A Digital Sexual Health Education Web-Application for Resource-Poor Regions in Kenya: Implementation-oriented Case Study using the In-tercultural Research Model

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Table of Contents

A Digital Sexual Health Education Web-Application for Resource-Poor Regions in Kenya: Implementation-oriented Case Study using the Intercultural Research Model

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Abstract

Background: Developing a digital educative application addressing sexual health education, requires a frame-work enriched with cultural considerations. Based on a previous study, the author identified the problem and needed requirements to incorporate cultural insights from various sources to devel-op a low-fidelity prototype solution.

Objective: Focusing on a reusable framework of the self-established Intercultural Research Model, to de-velop and implement a widely accessible sexual digital educative tool. The study focus on the development of a low-fidelity prototype (She!Masomo) to a high-fidelity prototype (We!Masomo).

Methods: The research methodology is anchored in the Solution Room of the self-expanded Intercultural Research Model, which incorporates cultural considerations. It employs a user-centered Design Thinking approach and a multimethod approach. This entails gathering descriptive textual user feedback on the initial low-fidelity prototype (She!Masomo) to inform the development of the high-fidelity prototype (We!Masomo). A comparison analysis between the two prototypes is conducted, supported by qualitative System Usability Scale Analysis (SUS) and semi-structured expert interviews, following COREQ guidelines. The initial sample size for the textual user feedback study and SUS-Analysis of the low-fidelity prototype is N=77, chosen due to data saturation in rural regions. Subsequently, data collection for the SUS-Analysis of the high-fidelity prototype yields N=90, also due to data saturation.

Results: The digital educational platform, We!Masomo, is designed to facilitate universal access to in-formation, thereby contributing to the achievement of Sustainable Development Goals 3, 4, and 5. Successfully implemented in Kenya, We!Masomo underwent iterative development, begin-ning with a low-fidelity prototype, revealing potential limitations. Utilizing textual user feedback and prototype comparisons, We!Masomo iteratively improved, culminating in an enhanced high-fidelity prototype. The improved effectiveness of the enhanced prototype was assessed using qualitative SUS-Analysis, yielding a favorable score of 77.3, compared to the former SUS-score of 67 of the low-fidelity prototype. This underscores the significance of accessible digital educational tools in promoting equal access to education.

Conclusions: The research presents a detailed examination of utilizing a case study methodology to advance the development of a digital educational web tool, particularly concerning sensitive educational subjects. It offers critical insights for effectively introducing such tools in regions with limited resources. Nonetheless, it is imperative to highlight findings indicating the significance of incor-porating culture-specific components into the design phase. This underscores the importance of conducting thorough requirement engineering analysis and creating a low-fidelity prototype, followed by SUS-analysis. Such measures are especially crucial when disseminating sensitive information, such as sexual health, through digital platforms. Clinical Trial: This research study reports the results of a health care intervention on human participants, con-ducted in accordance with the Declaration of Helsinki and approved and registered in an appro-priate registry by the Institutional Ethics Committee of Witten/Herdecke University with proto-col code: S-119/2022 and date of approval: 06.08.2022.

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A Digital Sexual Health Education Web-Application for Resource-Poor Regions in Kenya: Implementation-oriented Case Study using the Intercultural Research Model

Abstract

Background: Developing a digital educative application addressing sexual health education, requires a framework enriched with cultural considerations. Based on a previous study, the author identified the problem and needed requirements to incorporate cultural insights to develop a solution.
Objective: Delving into the Solution Room of the self-established Intercultural Research Model, by focusing on a reusable framework, to develop and implement a widely accessible sexual digital educative tool. The study focus on the further development from a low-fidelity prototype (She! Masomo) to a high-fidelity prototype (We!Masomo), while evaluating it system usability by differentiating. Thereby contributing to the achievement of Sustainable Development Goals 3, 4, and 5.
Methods: The research methodology is anchored in the Solution Room of the self-expanded Intercultural Research Model, incorporating cultural considerations. Hereby employing a multimethod user-centered Design Thinking approach based on encompassing human involvement for the open web-based app via self-assessed textual user feedback, the System Usability Scale (SUS) Analysis and four face-to-face semi-structured expert interviews, following COREQ guidelines.
Results: Based on the revealed limitations of the low-fidelity prototype, She!Masom, (SUS Score 67), utilizing textual user feedback (n=63/N=77) as well as prototype feature comparisons. She! Masomo underwent iterative development and improvment, culminating in an enhanced high-fidelity prototype, We!Masomo. The improved effectiveness of the enhanced prototype was assessed using the qualitative SUS-Analysis (n=82/N=90), yielding a favorable score of 77.3, compared to the former SUS-score of 67 of the low-fidelity prototype. Demonstrating the significance of accessible digital educational tools in promoting equal access by four expert interviews (n=4/N=4). The e-survey results are reported following the CHERRIES guideline. The digital educational platform, We!Masomo, is designed to facilitate universal all-inclusive free access to information. Hence the developed high-fidelity prototype, was implemented in Kenya.
Conclusions: The research primarily outcome presents a detailed examination of utilizing a case study methodology to advance the development of a digital educational web tools, particular concerning cultural sensitivity and sensitive educational subjects. It offers critical insights for effective tool introduction in regions with limited resources. Nonetheless, it is imperative to highlight, the findings indicate the significance of incorporating culture-specific components into design phase, underscoring the importance of conducting thorough requirement engineering analysis and creating a low-fidelity prototype, followed by SUS-analysis. Such measures are especially crucial when disseminating sensitive information, such as sexual health, through digital platforms.
Trail Registration: The study is conducted in accordance with the Declaration of Helsinki and approved by the Institutional. Review Board (or Ethics Committee) of Witten/Herdecke University with protocol code: S-119/2022 and date of approval: 06.08.2022.

Keywords: Sexual Health Education, Intercultural Research Model, Semi-structured Interview, SUS Analysis, User-centered Design,

Introduction

Sub-Sahara Africa has a population of about 1.1 billion, people, which is roughly 14% of the global population. While the global share of new HIV infections in sub-Saharan Africa has decreased, the region still accounted for 59% of all new infections globally in 2021 [1]. The region accounts for two-thirds of new sexually transmitted infection cases [2] and HIV continues to be the primary cause of death among sub-Saharan African adolescents [3]. “In 10 out of 11 countries in western and central Africa, less than half of women surveyed reported that they were able to make their own decisions with respect to sexual relations, contraceptive use and their own health care” [4]. Furthermore, over 80% of individuals report incidents of technology-facilitated sexual violence, gender-based violence, or other forms of violence [2, 5]. Given these challenges in Sub-Saharan Africa, it is imperative to reduce unplanned pregnancies and the transmission of diseases. This entails providing adolescents with access to contraception information [5] and comprehensive sexual health education to make informed decisions. Access to knowledge empowers individuals to make informed and sustainable choices regarding their bodies and health. Adolescent often lack access to crucial healthcare information [6]. One potential reason is the absence of comprehensive sex education in the national school curriculum, resulting in teachers being ill-equipped to address these topics in the classroom [7], also in Kenya. Kenya is selected as an example for this study based on its network of community centers, mobile infrastructure, and presence of low-income regions, which enable evaluation. The absence of structured, verified, valid, and reliable sexual information, particularly concerning contraception, menstruation, and female genital mutilation, leaves young women vulnerable to health risks [8]. Additionally, sexual health discussions are influenced by religious, tribal, and social affiliations, which can lead to varying or suppressed conversations [8, 9]. The societal taboo surrounding contraceptive practices can even drive some to resort to fatal abortions to prevent unwanted pregnancies[10]. Given the challenges of limited infrastructure, financial resources, and access to education and sexual health information, the increased use of the internet and digital technologies presents an opportunity for behavioral change [11]. Literature demonstrates a growing emphasis on digital tools to address these issues [8, 10, 12–17]. A study conducted providing contraceptive information to you people, [18] also cites research indicating that mass media, particularly digital media, effectively reaches and educates young adults about sexual health. Another study confirms the results that adolescents in Kenya feel the desire to discovery, easily accessible and trustworthy information about maintaining sexual health [19]. The use of digital tools and social media has bolstered confidence in addressing these topics, allowing for feedback and dispelling misconceptions [8, 12, 13]. Disseminating information can contribute significantly to reducing the risks of sexually transmitted infections like HIV and unplanned pregnancies, with considerable potential for educating low-income and vulnerable communities [14, 15]. However, ensuring lasting user engagement remains crucial [13].

