QUEENS OF SCIENCE
KINGS OF CHANGE
ACE OF IDENTITY

DEVELOPMENT OF A COMMUNICATION TOOL FOR INCLUSIVE HEALTH RESEARCH

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24 March 2025

DPM 2187

STUDY PROGRAM

MSc Industrial Design Engineering
Human Technology Relations
Faculty of Engineering Technology

EXAMINATION COMMITTEE

Chair: prof.dr.ir. G.D.S. Ludden
Supervisor: dr. J.L. Sturge
Internal Member: dr. A. Günay

UNIVERSITY OF TWENTE.

Queens of Science, Kings of Change, Ace of Identity: Development of a communication tool for inclusive health research.

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This research project was funded by ZonMw through the 2023 Erasmus Summer Programme.

Acknowledgements

Looking back at the beginning of the project, I had no idea where the design process would take me. The proposal intrigued me, a conversation tool can be such a broad concept and designing for health researchers was new to me. This project has taught me so much, and at times, it felt like a rollercoaster. Now, as the journey comes to an end, it is hard to believe the ride is over. I am incredibly proud of the results and deeply grateful to everyone who helped make them possible.

First, I would like to thank my supervisor Jodi Sturge, for her support and encouragement throughout this project. The collaborative feedback sessions she organized with other master's students always led to interesting discussions and insights. I truly appreciate the time and attention everyone in these meetings dedicated to engaging with my work. Jodi not only pushed me to improve and refine my ideas but also encouraged me to put my mental and physical health first. I couldn't have asked for a better supervisor.

This project would not have been possible without the participants who generously lent their time to test the tool, provide feedback, brainstorm ideas, and engage in discussions. Their input was crucial in shaping the final product, and I deeply appreciate their willingness to contribute. I am also grateful to those who shared communication tools with me, extended workshop invitations, and connected me with participants, ensuring the project reached the right people. I also want to thank the Sickhouse community for providing a creative and playful space where I could learn, connect with people, and explore life. Without this community, my experience in Enschede would not have been the same. A special thanks to the staff at the Xerox copy shop in Carré for their patience and efficiency in printing countless card decks. Finally, to everyone who took part, whether through testing, interviews, discussions, or workshops, your time and contributions were invaluable, and I am grateful for the role each of you played in bringing this project to life.

To my friends and family:

Gracias a mi familia por apoyarme en esta aventura. No habría llegado hasta aquí sin su amor y apoyo incondicional. Gracias por creer en mí y por estar siempre a mi lado cuando los necesito. Los quiero y los extraño mucho.

I would like to thank all my friends who accompanied me on this journey, everyone in Mexico, Enschede and beyond, for cheering me on, sending me memes and music, sharing stories, going for walks, and helping me get through the cold winters. There are too many of you to name, but please know that even if I take my time responding, I am so grateful to have you in my life.

Special thanks to Gyöngyi, Yari, Berni, and Andrea for the food, company and for checking up on me during these last months when I was locked up at home writing. Your kindness and support meant a lot to me, and I can't thank you enough.

Contents

1 Introduction

Historically in research and other fields, there has been a bias unintentionally favouring the perspective of men, both as the researcher and as the reference of what is representative as human. Having male characteristics and what is perceived as masculine as the normative reference in science gravely affects people that are excluded or judged based on stereotypes. Korsvik and Rustad (2022) explain how the effects of this can not only reinforce stereotyped ideas of gender but gravely affect people in areas such as health care by leading to incorrect diagnosis and treatment.

Several reasons have historically been cited for avoiding more diversity in the sex and gender of subjects from research, such as insufficient physiological data, the need to replicate studies conducted on men or male subjects for comparability, and the perceived higher economic cost of including a more diverse pool of subjects. However, incorporating a broader understanding of sex and gender into clinical research acknowledges that the population is not uniform, that research should benefit everyone, that preventive measures often leave out the most vulnerable, and that exclusion can lead to missed opportunities and harmful consequences (Holdcroft, 2007). For instance, protocols for diagnosing and treating heart disease, the leading cause of death in the United States, were historically based on studies involving middle-aged white men. As a result, women were diagnosed later in the disease's progression, making effective treatment more difficult (Vlassoff, 2007).

Recognizing these issues has led to a shift toward inclusion across various fields and a deeper understanding of how sex and gender are defined. Although there are no universally accepted definitions of these terms, for the purposes of this thesis, sex refers to a set of biological attributes associated with physical and physiological features, while gender refers to socially constructed roles, behaviours, and identities (Heidari et al., 2016). Gender is understood as a spectrum of identities and expressions that go beyond the binary notion of men and women.

Furthermore, health outcomes are also shaped by numerous other factors, such as social determinants, geographic location, or access to resources. Subramaniapillai et al. (2023) explain how to understand health disparity among individuals it is important to consider the framework of intersectionality. Through this lens the relationship between sex and gender, and how they come into play with societal, economic and cultural factors can be examined and understood in relation to health outcomes.

1.1 Project Background

To overcome the disparity in addressing sex and gender in health research, increased knowledge and attention are needed across all stages of research and among all individuals involved. This includes considerations for research design and implementation, scientific reporting, the diversity of research teams and reviewers, and the policies and programs that support these efforts. Recent years have seen growing recognition of this need, with various organizations and institutions increasing expectations to address sex and gender as critical dimensions in research, alongside a rise in studies focusing on these topics (Burtscher & Spiel, 2021; Tannenbaum et al., 2016).

This thesis project originated from an initiative aligned with this growing understanding. Every year, ZonMw and Erasmus MC jointly organize a summer program focused on the influence of sex and gender on health and their integration into health research (ZonMw, n.d.). During the 2023 Erasmus Summer

Programme, an interdisciplinary team of health researchers identified a significant gap in this area, which became the foundation of the project. Details on the core team are provided in Section 1.2.

When applying for funding through ZonMw, the application process requires an evaluation of how sex, gender, and diversity are addressed both in the research proposal and within the research team. The gap identified by the team lies in this process: while expectations to address sex and gender are clear, many researchers lack the knowledge or tools to effectively implement these considerations and reflect them in their proposals. This challenge is especially evident for researchers and reviewers who have not previously considered sex and gender as relevant to their work and are unsure where to begin.

Making this shift requires individuals to unlearn outdated paradigms and develop a new understanding of the components that define sex and gender (Tannenbaum et al., 2016). While various tools and guidelines exist to support this process, changing perceptions and becoming aware of biases can often be more effective with playful and interactive methods. Serious games, for instance, can change behaviour and facilitate the acceptance of new knowledge by creating safe environments where individuals can make mistakes, ask questions, and explore different perspectives without fear of judgment (Wehbe et al., 2022). Such approaches are especially valuable for addressing sensitive topics, challenging stigmas, and dismantling stereotypes.

An example of this is the work by Burtscher and Spiel (2021), who identified a gap in the existing guidelines available for human-interaction researchers addressing gender sensitivity. They recognized the need for a practical tool that would serve as a starting point to develop gender sensitivity and facilitate further exploration and discussion. The result was the development of a card deck titled 'Let's Talk About Gender', that guides the integration of gender and diversity considerations across the different stages of the research process. Building on the insights and methodologies of the 'Let's Talk About Gender' card deck, the team proposed to create a new tool to guide discussions and foster a cross-disciplinary understanding of sex and gender within health research consortiums. Expanding the target audience to researchers and reviewers new to these topics, those interested in studying them more thoroughly, and those seeking to advocate for the importance of sex and gender considerations within their teams or organizations.

1.2 Collaborators

The development of this thesis was supported by the contributions of various groups (see Figure 1). Their expertise, feedback, and involvement were essential in shaping the resulting conversation tool.

Core Team

The Core Team consists of the initial group of researchers who developed the project proposal. This team was formed during the Erasmus Summer Programme and included five researchers from the Netherlands and Canada:

- **Jodi Sturge** (thesis supervisor), Assistant Professor in the Department of Design, Production and Management in the Faculty of Engineering Technology, University of Twente
- **Holly Mathias**, PhD student in the School of Public Health, University of Alberta
- **Anne Marieke Doornweerd**, PhD candidate in Clinical and Experimental Psychology
- **Janneke Mulder, MD**, PhD candidate in Internal Medicine, Erasmus MC
- **Michiel de Graaff**, PhD student in Sociology, Maastricht University

Academic Experts

With the support of the Core Team, Academic Experts were contacted. These experts, primarily from the University of Twente, had experience in health research, grant applications, and peer review. Both the Core Team and Academic Experts represent the primary target group of this thesis, making their involvement indispensable. Their contributions took the form of interviews, feedback sessions, and prototype testing.

Interdisciplinary Consultants

Experts from other disciplines also contributed to the project. The core team contacted Ink Social Design Studio for their experience developing similar tools. They provided support during the prototype development phase. Additional insights were gathered from collaborators with expertise in game development and design.

Early-Career Participants

To broaden the pool of participants in certain design stages, university students were recruited. Their involvement allowed to diversify perspectives and expand participation in activities that did not require a health research background.

Figure 1. Collaborator relation map.

1.3 Design Challenge

Following the information provided at the start of this thesis, a list of requirements was developed. This information was used as the basis from which the different topics of research were identified. Some of the elements of the brief were discussed to be flexible, meaning that they were expected to shift and change depending on the research, interactions with collaborators, and testing results. They were divided into core elements and design decisions. The core elements needed to be there to achieve the goal and answer the research question. The design decisions were the elements that needed to be questioned to validate if they provided the best solutions.

Core elements

To develop a conversation tool that:

Creates a common cross-discipline understanding of sex and gender considerations within health research consortiums.
Provides a starting point for researchers and reviewers who are interested in addressing sex and gender in their projects and want to learn how to study it more optimally.
Creates awareness of the importance of addressing sex and gender in research.
Helps identify biases and assumptions that affect how research is carried and how data is analysed and shared.
Promotes discussion, collaboration and the formation of new insights between researchers of different backgrounds.
Is highly accessible and ready to be distributed to an international audience.

Design Decisions

The initial proposal was inspired on the 'Let's Talk About Gender' card deck with the idea to broaden the target group and to make it more playful.

The initial idea was that each card would present statements, riddles, or questions related to sex and gender in health research and study design. While the reverse side of each card would provide more information on the topic and links to relevant sources. It was envisioned as a physical tool to be used in a variety of casual and informal settings, such as university coffee rooms and common spaces.

This part of the proposal was discussed to be flexible, and so it was abstracted to understand the reasoning and advantage of the proposed elements.

From this initial idea, the following areas of opportunity were identified:

- The conversation tool format
- The amount and type of information
- The use of playful elements to guide serious and sensitive conversations

By abstracting these elements, the most important aspects of the design brief were highlighted, allowing a wider scope of paths to be considered for the design project.

1.4 Research Question

To guide the investigation into affective ways to promote discussion and the sharing of knowledge among researchers, this thesis aims to answer the following research question:

> *How can a tool be designed to promote discussion and create a cross-discipline understanding of sex and gender in health research?*

To address this question, the thesis applies strategies and methods rooted in Human-Centred Design (HCD), an approach that prioritizes the needs, experiences, and perspectives of the people impacted by the design. Empathy is central to HCD, enabling designers to connect with users, uncover unarticulated needs,

and translate observations into insights. Users are regarded as experts of their own experiences, making their input and knowledge crucial in shaping the design (Steen, 2011).

In this thesis, user involvement is achieved through iterative cycles of engagement, incorporating their feedback and input at each stage to refine and align the design with their needs. Collaboration begins with the core team of health researchers, with the aim of using their expertise and connections to involve a broader network of participants.

The focus of this thesis is not only on the resulting conversation tool, but equal focus is placed on the design process itself to ensure that the outcomes closely align with the users' needs, environments, and practices.

1.5 Positionality Statement

This research is carried out in the Netherlands; however, I am originally from Mexico, where I lived most of my life. I am also half Hungarian and have had the privilege of traveling extensively from a young age. These experiences have exposed me to different cultures and shaped my perspective, fostering an awareness of diverse societal norms and challenges. My academic background lies in industrial design. I completed a bachelor's degree in Mexico before moving to the Netherlands to pursue a master's degree specializing in human-technology relations. Throughout my studies, I have been involved in projects emphasizing human-centred design, experience design, and designing for specific users. While sex and gender were not central themes in most of these projects, I have always been drawn to projects that focus on the inclusion of underrepresented or minority groups, and I actively work to integrate this approach into other projects whenever possible.

I recognize my privileges as an able-bodied, cisgender person who has had access to private education and whose gender identity aligns with societal and cultural expectations. However, living in Mexico as a cisgender woman made me acutely aware of issues such as gender discrimination, sexism, patriarchy, and gender-based violence. Traveling and learning about other cultures have shown me that these issues are not confined to one region but are global challenges. The integration of sex and gender in health research and its effects on healthcare outcomes is a topic I consider important. From personal experience, and from others close to me, I have seen how this is reflected in the difficulties in being acknowledged and treated by health practitioners, misdiagnoses, dismissal of symptoms, and challenges in receiving accurate diagnoses due to insufficient interest, knowledge or research. Seeking adequate healthcare can consequently become a lengthy, stressful process for many, myself included.

This thesis is an opportunity to contribute to the inclusion of sex and gender in health research. My position in this thesis is that of a design researcher working to create a tool for health research. In this context, I consider myself an outsider due to my limited experience with health research and the research activities involved in funding, reviewing, and sharing results within research consortiums. To minimize biases and assumptions that could influence the research process, I have prioritized the involvement of various collaborators throughout the design process. The final design is intended for an international and multidisciplinary audience, and I aim for the collaborators involved in this thesis to reflect this diversity as fully as possible. While testing the prototype may primarily involve locally recruited participants, efforts will be made to include individuals from diverse backgrounds. Additionally, online activities will provide opportunities to recruit collaborators beyond the Netherlands.

1.6 Approach

To guide the design process, the Double Diamond Framework (Design Council, 2015) was used as a basis and adapted for this thesis. The framework consists of four stages: Discover, Define, Develop, and Deliver. It was particularly well-suited to this project due to its emphasis in the first diamond on understanding and framing the problem. By incorporating a deliberate pause between understanding and creating, the design challenge can be revisited and redefined using the insights gathered. This approach provides a strong foundation for the second diamond, which focuses on creating and implementing solutions. In this thesis, each chapter corresponds to one of the framework's stages. An overview of the framework and its contents in relation to this thesis is presented in Figure 2. Additionally, it illustrates the involvement of the different collaborator groups throughout the design process.

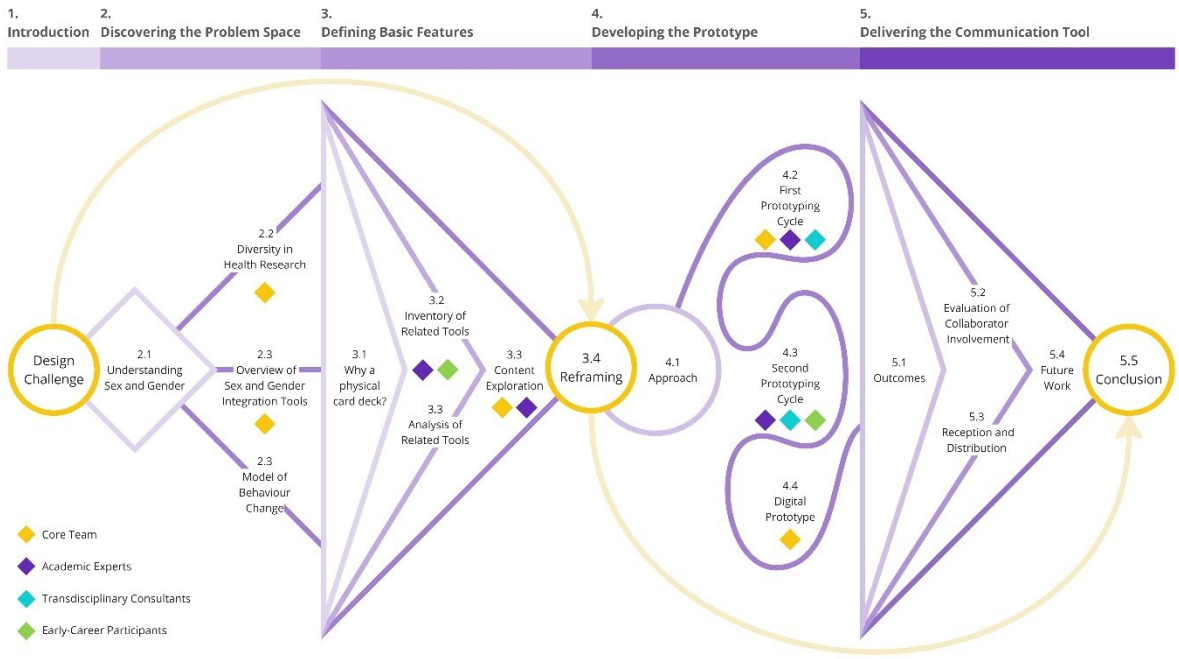

Figure 2. Overview of the Double Diamond Framework and its application to the thesis.

2 Discovering the Problem Space

The Discover stage centres on gathering and validating information related to the problem space while exploring the context of the design challenge. During this stage, initial contact with the core team was established, playing a crucial role in validating information and guiding the direction of the desk research. Introductions to academic experts and Ink Social Design Studio also took place during this phase in preparation for future collaboration.

The chapter begins with an exploration of sex and gender, how they are influenced by various factors, and how these, in turn, affect health outcomes. Section 2.2 delves into the context of diversity in health research and how this is reflected in the requirements when applying for funding. In Section 2.3, the focus shifts to the resources to support researchers and reviewers in the integration of sex and gender in health research. Finally, Section 2.4 introduces a model of behaviour change, exploring how it can be applied to understand the barriers researchers face and identify gaps in the available support. The results from this stage deepened the understanding of the design challenge, revealing opportunities and potential paths to explore.

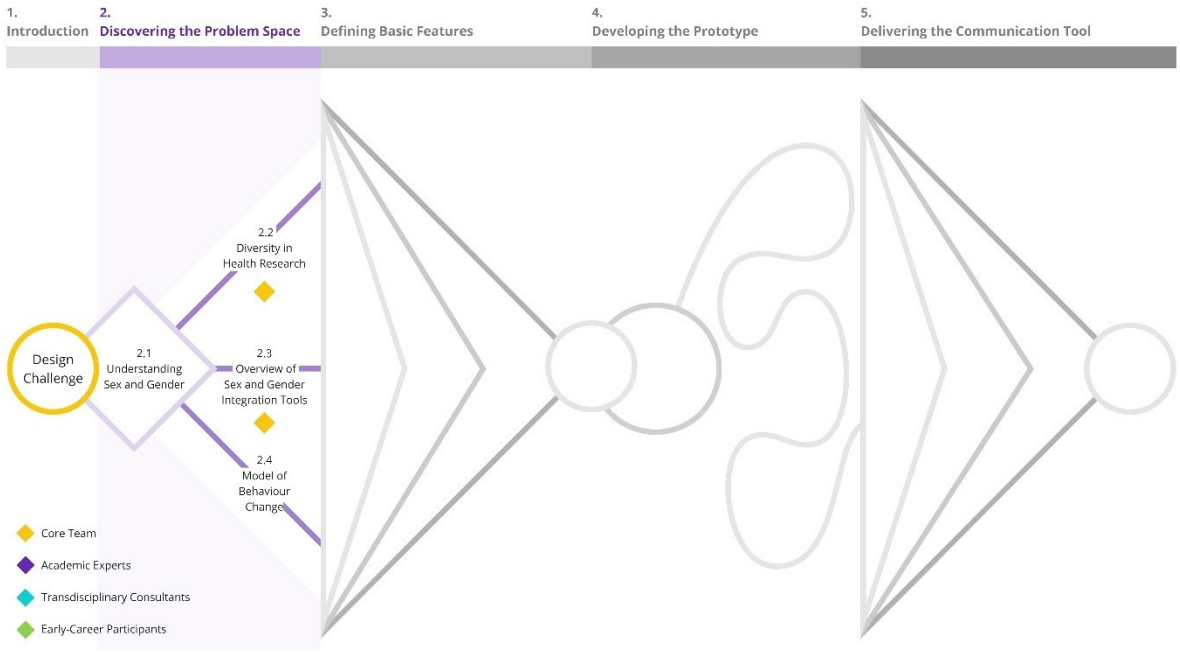

Figure 3. Overview of the Discover stage.

2.1 Understanding Sex and Gender

A simple way of differentiating between sex and gender is by defining one as biological and the latter as sociological. The problem of such a simple definition is that it fails to convey how intricate those terms are, and how differently they present for everyone.

