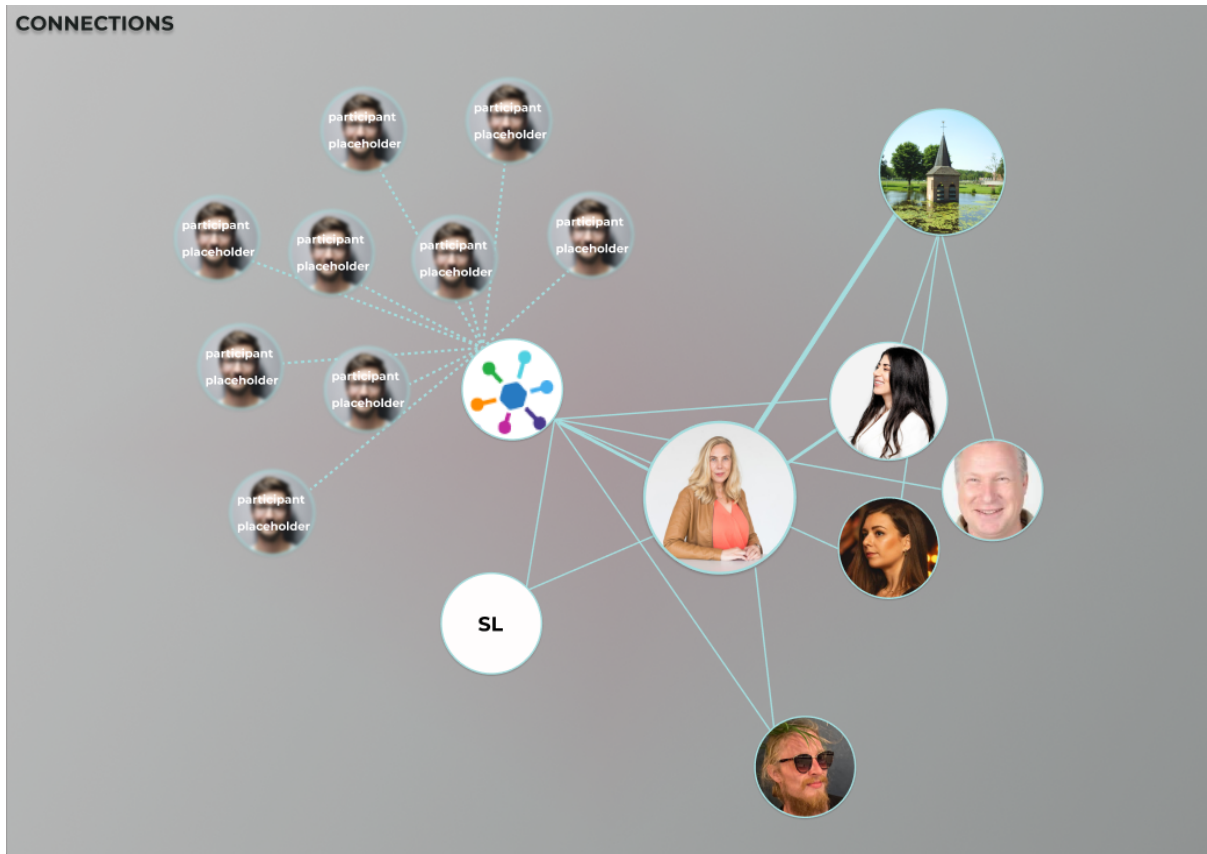


Figure 29: Connections overlay concept

Figure twenty-nine shows how the platform could incorporate a unique and visually engaging function that shows the connections a user has on the platform. The network of an account is illustrated by the interconnected profile pictures. At the heart of this network visualisation is the primary account, depicted by the largest profile picture. The connections are represented by lines of varying thickness that indicate the level of collaboration and proximity within the network. Thicker lines and larger profile pictures signify closer bonds,

emphasising the significance of these relationships. On the other hand, thin lines and smaller profile pictures denote lesser connections. Additionally, the design incorporates dotted lines to represent participants of projects that are not directly connected to you. It is important to note that this connection function is a preliminary concept that requires further exploration and refinement. But the potential benefits and considerations for its incorporation into the platform are important enough to be noted.

With the implementation of a working version of this concept feature in a later prototype, the design of the platform will satisfy the following must-have requirement:

*“Connections: the connections section will show the network of a user.”*

This prototype satisfies almost all the must-have requirements. Yet, leaves the following requirements that can't be accomplished with this method of prototyping:

*“Trust Indicators (Badges, Certifications): the website of the platform must have all standard certifications, so the lock icon next to the web address appears. And the site should not be flagged by any antivirus or malware system.”*

*“Relevant and personalised content: Based on the content preferences and user behaviour, the system must be able to generate an interesting feed for the user.”*

## Chapter seven ‘Evaluation’

*In the evaluation chapter, we will assess the remaining design requirements using various methods to ensure inclusivity and measure usability.*

For the evaluation of the general design rules, we will employ AI testing tools that can analyse and provide feedback. Design elements such as layout, spacing, and visual hierarchy, will be reviewed. Identifying any potential design flaws, and making improvements based on established design principles. To evaluate the usability of the prototype, we will conduct participant task-time completion tests. Click testing is used as a measurement device. Participants will be given specific tasks to perform on the prototype. While their completion times, and interactions will be recorded and analysed. This will provide insights into the efficiency and effectiveness of the design, allowing us to identify areas for improvement.

In addition to performance metrics, we will gather user feedback with the System Usability Scale (SUS) questionnaire. This standardised questionnaire helps us assess the overall usability of the prototype from the participants' perspectives. We will supplement the SUS with a questionnaire that focuses on specific aspects of our design. Allowing us to gather more detailed insights on the remaining requirements.

We aim to comprehensively evaluate the design's adherence to the requirements, and its overall usability, by employing a combination of testing tools, metrics, and user feedback questionnaires. The evaluation process will provide valuable insights that can guide further iterations and refinements of the prototype.

### § 7.1 Remaining Requirements

In table eleven, the remaining must-have requirements are presented. These requirements can only be tested by users. The last remaining functional requirement is ‘seamless content loading’. This will be tested during the user evaluation by measuring the time between the clicking of a button and the moment when the page is fully loaded. The non-functional requirements will be evaluated by incorporating specific questions about the requirements in the user evaluation questionnaire.

Requirement	Functional/ Non-Functional
Seamless Content Loading: going from one page to another on the platform must be achieved in one click, with a loading time of less than one second.	Functional
The platform must have a clear and attractive logo that can be used as a link button to go back to the main/home feed of the platform.	Non-Functional
A clear and attractive logo adapted from the normal page logo to be largely displayed on the home/landing page.	Non-Functional
Engaging call-to-action: The landing page must have a call to action regarding signing up for this platform. Cookie tracking could be used to change the call to action for users who are already registered.	Non-Functional
Clean and intuitive design with only relevant and high-quality visual elements, with as little text as possible.	Non-Functional

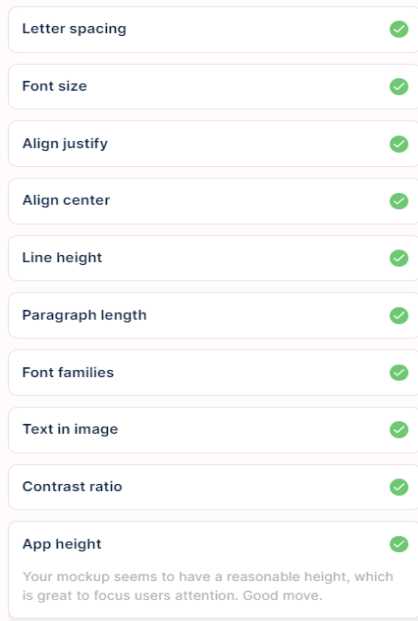
Table 11: Remaining requirements

## § 7.2 Automated Testing Methods

To validate several design choices, we will use automated testing. This means the design choices can be evaluated without the use of participants. The first method is an AI testing tool that will check the prototype according to the following general design rules: enough letter spacing, font size, no more than two font families, the alignment of elements and equal spacing between, line height equals 1.5x font size, high enough contrast ratio between for- and background elements, and standard screen sizes.