Design Thinking methodologies, as endorsed by Plattner et al. [20], offer a creative structure for effectively addressing social and cultural challenges, specifically catering to human needs [20]. This implies collaborating with diverse groups, continuously refining the process through interactions, and taking into account cultural-ergonomic factors, to guarantee usability and accessibility of the final product [21–23]. The Double Diamond Model forms the foundation of the Design Thinking approach, as fixed process nevertheless does not integrate intercultural principles. In the realm of Design Thinking process, recognizing the significance of cultural consistency, as underscored by Kroeber [22], is essential for developing digital educative tools focusing aiming a cross cultural usability.

The Intercultural Research Model

In a prior conducted study by the author, the original Double Diamond Model (“Multimedia Appendix A: Figure S1”) was adapted to the Intercultural Research Model (IRM), as Figure 1 shows,

to discern requirements and design principles, improving focus on user needs [24]. Hence, the research model was enriched with cultural considerations, drawing insights from Rau et al., Lachner et al., and Laws et al. [25–27], culminating in development of a solution, as Figure 1 shows. The model empowers users from a specific culture, to engage with developed products from foreign cultures, thereby enhancing accessibility and usability on a broader scale in the future. It establishes connection between diverse cultural spheres, through varied perspectives. In the context of globalization, this process becomes imperative [28]. When addressing sexual health education in Kenya, it becomes essential to delve into diverse perspectives beyond conventional literature to foster innovation. Culture plays a pivotal role in shaping both unconscious and conscious behaviors within a social group, impacting decision-making processes and various characteristics [22]. Firstly, the Problem Room, divided into Discover and Define Phases [26], the requirement engineering analysis is conducted. Phase 1, Discover Phase, identifies user requirements, resulting in defining primary-, secondary, and anti-persona, along with conducted empathy maps and storyboards [17]. Phase 2, Define Phase, conceptualizes a cross-cultural design philosophy. Focusing on user, environment, and cultural components, based on Smith-Jackson's Cultural-Ergonomics [16]. Resulting in a requirement engineering analysis (“Multimedia Appendix A: Table S1”) [24, 29]. Phase 3, the Develop Phase, meticulously outlines the product taking culture and end-user needs into account, while establishing a low-fertility prototype via a UI/UX design tool. The Deliver Phase, Phases 4, encompasses the high-fidelity prototype development, as well as implementation and delivering to the end-user, as evidenced in the initial three phases [24], Multimedia Appendix A: Figure S2 for the Intercultural Research Model, own illustration based on the Nielsen Norman Group Double Diamond Model and Rau et.al. [25][24][29]

From She!Masomo to We!Masomo

The first phase of the Intercultural Research Model, resulting in a requirement engineering analysis, offers the requirements for developing a low-fidelity prototype. The low-fidelity prototype in this development process is called She!Masomo. She!Masomo was intended to solely focus on women sexual health education [24]. It was developed using Balsamic Software [30] to visualize requirements, and to demonstrate user interactions aligned with Kenyan culture and educational knowledge status. The prototype underwent an end-user UTAUT and SUS evaluation as well as collecting feedback and improvement suggestions for the final high-fidelity prototype, being part of the Develop Phase, in the Solution Room [29], as Figure 1 shows. Resulting in collected end-user feedback and implementing improvement suggestions for the to be developed high-fidelity prototype. Resulting in the rebranding from She!Masomo to We!Masomo. We!Masomo, as an all-gender inclusive web-based application for sexual health education, combining She!Masomo, represented by its fictional character, Linda, and He!Masomo, with its fictional character Leo.

Aim and Objectives of this paper

This paper focuses on the Solution Room, encompassing the missing parts of the Development and the not yet addressed Delivery Phases, culminating in the high-fidelity prototype, the digital educational tool named We!Masomo. The objective of We!Masomo is to offer free digital information on contraceptive methods and menstruation education to empower and educate users. Given that the targeted end-users have diverse cultural backgrounds, their inclusion in the process is imperative Societal stigmas, cultural and religious backgrounds, and misconceptions [31–33] are identified as barriers to sexual health knowledge, but acceptance depends on various factors, and improving sexual health is deemed a major necessity [13], emphasizing tailored educative content to circumstances. Recognizing the impact of cultural differences on product usability, Barber and Badre [34] encapsulate this concept as "culturability." Consequently, this research falls under the umbrella

of cultural-ergonomics, as outlined by Smith [35], where culture is integrated into the development process of designing human-computer interaction systems [36]. The purpose of this case study is to design and implement We!Masomo in a manner that addresses the challenges of limited access to knowledge, particularly in the realm of sexual education. Thus, our research question is to what extent the intercultural Research Model can support the Develop & Delivery Phase (Solution Room) with a focus on a high-fidelity prototype, considering the following objectives:

• O1: To evaluate system usability as a measure of the fit between the low-fidelity and high-fidelity prototypes, transitioning from the problem room to the Solution Room.
• O2: To assert the difference between She!Masomo and the newly developed all-inclusive platform, We!Masomo.

We hypothesize that not all established requirements can be met during the development of the high-fidelity prototype and give an indication of digital literacy. However, we posit that this shortfall will not adversely affect the measurement of system usability.

Methods

Case study approach within the Develop Phase and Deliver Phase

Historically case study research is highly related to the work done by Yin [37] describing the preparation, collection, analysis and reporting. The case study approach is a suitable methodology for investigating contemporary phenomena in the natural context of software engineering. Runeson and Höst [38] provide guidelines for conducting and reporting case study research in software engineering, emphasizing the importance of understanding what constitutes a case study and its real-life context, in this case We!Masomo. The authors compile terminology and guidelines from various methodology handbooks in the social science and information systems fields, adapting them to the specific needs of software engineering, stressing the significance of checklists for researchers and readers, derived through a systematic analysis of existing literature [39]. The case study methodology is well suited for many kinds of software engineering research, as the objects of study are contemporary phenomena, which are hard to study in isolation. This case study aligns with the process suggested by Runeson and Höst [38] as follows: Case study design, preparation for data collection, data collection, analysis of collected data, and reporting.