2.1.1 Sex

Sex is usually attributed to chromosomes or in the case of individuals assigned sex at birth, it is based on external features, while their correspondence to internal features is often assumed rather than assessed (Subramaniapillai et al., 2023). The reality is that there are a wide array of biological processes and physical attributes that may not all line up to the bimodal idea of female and male. While it is recognized in the scientific community that for each sex there is not a single, correct developmental pathway, Blackless et al. (2000) explain that this assumption is widely applied to research and that any deviation from the bimodal ideal is defined as abnormal. They then suggest a change of view towards variability instead of bimodality. Therefore, a more comprehensive definition of sex comprises physical and physiological attributes, such as chromosomes, gene expression, hormone levels and hormonal functions, genitals and reproductive anatomy (Canadian Institutes of Health Research, 2023; ZonMw, 2023). It is usually categorized as female or male, but variation and overlap in those attributes and how they are expressed is expected.

2.1.2 Gender

Gender is a multifaceted concept that varies across cultures, institutions and generations. In Western societies, a traditional binary framework distinguishes between woman/girl and man/boy, but as with sex, a static framework fails to capture and understand the multifaceted dimensions of gender (Subramaniapillai et al., 2023). Since there is considerable diversity in how individuals and groups understand, experience and express gender, it is necessary for the definition of gender to be understood as socially constructed roles, identities, behaviors and expressions of girls, women, boys, men and gender diverse people. These aspects of gender can change over time and vary between individuals. Furthermore, gender influences individual and group perception, interaction, and the distribution of power and resources in society (Canadian Institutes of Health Research, 2023; ZonMw, 2023). With this definition an individual's sex recorded at birth may, or may not, align with their gender facets. For cisgender individuals, their gender identity and expression align with their sex recorded at birth. For gender diverse and gender expansive individuals, their gender identities encompass a range of transgender and nonbinary categories that differ from their sex recorded at birth (Subramaniapillai et al., 2023).

2.1.3 Intersectionality Framework

Sex and gender are closely intertwined and play a significant role in an individual's life and their health. For health research it can be especially important to understand how different factors affect a patient's health, as it goes beyond just biological factors. Gender has been shown to influence the implementation, development and response of health policies and systems. Furthermore, biological differences alone cannot explain health behaviour, as health outcomes also depend on social, economic and geographical factors (Vlassoff, 2007). Through the lens of the Intersectionality Framework, the combined effect of these factors can be better understood and provide a deeper understanding of sex and gender-related health disparities. Intersectionality shows the biological, sociological and socioeconomic differences between people, how these dimensions of diversity intersect and interact creating inequalities, and how the different systems of inequality reinforce each other. Some examples of the dimensions of diversity are sex, gender, education, age,

ethnicity, socio-economic status, disability, sexual orientation, race, religious culture, etc. Furthermore, the dimensions and their weight differ by culture (Hankivsky, 2014).

2.2 Diversity in Health Research

Over the past two decades, the efforts to integrate sex and gender in health research have been rising sharply. Some notable examples, are the Canadian Institutes of Health Research, that since 2010, requires researchers to account for sex or gender in research protocol, the U.S. National Institutes of Health Research, requiring applicants to consider sex as a biological factor in research design and analysis since 2016, and the Gender Advisory Group to the European Framework Program for Research and Innovation mandating the Gender Dimension across all sectors (Tannenbaum et al., 2016). Despite the increasing efforts for sex- and gender-inclusive research and reporting, women and gender-diverse individuals continue to be underrepresented as research participants, professional researchers and in other positions in academia (Peters & Woodward, 2023; European Institute for Gender Equality, 2016). In 2009, women accounted for 33% of European researchers in all sectors, and three years later that number remained roughly the same. Progress towards gender equality in research is difficult as it involves persistent gender inequalities on various levels, from gender-bias research and funding, to institutional processes and gender segregation in research and other gender-related career challenges (European Institute for Gender Equality, 2016). For this reasons it is important to be critical in how diversity is addressed, not only in regard to the research, but in the teams and organizations carrying it out and communicating the results.

2.2.1 Grant Application Requirements

The integration of sex, gender and diversity requirements in grant applications varies across organizations, reflecting diverse strategies to meet the growing expectations for inclusivity in research. These requirements are often embedded in the application and evaluation processes, ensuring that researchers actively consider sex and gender dimensions in their proposals (Heirdari et al, 2016). This thesis focuses particularly on the diversity of research subjects and research teams, as exemplified by the criteria set by funding bodies such as ZonMw and the Canadian Institutes of Health Research (CIHR). The added requirements ensure that applicants investigate whether sex (biological) and gender (socio-cultural) are relevant to their research before ruling them out. In some situations, integration of sex and gender may not be applicable, or the research may consciously focus on one element (ZonMw, 2023). However, the requirement ensures applicants explain how it is going to be considered or why not. Furthermore, grant evaluators may assess how teams plan to integrate underrepresented groups, whether based on gender, ethnicity, or other socio-cultural factors, to ensure inclusivity at both the individual and institutional levels (personal communication, July 23, 2024).

In addition to the focus on sex and gender dimensions within research proposals, many grant applications also emphasize the importance of diversity within the research teams themselves. Questions in the proposal process often address the composition of the team, evaluating factors such as gender balance, geographic representation, and the range of expertise or seniority among team members. The aim is to ensure that research teams are not only experienced but that they also present a variety of perspectives (Lowik et al., 2024; ZonMw, 2023 ; personal communication, July 23, 2024) .

Including questions about the diversity of research teams in grant applications encourages researchers to reflect on their positionality and its potential influence the research process and outcomes. Positionality refers to how a researcher's background, identity, and perspectives shape their approach to research, including the questions they ask, the methods they choose, and the interpretations they make. It normally

involves three areas: a researcher's relation to the subject, the research participants, and the research context and process. Awareness of a researcher's stance and influence on their work, and the incorporation of a diverse team, helps research teams to detect and avoid unintended biases and assumptions from affecting the way research is carried and interpreted (Darwin Holmes, 2020).

2.3 Overview of Sex and Gender Integration Tools

Efforts to integrate sex and gender in research have led to the development of various tools and strategies designed to help researchers and reviewers appropriately address, discuss, and report sex and gender differences. This section presents an exploration of some of these resources, selected based on their relevance to supporting researchers and reviewers in integrating sex and gender considerations. The tools were identified from scientific literature, public recommendations from institutions and non-systematic searches in public search databases and search engines. While not exhaustive, this exploration aims to provide an overview of available resources and highlight their contributions to advancing sex and gender integration in research.

Resource	**Purpose**	**Description**	**Key Features**
Gender Integration Continuum (a, b)	Diagnositc tool and planning framework.	Visual representation of gender integration, shown as a continuum from exploitative to transformative.	Guides the evaluation of different practices in a project, and helps identify opportunity areas, striving for gender-transformative outcomes. Adaptable to different research contexts.
SAGER Guidelines (c, d)	Guidelines to standardize sex and gender reporting in scientific publications.	Provides recommendations to facilitate sharing knowledge across research areas and disciplines.	Widely adopted by major academic publishers, scientific journals, and institutions.
GSMM Research Equity Toolkit (e)	Guidelines to build more equitable, reflective, and inclusive research on sex and gender in methods and measurement.	Addresses the erasure in research of people who are marginalized and minoritized based on their genders, sexes and sexualities.	Provides nine tools targeting areas such as eligibility criteria, recruitment strategies, sample size requirements, stratification and survey design. Applicable at various stages of research.
Genderful Research World (f)	Interactive platform designed to connect biomedical and health scientists with essential sex and gender resources.	Provides a visual overview of the research process with dividing pathways based on the context.	Emphasis on acquisition of foundational concepts and the preparation activities of a research project. Features a variety of resources such as, articles, case studies, checklists, videos, and guidelines.

Gendered Innovations (g)	Platform to promote practical methods and case studies of sex, gender, and intersectional analysis for scientists and engineers.	Provides peer-reviewed methods of analysis alongside case studies to demonstrate how implementing them can lead to discovery and innovation.	Features general and field-specific methods, applied to case studies in science, health and medicine, engineering, and the environment.
ZonMw website (h)	Provides an overview of knowledge, resources and tools to guide the integration of sex and gender analysis.	Series of articles to provide specific guidance for grant applicants and peer reviewers, along with links to a variety of tools and resources.	Clear and concise articles about the importance and impact of incorporating sex and gender considerations. Connects with external resources to continue exploring. Features short reading materials, video lectures and a podcast.
CIHR Gender and Health website (i)	Supports the integration of sex and gender considerations into every step of the research project.	Provides a comprehensive range of guidelines, tools, and resources that address diverse research contexts and levels of knowledge.	Clear organization, starting with foundational concepts, and progressing to context specific guidance. Materials include articles, videos, training modules, practical guidelines, and links to external resources.

a Interagency Gender Working Group (2017), b Parvez Butt et al. (2019), c Heidari et al. (2016), d Heidari et al (2024), e Centre for Gender & Sexual Health Equity (n.d.), f Boerner et al. (2022), g Schiebinger (2020), h ZonMw (2023), i Canadian Institutes of Health Research (2019).

Table 1. Overview of sex and gender integration resources.

2.3.1 Insights from the overview

While numerous other tools, guidelines, and websites exist, the examples highlighted here provided a representative glimpse into the variety, quality, and depth of available materials. From this overview, several important insights were gathered:

Resources accommodate diverse knowledge levels and specific research domains, ensuring accessibility for a broad audience.
Many resources focus on raising awareness and guiding researchers toward integrating better practices in their projects.
A significant portion of the resources are structured to reflect the research process, presenting information in phases for clarity and practicality.
Practical examples and academic papers are often included to demonstrate the integration of sex and gender considerations in research.
Most resources rely on text-based formats, with some exceptions presenting a mix of illustrations, videos, and interactive elements.
Visual representations of guidelines and tools facilitate comprehension and accessibility by simplifying complex material for users.

Providing source materials promotes transparency and offers opportunities for deeper exploration of specific topics.

There is a wide range of resources available for researchers, each offering distinct approaches to presentation and delivery. These variations highlight the need of adapting the content to the audience, particularly when engaging those who are unaware or starting to consider sex and gender in their research projects.

2.4 Promoting Behaviour Change

Behaviour change is a complex process that often requires individuals to transition through several stages before achieving sustained transformation. To better understand this process, the Transtheoretical Model (TTM) provides a framework that outlines distinct stages of change: precontemplation, contemplation, preparation, action, and maintenance. This model emphasizes that behaviour change is not a linear process but a dynamic progression, where individuals may move forward or backward through stages as they navigate challenges and develop readiness for change (Prochaska & Velicer, 1997; Raihan & Cogburn, 2023). By recognizing the stage-specific needs and barriers, design interventions can be informed, adapted and tailored to support behaviour change through the different stages. Although this model is mainly applied to changes involving health behaviour, it can also be adapted and used to understand behaviour change in other settings.

2.4.1 Behaviour Change in Health Research

In the context of this thesis, the model serves as a foundation for understanding how researchers and reviewers can adopt new perspectives on sex, gender, and diversity in their work. By using this model as a basis, a deeper understanding can be achieved on the stage-specific barriers and the approaches needed. Similarly, this tool also enables the analysis of strategies and resources, highlighting opportunity areas.

The desired behaviour in this context is for researchers and reviewers to successfully integrate sex and gender considerations in all stages of research, and for this to also be reflected in grant applications and team composition.

Setting this desired behaviour will guide the analysis of the resources in accordance with the stages of behaviour change. The focus of this thesis is on 'providing a starting point for researchers and reviewers who are interested in addressing sex and gender in their projects and want to learn how to study it more optimally' (Section 1.3), and therefore special focus is placed on the initial stages leading to action.

In this context the stages of change would be as follows:

Stages	**Behaviour**
Pre-contemplation	Unaware or limited awareness of the consequences of not accounting for sex and gender considerations in health research. Perception of higher negative consequences of changing and limited recognition of the benefits.

Contemplation	Acknowledges the consequences of not accounting for sex and gender considerations in health research. Perception of negative and positive consequences of changing are levelled. There is still uncertainty on the importance of addressing sex and gender, and how to approach it.
Preparation	Acknowledges the importance of sex and gender consideration in research and is able to commit to take action. The perceived benefits out weight the negative consequences. They are actively learning about the integration of sex and gender considerations and how to implement it in their projects.
Action	Takes specific and evident steps to integrate sex and gender considerations in their projects. Assistance and support are needed to implement changes in areas they may have missed, and to continue learning.
Maintenance	After some time learning and actively addressing sex and gender considerations in their research, they become confident in their skills to implement tools, strategies and guidelines appropriately. Although they continue to learn, they have knowledge and experience to discuss specific topics regarding sex and gender in health research and can help others that are starting on this path.

Table 2. Stages of behaviour change applied to the thesis context.

Using the descriptions of the stages outlined above, a quick analysis was conducted to identify which stages the resources in Section 2.3 are targeted toward and provide the most support for. Although all resources seem to provide support during Action and Maintenance stage, the support provided during the first three stages vary. Resources such as the *SAGER Guidelines* and the *Gender and Sex Research Equity Tool Kit* provide specific steps to take, therefore checking them during the Preparation stage is critical before applying them during Action or Maintenance stage. Other resources such as *Gendered Innovations* and the *CIHR-IGH website*, can be very useful during the Preparation stage. By providing extensive lists of resources covering several research contexts, researchers preparing to take action can browse and gather the resources most relevant to them easily. On the other hand, the simple and clear format of some resources on the *ZonMw website*, along with the variety of formats available, such as videos and illustrations, makes it a more accessible option for researchers in the Contemplation and Preparation stage. Similarly, *Genderful Research World* provides a great overview of what the integration of sex and gender at different stages of the research entails. The layout and playful elements may encourage users to interact and explore, making it a great resource to help with the uncertainty during Contemplation and guidance for those in Preparation.

Pre-contemplation is a stage that can be complicated to address as the people in this stage resist change and may not be willing to acknowledge that change is needed. Approaches such as a dedicated workshop (World Health Organization, 2011) may prove more effective at this stage. This type of resource, however, fell outside the scope of the overview in Section 2.3, as they require an intermediary to assist and are not aimed to be used directly by researchers and reviewers.

2.4.2 Insights from the behaviour change stages

Every stage presents unique needs and barriers, and to advance through them different approaches are needed. According to TTM, more experiential processes are required initially, while the later stages require more behavioural processes. Although the application of these processes requires adaptation to the context, some of these strategies can be seen implemented in the resources previously identified. The following insights were formed by matching the stage specific behaviours and needs to the resources to guide researchers in this process:

Requirements for the integration of sex and gender push researchers to the Action stage, but lack of preparation, experience and knowledge may result in poor outcomes.
Resources such as practical checklists, guidelines and resource lists provide support in line with the needs of researchers in the Preparation, Action and Maintenance stage.
Resources in line with the needs during Contemplation stage are limited. Although most address the importance of change and explain basic principles, the content is more focused on Preparation and Action.
Resources that address better the needs during Contemplation provide clear and concise information, focus on reflection, integration of new knowledge, and present options and variety in the type of materials.

Researchers beginning to integrate sex and gender considerations into their projects have access to various resources. However, these resources could be better designed to address the specific barriers and needs encountered during the Contemplation stage. There is an opportunity to develop a tool specifically designed for this phase, aiming to increase awareness, reduce uncertainty about the importance of change, and guide researchers toward existing information and guidelines, especially the ones that to some degree also address this stage. Additionally, a tool that increases awareness and promotes reflexion could also help individuals in the Precontemplation stage.

3 Defining Basic Features

The Define stage focuses on the second part of the design challenge, establishing the design decisions which were abstracted to understand and define areas of opportunity. During this stage, collaborators participated in interviews, testing, and feedback sessions, which guided the analysis and definition of important elements.

The chapter begins by defining the elements that comprise a conversation tool and the reasoning behind the tool's selected format. Section 3.2 sets the stage to analyse the use of playful elements to guide serious and sensitive conversations by gathering related tools. In Section 3.3 the approach to involving collaborators is explained along with the activities that took place to gather information on the performance of the tools. In Section 3.4 the focus turns to defining the requirements of the tool's content, while also taking a closer look into the context of use and target audience behaviour. Finally, in Section 3.4 the design challenge is revisited and redefined using the insights gathered. The results from this stage set the foundation for the second diamond, where solutions were explored.

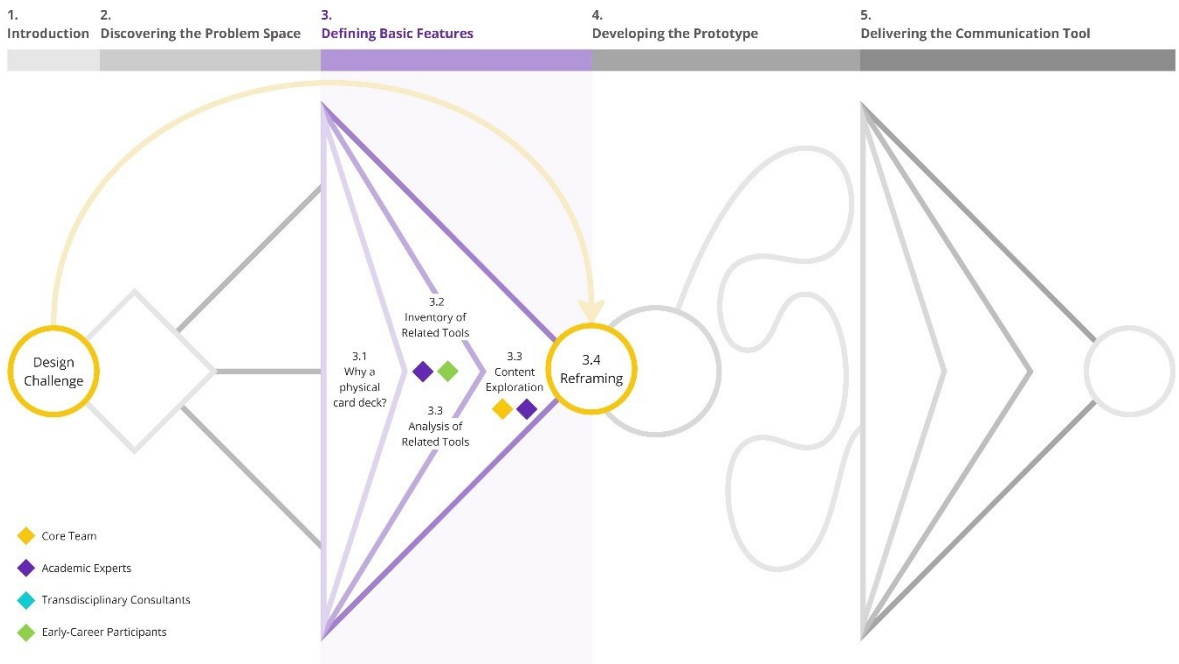

Figure 4. Overview of the Define stage.

3.1 Why a physical card deck?

Following the opportunity areas identified in Section 1.3, this exploration focuses on three topics: communication tools, external representations, and serious games.

3.1.1 Communication Tools

Communication tools can come in a variety of formats, and depending on the context, subject, or purpose, they can also have different definitions and names. This thesis uses the definition and classifications in the work of Fischer et al. (2024), where they are defined as practical tools that support individuals overcome challenges related to divergent mindsets. In the context of this thesis, communication tools are further specified as tailored tools explicitly designed to address specific aspects of the communication process. To differentiate between different types of communication tools the following categories are used:

Directionality	Information transfer is linear or reciprocal
Temporal nature	Synchronous or asynchronous
Semiotic	Auditory, visual, audio-visual, or textual
Purpose of participation	Inform, consult, or co-produce

Following the requirements outlined in Section 1.3, the proposed design is categorized as a tool that promotes reciprocal communication occurring in real-time where actors are engaged in a collaborative process. Additionally, there is a preference for physical tools over digital ones, a distinction that will be further explored next.

3.1.2 External Representations

In the context of knowledge production and collaborative problem-solving, external representations are often used to hold information, visualize ideas, create references, reframe problems, and facilitate dialogue (Kirsh, 2010; Peters at al., 2020). To understand how interacting with external representation improves cognitive processes the work of Kirsh (2010) is used. People interact with external representations for various reasons, commonly understood as a way to reduce the cognitive cost of sense making. Kirsh (2010) elaborates in his work that external representations significantly enhance cognitive abilities, enabling individuals to extract meaning, draw conclusions, and gain a deeper understanding of ideas that would otherwise remain inaccessible without such interactions. He goes further on to say that physical interaction with tangible elements is a necessary part of our thinking process because there are occasions when we must harness physical processes to formulate and transition between thoughts. The emphasis of physical tools can also be seen in the filed of design, specially during the early stages and when collaborating with others, as physical artefacts have distinctive affordances that can make group interaction more fluid and flexible (Peters et al., 2020).

Building on these sources, a communication tool, as a physical external structure, can enhance the discussion and acquisition of new ideas in several ways:

It creates persistent referents, providing a stable structure for exploration of ideas and discussions.
It serves as a shareable and identifiable object of thought, anchoring collaborative sense-making on a common focus.
It enables the manipulation and rearrangement of information, revealing new aspects and relationships.