To ensure our design is inclusive, it will be tested in a colour-blindness simulator. The colours used in the design may be perceived differently by people affected by colour-blindness. So the perceived contrast may be different, making it hard to distinguish between back- and foreground elements.

### § 7.3 Automated testing results



The AI testing tool thoroughly evaluated the design against a set of predefined design principles and guidelines, as depicted in figure thirty. The automated test results showed no major flaws in the design. This positive outcome signifies that the design adheres well to fundamental design principles, and is structurally sound. While further user testing and evaluation are necessary to gather feedback on specific user preferences and experiences, the initial AI testing provides confidence in the overall quality and adherence to basic design rules.

Figure 30: AI testing on general design rules  
From: <https://aidentic.io/tests/33bd6e99-d888-4c3f-ab5b-ba8ef1ce225f>

Because our platform is predominantly visual, one of the main considerations of inclusivity is accounting for colour-blind users. Therefore, thorough testing was conducted. Below the visibility testing of the user interface elements, for different forms of colour-blindness<sup>4</sup>, is depicted (National Eye Institute, 2023).

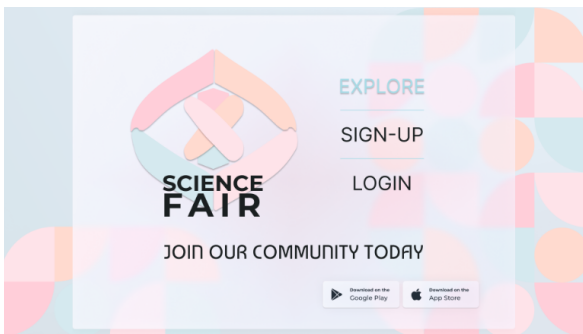


Figure 31: Tritanomaly



Figure 32: Tritanopia

<sup>4</sup> A small description of each type of colour blindness can be found in appendix C



Figure 33: Deuteranomaly

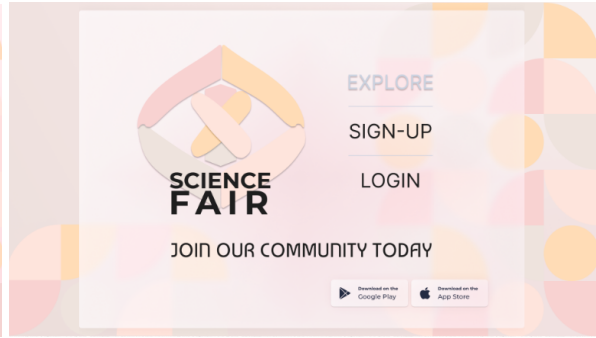


Figure 34: Deuteranopia



Figure 35: Protanomaly



Figure 36: Protanopia

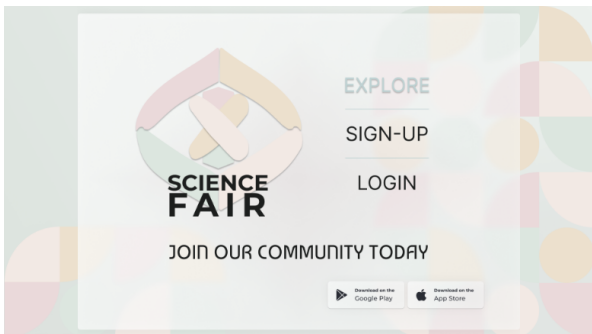


Figure 37: Blue Cone Monochromacy

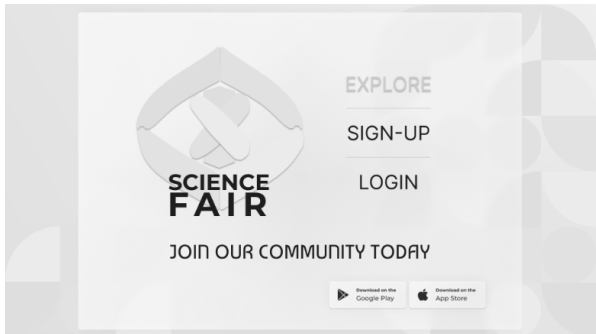


Figure 38: Monochromacy/Achromatopsia

Figures 31 to 38 are made with “coblis color” blindness simulator.

From: <https://www.color-blindness.com/coblis-color-blindness-simulator/>

The results of the colour blindness simulator, as depicted in Figures thirty-one to thirty-eight, indicate that the majority of design elements maintain a high level of visibility and sufficient contrast between foreground and background elements for different types of colour blindness. However, it is important to note that the light pastel blue "Explore" button proves to be challenging to see across all colour blindness simulations. This poses a potential accessibility issue, as users with various types of colour blindness may struggle to perceive the button clearly.



## § 7.4 User evaluation testing methods

For the evaluation of the usability of the design, we will use task success rate testing. This instrument measures the success rate of users completing specific tasks within our system. We can identify areas of improvement and measure the overall effectiveness of the design, by setting up defined tasks and tracking the completion rates. A click testing tool will be used to assess how fast tasks are completed, and how long the page takes to load. The participants will have to complete the following tasks:

1. On the landing page, click on explore when you are ready to start.
2. The feed has a featured project named “The Dutch Pharaon Pilot”, navigate to their project page.
3. On the project page, find and navigate to the profile of Dr. Femke Nijboer.
4. On the researchers page, find and navigate to the profile of The University of Twente.
5. Move back to the main feed (after 10 seconds, participants receive the following hint: “You can move back to the feed by clicking on the science fair logo”).
6. Now you can freely explore the system, you can stop anytime you like (measured the time that participants explored the system).

As previously stated, the second test was conducted with the System Usability Scale<sup>5</sup> (SUS). The SUS is a widely used questionnaire for measuring the perceived usability of a system or design. It consists of ten statements that participants will rate on a five-point Likert scale. The test provides a standardised score that can be used to compare different designs, or track the improvement of usability over time.

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

---

<sup>5</sup> From: <https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.htm>

To compare the results, we need to convert the questionnaire into a usable score. The following steps are required:

Step 1: Convert the scale into number for each of the 10 questions

- Strongly Disagree: 1 point
- Disagree: 2 points
- Neutral: 3 points
- Agree: 4 points
- Strongly Agree: 5 points

Step 2: Calculate

- $X = \text{Sum of the points for all odd-numbered questions} - 5$
- $Y = 25 - \text{Sum of the points for all even-numbered questions}$
- $\text{SUS Score} = (X + Y) \times 2.5$

After these steps, the results between users can be compared. To evaluate the usability of the prototype compared to other user interfaces, we will take the average of all SUS scores. Also, the scores will be analysed looking at the age and education of the participants, to check if these variables have some correlation.

Thirdly, a subsidiary questionnaire will be used to evaluate the elements specific to the user interface prototype of our participant management system.

Questionnaire:

1. What was your first impression of the design of the Science Fair Platform?
2. What do you think the logo is representing?
3. Do you think the logo is attractive?
4. Do you remember the call to action on the landing page?
5. What could make this platform able to sustain an online science community
6. Are there in your opinion key features missing from the design? If yes, what is missing?

## § 7.5 User evaluation testing results

The testing pool for this study consisted of ten individuals representing a diverse age range, educational backgrounds, and self-assessed digital skills. The participants' ages spanned from twenty-two to eighty-six. Education levels varied from HAVO, a secondary education level, to Master's degree. The participants' self-assessed digital skills ranged from poor to excellent. Capturing different levels of proficiency and comfort with digital technologies. The diverse testing pool allowed a wide array of perspectives to be evaluated.

Acknowledging some limitations of the study, it is important to note that the test population had certain restrictions and considerations. First, the absence of participants within the age range of thirty to fifty, limits the representation of individuals in their prime working and professional years. This could potentially withhold us from finding results specific to this age group. Additionally, the inclusion of participants with education levels lower than HAVO was not possible. This may limit perspectives and experiences within the study. Moreover, the study's small sample size of ten participants may restrict the ability to draw definitive conclusions, and could limit the statistical power of the findings. Despite these limitations, the study aimed to provide a starting point for future research.