Case study design within the Develop and Deliver Phase: From the low-fidelity prototype She!Masomo to develop the high-fidelity prototype We! Masomo

The Solution Room Develop Phase yielded the creation of a low-fidelity prototype, She!Masomo, and its analysis of the environment of the end user. This prototype served to visually represent user requirements and demonstrated through abstract depictions in established storyboards [37][26]. Moving into the subsequent Deliver Phase, the analysis shifts towards the high-fidelity prototype, now named We!Masomo. The high-fidelity prototype designed for sexual health education in sub-Saharan Africa. This evolution includes content extension and a shifting target group to encompass both women and men. Thus, our case study approach aims to be holistic and therefore needs to investigate and describe the transition from She!Masomo to We!Masomo, by paying attention to the objectives described in the introduction. The scope confirmatory as well as explanatory, helps the authors to improve the users experience of We!Masomo. It is decided for data as well as method triangulation, in terms of a mixed-methods approach as follows in four steps:

Step 1 Descriptive analysis of textual user feedback, by evaluating descriptive textual feedback, collected from the low-fidelity prototype, She!Masomo. Identifying improvement suggestions

derived from end-user evaluation and enhancement recommendations.

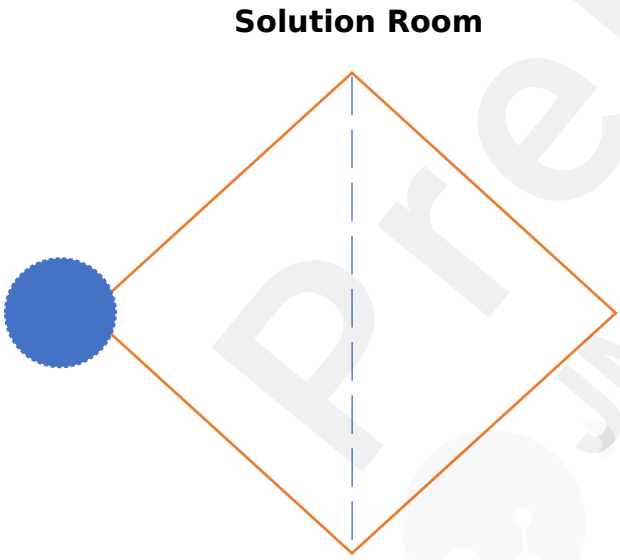
Step 2 Prototype comparison, comparing the prior established low-fidelity click-dummy, She! Masomo, with the high-fidelity prototype, We!Masomo, which highlights the eliminated or adjusted requirements during the development process.

Step 3 System Usability Scale (SUS) analysis for the We!Masomo web-app. Utilizing the widely recognized qualitative SUS questionnaire, to assess the usability and user perception of the high-fidelity prototype, We!Masomo. Applying descriptive statistics for a product-centered evaluation of SUS analysis to quantify the usability of a software product [40]. Comparing SUS analysis results of She!Masomo, analyzed in the Develop Phase [29]. Followed by improvement suggestions derived from the end-user evaluation and enhancement recommendations, We!Masomo, highlighting the evolution of requirements during development.

Step 4 Qualitative semi – structured expert interviews, conducted via four qualitative experts interviews with local supervisors of potential end-users. Exploring insights for long-term improvement suggestion with semi – structed questions to offer a set of open questions to enhance a discussion and explore different feedback, in alignment with the 32-item checklist, known as Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines[41] [42].

Each step focuses on a specific aspect of the evaluation process, allowing a clear and structured presentation of the analysis conducted in the development process to the final product, the high-fidelity prototype, We!Masomo. Figure 1 demonstrates the imperative steps to do so.

Figure 1 - Case Study Design and analysis steps



Preparation for data collection, recruiting, and data collection

The preparation, recruiting and collecting of implementation user feedback data is divided into three different research phases for the later four step analysis, to comply with the triangulation requirements.

The first research phase, qualitative descriptive analysis of textual user feedback on She!Masomo, spanned from December 1, 2022, to January 31, 2023, implemented through community centers, girls' schools, and universities in rural regions of Kenya as well during a fieldtrip. A convenience sampling technique was employed to reach the predominantly female target group aged 18 to 35. Recognizing the importance of participant support, the survey on the low-fidelity prototype was supplemented with an in-person assistance from January 11 to January 23, 2023. During the self-

assessed of the participants through online questionnaires, various community centers in Eldoret, Making More Health, MOI University in Eldoret, and Learning Lions were visited for three days, each. To ensure a comfortable environment for discussing the sensitive topic, the in-person support team consisted of the main author and a trusted local representatives conducted a small introduction to the tool and mission, followed by a 20-minute testing of the low-fidelity prototype via their smartphone or provided smartphones. The information was provided via the online format Lime Survey, where all participants provided a constant to participate and no indication of unwillingness to participate in the study was detected [43]. The vulnerability of the target group is exacerbated by gendered social norms, practices, and inequalities, particularly evident in Sub-Saharan Africa, which has the highest rates of child marriage globally [4].

The second research phase, SUS analysis of We!Masomo, between November 15, 2023, and December 31, 2023. The online format, LimeSurvey, was utilized and distributed through community centers, high schools, and universities in both rural and urban areas of Kenya, employing a convenience sampling technique. All participant provided a consent and no indication of unwillingness to participate in the study was detected [43]. The study targeted males and females aged 18 to 35. To ensure participant support and improve response rates, in-person survey facilitation occurred from November 15 to December 15, 2023. This approach aimed to create a comfortable environment for discussing sensitive topics and addressing potential challenges related to comprehension of content and language. The web-based application allowed them to access and review the provided content. Following the exploration period, participants proceeded to complete the survey with the device. Participants were provided with smartphones or laptops if they didn't possess digital devices themselves, allowing them a 20-minute window to explore the high-fidelity prototype through a web-based application. Following exploration, participants completed the survey using the provided device.

The third data collection research phase, are qualitative expert interviews conducted by the author, being female and founder of We!Masomo. Using Microsoft Teams for audio recording [44], and coded by the first author and in alignment with COREQ guidelines. Due to data saturation n=4 expert interviews are sufficient. The participants provide consent. No indication of unwillingness to participate during the interviews are detected [44]. Additional, to ensure a supportive environment while addressing potential comprehension challenges, a local supervisor was present. The interviews have a duration of 30 - 70 minutes [44].

Data analysis and reporting

Based on our triangulation requirements method approach, the data analysis is also split into four analysis steps: Step 1, a descriptive analysis of collected textual user feedback on the low-fidelity prototype, step 2, prototype comparison, step 3, conducting a SUS-analysis on We!Masomo, and comparing the SUS-score to the low-fidelity prototype, step 4, qualitative expert interviews using qualitative research methods on the high-fidelity prototype, as Figure 2 shows.