It externalizes ideas, facilitating dialogue and promoting group collaboration over individual thought processes.
It supports the coordination of thought, enhancing collective understanding and exploration.

3.1.3 Formats of Physical Tools

Physical tools come in various formats and apply diverse approaches. To better understand existing format options and their potential benefits, this thesis draws on the work of Peters et al. (2020), which gathers and reviews analogue tools for collaborative ideation. While Peters' research focuses on tools designed for the creation of technologies and services, it offers valuable insights that can be adapted to this context. Moreover, it serves as a general reference for analysing collaborative tools, addressing the gap in studies specifically examining communication tools aimed at fostering discussion and learning.

The results of the review showed that, besides card decks, design tools can be found in the form of templates, collections of physical artefacts, table games, posters, wearables, and construction materials. On the other hand, the results also showed that card decks overwhelmingly dominate over other formats with an increasing popularity over the past decade. Other reviews confirm the long-stablished use of a card deck format for design tools, and the distinct increase in number and variety (Roy & Warren, 2019). Reasons for their vast use can be explained by the affordances they provide, such as cognitive support (as external representations), structures for playful work (further explored in a subsequent section), and bridges between individuals and structured information (Peters et al., 2020; Roy & Warren, 2019). An important aspect of the cognitive support they offer is the ability to handle and arrange information to create new connections and provide visual structures that are also available to others (Roy & Warren, 2019; Baxter et al., 2015; Maare, 2018). Structured information, such as manuals, reports, and guidelines, often require individual processing before collaboration can effectively take place. Card decks serve as a bridge by offering small, semi-structured chunks of information that facilitate collaborative exploration and understanding, preparing individuals to employ more detailed, structured materials (Roy & Warren, 2019).

The prevalence of card decks may partly stem from fixation on the format, where familiarity with the card approach has led to its repeated use (Peters et al., 2020). In this context, this familiarity is perceived as a strength to promote the adoption of the tool, specially considering that a card deck would already present an evident change from the formats of the resources in section 2.3. Furthermore, as outlined by the design challenge, it is important for the tool to be adaptable to different environments (e.g. common spaces and break rooms) and accessible for an international audience of researchers. The relative lightweight, compact nature and low-cost qualities of card decks make them a practical solution. Their distribution can be done in print or digitally as a printable pdf, allowing them to reach a broader audience.

Like any format, card decks may present specific weaknesses, such as information overload, oversimplification, overly complex rules or structures, and difficulty to change and update (Roy & Warren, 2019). Identifying these potential barriers is crucial to address and mitigate them during the tool's development. A more comprehensive analysis of the aspects that contribute to the effectiveness of conversation card decks, as well as the challenges they may present, will follow in a subsequent section to guide the design process.

3.1.4 Playful Elements in Tools

The use of game elements and mechanics is a well-established strategy for promoting learning and discussion, particularly when addressing sensitive or serious topics (Dupont et al., 2022; Wehbe, 2022; Hidayat & Okawa, 2020). While integrating sex and gender considerations into health research may not be a difficult topic for everyone, researchers and reviewers with limited awareness or knowledge on the topic may find it more challenging. This difficulty can stem from many reasons, but in cases where resistance arises from fear of failure or hesitation to openly reflect on one's shortcomings, the use of playful elements can support individuals to overcome these barriers.

Games have been shown to help overcome such challenges by creating a 'magic circle', a safe and playful space where participants can make mistakes, ask questions and explore new perspectives without fear of judgment. They also facilitate the re-evaluation of ideas, supporting changes in attitudes, behaviours and beliefs (Wehbe, 2022; Hidayat & Okawa, 2020).

3.2 Inventory of Related Tools

Incorporating playful elements into the design of the tool aims to encourage group discussion, reflection, and shared understanding. However, the extent to which game elements are implemented may vary, meaning that the tools may not necessarily be classified as a game. To understand the strategies used by other tools with similarities to the one proposed in this thesis, the first step was to systematically search for, acquire, and compile an inventory of relevant conversation card decks. This inventory serves as a foundation for the analysis conducted in the following section.

3.2.1 Focus

Following the previously defined elements the search focuses on (1) tools that increase awareness and promote reflexivity, (2) tools that facilitate reciprocal communication occurring in real-time where actors are engaged in a collaborative process, (3) physical tools in card deck formats, and (4) tools that implement playful elements to address a topic. To further specify the topics addressed by the tools, the following areas are emphasized: (1) tools for sex and gender education, (2) tools for project/research development, and (3) tools addressing sensitive topics.

3.2.2 Method

The tools were identified from scientific literature, direct recommendations from academic experts and interdisciplinary consultants, and non-systematic searches in public search databases and search engines. Special attention was placed on ensuring variety in the tools' target group, context of use, and approaches.

To guide variety in approaches, an adapted version of the content-based approaches identified by Peters et al. (2020) was used. The most relevant approaches identified were *Methods* (a collection of methods or strategies), *Prompts* (questions, triggers or abstract visuals), *Components* (representation of components within a system or problem), *Concepts* (small portions of expert knowledge), *Stories* (narratives to illustrate ideas), and *Embodiment* (incorporates movement or physical activities).

3.2.3 Inclusion/Exclusion Criteria

In addition to the previously mentioned focus points, the following criteria guided the inclusion and exclusion of tools in the review.

Inclusions

- Publicly available
- Available to order, or to download and print
- Relation to the focus points in terms of topic, target group or purpose
- Provides information on its purpose, development and/or performance
- Functions independently of digital materials
- Can be effectively tested by university students and researchers

Exclusions

- Published in a language other than English and not easily translatable
- Does not provide or has an unclear purpose or instructions
- Tool and shipping costs exceed 100 EUR
- Highly similar in purpose, strategies and content to other included tools

3.2.4 Overview of Included Tools

Building on and adapting methods from previous reviews (Peters et al., 2020; Roy & Warren, 2019; Roosink et al., 2024), the tools were described based on: topic, title, author, design context (country), purpose, target group, approach (content-based), elements (provided by the tool), use context (time, space, people and extra materials needed), and additional materials (publications, sources, support).

A filtering process was applied to select the tools for analysis, based on the exclusion criteria and guided by the question, 'Why should this tool be analysed in more detail?' This resulted in a final selection of eight tools, five of which were contributed by collaborators. The following table presents a compacted overview of these tools. For the full table with all description categories, see Appendix A.

Topic	Title	Purpose	Target Group	Approach	Elements	Additional Materials
Sex and Gender Education + Project/ Research Development	Let's Talk about Gender: Anti-Bias Card Deck (ABC) (Austria)	To develop (gender) sensitivity in research and practice in HCI	Project teams and/or collaborators regardless of their level of knowledge, research, or project focus	Methods Prompts Concepts	15 Cards Thematic categories Links to resources	Research article - development and testing (Burtscher & Spiel, 2021) Paper - insights from workshops (Burtscher & Spiel, 2023) Website - digital deck and information (Burtscher, n.d.)
Sex and Gender Education + Sensitive Topics	The Gender Deck (Triska, 2023) (United States)	To guide conversations about gender identity, gender expression and relationships	Therapists, students and school staff, support groups, youth workers, family, friends...	Prompts Stories	100 cards Thematic categories Links to resources	---
Sex and Gender Education + Project/ Research Development	MethodKit for Gender Equality (Sweden)	To help discuss, map, plan, ideate, and prioritize	Organizations or companies	Prompts Components	51 cards	Online resources - guides and worksheets (MethodKit, n.d.) Posts - reasoning, use and development (Möller, 2014)

Sex and Gender Education	Let's Talk Gender Diversity (Denmark)	To start engaging in conversations about gender diversity	General public (inferred)	Prompts Stories	31 cards Thematic categories	---
Sex and Gender Education + Sensitive Topics	Let's Talk! Youth SRHR Card Game (Burundi, Colombia and the Netherlands)	To encourage open and honest conversations about sexual reproductive health and rights	young people (ages 14-24)	Prompts Stories Concepts	73 cards Starting activity Thematic categories Spinning wheel	Project information, digital deck, and facilitator's guide (FairSpace et al., 2023)
Sex and Gender Education + Sensitive Topics	Catcall (Japan)	To trigger conversations about sexism and gender stereotypes	General public (Young) adults (inferred)	Components Stories	370 cards Thematic categories	Paper - development and testing (Hidayat & Okawa, 2020)
Sex and Gender Education + Sensitive Topics	AbFabFlashes toolkit: Menomana (Netherlands)	To break the taboo on menopause	Executives, HR employees, coaches, for women between 45-60 years and general public	Prompts Components Concepts Stories Embodiment	120 cards Thematic categories Dice Links to materials	Website - toolkit information (Vermeulen, n.d.)
Sex and Gender Education	Komt een man/vrouw bij de dokter Once upon a time a man/ woman visited the GP (Netherlands)	To learn about how gender and sex play a role in care pathways for men and women (inferred)	-	Concepts Stories	40 cards Thematic categories Links to sources	---
Project/ Research Development	The Tarot Cards of Tech (United States)	To inspire conversations around the impact of technology and products	Companies, start-ups, and project teams	Prompts	12 cards	Webpage – information and digital deck (Artefact, n.d.)
Project/ Research Development	Crossing Cultural Chasms (Netherlands)	To develop a culture-conscious approach to design	Designers developing products for users from cultures they are not familiar with	Methods Concepts Stories	48 cards Thematic categories Links to sources	Doctoral thesis (van Boeijen, 2015) Webpage - digital card deck and information (van Boeijen, 2014)
Sensitive Topics	The Death Deck (United States)	To spark discussions around the topic of death	General public (ages 13+)	Prompts Stories	112 cards	Website - information and sheet score (The Death Deck, n.d.)
Sensitive Topics	Open Kaart (Netherlands)	To improve self-esteem, build resilience, and develop empathy	Young people (ages 10+)	Prompts	60 cards Dice	Webpage – information (Ink, n.d.)
Project/ Research Development	NOVA - Norm Creative Innovation (Sweden)	To support the development of innovative solutions for a more equal and gender-equal society	Project teams	Methods Prompts Stories Embodiment	54 cards Thematic categories	Website - information, digital deck, and support materials (Ivarsson, n.d.)

Table 3. Overview of related card decks.

3.2.5 Preparing the tools

The selected tools were acquired by various methods: purchased online (n=4), downloaded from the creator's website (n=5), acquired as digital files by contacting the creator (n=1), and shared by academic experts and interdisciplinary consultants who had physical copies (n=3).

The acquisition of non-commercial decks presented both opportunities and challenges. These decks provided valuable case studies on accessibility and transparency in card deck design. Notably, three decks developed in a university context were accompanied by academic papers detailing the development process and design decisions. However, obtaining these decks as digital files introduced a significant challenge: they needed to be printed to be able to test them. Additionally, to improve comparability with commercially produced decks and allow testing to focus on design and content, the printed versions needed to maintain a similar level of quality.

Initially, this seemed straightforward, especially since many files appeared print ready. However, in practice, printing the card decks proved to be a complex process that required technical knowledge, part of which was acquired through trial and error. The first batch of printed cards included the *Anti-bias Card Deck*, *Let's Talk*, *Tarot Cards of Tech*, and *Let's Talk Gender Diversity*. These files were printed as provided by their creators. For decks that included back covers (n=2), the files were designed so that the front and back sides were placed side by side. After printing, they were meant to be folded, glued, and cut. To provide the look and feel of playing cards, all decks were printed in colour on 300g paper. While the resulting quality was good, the manual effort required, specially for decks with many cards, proved excessive. For the next batch, which included *CatCall* and *Nova* card decks, a different approach was taken: printing double-sided pages to minimize manual labour. This required additional preparation, such as rearranging the page order and checking image alignment. Although this method significantly reduced the amount of manual labour, it was still time consuming.

Considerations for Printing

The following considerations were gathered during the printing process and were kept in mind to ensure the accessibility of the card deck as a digital file:

Provide instructions for printing.
Include clear cutting guides in the document.
Align and layout the cards strategically to reduce the number of cuts required.
Designing double-sided cards or adding back covers requires careful planning.
White outlines and misaligned images can be avoided by accounting for bleed or by using one side as a guide while expanding the background (or leaving it white) on the opposite side.
Avoiding rounded corners, or making them optional, makes the design more practical.
Smaller cards are less affected by paper weight in terms of firmness.
The number of cards directly impacts cost, materials, and effort required.

3.3 Analysis of Tools

Looking at the inventory of selected tools, a variety of strategies are implemented to guide and promote discussion. This section focuses on gathering information to understand the aspects that contribute to the effectiveness of conversation card decks, as well as the challenges.

3.3.1 Method

The analysis of the tools followed three paths: individual exploration, focus group testing, and interviews for collaborative exploration. Each path had a specific goal, ensuring a comprehensive approach to gathering information from different perspectives while efficiently covering key areas of interest.

The number of tools included, and the chosen analysis approach were influenced by time and resource constraints, as well as the availability of collaborators. While adjustments were made to the initial plan during the process, the overall structure of the three analysis paths remained the same.

3.3.2 Individual exploration

The analysis of the tools began with an individual exploration, conducted by the research designer. This path served as a foundation for the other two and involved familiarization with the tools, identification of key design features and defining the testing approach with collaborators.

The following table provides an overview of the activities carried out and their description.

Activity	**Description**
Tool familiarisation	Checking the available information on the tools, both information provided with the physical deck and the additional materials found online.
Testing simulation	Testing the tools individually following the instructions. When questions or activities were directed to a specific project, this thesis was used to answer.
Feature isolation	Identify and isolate the different features that make up the tools, expanding on the categories of approach, elements, and setting, found in Table 3.
Testing approach	With the information gathered by the previous activities, the testing approach with collaborators was defined, and key interest areas were identified.

Table 4. Description of activities during individual exploration of the tools.

Feature Isolation

The results from the first three activities informed the identification and initial analysis of the building blocks of the conversation tools. The design features identified cover a variety of quantitative and qualitative categories (see Table 5). They represent specific features that need to be considered during the development of the tool. To gather insights and validate initial observations, the design features were used as focus points for the testing sessions.

Design feature	**Description**
Volume	Considered the size and quantity of cards. While the printing process may change the intended size and volume of some tools, printing instructions were followed when provided.
Packaging	Looked at the presentation, functionality and size of the case to store the cards. Printed decks do not come with a case, in which cases rubber ties or folded paper was used.
Components	Assessed the type of components the tool provides. All the tools use cards as their main component, but some provide extra components.

Space	Focused on the physical space and external objects that the tool needed to be used.
Flexibility	Looked at how much the tool can be adapted to different users' needs and settings, as well as the time and effort required from the users, and the time needed to set up and prepare.
Guidance	Assessed the amount of guidance that the tool provides without considering the instructions. Checking for affordances and how intuitive it is to use, or guiding elements embedded in the cards.
Instructions	Most of the tools come with instructions with some exceptions. In those cases, instructions can be found online, but not as part of the physical tool. For some tools reading the instructions before starting is important. Under this element, it was also considered whether the tool can still be used as designed in the case that the user does not read the instructions, and strategies placed to avoid or go around that situation.
Information	Looked at the amount, type and arrangement of information on the cards.
Categories	Identified how the content was presented and categorized.
Goal	Assessed the elements and mechanics in place to communicate the goal to the users, and how this was adapted to the different target groups.
Playful elements	Assessed the different elements that each tool would implement to make the experience enjoyable. Specially in the tools that target sensitive topics, what elements are in place that create a safe space and invite people to be curious and open.
Attention	Focused on identifying the elements that each tool uses to grab the attention of the users' and keep them engaged during its use. Also checking for elements that could divert the attention of the users outside of the conversation/activity.

Table 5. Design features identified as building blocks of the tools.

Setting Up Test Structure

Based on their target group and context of use, the tools were broken down into two main groups, which were labelled as 'project specific' and 'general use' (see Figure 5). The project specific tools, as the name suggests, are meant to be used with a specific project in mind, building up on it. While the general use ones are more flexible as, depending on the tool, they do not require for the users to have a shared background, an existing project, or knowledge about the topic.

This key difference in the context of use shaped the testing approach of the card decks. The flexibility of the general use tools allowed for a broader participant pool, which included early-career participants from different academic programmes. On the other hand, project specific tools were best suited for testing by groups already working together in a shared project. Although some of these decks can be applied to a broad range of projects, making sure that the tools could be applied to the projects of the participants was another possible challenge. It was decided to simplify the testing approach for project specific tools by providing an example scenario, or, if participants preferred, they could share a project they were involved in with the group.

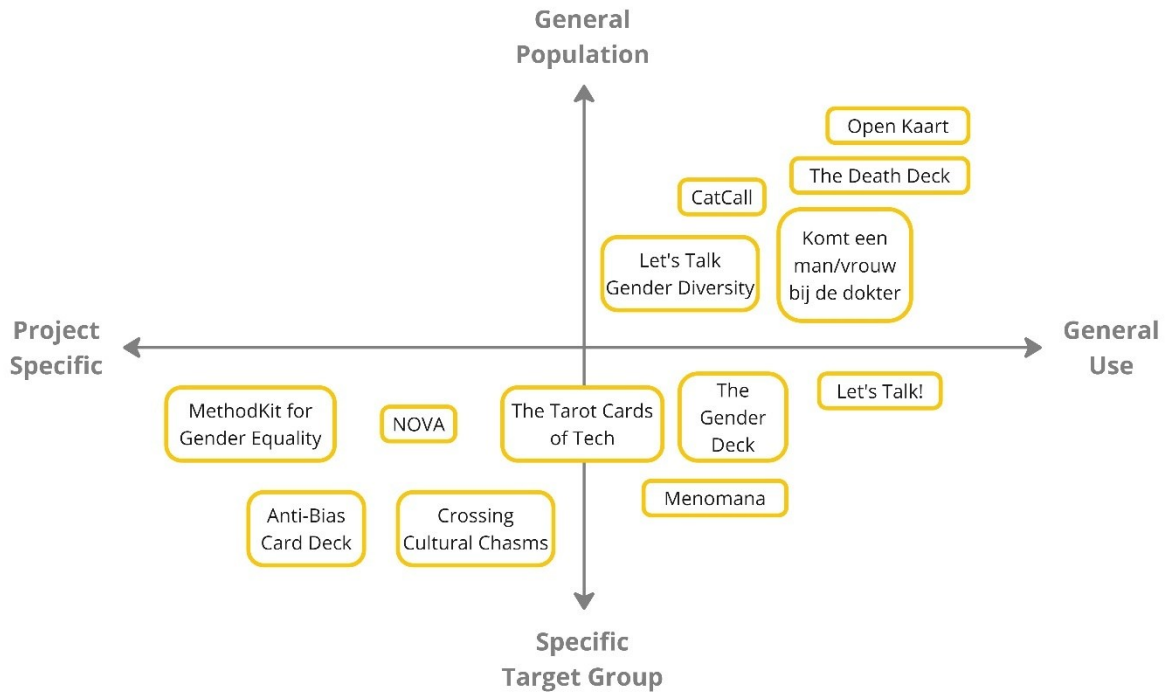

Figure 5. Division of tools by target group and context of use.

Information Gaps

Testing the tools with early-career participants, allowed the interactions with the target group (academic experts) to focus on gathering missing information that was needed to develop the tool. These interactions were in the shape of interviews, where discussion was centred around their experience working with sex- and gender-related topics, their perspective on the conversation tools and testing results, and gathering ideas on how a communication tool for researchers could be designed and used. Furthermore, insights from these collaborations helped define the content of the tool, which is further explored in the next section.

3.3.3 Focus Group Testing

The goal of the focus groups was to test the tools and explore how playful elements affect the depth and seriousness of the conversation, how design features impact engagement and conversational flow, and whether using the tools could lead to shifts in personal opinions and perspectives on the topics discussed.

Participants

The early-career participants of the focus groups included bachelor's, master's and PhD students mainly from the University of Twente, recruited through various channels. Invitations were shared with the help of study associations and other student groups, as well as directly with individual students, who further extended the invitation to others. Additionally, academic experts provided support by advising on recruitment strategies and offering feedback on the testing structure.

Testing conditions

Two different conditions were used for the testing sessions. The first took place in a reserved room, where participants engaged in a series of activities, including filling out surveys, open discussions, and selecting a tool to use. However, out of four planned sessions, only one was conducted with two participants. Due to the low participation rates a second testing condition was set.

To lower participation barriers, the sessions were restructured to be more flexible by breaking them down into their core components, allowing for shorter sessions. Instead of reserving a room, participants were invited on the spot, mainly around the campus. Under these conditions, five sessions were held, with participant numbers ranging from one to three per session.

During the sessions, the design researcher guided the activities and acted as a facilitator when required by the tool. In sessions with only one participant, the design researcher also took the role of a participant. Observations were recorded as written notes, and audio recordings were used to support the observations and expansion of the notes after the sessions.