### Task Time Completion Test Results

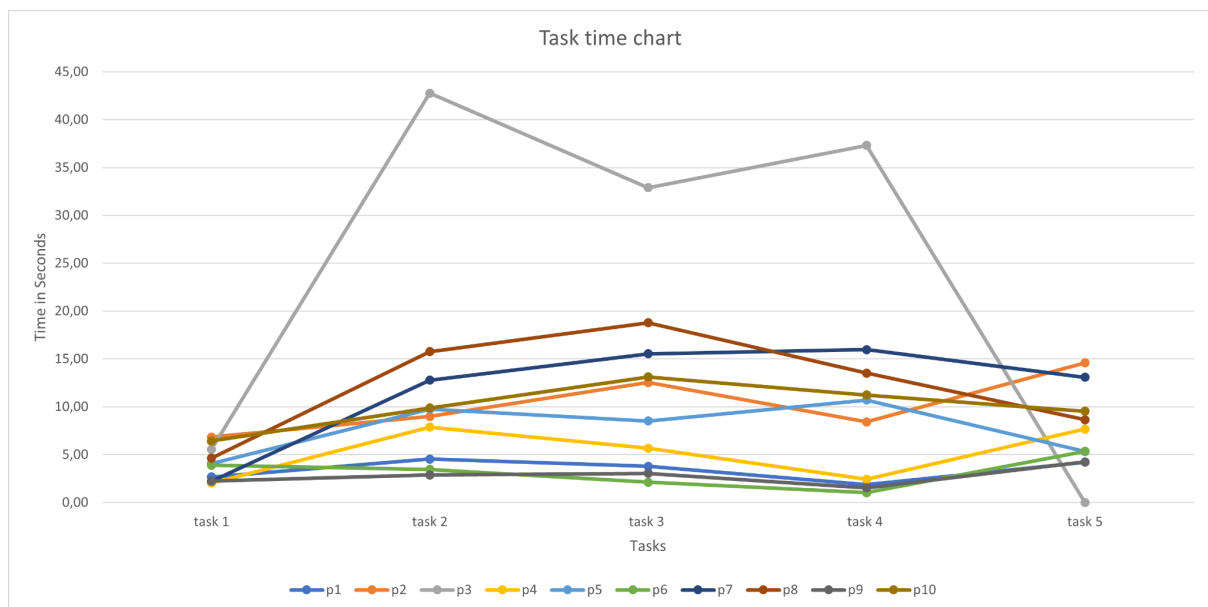


Figure 39: Task time chart

During the testing phase, it was observed that certain participants (p1, p4, p6, p9) approached the tasks with a “winners” mindset. They treated the assignments of the first test as a timed game, and attempted to complete them as quickly as possible. The other participants (p2, p3, p5, p7, p8, p10) displayed a higher level of interest in the content and took more time to engage with the information presented. This significant variation in testing approaches heavily influenced the results obtained. The name of the test, task time completion, might have solicited this game-like behaviour by some participants. For further testing in the future, we suggest using the name “scripted user scenario”. And to withhold the information that participants are being timed.

Participants varied in their task completion times across the different tasks. These times ranged from relatively short durations to longer ones. Such as participant six completing task four in just 1.03 seconds, and participant three spending 42.77 seconds on task number two. The average of all participants across all tasks was 9.2 seconds. This is a reasonable time for completion, therefore these results can be called favourable.

When looking at the completion results task five deserves some further attention. Participants were asked to return to the main feed, and after ten seconds they would receive the hint to click on the science fair logo. The success rate of task five is indicated for each participant in appendix E. The majority of participants (n=7) successfully completed the task, while two participants needed the hint. Only participant one failed to complete the task entirely. An important quote from this participant (P3), age 86, is: "*Without the tasks on paper and your help I would be completely lost from the beginning*". This statement suggests that we need some form of onboarding tutorial for new users without a lot of digital skills, this will be discussed in the recommendations section.

Overall, the data suggests that the completion times for the tasks varied among participants, with some participants taking longer than others. However, the majority of participants successfully completed the tasks, indicating a satisfactory level of usability. The inclusion of hints for some participants aided in their successful completion of task number five. These findings will guide future improvements to optimise task efficiency and success rates.

### System Usability Score (SUS) Results

A score of 72.3 indicates that on average, the participants found our system to be easy and satisfying to use. There may be room for improvement in terms of learnability and efficiency. This score can be used to compare the usability of this system to other systems, or to track our usability progress over time as improvements are made. The fiftieth percentile score of SUS equals sixty-eight on average, this means that with 72.3 we score in the top fiftieth percentile. Correlating to a good score on average, with some results in the excellent range in terms of usability (Will, 2021).

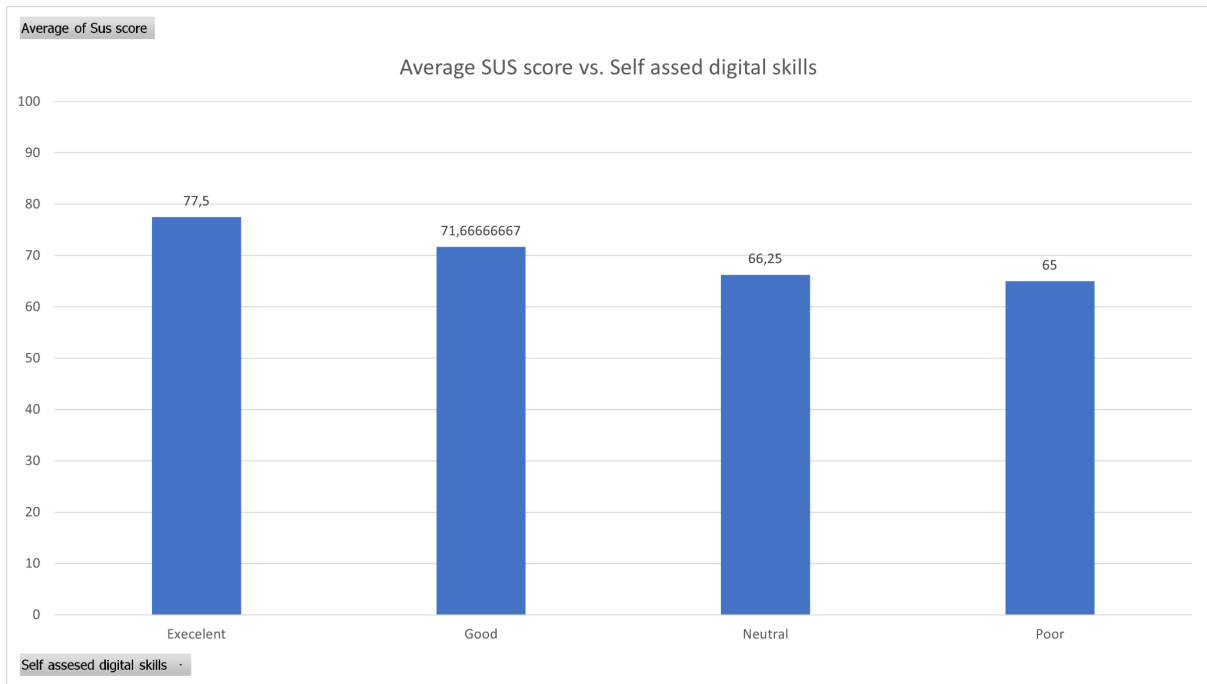


Figure 40: Average SUS score versus self accessed digital skills

Figure forty shows the average SUS score versus the self assessed digital skills. Participants' self-assessed digital skills were classified as excellent, good, neutral, or poor. The graph in figure forty illustrates a noteworthy trend suggesting a potential correlation; those who rated their digital skills as excellent or good tended to have higher SUS scores. Indicating a positive correlation between self-assessed digital skills and perceived usability. It highlights the importance of considering users' digital skill levels when designing and evaluating user interfaces, as these factors might impact their overall perception of usability.