First step, the textual user feedback descriptive analysis used to describe the sample characteristics of the N=77 study respondents. The feedback collected during the initial fieldwork study, from December 1, 2022 to January 31, 2023, was analyzed using the grounded theory [38, 45]. Grounded theory allows the systematic collection and categorization of textual user feedback on the research questions. Each idea is noted on and organized into thematic areas, facilitating a comprehensive understanding [38]. Ideas, content, and quotes of each participant were individually written on notes, with different colors used to distinguish thematic areas. This approach allowed a nuanced analysis of feedback in the context of its origin and inductive categorization. The clustering process, guided by predefined dimensions also incorporates additional categories and subcategories, resulting in identifying four clusters with subcategories. Systematically the textual feedback is allocated to categories and subcategories. In compliance with user feedback and the improvement suggestions,

the development of the high-fidelity prototype concludes and results in rebranding to We!Masomo.
Step 2 a comparison study of the low- and high-fidelity prototype, was conducted to evaluate the usability and features of We!Masomo. Features and content are systematically analyzed to identify enhancements and improvements of the high-fidelity version.
Third step, qualitative System Usability Scale (SUS) analysis of We!Masomo. The online SUS-analysis, as quantitative method, assesses usability divided into two sections. Section A gathers demographic data and information on respondents' patterns of electronic device usage for accessing health-related information. Section B incorporates standardized SUS questionnaire. The SUS questionnaire consists of ten items rated on a 5-point Likert scale, yielding scores between 0 and 100 [46] Scores of 68 or above indicate good usability [46, 47] For reporting e-survey results, the recommended checklist, by Eysenbach [42], CHERRIES [42] is followed (“Multimedia Appendix B: Table 1”).
The fourth and final analysis step, involves qualitative expert interviews using qualitative research methods. Expert interviews offer deep insights into user experiences, perceptions, and suggestions for improvement. Including employing one of Kuckartz's [48] evaluation approaches for content-structuring qualitative analysis, utilizing inductive coding during the qualitative interviews as part of qualitative research methods.
The analysis of the collected textual user feedback, prototype comparison, SUS-score analysis and comparison, as well as qualitative expert interviews, contribute to assess usability, effectiveness, and user satisfaction of We!Masomo, as a web-based application, aiming promoting sexual health education in sub-Saharan Africa.
All Problem Room findings are consolidated in the subsequent study and at the online available web-application, of We!Masomo [49].

Ethical considerations

The research adheres to the principles outlined in the Declaration of Helsinki and has received approval from the Institutional Review Board (or Ethics Committee) at Witten/Herdecke University, with protocol code: S-119/2022 and approval date: 06.08.2022. Prior to participation, all subjects in the study provided informed consent for publication. This involved signing a consent form after receiving written information and a verbal explanation regarding the study's context, intended procedures, and data usage. Each participant received a copy of the signed informed consent documentation. To protect confidentiality, the study data is anonymized to ensure that participants cannot be identified in any publications or research data. Importantly, participants did not receive any financial compensation for their involvement in the study.

Results

Case study approach within the Develop Phase and Deliver Phase

Analyzing from various methodology handbooks in the social science and information systems fields the low-fidelity prototype She!Masomo to conduct congrid adjustments by overcoming limitations, based on cultural differences, and barriers increase its future usability evolving into the Deliver Phase to analyze the high fidelity prototype, We!Masomo. via four different analysis steps to adapt to specific needs of software engineering process. The case study methodology is well suited for this approach and study, as contemporary phenomena objects, are hard to study in isolation.

Case study design within the Develop Phase: Using textual user feedback from the low-fidelity prototype She!Masomo to develop the high-fidelity prototype We!Masomo

The Develop Phase led to the creation of a low-fidelity prototype called She!Masomo and an analysis of the end user's environment. Transitioning to the Deliver Phase, we introduced the high-fidelity prototype, We!Masomo, designed for sexual health education in sub-Saharan Africa, with expanded content and a broader target audience, including both women and men.

Implementing textual user feedback – Adjustment of the low-fidelity prototype She!Masomo in the Develop Phase

In the first step of the analysis, adolescent women tested the low-fidelity prototype assessing the application's accessibility, voice control, and mechanisms designed to create a secure familial space. As emphasized by Rau et al. [25]. The collected, self-assessed textual user feedback (n=63/N=77) was analyzed using the affinity mapping method, resulting in the identification of four distinct clusters through inductive coding.

In Cluster 1, 36 out of 63 participants (36/63, 57.1%) offered non-concrete feedback on the low-fidelity prototype are summarized. Responses varied, with suggesting that no additional feature nor content is necessary, while others expressed positive sentiments for She!Masomo, as "I believe it's a valuable system as it enhances our understanding of health." Notably, one underscored the significance of women's health, asserting, "No changes are needed; it is crucial for women to maintain good health as men often neglect their well-being." Participants conveyed the ease use of the tool, anticipating most individuals would quickly grasp its functionality. A forward-looking perspective was also evident, highlighting, "This tool is secure and beneficial for girls and women in the community. However, several participants noted the tool's ease of use and advocated for broader outreach, including schools and community centers, to effectively reach a wider audience, including men. It is imperative for both men and women to be informed", indicating to add male content.

Cluster 2 comprised technical improvement suggestions, with 7 out of 63 participants (7/63, 11.1%) focus on enhancements of the platform's interface, user-friendliness, and visual appeal. Recommendations included the introduction of a login page for user profile verification, a search bar for specific content suggestions, integrating social media, and robust privacy regulations.

Cluster 3 combined content suggestions, with 17 out of 63 participants (17/63, 26.9%) defined three key areas of emphasis: gender equality and violence, the inclusion of men in the conversation, information on cervical and breast cancer, as well as parenting styles and menstruation**,** as well as sexual reproductive health rights. Within the realm of gender equality and violence, there was a notable demand for expanding content to include the male perspective. A participant articulated, "Violence and abuse against women - what can we do? What do we have to do initially? Can we talk?" Another participant underscored, "It is very attractive to use, but the men's content is missing. Also, men need to know this information." One participant conveyed, "This tool has helped me with family planning. It makes my marriage peaceful and nice, so my husband is nice to me. It also helps me understand why I need to go to the hospital regularly to check and when to go and to learn and understand more." Participants expressed a need for content related to cervical and breast cancer, along with information on sexually transmitted illnesses, emphasizing the identification and home testing when lacking resources for hospital visits. The sub-cluster. parenting style and family planning garnered attention, inquiring, "How to give birth to a child and how to raise it? - explanation - we need a parenting style guideline - which milestones are needed by a child, what can they do and what not at what age - What can I do with them, at what age can they walk, talk, and work?" Participants sought comprehensive and easily comprehensible content, preferably in video format and available in both English and Swahili. There was also a request for information on

nutritional intake. Furthermore, participants expressed a need for a sub-cluster on menstruation. They sought information on how the monthly cycle functions, the physiological changes in the female body, and details related to menopause, prompting requesting more informative videos, as well as general information on "The contextual framework on sexual and reproductive health rights and services that often differ in East Africa. The cultural differences as well, who can we speak to on this topic.".