Tool Adaptation

Some tools required adaption to fit the testing conditions. This primarily involved shortening the usage time or omitting activities that were difficult to set up on the spot, such as spreading the cards in a limited space or following a scoring system when the tool was used for less than 10 minutes. As a result, the sessions served more as an introduction rather than a comprehensive exploration of the tools.

Included and Excluded Tools

Part of the test involved participants selecting a tool to try out, resulting in various degrees of testing, as not all tools were used or presented as options. In each session, only three or four tools were presented at a time, depending on the space constraints. Additionally, sessions were structured to ensure that each tool would be tested at least once, meaning that the tools already tested in previous sessions were rotated out. An overview of the tested tools is provided in Figure 6.

Some tools were excluded due to difficulties in adapting them to the testing conditions without significantly altering their intended use. For example, *Open Kaart* and *Menomana* are both in Dutch, however, *Open Kaart* contains only simple short sentences on each card, making it feasible for participants to translate and continue discussion in English, while *Menomana* presented greater language barriers, considering the design researcher's limited Dutch proficiency. As a result of these constraints, the testing primarily focused on general use decks, with only a few exceptions.

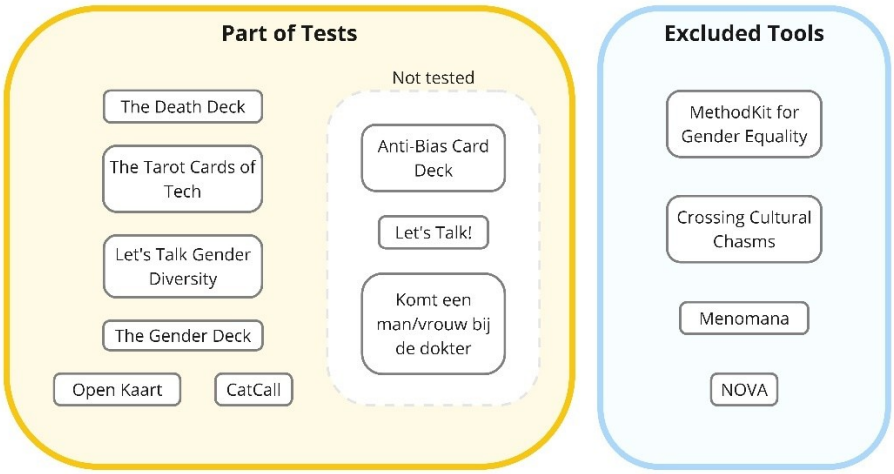

Figure 6. Overview of included and excluded tool during testing sessions.

Outcomes

Although testing was limited by various factors, the discussions with participants provided enough information to continue the evaluation of the design features and strategies the card decks employ. Allowing participants to select a tool and dedicating time for discussion during the sessions provided important information on strategies to lower barriers of use. The following table presents a summary of the observations from the individual exploration and testing sessions.

Design feature	**Observations**
Volume	A higher quantity of cards increases perceived complexity and effort needed. Exploration of decks is easier with small sized cards (up to around 40 cards), or bigger sized cards (up to around 15).
Packaging	Compact packaging makes transportation and storage easier. Cards stored upright allow a few cards to be picked out without taking all of them out. Printed decks are more vulnerable if packaging is not provided.
Components	Cards can invite to grab, sort and lay down, depending on the size, quantity and volume of the deck. Dice attract attention, and afford grabbing and throwing.
Space	Under the testing conditions card decks that did not need to be laid down, organized or shuffled were easier to use.
Flexibility	Provide different use modes depending on time, goal, and number of participants.
Guidance	Decks presenting only simple questions in each card, proved more intuitive, as they would trigger an answer and thus start the conversation. Elements like dice paired with colour coded categories provided an evident mechanism to use.
Instructions	Opening the deck to instructions provides an evident place to start. When instructions are provided in a similar format as the cards they can be mixed and lost in between them. Instructions can attract attention by having a different format or graphic design than the normal cards.
Information	Amount of information affects the size of the cards. Adding explanations and stories provides clearer content but can be overwhelming or be perceived as complicated or requiring a lot of time to use. Reading and understanding can take time, and participants may need to take turns reading a card before starting.
Categories	Categories can provide participants with information on what to expect. Categories can provide stages of use and order, while allowing participants to decide where to start or cards to skip, and autonomy. Colour categories without indication of their meaning can lead to confusion.
Goal	Goal can be communicated directly in the instructions. Cards can reflect the goal, in how the content is presented or the information provided. Categories can help reflect the goal.
Playful elements	Unrealistic or extreme scenarios can lower the seriousness of a topic. Activities involving movement and interacting with objects can take the focus away from individuals. Point systems encourage involvement in the activity. Shared activity objectives promote collaboration.

Attention	Short sentences can be read out loud and promote collaborative sense-making. Diversity in activities and quick exercises demand active attention from participants. Long set-up or transition times allow participants' attention to shift. Images paired with text can improve attention and understanding of activities and concepts.

Table 6. Summary of the observations from the individual exploration and testing sessions.

3.3.4 Interviews for Collaborative Exploration

The goal of the interviews was to explore the perspective of academic experts on the design of a communication tool to discuss sex and gender topics. To achieve this, the focus was placed on two main areas: researchers' needs and behaviour, and communication tool design.

Participants

Professors from the University of Twente with experience in health research were invited to participate in the interviews. In total, six professors with diverse academic backgrounds and research projects, and with varying degrees of experience in health research participated the interviews. Their different perspectives helped identify opportunity areas and raised critical questions, ensuring a more comprehensive consideration of critical elements in the development process

Approach

A semi-structured interview format was used to promote in-depth exploration of the main topics and encourage collaborative discussion. A shared structure ensured that all interviews covered the same topics and gather specific information. At the same time, the flexible format allowed conversations to adapt to each participant's expertise and interest areas. A set of guiding questions were prepared in advance but were adjusted and expanded upon during the interviews based on participants' responses. Moreover, space was provided for participants to ask questions, provide feedback, and make suggestions.

Interview Structure

The interviews were divided into three main sections. First, the questions explored the participant's background and experience, as well as their familiarity with communication tools or similar resources. Then, the inventory of tools was presented, and participants were encouraged to interact with them. The discussion focused on their impressions of the tools and the responses observed during previous testing sessions. The final part of the interview focused on gathering relevant information for the development of the new tool, including potential environments of use and strategies for sharing knowledge.

Each interview lasted approximately 30 minutes, although depending on the availability and interest of individual participants the sessions were extended. While using the tools was not part of the planned structure, participants who wished to try out a tool were given the opportunity to do so at the end of the session.

Outcomes

The interviews with academic experts achieved the crucial role of increasing target group involvement and refining the direction of the tool's development. Key outcomes included:

Validation and expansion of insights	Experts contributed new perspectives, helping evaluate existing observations and uncover additional considerations.

Identification of additional tools	Experts shared relevant tools they were familiar with, expanding the inventory of related tools.
Exploration of new design directions	Collaborative discussion facilitated the generation of new ideas and potential design strategies.

Data from the interviews was gathered as written notes and audio recordings, which were later transcribed and analysed. Findings from the interviews informed both the process of content definition and the insights presented in Section 3.5, where the design challenge is redefined in preparation for the Develop stage.

3.4 Content Exploration

The interviews provided valuable insights into potential focus areas for the tool's content, while the analysis of similar tools helped identify different ways of structuring and presenting information. However further exploration into the specific context of use was needed to determine the most suitable approach for this project. The exploration and definition of these topics was done by collaborating with the core team. The collaboration aimed to clarify content needs while considering the tool's intended context of use. Additionally, the meeting served as an opportunity to update the team on project progress and gather perspectives beyond the University of Twente and the Netherlands.

To make the discussion as effective as possible, meeting goals and focus areas were outlined in advance. The intention was to engage the core team in a collaborative design process through activities. However, given the constraints of online meetings and time zone differences, a group session was not possible. Instead, only one meeting with Holly Mathias was scheduled. Despite these limitations, the discussion provided valuable input that informed decisions on the tool's content, and a deeper understanding of the adaptation requirements of the tool to the different research environments.

3.4.1 Revisiting Starting Point

To assess progress and identify key areas to address in the meeting, a reflective exercise was conducted by revisiting the project's starting point and framing the problem using the Five W's.

Who?	Health researchers and reviewers interested in learning more about sex and gender integration in research.
What?	To help discuss, create awareness, and advocate for the importance of sex and gender considerations within teams or organizations.
Why?	Ensuring teams have a shared understanding of sex and gender considerations and are thoroughly considering them in all stages of the research process can be challenging, specially when it involves changing perceptions, creating awareness of gaps in knowledge and identifying biases and assumptions.
Where?	Casual and informal settings, such as university coffee rooms and common spaces.
When?	In preparation for a team to work together, during breaks to spark discussion, or as a refresher activity before checking formal resources.

From the Discover stage up until Define Section 3.1 the focus was on answering *Who*, *What* and *Why*. Some insights were gathered to answer where and when from the interviews and observations of common areas around the university, but more information was needed to evaluate the context of use. *Where* and *When* the new tool is designed to be used directly affects the decisions in implemented design features, the type of information needed, and the best way to present it.

Furthermore, the gap identified by the core team was rephrased as a guiding case scenario for the content requirements. The case scenario is a research team working on a grant application, where we want to provide a tool to serve as a starting point to improve sex and gender considerations in their research and help them match expectations of funding bodies. This case scenario was followed to look back on the sources and gather examples of the specific topics that researchers in this situation must cover.

3.4.2 Core Team Meeting

The meeting was conducted online via *Microsoft Teams* and involved three main activities: sharing project updates, exploring *Where* and *When*, and discussing potential strategies and topics for the tool. To facilitate virtual collaboration, *Miro* was used as an interactive workspace, allowing participants to navigate, modify, and visually arrange information. Project progress was presented in a map format, with arrows illustrating the development through different activities and connecting key insights. This setup ensured that all participants could interact with the content, revisit previous points, and contribute additional input.

To explore *Where* and *When*, an activity was integrated into the visual path. The activity consisted in a series of questions aimed at gathering insights on common spaces available at their university, focusing on both the physical environment and the behaviour of people using them.

The final part of the meeting focused on open discussion and feedback, allowing for reflections on potential challenges and directions for the tool. This exchange provided valuable observations and led to the identification of possible paths to follow regarding content, approach, and physical design.

3.4.3 Outcomes

The meeting with the core team provided valuable insights into how university common spaces are used by researchers. These spaces are diverse, often multipurpose and shared by different departments, which presents both opportunities and challenges.

Opportunities	They provide a space to talk with coworkers from various departments and projects.
	They can serve as settings for small meetings and open discussions.
	The constant flow of people throughout the day creates spontaneous opportunities for interaction.
Challenges	They are often multipurpose and vary in size, so available space can be limited.
	Paper-based materials are vulnerable if left in areas where food and drinks are prepared.
	Seating and working surfaces may be limited or already occupied.
	The amount of time individuals spend in these spaces can vary greatly.

Based on these opportunities and challenges, a set of design requirements for the tool were identified:

Compact design	The tool should be easy to integrate into limited spaces.
Invites to explore	The tool should encourage users to engage with the content.
Low starting effort	Users should be able to begin quickly, and the tool should reflect this.
Flexible set-up	The tool should not require to be laid down or to use several cards simultaneously.

Flexible session length	The tool should allow for session as brief as five minutes, with only one or two cards needed per session.

For the content, the recommendations included:

Visual support	Text paired with images support understanding.
Updatability	Linking to trusted sources to facilitate content maintenance.
Use outcomes	Show relevancy, impact and importance of the topic.
Basic concepts	Create a shared understanding of basic concepts.
Scope	Cover various aspects and stages of a research project.

The insights gathered informed the redefining of the design challenge and guided design decisions made during the Develop stage.

3.5 Reframing the Design Challenge

As the research phase concluded, key insights from tool analysis, user testing, and expert interviews provided a clearer understanding of the challenges and opportunities in designing a conversation tool for discussing sex and gender in research. With this refined perspective, the initial design challenge was revisited to reflect the insights gathered on the needs, contexts, and constraints identified.

The core elements of the design challenge remained consistent, while the design decisions turned into specific design requirements gathered throughout the exploration of the problem space.

The tool to be designed was defined to be physical card deck that:

Creates a common cross-discipline understanding of sex and gender considerations within health research consortiums.
Provides a starting point for researchers and reviewers who are interested in addressing sex and gender in their projects and want to learn how to study it more optimally.
Creates awareness of the importance of addressing sex and gender in research.
Helps identify biases and assumptions that affect how research is carried and how data is analysed and shared.
Promotes discussion, collaboration and the formation of new insights between researchers of different backgrounds.
Is highly accessible and ready to be distributed to an international audience.

Furthermore, the tool's aim is to support researchers in the Contemplation stage, and therefore focuses on reflexive activities to:

Increase awareness
Re-evaluate impact of personal and group actions
Facilitate acquisition of new knowledge
Guide toward existing resources

Research groups using the tool may include participants at different stages of readiness, with varying levels of knowledge and experience. Therefore, the tool should provide valuable information and activities suited to diverse users while creating an environment where all participants can share their perspectives equally, regardless of their background, expertise, or experience.

From the exploration of tool strategies and content requirements, some of the design features were defined, while others were left open to explore during prototyping activities. Additionally, four decks were identified to provide useful examples of strategies that could be implemented: *Anti-Bias Card Deck*, *Crossing Cultural Chasms*, *Let's Talk Gender Diversity*, and *Tarot Cards of Tech*. Their design provided valuable insights and inspiration, as they each presented design features that aligned with some of the requirements defined for the new tool.

4 Developing the Prototype

The Develop stage focused on exploring solutions through an iterative process of prototyping and testing. Each iteration was guided by interactions with collaborators, marking the start and end of each development cycle. During this stage, collaborative activities involved the core team, academic experts and interdisciplinary consultants.

The chapter begins by outlining the plan of approach and the role of collaborators. Section 4.2 presents the first iteration, where a low-fidelity prototype was created and tested. Section 4.3 builds on the insights gained to develop and test a high-fidelity prototype. Additionally, opportunities for online testing led to the adaptation of the prototype into a digital format. Section 4.4 details the adaptation process, along with its limitations and testing results.

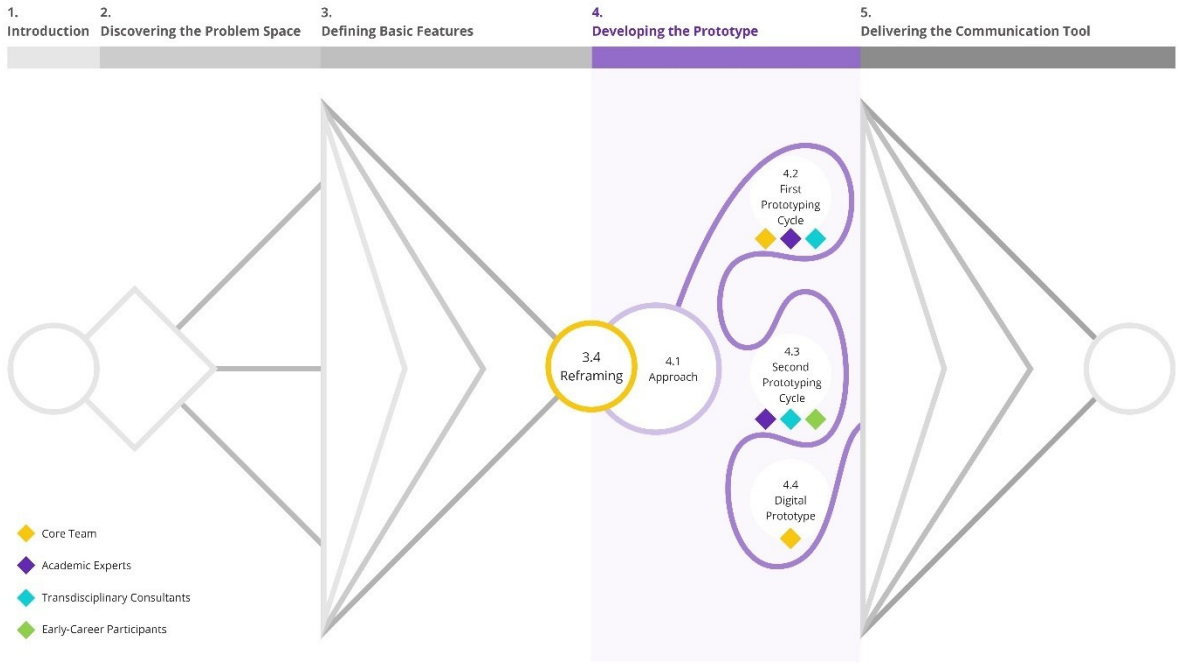

Figure 7. Overview of the Develop stage.

4.1 Approach to Prototype Development

The development phase followed an iterative prototyping process, ensuring that each version of the tool was tested, refined, and improved based on feedback. These iterations gradually shaped the final design by integrating insights from collaborators with diverse expertise. Each iteration cycle consisted of three main steps: developing a prototype based on previous insights, testing in workshops, and identifying new areas for improvement. Throughout the process, the core team and Ink Social Design Studio were contacted to provide updates and gather additional feedback.

Although only two distinct prototype versions were formally tested, numerous smaller adjustments were made between these iterations. As a result, the overall process can be summarized as two major iteration rounds that encompass all activities and incremental adjustments. Each activity served as a stepping stone toward a high-fidelity prototype, following a specific focus for each iteration cycle. The first cycle emphasized content definition, resulting in a low-fidelity prototype featuring simple black text on white pages and minimal design elements. In contrast, the second cycle concentrated on incorporating playful and guiding elements, culminating in a high-fidelity prototype that was tested without external guidance.

The development of the prototypes was primarily done through *Miro*, a digital collaboration platform. *Miro* provided a workspace where individuals could be invited to collaborate, while also serving as a visual record of the steps and changes made throughout the process. This digital trail not only documented the tool's progress but also allowed for reflection on past decisions, offering insight into their origins and impact.

4.1.1 Role of Collaborators

During this stage a wide variety of collaborators participated in activities such as brainstorming, providing feedback, and testing. An overview of the collaborators involved and the activities they participated in is presented below, while further insights and outcomes from their contributions are detailed in subsequent sections. Although only two prototype versions were formally tested, additional meetings to gather feedback were conducted throughout the process. The diverse perspectives of collaborators helped identify opportunities and address issues in advance, ensuring that the limited formal testing opportunities were as effective as possible.

Core team

Updates on the prototype's progress were shared with the core team, and they were invited to provide feedback via email. ZonMw representatives were also contacted to offer insights from a funder's perspective and to stay informed about the project's progress. To further involve the core team and gather their perspectives, a digital version of the prototype was created for online testing, which was conducted with two core team members.

Interdisciplinary Consultants

Ink Social Design Studio provided ongoing support and received regular progress updates. Their interactions primarily involved feedback sessions but also included a brainstorming session at the start of the first iteration cycle and a dedicated testing session for the final prototype.

Additional input was gathered through informal brainstorming sessions with collaborators from non-health research backgrounds. During the second iteration, further feedback was obtained from experts in game development and design at game makers' meet-ups Colliders (Sickhouse, 2024). Although this group mainly

focuses on video game development, the featured talks and discussions with participants at the event provided valuable observations that shaped the final design of the tool.

Academic Experts

Academic experts, who had previously participated in interviews (see in Section 3.3.4), were invited to test the prototype to promote their continued involvement in the process. Although individual availability was a limiting factor, some of them were able to test the final prototype. Furthermore, they also facilitated outreach by extending the invitation to other researchers within their network. The testing group predominantly included health researchers from the University of Twente, where most workshops were conducted.

To broaden the evaluation, the prototype was tested with researchers from Utrecht University working in various fields beyond health research. This broader testing aimed to assess the tool's adaptability to different fields and evaluate its effectiveness for non-target groups and help determine whether the target audience could be expanded without requiring major modifications to the tool.

4.2 First Prototyping Cycle

The first prototyping cycle focused on content definition. The goal was to assess the performance and usefulness of the content before developing the strategies needed to shape it into a conversation tool.

4.2.1 Prototype Development

The first step to define the tool's content was to review the resources and information gathered in the previous stages, identifying specific content samples aimed at helping researchers and reviewers evaluate sex and gender considerations. Discussions with the core team and Ink, led to defining the tool's overall content focus:

> *Setting up research: Critical questions for analysing the significance (if any) of sex and gender across different aspects and stages of research.*

This focus guided the search for content samples, which included example questions from grant applications, foundational concepts, guidelines to rethink concepts and improve sex and gender considerations, and evaluation criteria for the integration of sex and gender. The samples were compiled into a *Miro* board, where they were sorted and grouped into themes. Simultaneously, the four card decks selected as inspiration for the new tool were further analysed.