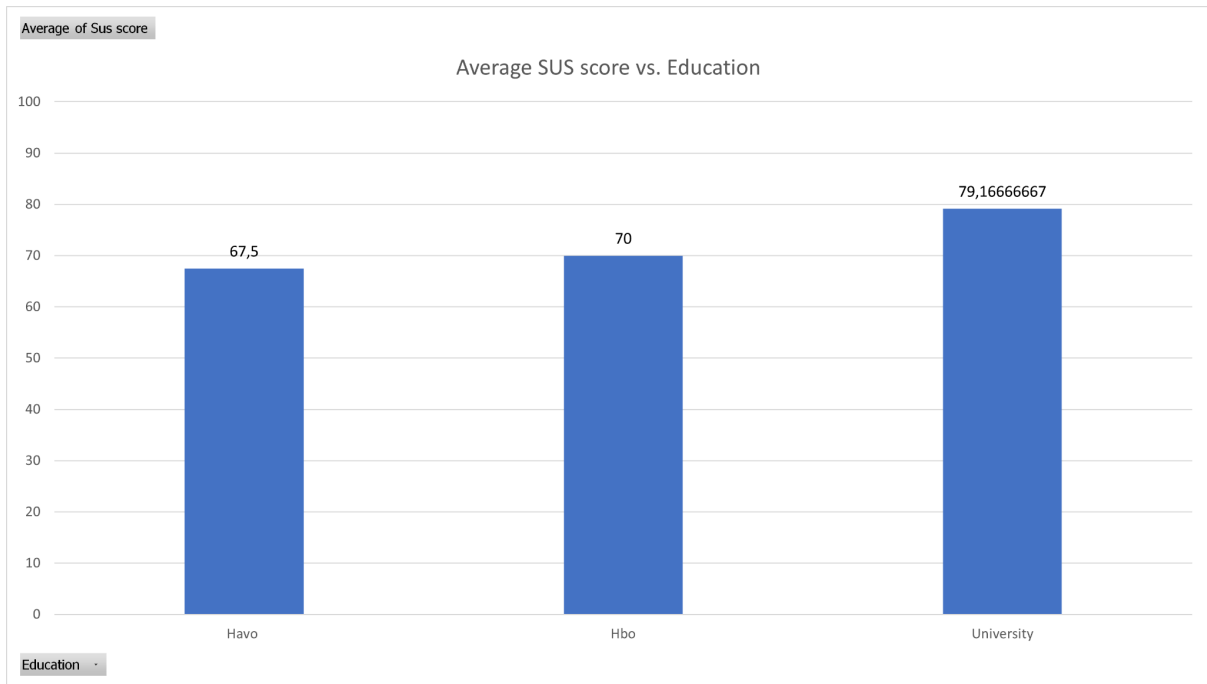


Figure 41: Average SUS score versus education

The graph in figure forty-one demonstrates a similar trend when comparing education levels with the SUS score. Participants with higher levels of education exhibit higher SUS scores, indicating a perceived higher usability of the system. On average, participants with university degrees on average achieve SUS scores of around seventy-nine. While participants with lower levels of education, such as a high school diploma, have lower SUS scores with an average of around sixty-seven. This suggests that education levels may play a role in users' perceptions of system usability. A huge limitation in this study is the sample size of N=10. Furthermore, the range of education levels is very small and skewed to the high side, with no participants that have educational levels lower than HAVO.

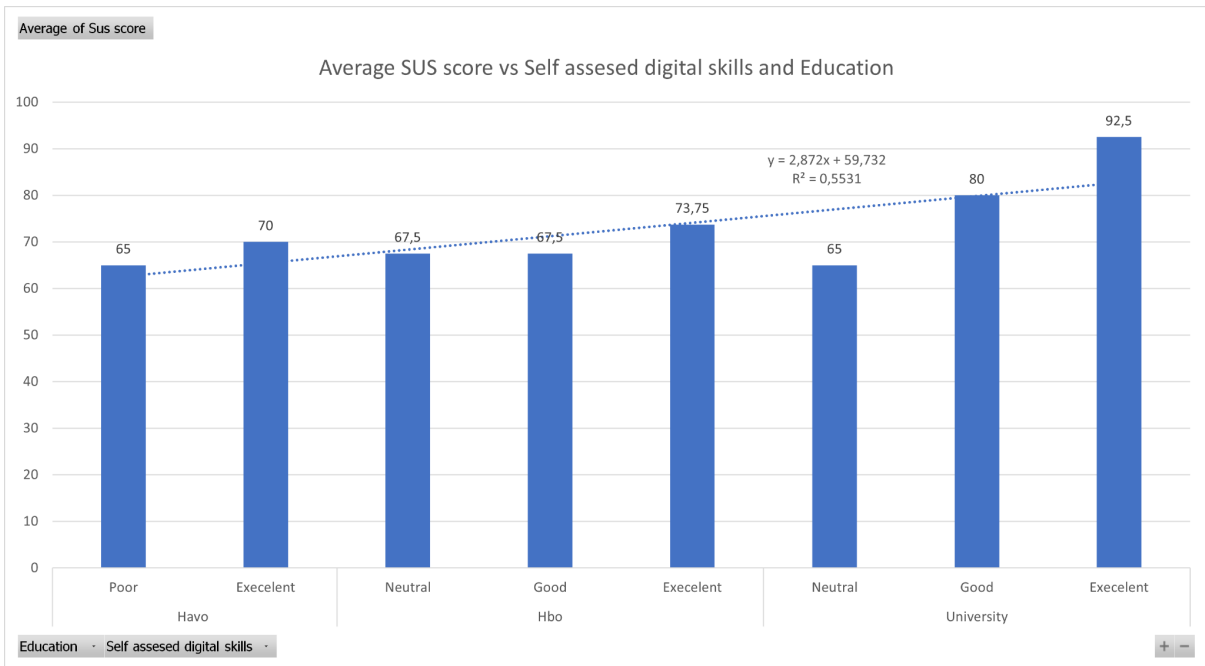


Figure 42: Average SUS score versus self assessed digital skills and education

In figure forty-two, the two graphs of figures forty and forty-one are combined. It shows that the platforms' usability score is higher for participants with university degrees and/or excellent digital skills. The fitting function shows a positive correlation between the variables and the SUS score. This fitting function has an R<sup>2</sup> value of 0.5531, which suggests a moderately strong effect.

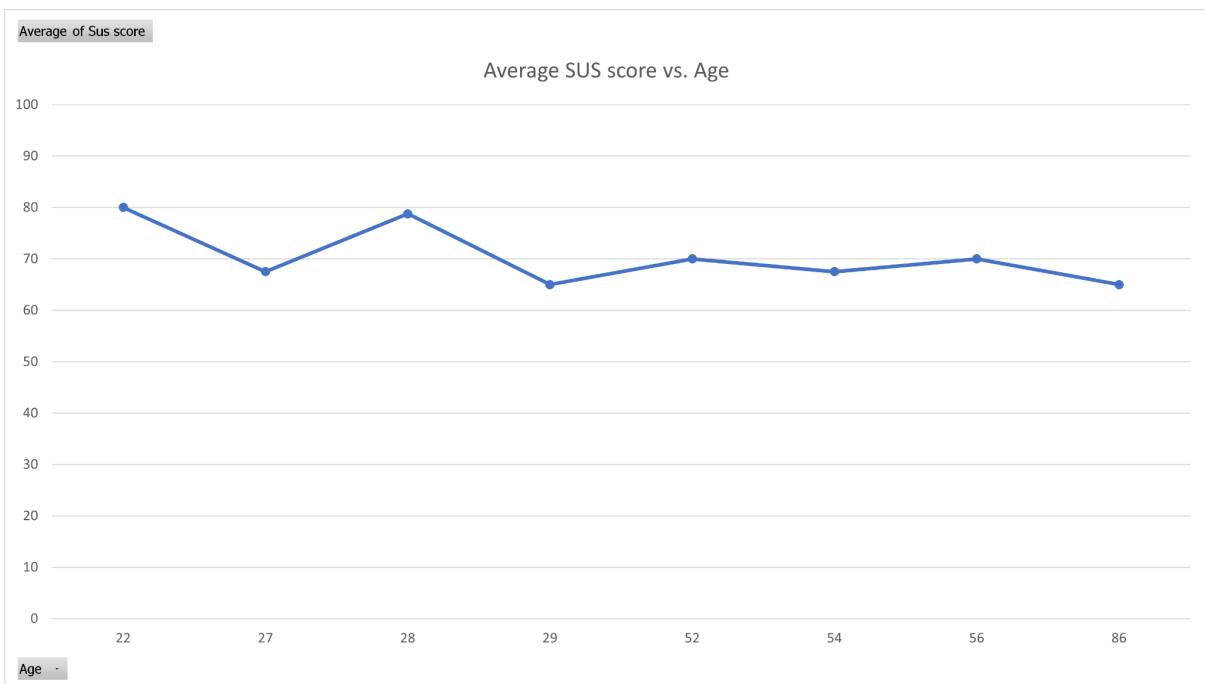


Figure 43: Average SUS score versus age

The age versus average score is shown in figure forty-three. There is no clear correlation between age and the SUS scores. The scores vary across different ages, indicating that age alone may not be a significant factor influencing the perceived usability.