In Cluster 4 improvements focusing on potential feature extension. Merely 3 out of 63 participants (3/63, 4.8%) indicated a desire for additional features such as a period tracker and a 24-hour online service for inquiries related to sexual well-being and emergencies. Additionally, participants highlighted the importance of user engagement through features facilitating questions and discussions on controversial topics. Furthermore, the incorporation of a period tracker could serve as an optional contraceptive method, consistent with the extensive listing of contraceptive methods. Another participant expressed a need for a 24-hour online service, allowing users to inquire about any matter related to sexual well-being at any time and emergencies. This indicates a preference for an optional hotline feature to be incorporated into the platform. Notably, a participant underscored the significance of user engagement, expressing to add the opportunity for questions or engage in discussions via an additional feature, a functionality that could be facilitated through an exchange platform for user interaction. The evaluation marks the transition from She!Masomo to We!Masomo. We!Masomo, the developed high-fidelity prototype, is coded via GitHub, deployed at Vercel, with Google Firebase as the backend, concluding the Develop Phase of the Solution Room of the Intercultural Research Model, as Figure 1 shows, followed by the Deliver Phase.

Comparing Low- and High-fidelity Prototype in the Deliver Phase

The associated steps for step 2 of the analysis, involve continuous engagement with potential users over an extended period. The Intercultural Research Model process concludes with the Deliver Phase, where the previous results are condensed into a solution [43]. The results will inform further development of a high-fidelity prototype to refine the detailed concept. This involves considerations of sizes, fonts, colors, and content. The high-fidelity prototype incorporates mature functionalities and represents the final minimum viable product [43] In terms of intercultural design, the mechanisms will be assessed for their functionality within the target culture. Kenyan users are the focus of intercultural design, to tailor features to identified needs to the best extent possible.

Table 1 - Feature comparison of Low-Fidelity vs. High-Fidelity Prototype

Feature	Low-Fidelity Prototype	High-Fidelity Prototype
Explore Page	Content: Menstruation Content, Contraception Methods, 15 Female Genital Mutilation Videos, potential list of HealthCare Centers, Partnership Organizations, About She!Masomo	Added content: Cervical Cancer, Breast Cancer, Mental Health Issues, Parenting Content, Exchange Platform, He!Masomo for male focused content, Period tracking option, Leo and Linda as comic figures, Extended user profile option,
Landing Page	African Map, Linda is shown, Logo She! Masomo	Changes Color Scheme, changes logo to We! Masomo, directed to Explore page, Cookie request, Introduction by Leo and Linda
Added Content	Menstruation Content, Contraception Methods, 15 Female genital mutilation videos	Cervical Cancer, Breast Cancer, Parenting Content, Mental Help Support Content, Swahili audio files,
Hotline	/	Not yet – in discussion with partner organization for emergency abuse cases
Gender	Female (Linda)	Male & Female (Leo and Linda comic figures)
Free Access to content	All content	Content of menstruation information, cervical and breast cancer, contracepting methods
Logo	She!Masomo	We!Masomo – as all-inclusive platform for She! Masomo and He!Masomo

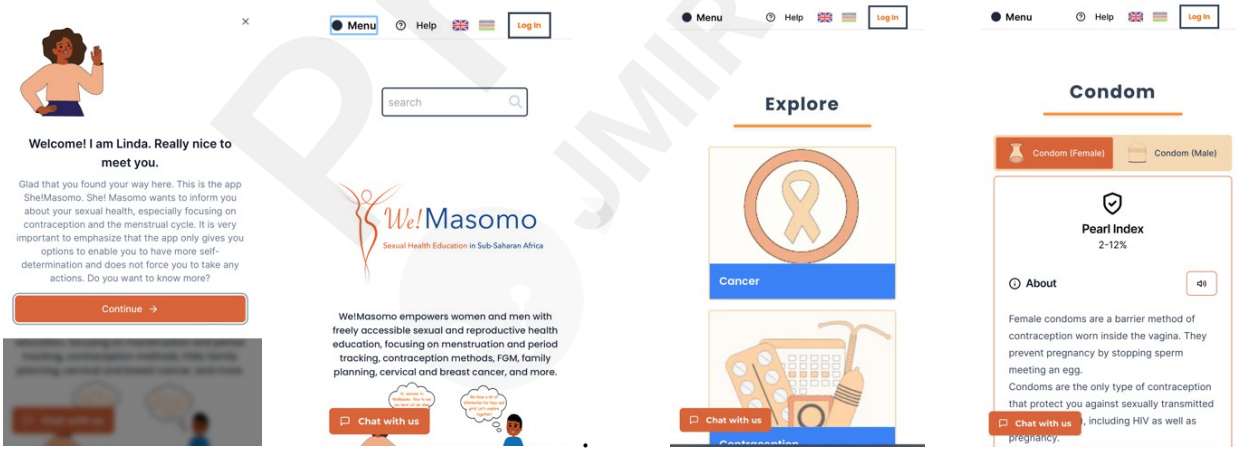
User Profiles	Not necessary	Added verified user profile via phone number or e-mail address.
Exchange Platform	/	Added a platform so users can ask question only via verified user profiles
Period tracker	/	Added a period tracking feature as natural contraction option, tracking, mood, menstruation
Contact Formular	/	Contact Option for specific questions, feedback
Feedback Option	/	Added a thump down/up option as direct feedback option per provided content.
Languages	Swahili, English	Swahili, English, audio files for Readout loud function
User Profiles	/	General questions, Family status, Menstruation information, Use of contraception method, Female genital mutilation – beside general the rest is optional

Case study design within the Deliver Phase: High-fidelity prototype We! Masomo - introduction to the web-based application

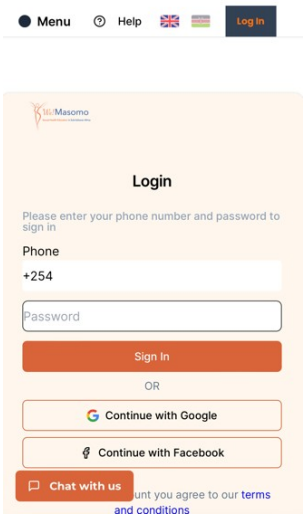
Utilizing the outcome and feedback derived from the low-fidelity prototype, coupled with insights from the SUS study [29], as well as textual user feedback, the development of the high-fidelity prototype as a web-based application with online user interactions has been undertaken. This advanced high fidelity prototype, We!Masomo, serves as a visual representation of the user interface, incorporating refined feedback. Figure 2 portrays the online free accessible web-based application, We!Masomo [49] (Date: 04.02.2024) developed based on the structure from the low-fidelity prototype She!Masomo. Please see Multimedia Appendix A: Table S1 for a full explanation of the meaning for the mentioned requirements, Task appropriateness (TA), Self-descriptiveness (SD), Controllability (C), Conformity to Expectations (CE), Learnability (L), User retention (UR).