Insights from Tools

Four tools were used as examples of possible strategies to implement: *Anti-Bias Card Deck*, *Crossing Cultural Chasms*, *Let's Talk Gender Diversity*, and *Tarot Cards of Tech*. The following table provides an overview of the features of interest.

Tool	**Anti-Bias Card Deck**	**Crossing Cultural Chasms**	**Let's Talk Gender Diversity**	**Tarot Cards of Tech**
Information categorization	♦ Designing research ♦ Acquiring funding ♦ Conducting research ♦ Presenting research The cards present additional categories, marked with icons, relating to vocabulary, explanation, reflection, inclusion, and theory	♦ Eye openers ♦ Insights ♦ Activities	♦ Reflection ♦ Knowledge ♦ Challenge	Each card presents a different topic, and all can be categorized as questions designed to 'challenge' The online version presents themes: ♦ Scale and disruption ♦ Usage ♦ Equity and access
Content-based strategy	♦ Open questions ♦ Content explanation ♦ Concept definitions	♦ Content explanation ♦ Infographics ♦ Case scenarios ♦ Activity options	♦ Open-ended questions ♦ Case scenarios	Open-ended questions
Conversation flow	♦ Use individual cards as needed ♦ Select by project phase or additional categories	♦ In order selecting and discussing cards relevant to the project ♦ Activities reference cards form other sections to expand information	Select randomly	Select randomly

Table 7. Features of interest from select card decks for the prototype development.

The card decks have distinct characteristics that set them apart while also sharing important commonalities. Some elements they have in common, which align with requirements outlined for the new tool, include:

Ease of exploration	They can be held and examined without needing to be placed on a surface. *Crossing Cultural Chasms* has 48 cards, but only 16 per category, making them easy to explore within specific categories.
Versatility	Only a few cards are used per session, supporting effective use multiple times while also allowing for selection based on specific needs. Furthermore, the length of sessions is defined by participants and can be used to trigger short informal conversations.

Participant background	The content is designed to engage participants with varying levels of knowledge and experience by focusing on reflection and providing explanation of important concepts.

Additionally, these card decks were selected because they represented two distinct approaches to spark conversations. On one hand, the *Anti-bias Card Deck* and *Crossing Cultural Chasms* focus on providing structured information to guide knowledge acquisition. On the other hand, *Let's Talk Gender Diversity* and *Tarot Cards of Tech* rely on open-ended question with minimum context information encouraging group discussion and reflection.

In the context of triggering informal conversations on serious topics, the more information-heavy approach of the first two decks was found to impact ease of collaborative exploration and increase initial engagement barriers. However, providing too little information could risk the tool failing to achieve its purpose, or, in the worst-case scenario, reinforcing assumptions and biases if no guidance is provided to steer discussions in the intended direction.

Defining Structure

The strategies explored in the previous tools, combined with insights from discussions with collaborators, led to the definition of specific elements for the prototype.

The idea was for the card deck to consist of 15 cards, each featuring open-ended questions that prompt reflection on the integration of sex and gender across different aspects of a research project, particularly in the early stages of research design. Each card would centre on a primary question, accompanied by two or three sub-questions to guide discussion and ensure a comprehensive exploration of the topic.

To prevent information overload and maintain adaptability as knowledge evolves, the questions would remain intentionally unanswered. Additionally, a separate list of websites, such as the ones gathered in Section 2.3, would be provided to connect researchers with up-to-date resources, which would be incorporated into the final design. Lastly, the reverse side of each card would feature illustrations or infographics to visually support the topic, although these elements were not included in the low-fidelity prototype.

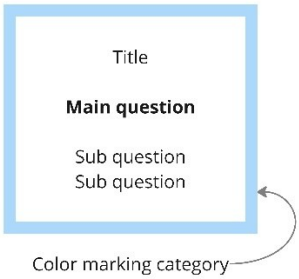

Figure 8. Basic card composition.

From the content analysis, it became clear that several questions addressed the same topic but from different perspectives. This observation led to the division of topics into two categories: questions to reflect on the research team, and question to reflect on the research project. This division ensured that, while not all project-related questions may be applicable to every participant, the researcher-focused questions could still spark valuable discussions, benefiting participants regardless of their field or whether they shared a specific

project. Additionally, a third category of base topics was added to cover fundamental concepts that should be discussed at the beginning, ensuring a shared understanding before engaging in deeper conversations.

Defining Content

The initial content themes were further refined and separated into the three categories, which led to the selection of 15 starting topics. The titles, topics and questions underwent three major cycles of refinement before resulting in the first prototype. Table 8 illustrates the evolution of the categories and titles, comparing the starting point with the results after the refinement cycles.

Initial Content Themes	*Low-fidelity Prototype Content Themes*
Base Topic	**Before you start**
1. Sex and gender	1. Define sex and gender
Topics to reflect on the research team	**Look at yourself**
2. Intersectionality and positionality	2. Intersectionality
3. Diversity in the team	3. Diversity
4. Representation	4. Representation
5. Previous experience	5. Expertise
6. Recognizing assumptions and biases	6. Previous assumptions
Topics to reflect on the research project	**Look at the research**
7. Sex and gender in research (variables)	7. Sex and gender
8. Current state of knowledge in the field	8. Intersectionality
9. Intersectionality	9. Impact
10. Benefits from the research	10. Biases and assumptions
11. Biases and gaps	11. Mind the gap
12. Norms and relations	12. Norms and relations
13. Exclusions	13. Exclusions
14. Limitations	14. Unlimited
15. Involvement of external parties	15. Predict the future

Table 8. Comparison of first and final iteration of categories and titles.

The evolution of topics was not only the result of rephrasing titles but also of refining the content itself. Some cards were found to be too similar and were merged, while others covered topics that were too broad and were split into separate cards. Two titles were reworded to make them more interesting, while the rest remained simple to more clearly reflect the topic of discussion. The *Predict the Future* card was added, featuring playful, thought-provoking questions. These additions would allow to test how could playful elements be added into the content without affecting the desired outcomes in depth of discussion.

The refinement process involved collaborators from diverse backgrounds to evaluate the importance, phrasing, and scope of the questions. Their feedback ensured that the content remained broad enough to be applicable across various research fields while still maintaining relevance to the tool's core focus.

Low-fidelity Prototype

The final design of the first iteration was printed in black and white, with content displayed on only one side of each card. The layout followed a consistent structure, featuring the topic at the top, followed by the main

question in bold, sub-questions for further guidance, and the corresponding category at the bottom. A preview of the printed deck and some example cards can be seen in Figure 9.

Figure 9. Low-fidelity prototype.

The final set of cards was further analysed to assess their connection to sex and gender topics. The deck consists of five cards with questions directly addressing sex and gender, seven with an indirect connection, and three covering general topics. This balance was essential to ensure the tool's applicability across diverse research areas while offering participants a range of conversation prompts varying in depth and complexity. Figure 10 provides an overview of the cards, displaying their titles and main questions, categorized by their level of connection to sex and gender topics.

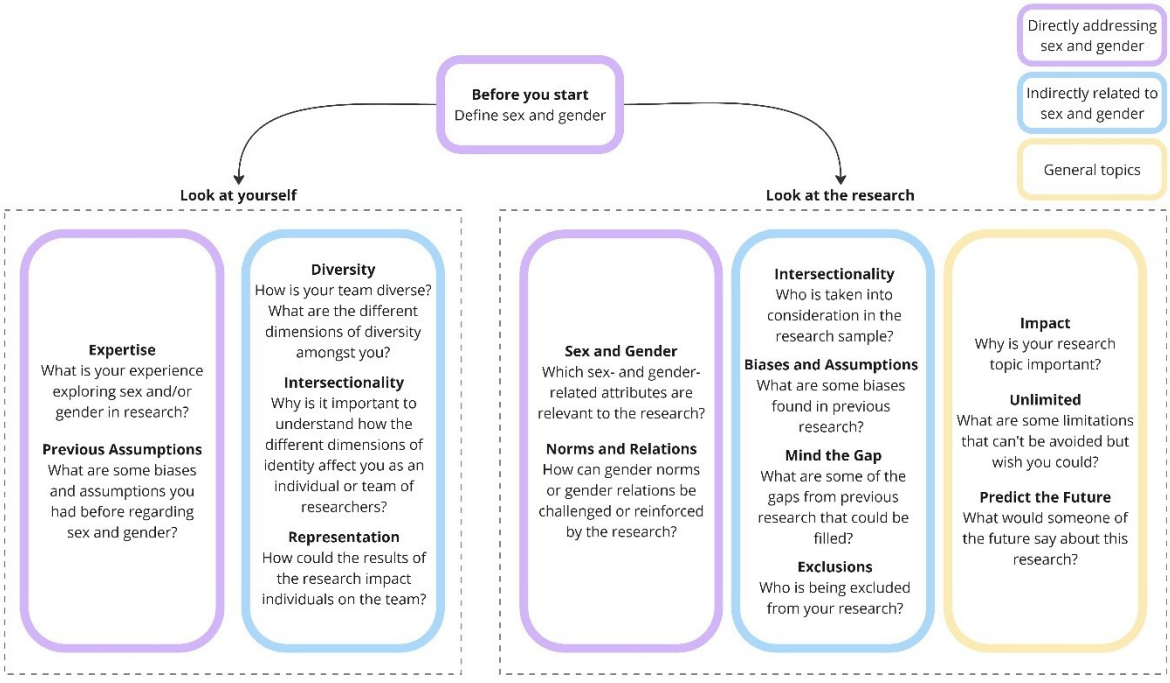

Figure 10. Overview of Topic Cards divided by category and content relatedness to sex and gender topics.

4.2.2 Prototype Testing

To evaluate the prototype, a series of workshops were conducted, each consisting of two parts. The first focused on using the prototype, while the second involved an open discussion about the tool and its content. During the discussion, participants were encouraged to share their opinions and collaboratively brainstorm potential improvements. This approach ensured that observations from direct testing were complemented by participants' verbal feedback, providing a more comprehensive understanding of the tool's effectiveness.

Focus

The workshops aimed to gather data on the participants' experience, group dynamics, affordances provided by the cards, card-sorting approaches, and potential use barriers. Through observations and discussions with participants, opportunity areas and missing elements in both content and design were identified. Data was collected through written notes and audio recordings, which were later analysed to expand and refine the observations made during the workshops.

Workshops

The workshops were conducted in a closed setting, with sessions lasting between 30 minutes and one hour, depending on participant availability. The design researcher acted as a facilitator, providing initial instructions, answering questions and prompting participants to move forward in discussions when necessary, and introducing key discussion points after testing.

At the start of each session, participants were directed towards the starting card. Minimal verbal guidance on how to use it was provided, and the tool itself contained no additional instructions beyond the initial discussion prompts. This approach allowed participants to collaboratively make sense of the tool and define their own approach of use.

During the sessions, observations were taken on conversation length, topics discussed, discussion depth, card selection methods, and participant interactions with both the tool and each other. After discussing two to four cards, the testing phase concluded, and participants were invited to share their experiences, provide feedback on the card deck and its content, suggest improvements, and discuss potential applications of the tool in their own contexts.

A total of three workshops were conducted:

University of Twente (Enschede)	3 health researchers 10 minutes
	1 health researcher 18 minutes
Utrecht	3 fundamental researchers (+1 person during the start card) 1 hour

4.2.3 From Observations to Insights

The data gathered during the workshops helped identify improvement areas for the next prototype. A list of requirements was developed to address missing elements and opportunities discovered during testing. Additionally, the workshops provided valuable insights into how the tool was used, revealing ways to improve the overall user experience.

Requirements

The following requirements were established for the next prototype iteration:

Provide a clear start	Although one card was designated as the starting point, it could easily get lost within the deck if participants are not aware of its existence. Additional guidance is needed to provide a smooth start and clarify how to progress through the deck.
Include instructions	Participants need guiding points at the beginning of the session. Instructions need to be brief but effective to guide participants on how to use the tool independently, without the need for a facilitator or familiarity with the tool.
Clarify categories	In some cases, participants overlooked or misunderstood the categories until later in the session, after using the tool for a while. Improving visibility and clarity is necessary to provide participants with information on what to expect and allow them to make decisions on the type of conversations they wish to start.
Offer optional paths	The tool should accommodate different use cases, such as informal conversations, individual reflection, and structured activities for workshops or meetings.
Define a clear endpoint	A lack of a clear goal or concluding activity left participants uncertain about when they had discussed enough or how to wrap up a session.
Addition of a new card	An additional card should be included to reflect on personal motivations and perceived importance of the topic.
Rephrasing titles	Some duplicate or overly similar titles caused confusion, whereas playful titles generated interest. Content expectations based on titles did not always match featured questions, which was both discussed as positive and a negative element.

Insights

The following insights were gathered from the workshops and informed changes in the use and design of the next iteration:

The tool is most effective in groups of up to five people, as larger groups may result in some participants having limited opportunities to contribute.
Effective discussion per card lasted approximately 7 minutes, however larger groups may require more time per card.
The cards afford to be paired, allowing for deeper conversation around a specific topic.

Discussions can continue beyond the point of productivity without a prompt to transition to a new card.
The depth and seriousness of the topic make the tool better suited as an intentional activity for workshops and meetings, although some research groups do engage in similarly serious conversations in common areas.
The structure of the questions effectively guided discussions, allowing participants to either answer all sub-questions on a card or follow the natural flow of the conversation they triggered.
When selecting cards intentionally, participants preferred titles that stood out as interesting and questions that appeared visually shorter.
Some cards were more challenging to answer and were not suited to be chosen at the beginning of the session.
There is flexibility to make the titles more playful, however, the questions should maintain a certain level of seriousness to ensure meaningful discussions.

4.3 Second Prototyping Cycle

The second prototyping cycle focused on incorporating playful and guiding elements. The goal was to produce a high-fidelity prototype that could be tested without external guidance, allowing for an evaluation of both the participant experience and the tool's effectiveness in guiding conversations.

4.3.1 Prototype Development

Individual and collaborative brainstorming sessions were used to explore potential guiding elements and their implications on the design and participant experience. Feedback from the first prototype made it clear that participants needed additional support to navigate the conversation. In response, elements were introduced to establish a clear starting and ending point, along with guiding prompts on individual cards to help participants transition between topics. These prompts aimed to remind participants that they could explore other topics and offer suggestions to continue discussions with other cards. Additionally, strategies were explored to help participants select cards that were better suited for the beginning of a session, ensuring a smoother conversational flow.

Further Analysis of Cards

An important observation from the workshops was that without guidance participants would select cards in a variety of ways, each group adopting a different approach. Some picked cards randomly from the deck, while others spread them out or browsed through a few before selecting cards based on the title or the questions. Observations of the resulting discussions revealed that not all cards were equally suitable for starting a conversation. When participants began with more complex questions, they often required extra time to process the topic before engaging in discussion.

To analyse this further, the cards were mapped according to two dimensions: specificity and complexity of the questions. This mapping helped identify which cards were better suited for the beginning of a session and which were more effective later, once participants were fully engaged in the discussion. Figure 11Figure 11 presents the resulting difficulty map, illustrating how the cards were categorized based on these factors.

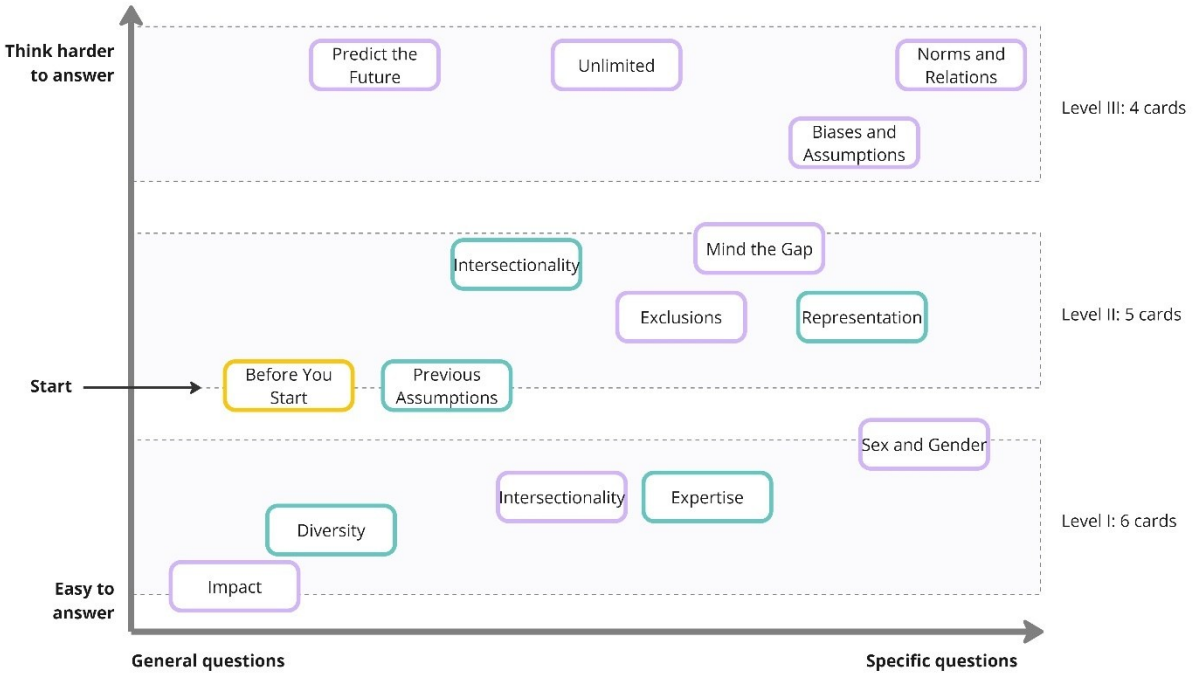

Figure 11. Difficulty Map Low-fidelity Prototype.

The placement of the cards on the map was determined through a combination of individual card analysis and observations from the workshops, although participants were not explicitly asked to categorize them. To further refine this classification, additional feedback was gathered from collaborators with research experience.

This analysis led to the identification of three difficulty levels, as marked in Figure 11. While not all cards fit neatly into a single category, they were grouped in a way that ensured a broader selection of cards at the first level and progressively fewer options in the subsequent levels. This decision was based on workshop observations indicating that participants may go through two to five cards in a session (including the starting card), reducing the likelihood of selecting a level three card during a session if this path is followed.

Another important observation is the placement of the starting card, falling in level two according to the map. To understand better how the starting point and the lack of guiding elements affected the experience of use, the path followed by participants during workshops was overlaid onto the difficulty map, resulting in a journey map (see Figure 12).

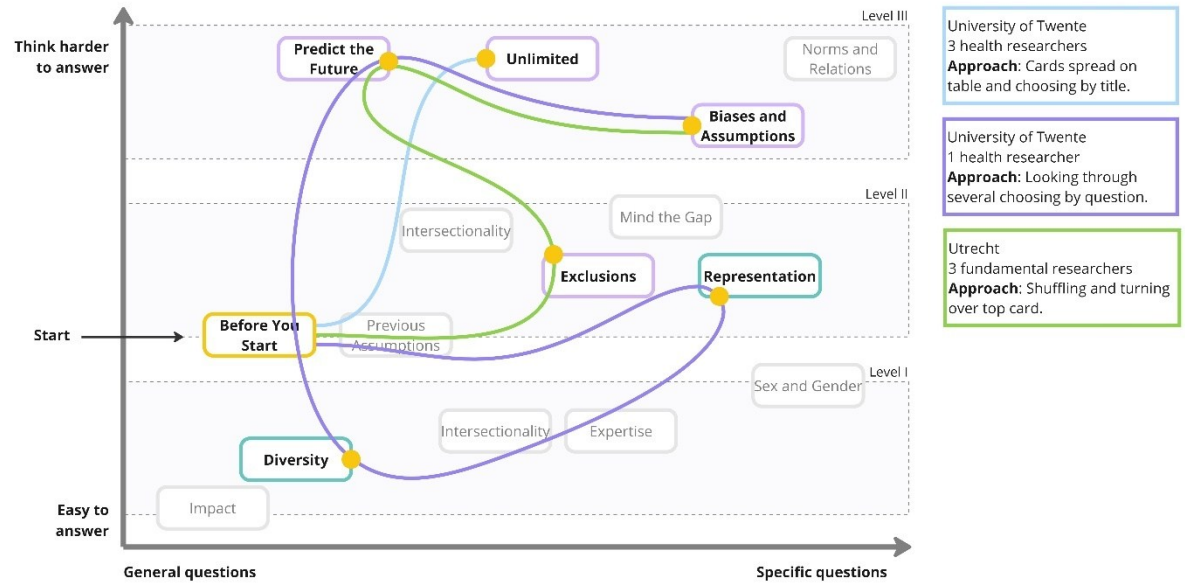

Figure 12. Journey Map Low-fidelity Prototype

In the journey map, only the cards selected during workshops are highlighted. While some cards were not used during the testing phase, all were included in the open discussion segment. The journey map illustrates the sequence in which cards were selected and their relative difficulty levels. Each arrow represents a different workshop, and additional information relating to the setting and activities are provided next to the map.