Overall, while education and self-assessed digital skills may play a role in influencing the SUS scores, other factors such as; individual preferences, personal interests, or perceived task complexity, can also impact the usability score. It is important to note that this conclusion is based on a small dataset, and further analysis with a larger sample size would be necessary to validate and generalise these findings. Furthermore, these findings strengthen the argument that an onboarding tutorial, information, and educational materials should be made available for all users.

### Results of the Subsidiary Questionnaire

In the evaluation of the subsidiary questionnaire specific to the Science Fair platform, it became clear that content is key. One participant noted that the platform is very reliant on quality content to get the user “hooked”, successfully onboard the community. Another participant made the prediction that the addition of content on the platform will have a snowball effect. If a large amount of quality content is made available, it will attract more. The amount of content will be essential, because the majority of the testers found the frequency of new content to be the deciding factor whether to incorporate use of the platform in their daily routine.

The user tests also revealed that the colour scheme and layout was appreciated by both male and female testers upon the first impression. The design was seen as professional, which added to the trustworthiness of the platform. Several testers found the multiple account types an interesting concept. Their prediction was that this feature will set the platform apart from other social media types.

The questions regarding the logo established that none of the participants were able to somewhat relate to the quadruple helix model. Or even point out that it had something to do with the involved parties in science. But a few participants did note “Logos do not always have to be explanatory, but recognisable”. One participant said: “It’s a bit like the Google Chrome logo. For me, it doesn’t mean anything. But I know it’s chrome. And in my opinion, the Science Fair logo looks very appealing” This was the case with most participants, they didn’t know the meaning, but found the logo appealing. The testing pool was also asked if they could remember the call to action. Not many did, but a few participants did note that the call to action was not very special.



Most of the testers could not point out missing features. They did mention new needs for functions or tools could arise with long term use. One of the participants made a valid point about privacy: "I know my data will be well protected according to data protection laws, but if I would join a study with a sensitive subject. I don't want this to show up on my profile or be public to other participants. For instance my insurance, or the company I work for, shouldn't be able to see this. I would suggest the possibility of an anonymous entry into a project. Of course the researchers will know my identity, but it shouldn't be public." Another missing feature that was discussed is the sharing of posts on third party apps, such as; Facebook, Instagram, Twitter, LinkedIn. Lastly, the suggestion was made to add push notifications for messages and important notifications.

In conclusion, the prototype is considered to be an easy to navigate platform, with a well-designed layout and colour scheme. But in terms of long term engagement, this remains speculation for now. The participants did note that the size of the community, in combination with the amount and quality of the content, are important factors to make this platform a success.

## Chapter Eight ‘Discussion and Recommendations’

*Based on the findings and insights obtained during the evaluation phase, we established a set of recommendations on how to proceed with the project.*

The first recommendation is to conduct a large-scale pilot study. This is crucial for the evaluation of the system's performance and user satisfaction on a broader scale. By involving a significant number of participants, we can gather more comprehensive feedback, identify potential issues, and validate the effectiveness of the platform in real-world scenarios. Large scale testing would equip us to predict if an active community could form on the Science Fair platform.

To accommodate a large-scale pilot, the back-end infrastructure of the platform needs to be implemented. This phase involves designing and developing the server components, databases, and APIs, necessary to support the platform's functionality. Development could be based on the insights gained from the evaluation of the Figma prototype, and the requirements set in table ten. During the back-end development process, careful attention should be given to optimising performance and ensuring scalability. Thorough testing should be conducted to identify and address any potential bottlenecks, or issues related to data storage, -retrieval, and -processing. Additionally, it is important to consider security measures to protect user data, and prevent unauthorised access. Collaborating with experienced back-end developers can greatly contribute to the successful implementation of an efficient back-end architecture.

With the back-end in place, the platform needs to be filled with engaging content. The platform will host two main types of content. The so-called casual science content, and research projects. For the first category, we need to collaborate with experienced content creators, like YouTubers with scientifically orientated channels. Researchers could also be encouraged to present their findings playfully. For the second category, we need to find research groups that are willing to participate with their project in the pilot study.

Results from the evaluation phase suggest that the platform currently does not provide enough information or instructions to learn about the system's features. Several tutorials and information pages should tackle this challenge. First, introducing a help button with hover hints can provide on-demand assistance to users. By incorporating tooltips, or pop-up explanations, we can enhance the user's understanding of complex features. This would reduce the need for external support. Second, writing a comprehensive Frequently

Asked Questions (FAQ) page can address common user questions. This resource should cover a wide range of topics and provide clear and concise answers, empowering users to find solutions independently and reducing the burden on customer service. Third, a well-designed starter tutorial, preferably a guided tour would aid new users in their onboarding. This tutorial should introduce the platform's key features, and demonstrate their benefits. The onboarding tutorial should be specifically designed for each account type. Fourth, establishing a dedicated customer service team, or channel, is vital to address users' questions. They would provide technical support, and handle feedback or issues that arise during platform usage. Offering prompt and reliable customer service will foster user satisfaction and loyalty.

During our project, we encountered several challenges regarding the workload of researchers. The researchers are hesitant about using our platform because of time commitment concerns. They expressed reservations about incorporating the platform into their research activities, fearing that it would add to their already large work load. However, it is important to recognise that disseminating research findings to civil society is a fundamental aspect of their responsibilities. By streamlining their research activities, and leveraging the platform's capabilities, researchers can potentially save time in the long run. To address the reluctance and concerns of researchers, it is crucial to emphasise the potential time-saving benefits of the platform. This can be achieved by highlighting the streamlined workflows, improved data management, and enhanced collaboration opportunities provided by the platform. Demonstrating how the platform can alleviate administrative burdens, and facilitate knowledge dissemination, may help researchers recognise the long-term advantages. This, in turn, might encourage their active participation.

Lastly, the platform needs to gain traction with the public, this can be achieved through a social media campaign and advertisement. And specifically make use of TV science personalities like Diederik Jekel, Erik Scherder and Lieven Scheire for the launch of the platform.

By considering these recommendations for further development and testing, we can improve the functionality, usability, and ultimately bring Science Fair closer to its full potential.

### 'Lessons Learned'

Throughout the course of this project, several valuable lessons have been learned. Some challenges occurred due to unforeseen events. Or because we tried to fix too much in one project, mainly due to our enthusiasm. Reflecting on the experiences, several insights

were identified that can guide the future advancement of Science Fair. The following lessons were obtained throughout our research and designed process:

A prominent personal lesson was the importance of carefully defining and managing the project scope. The initial scope was too ambitious. The platform cannot be fully realised without a development team. After reconsidering the scope of the project, this thesis focused on a user interface prototype with a comprehensive list of system requirements. Although, an enthusiastic and ambitious approach will definitely increase quality and productivity. In the future, it is important to set realistic and achievable goals to ensure a project's success and completion.

One of the crucial lessons we learned was the challenge of managing multiple perspectives while maintaining project scope. Throughout the project, we made a conscious effort to consider various viewpoints to ensure inclusivity, user satisfaction, and engagement. However, we discovered that accommodating all perspectives could significantly expand the scope of the project, which posed challenges in terms of prioritising requirements. In hindsight, while considering multiple perspectives is essential for creating an inclusive platform, it is equally important to strike a balance between inclusivity and project feasibility. In the future, we recommend carefully evaluating and prioritising perspectives based on their impact and alignment with the project goals. Although the MoSCoW method was a great aid in structuring the requirements, a method that includes the evaluation of the requirements could be helpful. This approach will help manage the scope effectively, and prevent project expansion beyond manageable limits.