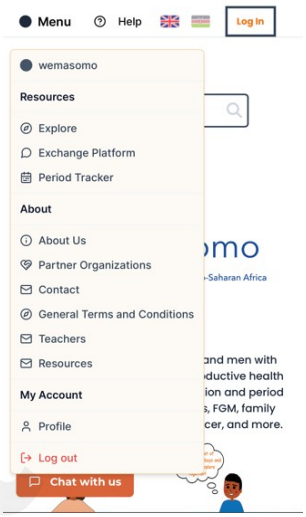
Figure 2 - Welcome screen when opening and introduction to the content and mechanism of the application is explained

Welcome Start screen Explore page Content page



User Log-In Navigation page





In accordance with requirement UR3, the tool is designed to be accessible without requiring users to log in, illustrating the application framework and delineating the structure to be accessible to everyone without needing a user profile. The welcome page introduces the user to the tool on how to use it best, as well as which cookies are being tracked. Addressing uncertainties among users regarding the sensitive content of the tool, Figure 2 displays an introductory text (L1), designed to alleviate concerns, and consider the users' environment, recommending a quiet, undisturbed moment to privately engage with the content (L1). To create a familiar atmosphere and foster a sense of guidance, a fictional character named Linda, resembling a big sister, is introduced. The placeholder, as per requirement UR4, is positioned in the upper-left corner of the introduction box, outlined in the storyboard of the primary version (“Multimedia Appendix A: Figure S3”). Users are provided with the option to close the introduction using a cross in the upper right corner. If they wish to revisit the introduction, they can click on help. Followed by the start screen, available without login credentials, is intentionally crafted to encourage exploratory experiences, eliminating the immediate need for users to disclose personal information, and provided free of charge (TA3). Subsequently, being guided through the tool by the fictional character, Linda for She!Masomo and Leo for He!Masomo. Following the initial presentation of the start screen, the subsequent page is the explore page. Commencing from the main page, diverse navigation options are available to enrich the exploratory experience of the application. The crux of the application resides in its content page. Presenting menu points guiding users to specific thematic areas addressed by We!Masomo, encompassing details on contraceptive methods as well as expanded content related to cervical and breast cancer, menstruation, parenting style, mental health issues, and myths (TA8). One such point is contraception methods (C2), shown on the content page. Upon selecting a specific topic, users are directed to an overview of categories within that topic (C2). From this point, users can delve into further sub-categories, as exemplified in the structure of the "Contraception Methods", if subdivisions exist, a tab bar emerges, featuring sub-categories (C2). These subcategories are visually presented in the bar to accommodate users with varying alphabetical knowledge levels, highlighting the selected option in color while graying out the unselected ones, accompanied by auditory and textual versions (TA12). For enhanced accessibility, particularly for those with limited literacy, each thematic area incorporates graphics and voice output. The interactive design integrates both written and auditory formats for all text passages, facilitating a read-aloud function supported in English and Swahili, demonstrated at the content page. Strategically placed speaker icons enable text-to-speech functionality for label reading, enhancing user comfort, especially for those with limited reading proficiency. Structurally, the content page is composed of modules, each consistently organized. The topic of the module is stated above, akin to the header section, and is succeeded by textual, visual, and auditory representations. An explanatory text of varying length is positioned below. The speaker icon is situated beneath the text, distinct from the buttons. Each module furnishes information on

how users can access more detailed and personalized information. During the content-scrolling process, both the header section and tab bar persist, allowing users to seamlessly switch between subcategories or revert to the previous page (C1). The content aims to communicate the purely informative and professionally validated nature of the application (TA1, TA4). Upon reaching the page's bottom, an upward arrow becomes visible, facilitating users' return to the beginning of the page (SD1), as well as a feedback option via a thumb up or down (dislike) option. Giving feedback is a valuable input to indicate if improvement of the content is needed.

Apart from the start screen, each page incorporates a header section at the top, encompassing the logo, language selection, and a hamburger icon. Language selection (CE2) allows users to choose their preferred language. The language selection feature remains visible throughout the entire user journey and is streamlined through globe icons representing the English and Kenyan flags. The selected language is highlighted, while the unused language appears in gray. Both the hamburger icon and the logo icon serve navigation purposes within the app. The hamburger icon opens a menu, as elaborated in the following section, while the logo links back to the main page, aligning with requirement C1, providing users the opportunity to apply their knowledge (SD1). In subsequent development stages, graphic placeholders will be replaced with sketches to provide a more abstract representation, mitigating the potential for embarrassment (CE5). In contrast, navigation using the Hamburger icon introduces an additional step compared to navigating via the main page (C1). Since the icon is accessible from any page, this approach involves an extra step, necessitating the display of all menu items. Upon selecting the Hamburger icon, it changes color to blue, indicating the current selection in harmony with the language selection. Clicking on another area closes the menu, and the icon reverts to its original color (SD1). As depicted in Figure 2, a designated space for the We! Masomo logo (UR5) is incorporated to instill trust (CE6). As in this case, user login is necessary, shown at the user log-in page to access newly developed features, such as the exchange platform and period tracker, to ensure users' data privacy.

Considering participants' improvement suggestions from the textual user feedback, the end-user can select their gender and additional preferences between genders of interest. For feature extension, as requested by textual user feedback and in alignment with CE7, in future development, the inclusion of a healthcare center locator (TA15) could potentially be explored, leveraging tools such as Google Analytics. However, the high-fidelity prototype development phase, the feature was omitted. Nonetheless, various other features have been successfully integrated.

SUS Data-Analysis of the high-fidelity prototype in the Deliver Phaser

Assessing We!Masomo, with the System Usability Scale (SUS) methodology, outlined by Brooke [46], as step 3 of the multimethod approach to measure the improved usability of the web-based application, compared to the prior conducted SUS-score of 67 of the low-fidelity prototype, She! Masomo. The comprehensive SUS survey involves N=90 individuals undertaken as part of the reevaluation of SUS-analysis during Phase 4 of the Intercultural Research Model. The redo of SUS-Analysis for We!Masomo was conducted in the fourth phase of the Intercultural Research Model. Of the total N=90 given responses, n=82 (82/90, 91.1%) responses, using We!Masomo are considered complete and therefore included in the subsequent analysis. Eight observations are excluded due to missing values. The descriptive characteristics of the participants of the LimeSurvey, are detailed in Multimedia Appendix A: Table S2.

Conversely, for negatively worded questions, the score contribution is determined as 5 minus the scale position. The overall SUS value computes multiplying the sum of the score contributions of each questionnaire by 2.5, following Brooke's methodology [46][46]A SUS-score of 68 or higher is considered good [47]. The questionnaire is illustrated in Multimedia Appendix A: Table S3. Comprising ten questions, each rated on a 5-point Likert scale, aligned with Brooke's guidelines [46]. Positive framed questions (1, 3, 5, 7, 9) contribute score based on the scale position, the score contribution is calculated as scale position minus 1, while negative questions (2, 4, 6, 8, 10) use

reversed scale positions. The computed SUS-score, placed on a scale of 0 to 100, is determined to be 77.3. Interpreting this score, it falls within the "high marginal" to "acceptable" range, classifying as "good" based on adjective ratings. Acceptability scores indicate a ranking above 70 as acceptable, below 50 as unacceptable, and scores in between as marginal [39, 43]. However, it's crucial to note that not all requirements of the former established requirement engineering analysis were fully met or significantly adjusted during the development as originally suggested based on feedback for the low-fidelity prototype. Despite, the high-fidelity prototype remains deemed acceptable, fostering a positive behavioral intention to use. Nevertheless, continuous improvement adjustment is essential to meet the evolving needs of its users.

Expert Interview – Review and feedback on We!Masomo in the Deliver Phase

The four expert interviews N=4, as step 4 in the qualitative research methodologies provide valuable insights into user feedback on the high-fidelity prototype, We!Masomo, highlighting its superiority as a more user-friendly tool compared to, She!Masomo. The fourth and final analysis stage, employs delving into user experiences, perceptions, and enhancement suggestions. Following Kuckartz's [48] evaluation methodologies, qualitative structured content and inductive coding was applied during expert interviews, adhering to established qualitative research practices.