Regardless of the selection method, most of the chosen cards fell into levels two and three, with only one level one card being selected. To create a more gradual progression in difficulty and depth of conversation, it was decided to make the difficulty levels more evident, lower the difficulty of the starting point, and provide a clear finish point.

Adjusting Content

The content of the cards presented in the first prototype underwent another cycle of analysis and adjustment, mainly involving rephrasing questions and titles. A more significant change was made to the starting card. Observations from the workshops revealed that the original starting card prompted an in-depth discussion on defining sex and gender and their impact on research. While this extensive discussion was valuable, it meant that after an initial discussion lasting around five minutes, participants had not started to explore the deck yet. This was not necessarily an issue in longer sessions, but for participants with limited time, it was important to encourage exploration beyond the starting card.

To maintain the depth of discussion prompted by the original questions, they were integrated to the deck as an individual card. Additionally, the questions were expanded to provide more guidance towards the desired path of discussion. Figure 13 presents a comparison between the original and revised version of the card, highlighting the changes made.

Figure 13. Adjustment of Before You Start card into Understanding Terms card.

This change allowed the starting card to take on a different role. The revised starting card was adapted to prompt a brief discussion to define sex and gender, lowering the difficulty of the initial questions. Additionally, guidance and rules on how to use the deck were incorporated to support independent use. For the finish card, questions were added to serve as a closing activity, prompting participants to reflect on the topics covered during the session.

The start and finish cards were designed as a single, double-sided card (see Figure 14). It is slightly taller than the rest of the deck, ensuring that it remains visible and easy to locate regardless of its placement. By combining the start and finish information on one card, participants have convenient access to the key information needed to begin and conclude the session, while keeping the tool as compact as possible. This card also displays the visual elements that categorize the remaining cards by level and theme, giving participants an overview of their options. In doing so, they can select cards based on the type of conversation they wish to trigger. The card's content was intentionally limited to prevent information overload and promote collaborative sense-making.

Figure 14. Start and Finish card of the high-fidelity prototype.

Adding Guidance to Individual Cards

Various options were explored to integrate guiding elements into individual cards. The primary goal was to ensure that participants could pick a random card and be able understand what to do next, regardless of their familiarity with the card deck. Additionally, these elements would also provide options on how to proceed after discussing a card, guiding participants while also allowing them to make choices. Inspiration for this approach was drawn from decision-based games, including card decks and video games, which often use structured pathways to guide interaction and present a story (Dear Villagers, 2022; Kubodera, 2022).

Additional inspiration and ideas were gathered by attending Colliders events (Sickhouse, 2024). The featured talks, hands-on exploration of various games, and informal discussions with makers, artists, and enthusiasts provided valuable insights into game mechanics, engagement strategies, and interactive design elements that informed the tool's development. Later in the process, an earlier version of the high-fidelity prototype was shared with individuals with experience in game design, who provided feedback and helped brainstorm solutions.

To differentiate categories, colour coding was implemented (see Figure 15). The back of each card displayed the card's title and category, while the front maintained the original content with additional guiding elements at the bottom. These elements would encourage participants to continue exploring and provide structured options for progressing through the discussion. Several pathway options were considered, including linking cards by similar topics or by presenting similar questions from different perspectives (research project versus research team). To maintain a clean design, clarity, and balance between options, only three would be presented: two options to help participants navigate between levels of increasing complexity (*explore more* or *go deeper*), while the third provides a direct link to the *finish* card. Including this

final option in every card would ensure that participants remember that they can conclude the session at any time and to carry out the reflective activity before doing so.

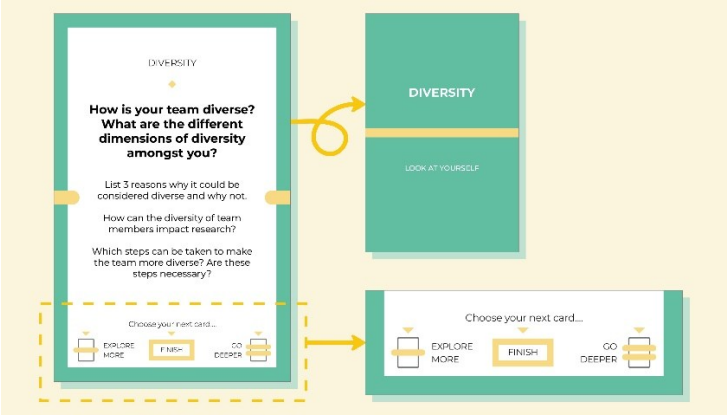

Figure 15. Example of a Topic Card of the high-fidelity prototype.

Reward Systems

In addition to guiding elements, different types of reward systems were analysed to explore how they could support engagement with the tool. Two types of rewards were considered: rewards of glory and rewards of access (Gazzard, 2011). Rewards of glory do not influence progression or provide advantages, but serve to provide progress feedback, peer recognition, and allow players to define their own goals. Rewards of access, on the other hand, unlock new areas or resources previously inaccessible, providing new content to explore and allowing players to progress through the game.

These reward systems were incorporated into the design to guide and motivate participants to explore while allowing them to create their own goals for the session. By following the designed pathway, participants begin with a level one card, which gradually grants access to level two and then level three cards. Gold lines on each card visually indicate its level, and as participants progress, they collect the cards they have discussed. By the end of the session, this collection serves as a tangible record of their discussion journey. While the golden lines could be interpreted as a scoring mechanism to track group progress, this remains an implicit feature to keep the focus on the depth and quality of discussion rather than the number of cards or points collected.

High-Fidelity Prototype

The final design of the high-fidelity prototype was printed in colour, each card presenting the content on one side and the back cover. The category, level and title can be seen on both sides, providing participants options in how they wish to interact with the tool. Additional cards were added during the development of the second prototype and some questions were adjusted. In total the high-fidelity prototype contains 18 cards, counting the start and finish. An overview of the topics, levels, and their relatedness to sex and gender topics can be seen in Figure 16, and the complete high-fidelity prototype can be found in Appendix B.

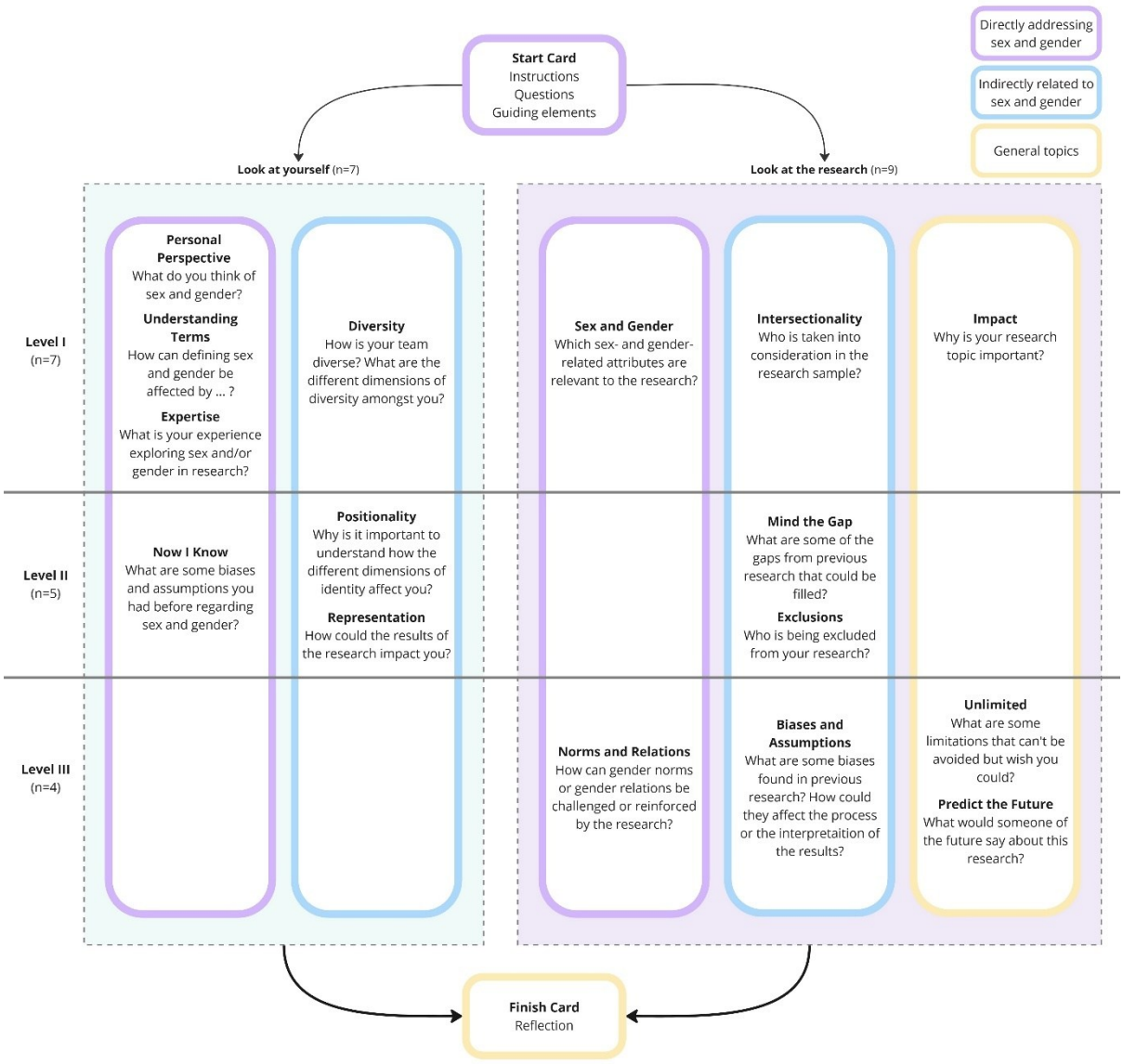

Figure 16. Overview of Topic Cards divided by category, level and content relatedness to sex and gender topics.

4.3.2 Prototype Testing

A similar testing approach was used for the second prototyping cycle, with workshops structured around testing the card deck, followed by an open discussion to share opinions and collaboratively brainstorm potential improvements.

Focus

The workshops focused on participants' experiences and group dynamics when using the deck to guide discussions. Through observations and discussions, the effectiveness of the cards' guidance and influence on conversation flow were evaluated. Data collection included written notes and audio recordings, which were later reviewed to expand on and refine the initial observations made during the sessions.

Workshops

The workshops were conducted in a closed setting, with sessions lasting between 45 minutes to an hour, depending on participant availability. Unlike previous workshops, no facilitator was appointed to support

participants during testing, creating a setting that more closely reflected real-world use. After a brief introduction, the design researcher stepped back, allowing participants to engage with the deck independently.

The card deck was placed on a table, where all instructions and guidance were provided by the tool itself. Participants collaboratively made sense of the tool and defined their own approach of using it. Observations focused on the time spent per card, topics discussed, discussion depth, card selection methods, and participant interactions with both the tool and each other. Special attention was placed on the effectiveness of guiding and visual elements in shaping the experience.

After discussing two to four cards, the testing phase concluded, and participants were invited to share their experiences, provide feedback on the card deck and its content, suggest improvements, and discuss potential applications of the tool in their own contexts.

A total of three workshops were conducted:

University of Twente (Enschede)	2 health researchers 28 minutes – 3 Topic cards
	2 industrial design master students, and 1 health researcher 27 minutes – 3 Topic cards
Ink Social Studio (Amsterdam)	3 social designers 27 minutes – 2 Topic cards

4.3.3 From Observations to Insights

Overall, the tool was well received, and the added guiding elements effectively improved the experience. The evaluation of the second prototype began by mapping the difficulty levels and participant journey, allowing for a direct comparison with the first prototype and evaluation of the improvements to the participant experience. Afterwards, opportunity areas for a future iteration were identified.

Comparing Participant Experiences

Figure 17 presents the difficulty map for the high-fidelity prototype. Since most card content remained unchanged, the overall difficulty distribution remained similar to the first prototype. Furthermore, participant feedback showed that the division of difficulty levels was useful and accurate.

Four cards underwent the most significant changes: *Personal Perspective*, *Understanding Terms*, and the *Start* and *Finish* cards. The *Personal Perspective* card was placed as a level one card, the topic of this card was not covered in the low-fidelity prototype.

The *Understanding Terms* card is an expanded version of the original start card. While its difficulty aligns more closely with level two cards, it was intentionally placed in level one, as the discussion it generates can help establish a foundational understanding of sex and gender for the rest of the session, making it a strong starting option.

The *Start* and *Finish* cards were combined into two sides of a single physical card but were considered separately in the difficulty mapping. Both present specific activities with a completion time comparable to that of the Topic cards. The relative difficulty of both cards was classified as level one, as they offer simple

activities to ease participants into and out of the session, but were placed outside the map to facilitate journey mapping.

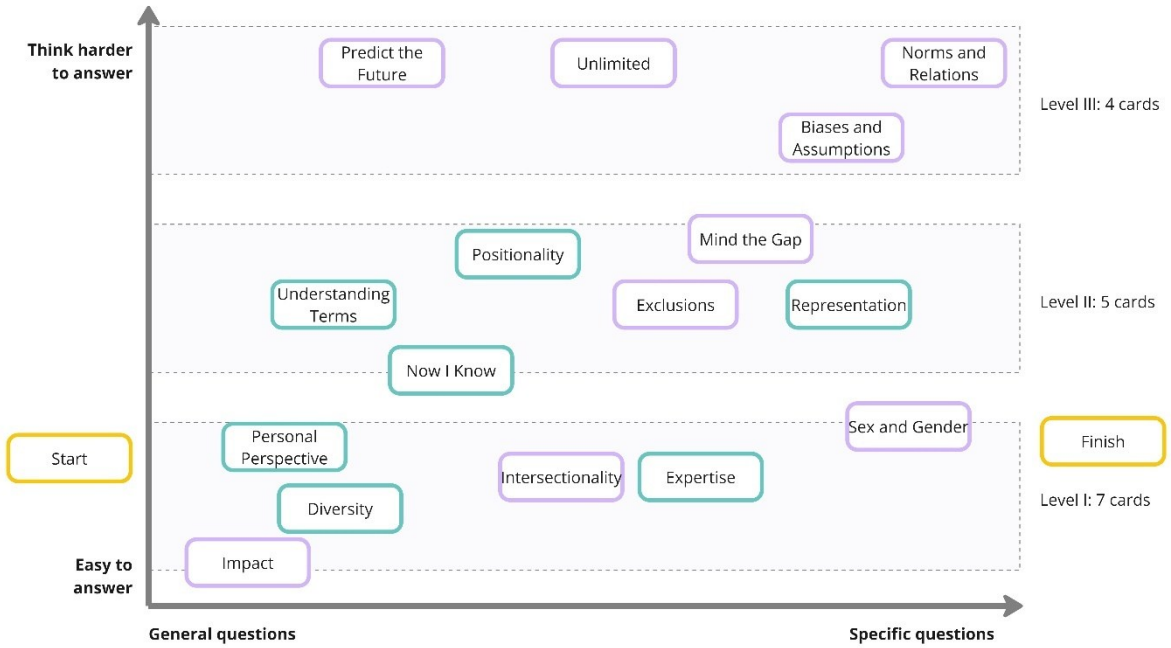

Figure 17. Difficulty Map High-fidelity Prototype.

Figure 18 presents the participants' journey overlaid onto the difficulty map, highlighting only the cards that were selected and discussed during the testing phase of the workshops. All cards were considered during the open discussion. Additionally, instructions on the finish card encourage participants to briefly explore the cards that were not discussed to identify any they would have liked to discuss.

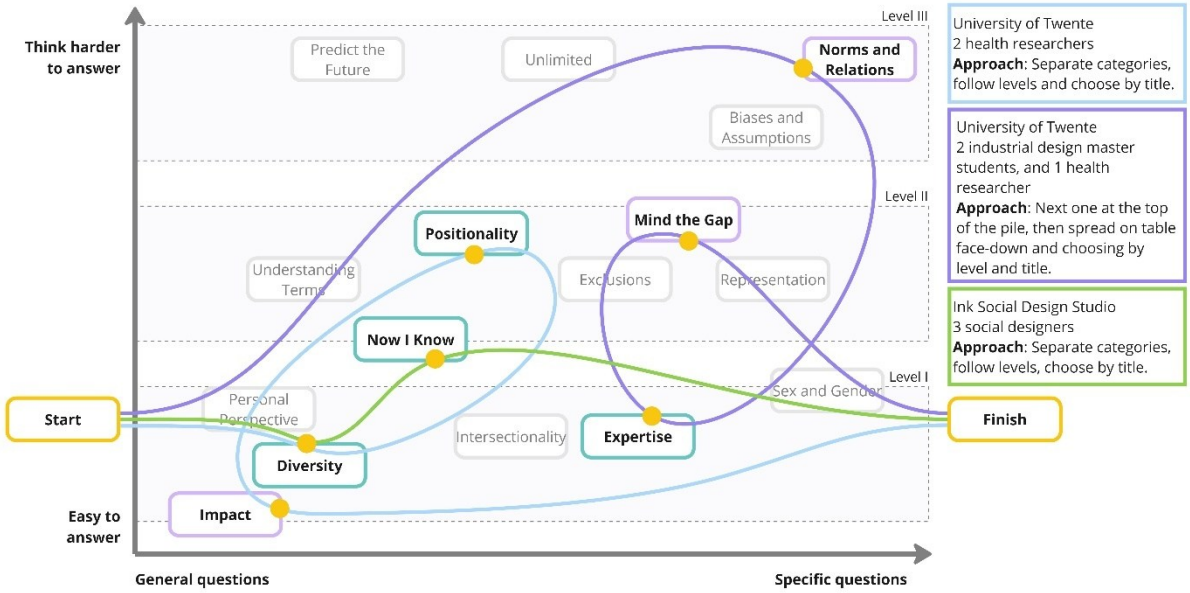

Figure 18. Journey Map High-fidelity Prototype.

In the journey map it can be seen how, in one testing session, the guiding elements did not successfully prompt participants to start with a level one card. This was not an intentional choice, as participants realized

it afterwards and then adjusted their selection process accordingly. In contrast, the guiding elements allowed the other two groups to make choices based on the levels and categories. One of these groups deliberately chose to discard the questions related to the research project to focus instead on those directed at the research team.

The changes made to the *Start* card effectively lowered its difficulty, and on average, participants spent less time on this card. Discussions around this card mainly involved participants collaboratively interpreting the information, agreeing on how to use it, and deciding how to proceed. While the visual elements representing categories and levels were included on the card, they were not explained in detail. Regardless of this, all groups correctly inferred their meaning, although some participants noted the lack of explicit information.

However, issues emerged during the transition to the next card. Although all groups read and appeared to understand the instructions, two groups skipped answering the initial questions and instead focused on exploring the categories and levels of other cards. Meanwhile, the group that did answer the initial questions ended up selecting their next card simply by picking the one on top of the pile, overlooking the level distinctions. These two situations suggest that the start card requires improvements in content hierarchy to better guide participants through each step. Alternatively, separating the instructions into distinct cards could help ensure that each step is completed before moving forward.

During the workshops, the design researcher prompted participants to use the *Finish* card to conclude the test. While some participants identified and even read the *Finish* card early on, it was not fully tested whether the guiding elements on the cards would naturally lead participants to it or if they would remember to complete the concluding activity on their own. It was identified that the *Finish* card could present similar transition issues as the *Start* card, if the guiding elements on the *Topic* cards failed to prompt participants to use it.

For all three groups, the reflective questions effectively encouraged participants to recall their journey and sparked brief discussions on their findings. Additionally, the prompt to review the cards that were not selected appeared to trigger curiosity, as participants collaboratively browsed through them and shared quick comments on those they found interesting.

Improvements and Observations

The following list highlights improvements observed in the second prototype, based on participant discussions and workshop observations:

Start Card	On average, participants took four minutes to read, understand, and discuss the *Start* card. While not all of its intended goals were completed, the reduced time allowed participants to explore more topics in one session.
Topic Cards	The average discussion time per cards slightly lowered to six minutes. This change was observed to arise from participants' curiosity to progress through the levels and explore more cards. The addition of continuation prompts at the bottom of each card seemed to effectively remind participants to move forward after discussing the questions, reducing the uncertainty observed in the previous prototype that sometimes led to overly extended discussions.
Finish Card	Participants spent on average five minutes discussing the *Finish* card. While most of the reflective questions sparked interesting discussions from participants, a few could be refined or removed. Overall, the *Finish* card successfully guided participants in summarizing their session and insights, providing a clear and structured endpoint.