## Chapter Nine 'Conclusion'

*This thesis lays out the research and design of a participant management platform called Science Fair.*

The idea came to be, because there is currently no forum available that offers all the components needed to conduct successful and efficient research. Many times research teams will develop a single use platform just for that project. Alongside, already existing communication tools like teams or skype are often employed. This scattered approach called for refinement. The premise of a cohesive participant management system was born. A single platform where researchers can promote their projects, recruit their participants, and do anything needed to conduct their research.

To ensure success in creating a functional design for the participant management platform, first a theoretical framework was established. The state-of-the-art analysis on already existing platforms soon revealed that, even though each of the currently existing solutions has its strengths, none combine all seemingly necessary features into a single platform that fully supports all stakeholders. The expert interviews yielded valuable insight in the challenges that researchers face regarding the eligibility, recruitment and retention of participants. Experts underlined 'reciprocity' between researcher and participant as something particularly challenging to maintain. That is, reciprocity is critical for the realisation of viable research. Furthermore, the overall enthusiasm experts conveyed toward this project confirmed the need for a system like ours.

To further expand our framework, a literature review was conducted. This helped to gain a better understanding of the theory of participant engagement. The findings were presented in two categories; namely practical interventions, and more abstract concepts. The practical interventions, which presented research in an entertaining way, increased participant engagement. The more abstract concepts: trust, reciprocity, authenticity, honesty and transparency, were not strictly defined in the literature. Therefore, the meaning of the abstract concepts was further explored by a set of interviews with students from different backgrounds. The interviewees all defined these terms slightly differently. To accommodate the multiple perspectives, a set of lenses were developed based on the interview data. These lenses were used in the ideation phase to ensure an inclusive design.

After the theoretical framework was successfully established, the design method to create the platform was selected; Mader & Eggink's '*A Design Process for Creative Technology*'. This method structures a design in four phases; the ideation phase,

specification phase, realisation phase and the evaluation phase. The ideation phase consisted of several brainstorming sessions. Those ultimately led to a set of ideas and functionalities that together formed the first outlines of the platform. The second step in the design process was the specification phase. In this stage, the previously formed ideas were moulded into specific requirements. The requirements were ordered according to the MoSCoW method to assure the most important requirements were incorporated into the design. The third step in the design process was the realisation phase, where the specified requirements were incorporated into the prototype. First, a low-fi prototype was created to validate the concept and form a solid base. Secondly, through several rounds of design iteration and a public prototyping session, a high-fi prototype was formed. The fourth and last stage in the design process is the evaluation. In this phase, the prototype was subjected to several tests. First, an automated test conducted by an AI model on general design rules, was passed with flying colours. Hereafter, the design was evaluated by user testing. Although most results of the user evaluation were very positive in general, the testing revealed some missing features that have been elaborated on in chapter eight 'discussion and recommendations'.

Now we have summarised the course followed during the research and design of Science Fair we ask if there is a conclusive answer to the main research question of this thesis:

*"How can existing digital features be combined into one multifunctional research participant management system to tackle challenges of eligibility, recruitment, retention, and participant engagement in the context of community-based research?"*

During the process described above, we came a long way in answering our research question. All of the identified digital features that proved useful were combined into the participant management platform 'Science Fair'. A concise style was used in the design of every page to create a sense of wholeness. The entire platform would be connected, instead of the separate entities currently in use by most research projects. While it still allows third party platforms to be utilised via plugins. The prototype shows that the aspired multifunctionality has been achieved. It can be used to advertise, to communicate, for the dissemination of information, and much more.

Science Fair was designed to tackle the challenges stated in the main research question: eligibility, recruitment, retention, and participant engagement. During the entirety of the thesis, these challenges have often been reversed. Therefore, in this conclusion, only the highlights will be discussed to form a short but coherent answer to our research question.

Some of the more prominent design elements that tackle the challenges will be touched upon.

The challenge of eligibility has steered the design the least, because this criterium is specific to every single study. But the introduction of profiles will aid researchers in determining whether a participant is suitable for the research they want to conduct. It would significantly reduce the workload during the recruitment phase. There is also the option for researchers to view the level of engagement a citizen has displayed in previous studies.

Science Fair offers a large amount of opportunities to streamline recruitment. Researchers are able to promote their projects, give information about the subject, and specify what they are looking for in participants. This element of informing the potential participants, and prioritising transparency on the platform as a whole, not only aids in recruitment but will also help retain the users. The possibility for communication through a chat service and clearly displaying contact information makes users feel seen and heard. The literature research revealed that these are important factors in retaining participants.

The concept of gamification was implemented to tackle not only participant engagement, but also recruitment and retainment. Users of Science Fair will be able to earn neutron shaped badges in different colours, each representing a higher level, based on their engagement. This is an attractive feature that could be the push to onboard the platform, and incentivise users to remain. It has long been proven that offering rewards is an effective manner to keep humans active and engaged. Another way we hope to serve our users is to offer a wide variety of knowledge and education. Both regarding the workings of the platform itself, and all of the projects available on Science Fair.

In conclusion, we have designed a multifunctional management tool that tackles the issues of eligibility, recruitment, retention and engagements of participants. The prototype developed shows a large amount of promise. If the results of the test conduction are taken into account, and the recommendations are taken, the prototype can be transformed into a fully functioning platform.

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## Informed consent

Interviews with experts about research participant engagement



D.S. Huybens  
Dr. F. Nijboer Msc.  
Dr. K. Zalewska

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## **INFORMATION BRIEF**

### **Introduction**

You are invited to participate in a research study that is being conducted by David Huybens and Dr. Femke Nijboer. We are interested in exploring participant engagement in long term user studies, and establishing design requirements for a research participant engagement tool. Before you decide whether or not to participate, it is important that you understand why the research is being conducted and what your involvement will entail. Please read this consent form carefully before deciding whether or not to participate. If you have any questions, please ask the researcher.

### **Procedure**

We would like to interview you for about 30-45 minutes. We will ask no personal questions, only regarding the needs and interesting observations of the interviewee during their regular work. The questions will be somewhat like: "How are you currently recruiting participants?" or "What current strategies are you using regarding participant engagement?". With consent this interview will be recorded (audio only).

### **Purpose of the Study**

**Background:** In a world with increasing digitization, the need for new digital research-participant management/interaction tools arose. This led to several solutions across many platforms, with no central dashboard.

**Objective:** Establishing the needs of both stakeholders and target groups. Combining the findings into design requirements, after this stage we will evaluate the feasibility of the design. The final stages of the project will include building and testing a high-fi prototype.

### **Benefits of Participating**

Although there may be no immediate personal benefit to you, your participation will help to advance our knowledge in: the current participant engagement strategies.

### **Risks of Participating**

There are no known risks to participation in this study.

### **Withdrawal from the Study**

You have the right to withdraw from the study at any time without penalty or loss of benefits. If you wish to withdraw, please inform the researcher. During the interview the interviewee has the right to deny answering any of the questions asked, without further explanation to the researcher.

### **Collection and Processing of Personal Information**

During this study, we may collect and process personal information about you. This information will be collected in accordance with GDPR. We will ensure that your personal information is kept confidential and secure, and that it is only used for the purposes of this study. Your personal information will be anonymized before it is used in any publications or presentations. You have the right to request access to and rectification or erasure of your personal data.

### **Data Usage, Dissemination, and Archiving**

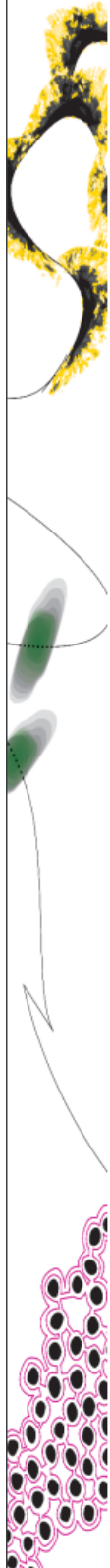
The data collected in this study will be used for research purposes only. We may use the data in publications or presentations, but your personal information will be anonymized before it is used. The data will be kept confidential and secure, and it will only be accessible to members of the research team. The retention period for the transcriptions data is one year, however the audio recordings will be destroyed within two months of the interview date.