The yielded main insights of the n=4 expert interviews, conclude in 105 Post-it notes categorized into 4 distinct clusters (s. “Multimedia Appendix A: Figure S5”). The clusters provided a comprehensive understanding of various perspectives, defined as social belonging, education, technology aspects, and application insights. Notably the experts emphasized the significance of We! Masomo as a digital educational app, particularly in addressing the challenges surrounding menstruation in sub-Saharan Africa and straightforward scaling knowledge and education throughout. Shedding light on the complexities of societal norms, cultural beliefs, and educational barriers affecting sexual health awareness, while underscoring the importance of technology accessibility, language inclusion, and creative engagement strategies in designing effective educational interventions. The experts delivered perspectives from Kenyan social workers and educator background.

In cluster 1, social belonging, comprised the participants characteristics, from Kenyan NGOs, teachers, and social workers, providing diverse perspectives based on their background and experiences of the end-user. B1 (yellow), a Kenyan male social worker and founder of a local IT education campus from the rural villages in northern Kenya. He conveys a supportive viewpoint, emphasizing the significance of religion and culture but also on how important it is to empower women and men by providing education. B2 (orange), hailing from the slums around Nairobi, brought insights from working for a local NGO founded community center, involvement in women empowerment groups and menstruation education. He has one daughter and is responsible for the technical aspects of NGO. He shares the perspective shaped interacting with users and having create experience on needed requirements to improve sexual health education. B3 (purple), a Kenyan start-up founder from Nairobi, working prior for international developed aid companies, providing insights from the perspective of an educated urban dweller, where women have greater access to education. She established her business around a mentorship program selling into local partners and NGOs. Her mission is to make the mentorship program mandatory for all-girls in secondary school to be educate about menstruation. B4 (green), originally from Nairobi, studied music at the Nairobi University and founded her own NGO focusing on sexual and reproductive health and rights. Her diverse background, spanning Kenya and Denmark, equipped her to offer insights into an educated perspective, particularly regarding schooling systems and international education standards. This cluster underscored the diverse social affiliations of the experts.

Cluster 2 focuses on education, addressing key aspects of the local schooling system, including

reasons for school dropouts and non-existence of sexual health education in the curriculum. In Kenya, most children enrolled in school benefiting from its free accessibility. However, secondary education typically requires fees, leading to a disparity where boys are more likely to attend secondary school compared to girls, as highlighted by B1, B2 and B2. The current government intends to increase the school fees, resulting in larger school-dropouts. Also, for primary school, according to B2 most primary schools are not free as the school admin still wants money from the parents. In certain regions, it remains uncommon for girls to pursue secondary education, as noted by B3. B3 start-up focus on menstruation education to keep girls in school. According to B3, only 30% of girls go to secondary school, due to missing on week per month, due to menstruation. Unfortunately, sexual education and contraceptive education are largely absent from secondary school curricula, as emphasized by B1, B2 and B3. B2 attributes the lack of comprehensive education to governmental policies and a conservative mindset. It is imperative to advocate inclusion of comprehensive sexual education, in secondary school curricula, and initiatives like We!Masomo could significantly contribute to this endeavor.

In cluster 3 targeting technology aspects. B2 highlights the divide between internet access in rural and urban areas. According to B1, approximately smartphone and internet coverage reaching 80% of the population in Kenya, as smartphone usage is on the rise, with due to various initiatives. The government has implemented a program distributing smartphones in rural areas, further increasing accessibility also with the support of Starlink. At B1 NGO every student receives a computer for free and to work and participate at the training program. B1 states, NGOs play a significant role by providing access to computers and internet facilities, particularly in rural low-income areas. The prevalence of the Kenyan online payment system M-PESA ensures that most individuals already possess a mobile phone, facilitating digital transactions. B3 noted that at least one friend in a group in rural areas owns a smartphone. Additionally, schools, community centers, and NGOs offer computer rooms, expanding digital access. These factors underscore the potential reach and impact of a digital sexual health education app like We!Masomo in Kenya's urban areas.

Cluster 4 highlights application insights, discussing improvement suggestions for We!Masomo. All four participants expressed strong support for We!Masomo and having it introduced to their communities. They emphasize that while not everything needs to be included initially, the app serves as a foundational resource for learning. B1 emphasizes how technology can motivate girls to pursue education, as he does at his NGO. While B3 liked the app to a supportive elder sister, providing essential information about sexual health. Suggestions included incorporating more graphics, and videos to enhance usability, as well as testimonials suggested by B2. Participants like that everything is being translated in Swahili and English as well as available in available audio files. The expert interviews provide a nuanced understanding of user perceptions and preferences, affirming We! Masomo's potential as a transformative tool.

The synthesized expert interview findings, along with other analytical components, inform continuous refinement and enhancement of We!Masomo to better serve its targeted audience and advance sexual health outcomes. The examination encompassed textual user feedback, prototype comparisons, SUS-analysis, and qualitative interviews, collectively contributing to the evaluation of We!Masomo's usability, effectiveness, and user satisfaction. Today we have enrolled 250 user profiles in the educative digital tool.

Discussion

The analysis centers on a practical triangulation case study approach, highlighting the developed concept for digital educative tools aiming for a cross-cultural usability to tackle culturally sensitive topics in resource-poor regions in sub-Sahara Africa, executed in Kenya. The developed concept, tailored in this triangulated case study method approach, addresses taboo, lack of sexual education and knowledge of adolescents [8, 50, 51], while aiming to tackle challenges associated with limited

access to education, digital infrastructure and stressing the need for accessible intimate content, and non-depriving cultural and religious differences. By following research objectives in evaluating system usability as a measure of the fit between the low-fidelity and high-fidelity prototypes, transitioning from the Problem Room to the Solution Room. As well as research objective two, assessing the difference between She!Masomo and the newly developed all-inclusive platform, We! Masomo.

[8, 50, 51]Therefore, the study employs the developed Intercultural Research Model, emphasizing the importance of cultural considerations throughout the tool development process and practical implementation in real life usage. While the case study accompanies the transitioning from the low-fidelity prototype, She!Masomo, to the high-fidelity prototype, We!Masomo, being implemented successfully. The results affirm the enhancing usability of the Intercultural Research Model in facilitating product development for foreign-affiliated cultures.

The research objectives revolve around the extent to which the requirements of the Intercultural Research Model support the development and implementation of culturally sensitive SRH educative tools under difficult circumstances. The target group is specifically defined based on the social affiliations and circumstances of Kenyan men and women [9, 10].