Difficulty Levels	Participants agreed that following the suggested levels provided a better experience, allowing for a gradual increase in conversation difficulty and depth. They also found the individual cards appropriately placed within their respective difficulty levels.
Card Deck Goal	Although most participants understood the flexibility in choosing to progress through levels or explore additional cards at the same level, some perceived level three to mark the goal or represent the key topics of the deck. While this did not substantially affect testing outcomes, this issue could be avoided by further clarifying goals of the card deck on the *Start* card.
Use Cases	Participants mainly envisioned the deck being used for team building activities, workshops, or as a tool to facilitate team meetings. It was also identified that the tool would likely be used by individuals familiar with the topic, and through them it could reach individuals that are just starting to consider it themselves. There was also interest in its potential for classroom settings, although the expansion of the target audience to teachers and students would probably require further adaptation of the content.

Opportunity Areas

While many design features of the card deck were successfully implemented, observations from the workshops revealed areas for further improvement. The following areas were identified as important focus points for a future iteration:

Content hierarchy in start card needs to be clearer or to be divided into separate sections, directing participants to search for a specific card to start.
Initial instructions should provide participants with clearer information on how to determine the session length, based on the number of cards or with a timer. Additionally, they should highlight that only a few cards are discussed per session.
Instructions should emphasize group discussion. While most of the time participants collaboratively answered questions, considering different perspectives and related topics, some were unsure whether they were meant to answer questions individually or take turns.
Some cards need further adjustments to how questions are framed. Additional workshops dedicated to collaboratively reviewing and refining the questions would be ideal, as not all cards were directly tested.
Core concepts need to be more emphasized. The *Understanding Terms* card is designed to deepen participants' knowledge of sex and gender. However, since it is presented at the same level as other cards, its selection is not guaranteed. Other foundational concepts, such as intersectionality and positionality, could also benefit from having dedicated cards to help participants explore and understand them more thoroughly.

4.4 Digital Prototype

To further involve the core team beyond providing feedback on the workshop results, the high-fidelity prototype was adapted into a digital format. Since meetings with the core team had to be remote, presenting and discussing a physical tool posed challenges. The digital prototype allowed the team to interact with the tool and gather additional feedback on its design and usability. While the low-fidelity prototype had been shared previously, the core team had not yet seen the alterations made during the second prototyping cycle.

The digital version was designed to closely resemble the physical card deck, preserving its structure and content while maintaining as much interactivity and freedom of exploration as possible. Developed as an interactive PDF, the digital prototype enables users to explore the deck by clicking on buttons that mimic the choices available in the physical tool. Although time constraints limited the level of interactivity that could be implemented, this approach successfully retained the playful and flexible interaction presented in the physical tool, allowing participants to choose the types of conversations they wished to have.

How it works

The digital prototype followed the structure of the physical deck, beginning with instructions, initial questions, and an introduction to the different card types. Unlike the physical version, the digital format restricted free exploration, as a set path had to be determined to some extent. However, this also provided greater design flexibility in how the *Start* and *Finish* cards were presented. The content was divided into sections, revealing limited information at a time, which helped address the content hierarchy challenges faced by the physical deck.

The Topic cards were grouped into their respective levels and displayed face-down, simulating how they would appear on a table. Participants could click on a card to flip it over and view its content. The options at the bottom of each card were transformed into clickable buttons, allowing users to navigate between different sections of the deck.

To conclude the session, participants could click on the *Finish* button, which guided them to the concluding questions. While these questions encouraged participants to reflect on the discussions they had, the interactive PDF lacked the overview that the physical tool provided. Participants could scroll back through the document to revisit previous cards, but this approach could cause frustration and disrupt the natural flow of conversation.

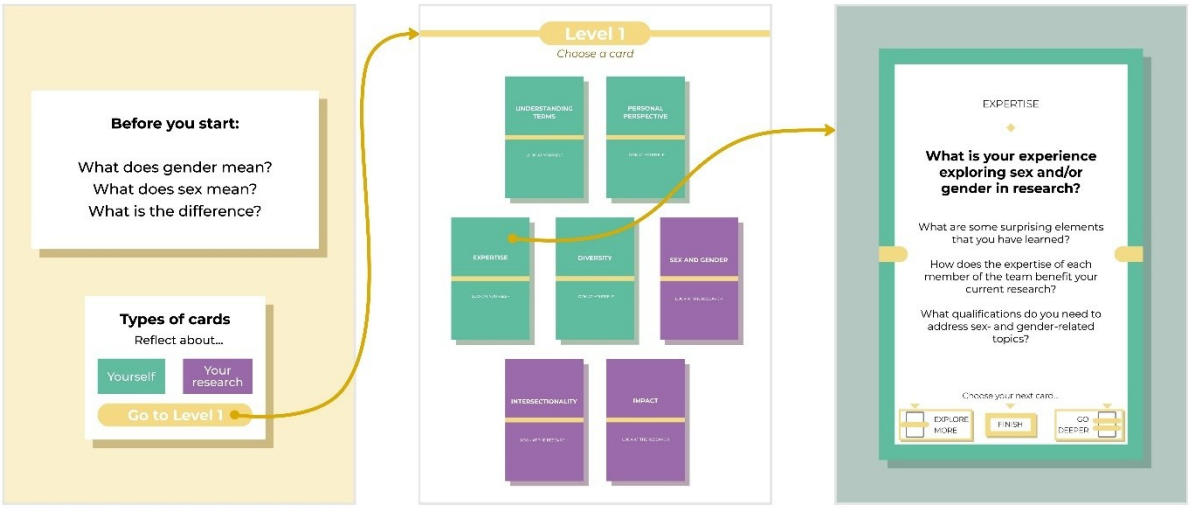

Figure 19. Preview of navigation in digital prototype.

Online Test

Similar to the previous workshops, the meeting began with a testing session, followed by an open discussion to gather feedback on the card deck and review the project's progress.

The meeting was conducted via *Microsoft Teams*, with one participant designated to download the file and share their screen. Once the tool was set up, the design researcher stepped back, allowing participants to collaboratively explore the deck and engage in discussion without external guidance.

Observations focused on the time spent per card, topics discussed, discussion depth, card selection methods, and participant interactions with both the tool and each other. Special attention was placed on the effectiveness of guiding and visual elements in shaping the experience.

Effect of the Digital Adaptation

Adapting the tool into a digital format provided opportunities to overcome certain limitations of the physical version, but it also introduced new constraints. Presential discussions paired with tangible external representations provide benefits which can improve interaction in ways that a digital tool cannot fully replicate.

One of the most significant differences in the participant experience was the limited freedom of interaction with the tool. While the digital format ensured that participants followed the designed structure, as shown in the journey map in Figure 20, it removed the ability to physically arrange and manipulate the cards collaboratively. Although all participants could see the tool, only one person could interact with it directly, reducing the hands-on engagement and flexibility in how the tool could be used compared to the physical version.

The online meeting setting further influenced the experience. The limited text and small size of the physical cards afforded participants to read aloud, pass them around, and engage in collaborative sense-making. As discussions unfolded, the cards became secondary, with participants naturally shifting their attention to the speaker. In contrast, the digital tool would cover most of the screen leading to participants to read individually before discussing the content. Additionally, during screen sharing, participant windows became small and secondary, keeping the focus on the displayed questions rather than the speaker. This shift in

focus, combined with typical challenges of online meetings, such as response lag, accidental interruptions, and variable sound and video quality, affected the flow of conversation and ease of collaboration.

Despite these limitations, the digital prototype proved to be a valuable addition to the physical tool, enabling collaboration among health researchers located in different countries. Many core aspects of the physical card deck were successfully adapted into the digital format, and more importantly, the discussions sparked by the Topic cards were engaging and meaningful for participants.

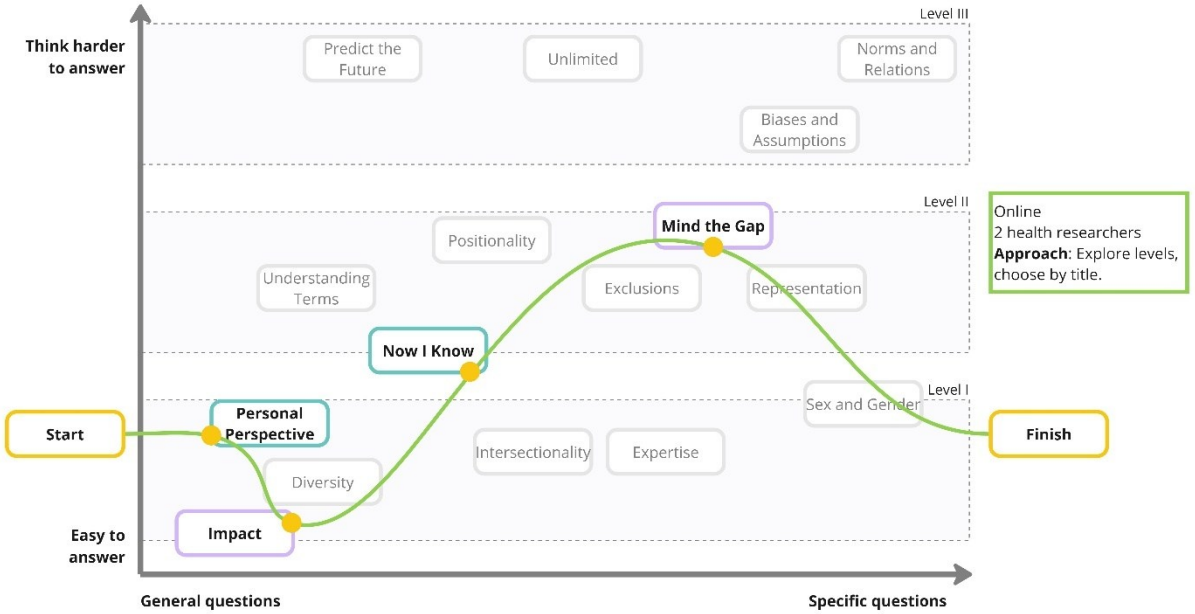

Figure 20. Journey Map Digital Prototype.

5 Delivering the Communication Tool

The Deliver stage focused on finalizing the project's outcomes and reflecting on the design research process. The chapter begins with an overview of the design outcomes, describing the physical card deck, digital prototype, and webpage created to support accessibility and distribution. Section 5.2 examines the extent of collaborator involvement, reflecting on their impact, contributions, and the limitations faced during the research project. Section 5.3 explores the responses to the tool in different contexts, analysing how various groups engaged with it and discussing the efforts made to distribute it more widely. Section 5.4 outlines future work, identifying opportunities for further development and adaptation. Finally, Section 5.5 presents the conclusion, summarizing the project's impact and potential long-term influence.

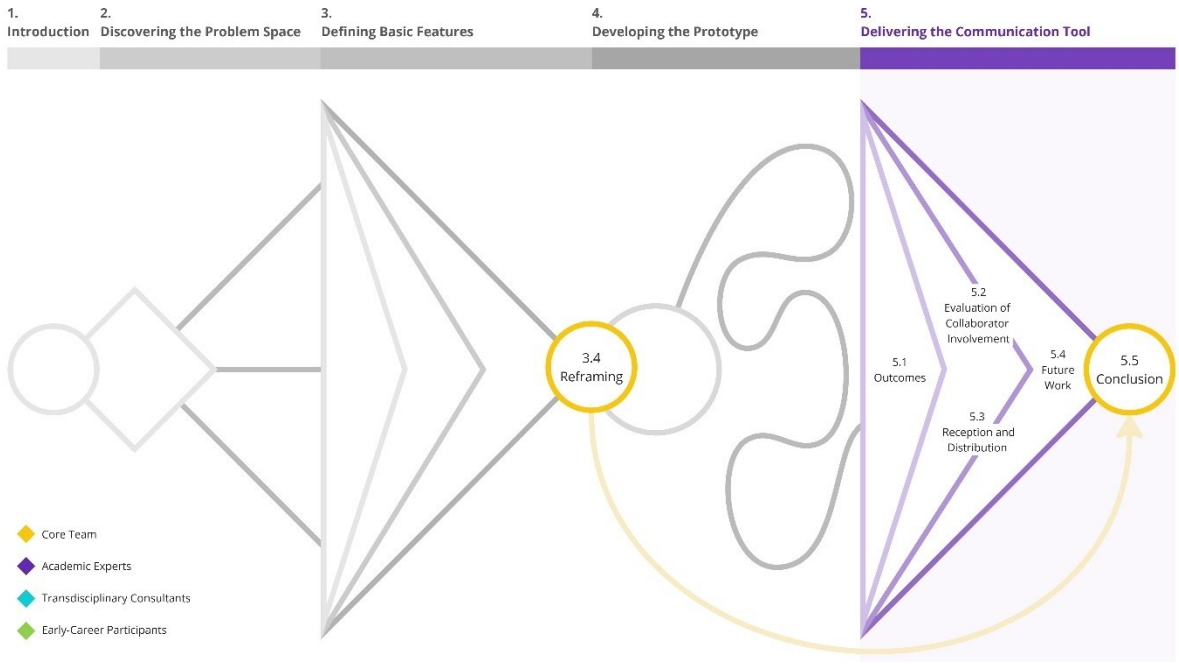

Figure 21. Overview of Deliver stage.

5.1 Outcomes

The project resulted in three main deliverables: the physical card deck, a digital prototype, and a webpage for distribution. The physical card deck can be printed, while the digital version provides an alternative format that can be used in online meetings. The webpage was developed to provide all the files and additional information in one place. These outcomes are a reflection of one the core concepts of the project: to develop a highly accessible tool, ready to be distributed to an international audience.

5.1.1 Physical Card Deck

The final version of the tool consists of 17 physical cards, one of which contains the starting and finishing activities, while the rest are Topic cards divided into the categories of *Look at Yourself* and *Look at the Research*. Each Topic card features golden lines representing its relative level. While it is meant to guide participants to select their first card from level one, the tool is meant to be flexible to adapt to group needs and interests, and allow them to create their own goals for the session.

The tool's context of use diverted from the initial idea of using it in casual and informal settings, to instead be used intentionally in team meetings and workshops. The tool can be used as a refresher activity for more experienced researchers, and to create awareness, promote the acquisition of new knowledge, and help identify biases and assumptions for researchers less experienced in sex and gender topics. For interdisciplinary teams this tool can help create a shared understanding of sex and gender considerations and serve as a reflective activity during the research design phase.

The content of the Topic cards fell into four main areas: sex and gender, diversity, biases and assumptions, and general research (see Figure 22). All cards present open questions, with sub-questions to guide the conversation into specific directions. This format allowed for the ensuing conversation to naturally drift into different topics using the questions as a starting point. This meant that according to participants input, they may relate their answers to other areas even if the questions do not directly address it.

For the final design of the physical card deck, some insights from the second prototyping cycle were implemented. However, due to time constraints, only small adjustments were made, primarily to improve content in the *Start* and *Finish* card, and refine some of the guiding elements.

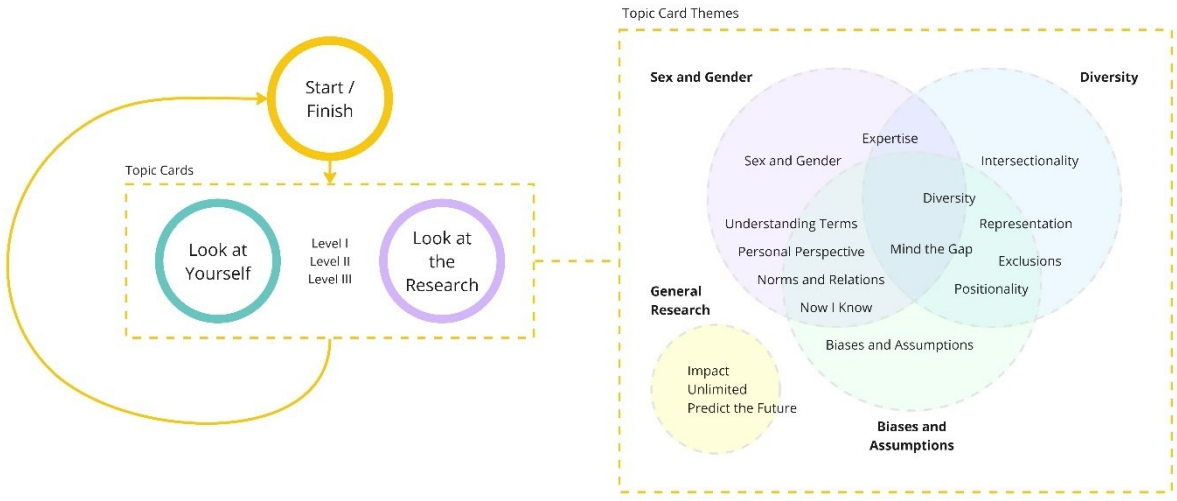

Figure 22. Overview of topics addressed by the tool.

5.1.2 Digital Prototype

The digital prototype was developed to extend the functionality of the physical card deck, enabling remote collaboration. Designed as an interactive PDF, it provided a level of exploration and flexibility similar to the physical version.

Following the same structure, the topic cards were grouped by levels and displayed face-down, offering an overview of the available options. Participants could click on a card to flip it over and view its content. After discussing the questions, the options at the bottom of each card connected participants between the different sections of the deck.

Although a digital prototype was not part of the initial plan, its development represented an important step to improve versatility and accessibility. The adaptation into a digital format expanded the context of use to online meetings, which can be particularly beneficial for remote teams and international collaboration. Additionally, it lowered acquisition barriers, allowing individuals to explore and test the tool when printing or acquiring the physical deck is not possible.

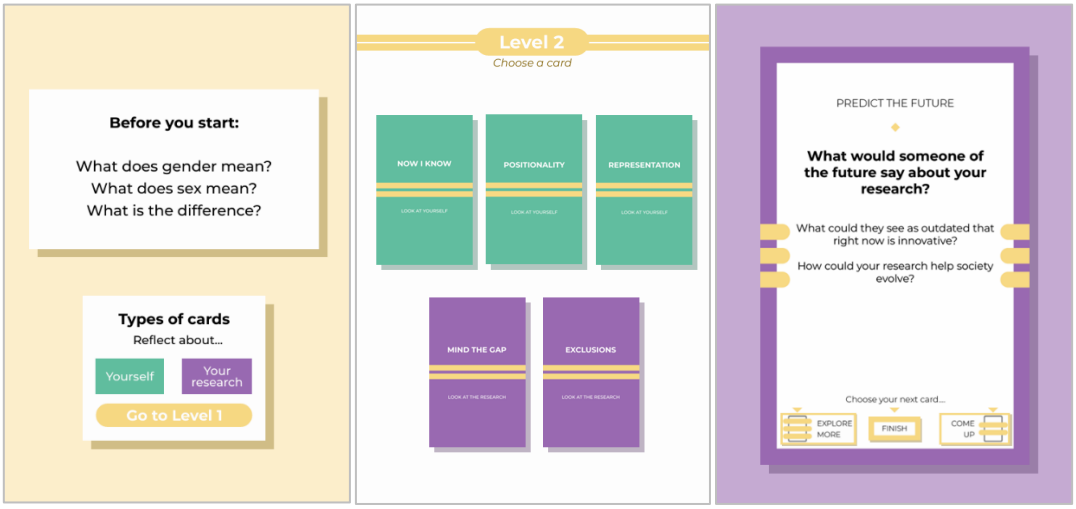

Figure 23. Digital prototype.

5.1.3 Webpage

A webpage was created to serve as a centralized, easily accessible space where information and materials from the research project could be found. It provides access to both a printable version of the card deck and the digital prototype, ensuring that the tool is widely available.

The main objective of the webpage is to enable interested parties to acquire and share the card deck freely. Alongside the downloadable files, the webpage includes information on the tool and the research project. The printable version was specifically designed for self-printing, with instructions and recommended settings to ensure quality.

5.2 Evaluation of Collaborator Involvement

Collaboration played a key role in shaping the research process and development of the tool. Various groups contributed by providing feedback, asking critical questions, testing the tool, and participating in brainstorming sessions, all of which significantly influenced the final design of the tool.

The **core team** provided guidance at critical moments, sharing their expertise as health researchers and offering insights into the research funding process. Their involvement brought perspectives from different universities and countries, while also facilitating valuable professional connections.

Academic experts expanded the range of perspectives considered, offering their time and experience mainly through interviews and workshops. Their observations and discussions led to important design adjustments, refining both the content and structure of the tool.

Interdisciplinary consultants introduced insights from outside academic fields, particularly in design and game development. Ink Social Design Studio contributed its expertise in developing conversation card decks and target group involvement, while additional input from game developers at Colliders' events enriched the interactive and guiding aspects of the tool.

Early-career participants played a crucial role in testing and providing feedback on the existing card decks. They brought a fresh perspective distinct from that of senior academic experts, helping to identify usability issues and refine the prototype development process through brainstorming sessions.

Limitations

Despite these valuable contributions, some limitations affected the extent of the collaboration. Although collaborators had diverse backgrounds and areas of expertise, the majority were from the University of Twente. Out of the eight workshops conducted to test the prototype, only three included participants from outside the university, which restricted the range of perspectives incorporated into the evaluation.