### **Contact Information**

If you have any questions about the study, please contact the research team at [d.s.huybens@student.utwente.nl](mailto:d.s.huybens@student.utwente.nl). 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](mailto:ethicscommittee-CIS@utwente.nl)

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**Consent Form for Expert interview**  
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 [27/02/2023], 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: Answering a series of questions during an interview.

**Use of the information in the study**

I understand that information I provide will be used for: a graduation project, presentations and possible publications. The audio recordings of interviews will be transcribed within two months, after this the data will be destroyed. The retention period for the transcriptions is one year.

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.

I agree that my information can be quoted in research outputs

**Consent to be Audio Recorded**

I agree to be audio recorded.

**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

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### Consent Form for Expert interview

COPY OF ORIGINAL

*Please tick the appropriate boxes*

Yes No

#### Taking part in the study

I have read and understood the study information dated [22/02/2023], 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: Answering a series of questions during an interview.

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I understand that information I provide will be used for: a graduation project, presentations and possible publications. The audio recordings of interviews will be transcribed within two months, after this the data will be destroyed. The retention period for the transcriptions is one year.

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#### Consent to be Audio Recorded

I agree to be audio recorded.

#### 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



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## Appendix B: Literature review synthesis matrix

Questions Papers	Participant roles	Type of engagement	Specific strategies to increase PE	Barriers for PE	Methods of communicating	Conclusion
Patient knowledge, experiences and preferences regarding retinoblastoma and research: A qualitative study(Moses et al., 2020)	Knowledge broker, experience expert	Focus groups		Time, lack of knowledge, Training time of participants	Live focus groups,	
The Impact of COVID-19 on Patient, Family Member, and Stakeholder Research Engagement: Insights from the PREPARE NOW Study (Browne et al., 2022)	Experience expert	patient-centred outcomes research engagement	active engagement; and promoting trust, honesty, transparency, and authenticity	Lock-down situations (this specific situation COVID-19)	Online voice service	The effects of moving all of the research activities to a virtual environment had no negative influence on participant engagement
Engagement design in studies on pregnancy and infant health using social media: Systematic review(Shieh et al., 2020)	Source of information	Engagement thru social media	Regularly sending study participants videos, infographics, messages, photos, Q/A, discussion forums, chat rooms, discussion	Falsify eligibility information by social media users Compete with other ads posted in free social media sites. Permission to access some social media groups may not be granted	Social media	
Engagement, recruitment, and retention in a trans-community, randomized controlled trial for the prevention of obesity in rural American Indian and Hispanic children(Cruz et al., 2014)			building on previous relationships, working with community leaders, forming partnerships with mutual benefits specified in a MOA, and having a member on the research team who serves as the primary point of contact with the community. It is also critical to be flexible and to respond to changes in the community as the study evolves, while still maintaining fidelity to the study protocol.	Underrepresented minorities or small groups are harder to include in a study. Not complying to the needs and standards of certain groups.	Personal contact	1st Relationship individual to individual <i>Identify a Champion</i> Create a Shared Agenda 2nd Relationship individual to community <i>Obtain Commitment</i> Adopt Formal Agreement 3rd Relationship research team to community <i>Foster Partnership</i> Nurture Relationships While Implementing Research Activities
From "participant" to "friend": the role of Facebook engagement in ethnographic research(Edrisingha et al., 2017)			"Friendship" as method. A more personalized approach towards research participants		Social media	Facebook engagement helps overcome three challenges inherent to ethnographic research: gaining access and immersion, capturing multiple perspectives, and developing rich and thick interpretations. The findings illustrate that adopting Facebook as a platform to strengthen "friendships" with research participants
Facilitating Community Participants' Research Engagement: Community Members' Perceptions of Community-based Research(M. Tse et al., 2015)		Community based participatory research CBPR	translating research findings into community actions is enhanced when the expectations of community members are taken into account  Making impact on a community.	The readiness off partners is something that needs evaluation. This is done by Andrew's CBPR Partnership Readiness Model.		Three key areas were identified: (1) reciprocal trustable is needed; (2) perceptions about the purpose, research intent and expectations; (3) expectations of roles and responsibilities of the researcher(s). A model showing the reciprocity between the academic partner and the community partner is needed to establish the full CBPR process is proposed.
Participant engagement with play research—examples and lessons learned from the Centre for Play in Education, Development and Learning(Blaskova et al., 2020)	Children as experience experts, teachers as co-researchers	Participant engagement with play research	Giving voice to children and considering teachers as co-researchers, we aim to empower two key stakeholders of the PEDAL projects and ensure that our research is meaningful to its recipients.		Their research is mostly in person, but they also use twitter discussions to reach larger amounts of people	In PEDAL, we consider children as experts on their lives and grasping the essence of social play and social development would not be thorough without involving children directly. Also they consider teachers as co-researchers on play-research.
Maximizing participant engagement, participation, and retention in cohort studies using digital methods: Rapid review to inform the next generation of very large birth cohorts(Nkyekyer et al., 2021)			1. Visual and personalized feedback seemed effective. 2. In e-intervention studies, goal setting has mostly been used as a behaviour change 3. Using digital push interventions for series completion 4. There was higher uptake when parental financial incentives or rewards were offered in quasi-mandatory schemes to increase the uptake of preschool vaccinations. Universal gifts were more acceptable than targeted parental financial incentives. 5. Mental health apps were effective or partially effective in producing beneficial changes in psychological outcomes among young adolescents. 6. Intensive guidance (with a human coach) was more efficacious than unguided interventions and a beneficial design feature, particularly for mental health studies. 7. Electronic text notifications improved attendance and reduced nonattendance across health care settings. Sending multiple notifications improved attendance rates.			Overall, no specific e-intervention strategy was identified as being superior. However, more interactive methods of delivery, such as videos and regular e-therapist contact for training, (1) improve adherence, (2) increase completion rates, and (3) improve fidelity. Further research is needed to understand the strategies that improve retention in longitudinal studies.
Principles of Precision Prevention Science for Improving Recruitment and Retention of Participants(Supplee et al., 2018)		community-based participatory research	When barriers and facilitators are clearly articulated through partnerships, using tools, such as mini-trials or fractional factorial designs, can help the team to identify what matters most to achieving high-quality engagement	Researchers struggling with the process of adaptation		Research practice partnerships are critical avenues for identifying facilitators and barriers to participant engagement from the perspectives of the participants and providers in community-based prevention programs
Rethinking arts-based research methods in education: enhanced participant engagement processes to increase research credibility and knowledge translation(Morris & Paris, 2022)		Arts-based research (Arts-based research is a participatory research practice that is well established in the qualitative field)			Interviews and co-creation of art	The integration of arts-based research within this case study resulted in more active participation of the early career teachers throughout the research process. Consequently, participants' voices resonated more strongly in the research output, as the iterative and participatory nature of the arts-based design supported a

						longitudinal dialogue between researcher and participant.
Strategies for research participant engagement: A synthetic review and conceptual framework(Wong et al., 2021)						<p>According to this paper there are 4 main groups of participant engagement strategies: changing attitudes by appealing to social motivators, changing attitudes by targeting individual psychology, reducing barriers and cognitive burdens, and providing incentives.</p> <p>Among interventions tested in randomized controlled trials, 51% had a null effect on research participant engagement, and 30% had a statistically significant positive effect.</p>
Patient stakeholder engagement in research: A narrative review to describe foundational principles and best practice activities(Harrison et al., 2019)			Engaging patient stakeholders in research as partner			<p>This paper reviewed 55 papers and the most commonly reported foundational principles were "respect" (n = 25, 45%) and "equitable power between all team members" (n = 21, 38%). Creating "trust between patient stakeholders and researchers" was described in 17 (31%) articles. Twenty-seven (49%) articles emphasized the importance of providing training and education for both patient stakeholder and researchers.</p> <p>Providing financial compensation for patient stakeholders' time and expertise was noted in 19 (35%) articles. Twenty articles (36%) emphasized regular, bidirectional dialogue between patient partners and researchers as important for successful engagement.</p>



## Appendix C: Description of types of colour blindness

Tritanomaly people with tritanomaly have a reduced sensitivity to blue light. They may have difficulty distinguishing between blue and green hues, as well as pink and gray shades.

Tritanopia: Individuals with tritanopia lack the ability to perceive blue light. They typically confuse blue and green colours and may perceive them as gray or yellowish.

Deuteranomaly: Deuteranomaly is the most common form of colour blindness, affecting the perception of green light. People with deuteranomaly have difficulty differentiating between red and green colours, but can still discern them to some extent.

Deuteranopia: Individuals with deuteranopia lack the ability to perceive green light. They often have trouble distinguishing between red and green colours, and may perceive them as shades of gray or brown.

Protanomaly: Protanomaly affects the perception of red light. People with protanomaly have a reduced sensitivity to red wavelengths and may struggle to distinguish between red and green colours.

Protanopia: Protanopia is a severe form of red colour deficiency. Individuals with protanopia are completely unable to perceive red light and often confuse red and green colours.

Blue Cone Monochromacy: People with blue cone monochromacy have only one functioning type of cone cells in their eyes, which affects their ability to perceive colours. They typically see the world in shades of blue and yellow.

Monochromacy/Achromatopsia: Monochromacy, also known as achromatopsia, is a rare form of colour blindness where individuals cannot perceive any colours. They see the world in shades of gray and have reduced visual acuity in bright light.

## Appendix D: Informed consent user testing



### **Informed consent**

UI/UX Testing X June



D.S. Huybens  
Dr. F. Nijboer Msc.  
Dr. K. Zalewska

**UNIVERSITY OF TWENTE.**



## INFORMATION BRIEF

### **Introduction**

You are invited to participate in a research study that is being conducted by David Huybens and Dr. Femke Nijboer. We are interested in exploring participant engagement in long-term user studies and are establishing a design for a research participant engagement tool. Before you decide whether or not to participate, it is important that you understand why the research is being conducted and what your involvement will entail. Please read this consent form carefully before deciding whether or not to participate. If you have any questions, please ask the researcher.

### **Procedure**

In this usability test, you have to perform several tasks in the design. Like, move from point A to B in the design and perform task X. This will take about 20-30 minutes after completion of the tasks you are invited to fill out a system usability scale questionnaire. We can use this data if we can verify improvement in the design of the second iteration.

After completing the questionnaire, there is time for open-ended questions about user engagement. And for general advice or feedback about the prototype.

### **Purpose of the Study**

**Background:** In a world with increasing digitization, the need for new digital research-participant management/interaction tools arose. This led to several solutions across many platforms, with no central dashboard.

**Objective:** we will evaluate the feasibility of the design. The final stages of the project will include building and testing a high-fi prototype.

### **Benefits of Participating**

Although there may be no immediate personal benefit to you, your participation will help to advance our knowledge of the current participant engagement strategies.

### **Risks of Participating**

There are no known risks to participation in this study.

### **Withdrawal from the Study**

You have the right to withdraw from the study at any time without penalty or loss of benefits. If you wish to withdraw, please inform the researcher. During the interview the interviewee has the right to deny answering any of the questions asked, without further explanation to the researcher.

### **Collection and Processing of Personal Information**

During this study, we collect and process demographic data about you. This information will be collected in accordance with GDPR. We will ensure that your personal information is kept confidential and secure and that it is only used for the purposes of this study. Your personal information will be limited to this information brief and consent form. You have the right to request access to and rectification or erasure of your collected data.

### **Data Usage, Dissemination, and Archiving**

The data collected in this study will be used for research purposes only. We may use the data in publications or presentations, but your personal information (only demographic data) will be anonymized before it is used. The data will be kept confidential and secure, and it will only be accessible to members of the research team.

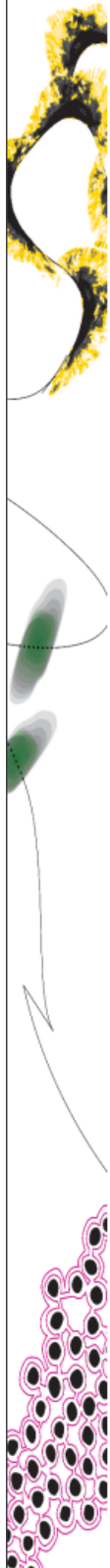
### **Contact Information**

If you have any questions about the study, please contact the research team at [d.s.huybens@student.utwente.nl](mailto:d.s.huybens@student.utwente.nl). 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](mailto:ethicscommittee-CIS@utwente.nl)



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**Consent Form for UI/UX Testing**  
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 [x/06/2023], 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.  Yes  No

I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and tasks. And I can withdraw from the study at any time, without having to give a reason.  Yes  No

I understand that taking part in the study involves: Interacting with a prototype and providing data thru various measuring instruments  Yes  No

**Use of the information in the study**

I understand that the information I provide will be used for a graduation project, presentations and possible publications.  Yes  No

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.  Yes  No

I agree that my information can be quoted in research outputs  Yes  No

**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

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## Appendix E: Data of the user evaluation

Population N = 10

Age = (22 ; 86)

Education = (HAVO ; Master's Degree)

Self assessed digital skills = (Poor ; excellent)

Participant	Age	Gender	Education	Self assessed digital skills
p1	56	Male	Havo	Excellent
p2	52	Female	Hbo	Good
p3	86	Female	Havo	Poor
p4	22	Female	University	Good
p5	28	Female	University	Excellent
p6	27	Male	Hbo	Excellent
p7	28	Female	University	Neutral
p8	22	Male	Hbo	Excellent
p9	29	Male	Hbo	Good
p10	54	Female	Hbo	Neutral

Participant	q1	q2	q3	q4	q5	q6	q7	q8	q9	q10	SUS Score
p1	4	3	3	1	3	2	4	2	4	2	<b>70,0</b>
p2	2	1	4	2	2	1	5	1	3	3	<b>70,0</b>
p3	3	2	4	3	3	1	3	3	5	3	<b>65,0</b>
p4	4	2	5	2	4	2	4	2	4	1	<b>80,0</b>
p5	5	2	5	1	5	1	5	1	4	2	<b>92,5</b>
p6	4	2	2	4	4	4	5	1	5	2	<b>67,5</b>
p7	5	3	1	3	4	1	2	2	4	1	<b>65,0</b>
p8	4	3	3	2	5	2	4	1	5	1	<b>80,0</b>
p9	4	1	2	2	5	1	2	4	3	2	<b>65,0</b>
p10	5	1	3	3	5	2	1	3	4	2	<b>67,5</b>
<b>avg</b>	<b>4,0</b>	<b>2,0</b>	<b>3,2</b>	<b>2,3</b>	<b>4,0</b>	<b>1,7</b>	<b>3,5</b>	<b>2,0</b>	<b>4,1</b>	<b>1,9</b>	<b>72,3</b>

Participant	task 1	task 2	task 3	task 4	task 5	task 5 succes	Remained for	character (reader/ rusher)
p1	2,67	4,54	3,78	1,87	4,21	Succes	487,98	Rusher
p2	6,84	8,98	12,54	8,43	14,59	Succes with Hint	561,53	Reader
p3	5,53	42,77	32,89	37,32	-	Failed	781,76	Reader
p4	2,03	7,88	5,67	2,43	7,67	Succes	167,53	Rusher
p5	4,07	9,76	8,52	10,70	5,33	Succes	208,66	Reader
p6	3,89	3,45	2,12	1,03	5,34	Succes	61,87	Rusher
p7	2,21	12,78	15,54	15,98	13,09	Succes with Hint	321,56	Reader
p8	4,63	15,76	18,78	13,51	8,65	Succes	243,93	Reader
p9	2,23	2,87	3,04	1,54	4,23	Succes	34,37	Rusher
p10	6,43	9,87	13,12	11,23	9,54	Succes	317,92	Reader