Another limitation was the absence of participants actively working on shared research projects at the time of testing. While some participants were familiar with each other's work or were part of the same department, others met for the first time during the sessions. This dynamic provided interesting insights into how the tool could facilitate discussions among new teams, but it did not allow for testing in scenarios where the tool would be used by pre-existing research teams. Evaluating the tool in settings such as grant application preparation, ongoing research projects, or multidisciplinary collaborations could have provided a more comprehensive assessment of its effectiveness.

Additionally, low response rates to workshop invitations posed a challenge. Although invitations were sent out widely with the help of collaborators, the number of responses remained limited. As a result, the sessions had to be optimized to cover multiple topics efficiently, making the most of participants' availability. To address this, invitations to workshops, focus groups, and meetings were sent well in advance with multiple scheduling options. Additionally, the range of participants was expanded, incorporating both university students and experienced researchers in different types of activities to gather diverse perspectives.

Another difficulty was the balancing of multiple roles by the design researcher, which made it challenging to effectively engage collaborators while also managing the various aspects of the project. Encouraging participation and gathering the necessary input required experimenting with different approaches to find the most effective ways to engage different collaborator groups.

Despite these challenges, efforts were made to involve academic experts and the core team as much as possible throughout the different stages of development. Their contributions helped shape the development of the communication tool, ensuring that its design and content considered the needs and lived experiences of the target audience.

5.3 Reception and Distribution

Feedback on the tool was largely positive, particularly regarding the relevance of the questions in helping research teams to address sex and gender considerations in their research projects. Testing with different groups also provided insights into the tool's applicability beyond its original target audience.

In the workshop with researchers from fundamental research backgrounds, participants found the content relevant and adaptable to their fields. However, they did not see it as a tool they would actively use in team meetings. In contrast, the workshop with non-researchers showed that while the questions sparked engaging discussions, they were often challenging to answer. Feedback from workshops with health researchers was consistently positive, with many participants expressing interest in acquiring the deck once finalized and sharing it with colleagues. These findings highlighted that, while the tool could be valuable beyond health research, further adaptations would be necessary to make it fully effective in other fields.

An opportunity to showcase the tool arose at the 2024 TechMed Event, an annual gathering focused on medical technology innovations. As part of the TechMed Innovation Trail, a stand was set up to present both the physical card deck and the digital prototype. The event attracted a diverse audience, including experts, healthcare professionals, policymakers, entrepreneurs, researchers, and students.

During the event, attendees were invited to explore the tool and learn about the project. Many expressed interest in using the deck for educational purposes and within corporate teams, suggesting potential applications beyond research settings. While further adaptations would be required for these contexts, the interest in the tool was evident. Several attendees signed up to receive the webpage link where the tool would be accessible.

Beyond using the webpage to share the project, distribution was further expanded through ZonMw, who funded this research. They facilitated the distribution of additional copies to their network of health researchers, increasing the tool's reach and accessibility.

5.4 Future Work

Throughout the prototype development process, several opportunities for further improvements and adaptations were identified. However, many of these could not be explored within this research project, and only small adjustments were implemented based on feedback from the final prototype testing. The following areas were identified as important focus points for future development of the tool.

Adaptations for Specific Target Groups

While the tool was designed for health researchers, its structure and content could be adapted for other audiences. The tool was effectively tested with groups with backgrounds outside of health research, but the content needs to be adapted to the specific groups. Future iterations could explore expanding the tool to other research fields, as well as for other types of projects in university and professional contexts to facilitate discussions on diversity and inclusion in collaborative projects.

Exploring Alternative Structures for the Start Card

The *Start* card plays a crucial role in guiding participants, but its structure could be refined to improve navigation and engagement. One possibility is dividing its content into multiple smaller cards, limiting the amount of information presented at once. A main card could then direct participants to the appropriate starting point, ensuring a structured progression through the tool.

Another approach is to reimagine the *Start* card as a board, helping participants organize and track their discussion flow. By arranging the cards in a specific order, users could ensure that discussed topics are collected systematically while keeping the *Finish* card visible throughout the session. Further ideation and testing could help determine the most effective way to structure the *Start* card to improve the overall user experience and ensure the information provided is clear.

Distinct Category for Foundational Concepts

The *Understanding Terms* card features guiding questions that help participants define sex and gender. While the questions are intentionally open-ended, they encourage a broader reflection on these concepts. A similar approach could be applied to other key terms used throughout the deck.

To improve accessibility to foundational concepts, these cards could be placed in a separate category that complements the Topic cards. For example, if participants struggle to answer a question or are unsure about a specific term, the Topic card could direct them to a related Concept card for further clarification.

Observations during workshops suggested that intersectionality could also benefit from having its own dedicated card. Further collaboration with health researchers could help identify additional foundational concepts to include in future iterations.

Content refinement

During the tool's development feedback was gathered on the content but not all cards were reviewed or evaluated in depth. Future collaborative sessions with health researchers could ensure that all questions are clearly phrased and appropriately structured.

One approach to refining the content would be to hold content evaluation workshops, where participants collaboratively assess the phrasing and hierarchy of questions, refining their clarity and relevance. Additionally, focused testing sessions could be conducted, where discussion would be prompted by a pre-determined selection of cards. This would allow for direct evaluation of how well individual cards prompt meaningful conversations, and ensure all cards are directly tested.

Continue Development of the Digital Prototype

Due to time constraints, the digital prototype received limited development and was only tested once. Further exploration is needed to refine its format, interactivity, and navigation. Future improvements could focus on enhancing interactive features, refining navigation flow, and incorporating a bookmarking system that allows users to track discussed cards and review them at the end of a session.

5.5 Conclusion

Incorporating a broader understanding of sex and gender in health research is critical, as exclusions can lead to missed opportunities and harmful consequences. Addressing this problem requires increased knowledge and attention of sex and gender considerations across all stages of research. Efforts are already underway, with funding bodies such as ZonMw and the Canadian Institutes of Health Research requiring applicants to explain how sex, gender, and diversity are reflected in their study designs and team compositions. However, for researchers new to this topic, meeting these criteria and effectively integrating them into research proposals can be challenging, and many may be unsure of where to start.

Recognizing this problem, a team of health researchers developed the initial proposal during the 2023 Erasmus Summer Programme and later took on the role of expert advisors during the research project. The goal was to develop a communication tool in a card deck format to promote discussion, increase awareness and created a cross-discipline understand of sex and gender considerations among health researchers. Through an iterative design process and continuous collaboration with the target audience, the resulting card deck successfully prompted participants to reflect on sex and gender considerations in their projects, assess team composition, and uncover biases and assumptions.

In addition to the physical card deck, a digital adaptation was developed to ensure accessibility for remote teams. To facilitate wider distribution, both versions were made freely available through a dedicated webpage. While the tool is already highly functional, there are still many opportunities for further development. One of the tool's key strengths is its flexibility, although its content is tailored for health research, adjusting the phrasing of questions allows for adaptation to other academic and professional fields while maintaining its core structure.

Looking ahead, the hope is that this tool will continue to spark conversations and facilitate meaningful discussions among health researchers, encouraging them to actively reflect on sex and gender considerations at all stages of their research. By making it freely accessible and encouraging further adaptations, this project also aims to inspire others to develop similar tools. Ultimately, fostering these discussions and reflections has the potential to contribute to more inclusive and impactful health research.

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7 Appendix

Appendix A - Complete Table of Related Tools

Topic	Title	Author	Design Context	Purpose	Target Group	Approach	Elements	Use Context	Additional Materials
Sex and Gender Education + Project/ Research Development	Let's Talk about Gender: Anti-Bias Card Deck (ABC)	Sabrina Burtscher	Austria	To develop (gender) sensitivity in research and practice in HCI	Project teams and/or collaborators regardless of their level of knowledge, research, or project focus	Methods Prompts Concepts	15 Cards Thematic categories Links to resources	Individual or team Applied to a project	Research article - development and testing (Burtscher & Spiel, 2021) Paper - insights from workshops (Burtscher & Spiel, 2023) Website - digital deck and information (Burtscher, n.d.)
Sex and Gender Education + Sensitive Topics	The Gender Deck	Andrew Triska (2023), LCSW	United States	To guide conversations about gender identity, gender expression and relationships	Therapists, students and school staff, support groups, youth workers, family, friends...	Prompts Stories	100 cards Thematic categories Links to resources	Facilitator Two or more players Materials for activities (paper, pen)	---
Sex and Gender Education + Project/ Research Development	MethodKit for Gender Equality	Ola Möller (MethodKit) Sara Haraldsson (Maktsalongen) Sofia Brändström (Maktsalongen)	Sweden	To help discuss, map, plan, ideate, and prioritize	Organizations or companies	Prompts Components	51 cards	Facilitator Individual or group Apply to a project Materials (Pens, gameboards, post-its...) Space (table or wall)	Online resources - guides and worksheets (MethodKit, n.d.) Posts - reasoning, use and development (Möller, 2014)

Sex and Gender Education	Let's Talk Gender Diversity	Danish Industry	Denmark	To start engaging in conversations about gender diversity	General public (inferred)	Prompts Stories	31 cards Thematic categories	2-6 people	---
Sex and Gender Education + Sensitive Topics	Let's Talk! Youth SRHR Card Game	FairSpace Mesa Comunitaria Share-Net Colombia Yaga	Burundi, Colombia and the Netherlands	To encourage open and honest conversations about sexual reproductive health and rights	young people (ages 14-24)	Prompts Stories Concepts	73 cards Starting activity Thematic categories Spinning wheel	Facilitator 4-6 people Time (45m-1h)	Project information, digital deck, and facilitator's guide (FairSpace et al., 2023)
Sex and Gender Education + Sensitive Topics	Catcall	Tania Ananta Hidayat Keiko Okawa	Japan	To trigger conversations about sexism and gender stereotypes	General public (Young) adults (inferred)	Components Stories	370 cards Thematic categories	4-6 people Time (30m)	Paper - development and testing (Hidayat & Okawa, 2020)
Sex and Gender Education + Sensitive Topics	AbFabFlashes toolkit: Menomana	Ellen Vermeulen	Netherlands	To break the taboo on menopause	Executives, HR employees, coaches, for women between 45-60 years and general public	Prompts Components Concepts Stories Embodiment	120 cards Thematic categories Dice Links to materials	Facilitator 2-6 people Time (1-1.5h) Space (table) Materials (smartphone, paper, pen)	Website - toolkit information (Vermeulen, n.d.)
Sex and Gender Education	Komt een man/vrouw bij de dokter Once upon a time a man/ woman visited the GP	Ilona Plug Aranka Ballering	Netherlands	To learn about how gender and sex play a role in care pathways for men and women (inferred)	-	Concepts Stories	40 cards Thematic categories Links to sources	Two or more people	---
Project/ Research Development	The Tarot Cards of Tech	Artefact Design Firm	United States	To inspire conversations around the impact of technology and products	Companies, start-ups, and project teams	Prompts	12 cards	Individual or team Apply to a project	Webpage – information and digital deck (Artefact, n.d.)
Project/ Research Development	Crossing Cultural Chasms	Annemiek van Boeijen	Netherlands	To develop a culture-conscious approach to design	Designers developing products for users from cultures they are not familiar with	Methods Concepts Stories	48 cards Thematic categories Links to sources	Team Apply to a project	Doctoral thesis (van Boeijen, 2015) Webpage - digital card deck and

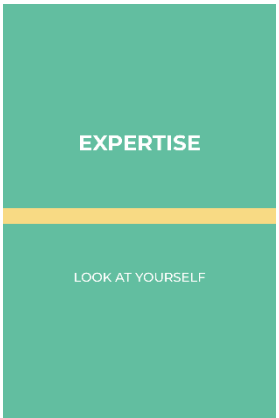
									information (van Boeijen, 2014)
Sensitive Topics	The Death Deck	Lori LoCicero Lisa Pahl, LCSW	United States	To spark discussions around the topic of death	General public (ages 13+)	Prompts Stories	112 cards	2-10 people Time (30-90m)	Website - information and sheet score (The Death Deck, n.d.)
Sensitive Topics	Open Kaart	Ink Social Desing Studio Garage2020	Netherlands	To improve self-esteem, build resilience, and develop empathy	Young people (ages 10+)	Prompts	60 cards Dice	3-8 people	Webpage – information (Ink, n.d.)
Project/ Research Development	NOVA - Norm Creative Innovation	Mariana Alves Silva Karin Ehrnberger Marcus Jahnke Åsa Wikberg Nilsson (Vinnova innovation agency)	Sweden	To support the development of innovative solutions for a more equal and gender-equal society	Project teams	Methods Prompts Stories Embodiment	54 cards Thematic categories	Method dependent	Website - information, digital deck, and support materials (Ivarsson, n.d.)

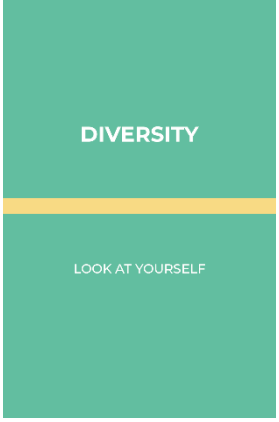
Appendix B – High-fidelity Prototype

Topic Cards

Front

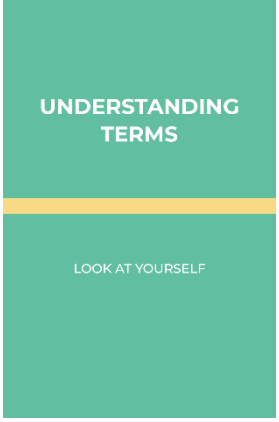
Back



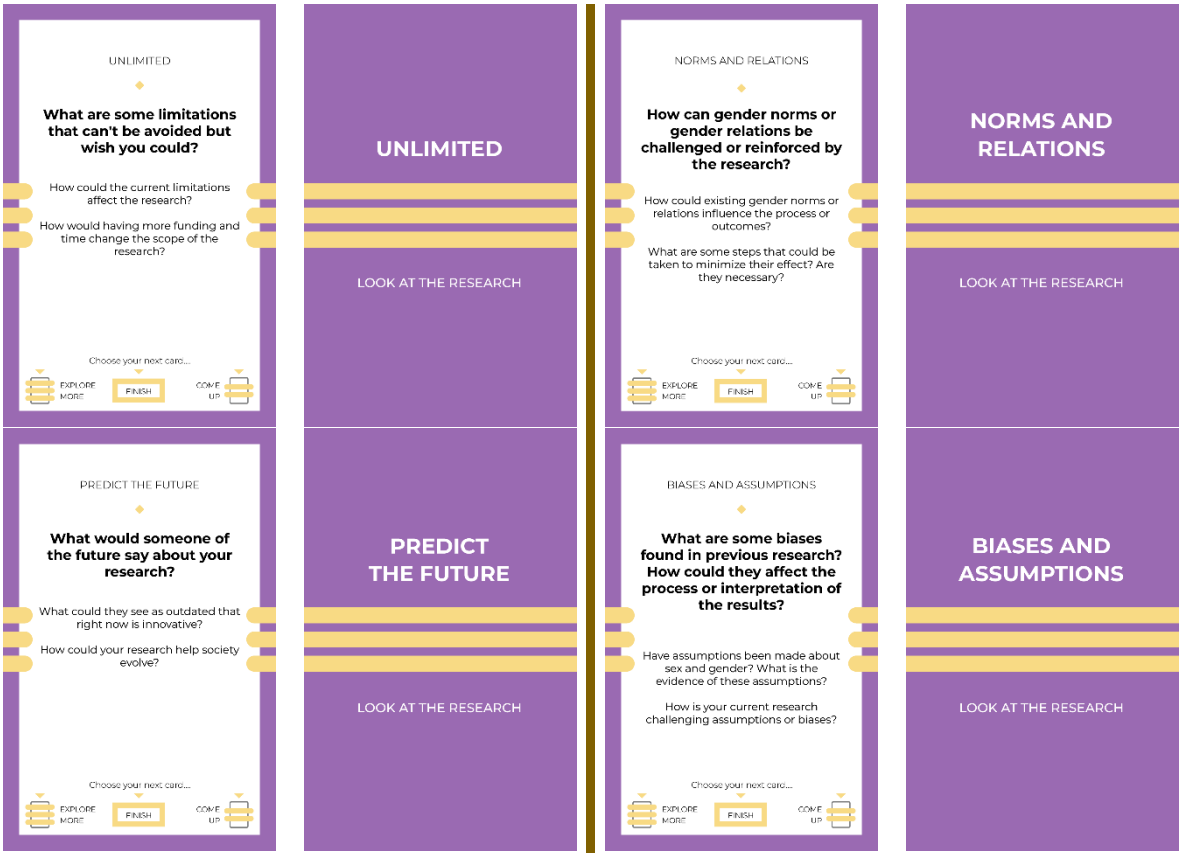


Front

Back




POSITIONALITY
Why is it important to understand how the different dimensions of identity affect you?
How can a researcher's positionality affect how research is carried or interpreted? Can you think of any examples?
Can a researcher study a topic without having any shared experience or dimensions of identity to the people it affects? Why?
Choose your next card...
EXPLORE MORE
FINISH
GO DEEPER
POSITIONALITY
LOOK AT YOURSELF
NOW I KNOW
What are some biases or assumptions you used to have regarding sex and gender?
Have you considered where these biases came from?
What can you do to recognize biases?
How can you make sure they do not influence your research process and the results' interpretation?
Choose your next card...
EXPLORE MORE
FINISH
GO DEEPER
NOW I KNOW
LOOK AT YOURSELF
IMPACT
Why is your research topic important?
Has this been researched before?
Who benefits from the research findings?
In which ways could the research have a negative impact?
Choose your next card...
EXPLORE MORE
FINISH
GO DEEPER
IMPACT
LOOK AT THE RESEARCH
REPRESENTATION
How could the results of the research impact you?
Think of groups of people that will be impacted by the research. Do they have shared experiences or dimensions of identity with you? How are their needs understood or considered?
What steps could be taken to improve representation of individuals impacted by the research? Who else should be involved?
Choose your next card...
EXPLORE MORE
FINISH
GO DEEPER
REPRESENTATION
LOOK AT YOURSELF
INTERSECTIONALITY
Who is taken into consideration in the research sample?
Which dimensions of identity are specially important to this research? Explain why the other dimensions are not as important.
How are participants being recruited? How are they being contacted? Are there other methods that could be considered?
Choose your next card...
EXPLORE MORE
FINISH
GO DEEPER
INTERSECTIONALITY
LOOK AT THE RESEARCH
SEX AND GENDER
Which sex- and gender-related attributes are relevant to the research?
Which attributes are left out?
How did you decide which attributes are relevant or not? Are these decisions based on relevant evidence?
Choose your next card...
EXPLORE MORE
FINISH
GO DEEPER
SEX AND GENDER
LOOK AT THE RESEARCH
EXCLUSIONS
Who is being excluded from your research?
Could the excluded groups of people be affected by the results?
Is the research including subjects that have been left out before?
Who is indirectly affected by the research or the results? Will they be taken into consideration?
Choose your next card...
EXPLORE MORE
FINISH
GO DEEPER
EXCLUSIONS
LOOK AT THE RESEARCH
MIND THE GAP
What are some of the gaps from previous research that could be filled?
Have any potentially relevant groups of research subjects been left out?
What do we not know in this field from (not) analyzing sex and gender?
What issues related to sex and gender are not being addressed, or are being misunderstood or misrepresented?
Choose your next card...
EXPLORE MORE
FINISH
GO DEEPER
MIND THE GAP
LOOK AT THE RESEARCH


UNLIMITED
What are some limitations that can't be avoided but wish you could?
How could the current limitations affect the research?
How would having more funding and time change the scope of the research?
Choose your next card...
EXPLORE MORE
FINISH
COME UP
UNLIMITED
LOOK AT THE RESEARCH
NORMS AND RELATIONS
How can gender norms or gender relations be challenged or reinforced by the research?
How could existing gender norms or relations influence the process or outcomes?
What are some steps that could be taken to minimize their effect? Are they necessary?
Choose your next card...
EXPLORE MORE
FINISH
COME UP
NORMS AND RELATIONS
LOOK AT THE RESEARCH
PREDICT THE FUTURE
What would someone of the future say about your research?
What could they see as outdated that right now is innovative?
How could your research help society evolve?
Choose your next card...
EXPLORE MORE
FINISH
COME UP
PREDICT THE FUTURE
LOOK AT THE RESEARCH
BIASES AND ASSUMPTIONS
What are some biases found in previous research? How could they affect the process or interpretation of the results?
Have assumptions been made about sex and gender? What is the evidence of these assumptions?
How is your current research challenging assumptions or biases?
Choose your next card...
EXPLORE MORE
FINISH
COME UP
BIASES AND ASSUMPTIONS
LOOK AT THE RESEARCH