The objectives position all established requirements will be met for the final tool implementation. However, despite the qualified conducted requirement engineering analysis, it is observed that not all requirements, need to be met in reaching high usability, prompting a reassessment of the framework. Anticipating a shortfall will not adversely impact the measurement of usability, measured as system usability score. Answering objective 1, the study reveals a significant improvement in usability and acceptance of the high-fidelity prototype, throughout its development process, as evidenced by its SUS score of 77. Compared to the low-fidelity prototype, She!Masomo, scoring 67 [29]. For instance, the tool accessibility is designed to be without user login. Nevertheless, to ensure data privacy, additional features need users to log in, due to sensitive information. Furthermore, We! Masomo adjusted, such as including a feedback option, highlight the iterative nature of the development process and the importance of users' input in refining content. It is proven that integrated user- and human-centered evaluation, enriched by cultural ergonomics, derived from the established Double Diamond Model, inspired by Laws et al., Rau et. al., and Lachner et. al. [25–27], is not sufficient for a successful development and implementation approach. Constant field-testing and exchange with the end-user are a needed requirement, whereby user and youth-friendly services shall be put in focus. Whereby also the school and health educators play a significant role in implementation and usage, as those a positive common on the usage of such tool in communities. The study conducted by J Decker, et al., [52] demonstrates technology issues affecting SRH technology implementation processes, aiming to improve adolescent health, such as increasing condom usage and knowledge. Health educators are mostly also non-technology, nor SRH conform, to educated youth due to the lack of information provided. The study results align with this study difficulties, demonstrating technological issues during data collection, difficulties with WiFi hotspot, users forgetting login data, or bad function technology smartphones. On the other side, the positive responses are demonstrating to online consent and resources using the tool as a local reference service as add-on for the on the groundwork. The study conducted by Ouma demonstrates despite ongoing international commitment to increase accessibility and improve knowledge of contraceptive method in Kenya, the adolescent study participating still share safety concerns about contraceptive methods' side effects [8].

Therefore, We!Masomo makes use of requirement CE6 by introducing the fictional characters Linda and Leo, for both genders to guide adolescence and creating a trustworthy atmosphere, as per se requirement in L1. Increasing usability by implementing additional content, as of male content, HIV, child nutrition, and cervical and breast cancer could support usage and weight again such concerns (O2), as well as increasing the parameter for visiting frequency, answering research objective 2. A study conducted by Njagi et al. demonstrates feasibility and increased acceptability of eHealth

interventions with HIV content, while offering insights into health-seeking behavior [53, 54]. It became evident that despite facing challenges in resource-poor regions, financial constraints, and cultural stigmatization, there is a pressing need for policymakers to adopt a variety of educational approaches to tackle and provide comprehensive sexual and reproductive health (SRH) education to youth. Utilizing mass media for disseminating information has the potential to enhance awareness and utilization of modern contraceptives. It is advisable to implement similar initiatives focusing on segments of the population with low contraceptive uptake [55].

Looking ahead, future studies should involve a broader range of health and school educators in the evaluation process to help distribute the tool as well as educate them, as local educators determine accessibility and potential limitations of the tool. Hereby including the public sector and policy makers to guarantee a praxis usage of We!Masomo. Additionally, exploring the transferability of the Intercultural Research Model to other cultural contexts and considering demographics like MSM demographics will be critical for comprehensive research efforts[56]. Besides research studies the tool is to be intended to be used long term with increasing relogging logging in or using the intervention. Despite the study conducted by Norten, [57] the opportunity for standardized research model to better inform the evidence base to improve the delivery of sexual and reproductive health interventions in humanitarian settings is given, when using this self-adjusted intercultural research model, nevertheless, practical use cases should be implemented and analyzed more close on case study examples in teh future.

It is important to acknowledge potential limitations and potential biases related to the sensitive nature of the topic, as well as biases among participants when addressing intimate topics considered taboo in society, which may lead to feelings of shame, along with language barriers, which make detailed statements challenging to analyze [58]. It's important to note that the applicability of the study's findings on digital tools for sexual health information is restricted to the specifically developed web-based application prototype, We!Masomo to implemented as a practical, easy to use tool. Furthermore, caution should be exercised in generalizing the results, given the use of a convenience sample, which may not be representative of the larger population, due to the limited access to internet and devices as well as present digital literacy. To enhance comparability with other studies, future research should incorporate standardized measurements like the widely used SUS measurement alongside context-specific methods [43] [43]

Conclusions

Individuals facing reproductive and sexual health challenges often encounter educational disparities. Discussions about sexuality are limited due to cultural stigmas as well as lack of resources, and sexual autonomy is a crucial aspect of well-being. Unfortunately, around 45% of women aged 15 to 49 in relationships or marriages lack this autonomy, particularly in sub-Saharan Africa, according to data from 57 countries [1]. This study focuses on concepted reusable universal framework for developing a practical digital educative scalable platform addressing taboo and intimate topics, throughout a digital educative scalable, specifically designed for resource-poor regions. The concepted Intercultural Research Model, derived from the user-centered Double Diamond Model, guides as development process framework while focusing on cultural considerations. The study targets 14 – 35-year-old Kenyans, as a case study, aiming to offer accessible sexual health education tailored to the specific needs of men and women aged in Kenya. The research procedure, involves engagement with targeted culture, reevaluating the digital tool suitable for obtaining educational sexual health information. Requirement engineering analysis suggest the enhancement of text communication with visual and auditory channels, the inclusion of a fictional characters guiding through the digital tool to minimize taboos and addressing language barriers as well as user log-in feature, exchange platform between the users and feedback options. The study recommends on-site evaluation of a low and a high-fidelity prototype, exploring interactive user feedback. Triangulated

multimethod approach of, combining collected textual user feedback, prototype comparison, a SUS-analysis on We!Masomo, and comparing the SUS-score to the low-fidelity prototype, as well as qualitative expert interviews using qualitative research methods, results underscore the need for accessible intimate content while respecting cultural and religious differences [34] as well as the ongoing need for refine and explore to ensure inclusivity and effectiveness across diverse cultural contexts. The objectives of the study, including evaluating system usability and discerning differences between prototypes, highlight the critical aspects of the Solution Room, encompassing the Development and Delivery Phases, ultimately leading to the creation of the high-fidelity prototype, We!Masomo. The primary objective of We!Masomo is to provide free digital information on contraceptive methods and menstruation education, aiming to empower and educate users, particularly in regions with limited access to sexual health knowledge. Social stigmas, cultural nuances, and religious beliefs have been identified as significant barriers to sexual health knowledge, highlighting the necessity for tailored educative content to address specific circumstances. In essence, the discussion highlights the intricate interplay between cultural considerations, usability evaluation, and other studies in the field. It emphasizes the importance of adaptive methodologies that can accommodate diverse contexts while maintaining a focus on user-centered design principles. As an outlook, We!Masomo expansion to other regions is considered. Even though requirements of the self-established Intercultural Research Model were not all met. The digital tool, We!Masomo, indicates a high behavioral intention to use according to its SUS-score and successful implementation. In conclusion, the study concludes by emphasizing significant progress made in addressing reproductive and sexual health challenges through digital educational tools. As the studies tailored survey methods emphasizes the potential effectiveness with adjusting initial suggested requirements for successful implementation. It opens avenues for exploring the influence of cultural and religious factors on technology acceptance and the future to reach a higher number of populations.

Declarations

Ethics approval and consent to participate

The study is conducted in accordance with the Declaration of Helsinki and approved by the Institutional. Review Board (or Ethics Committee) of Witten/Herdecke University with protocol code: S-119/2022 and date of approval: 06.08.2022.

Consent for publication

Consent for publication was obtained from all subjects involved in the study through a signed content participation, all patients cannot be identified in publication and research data due to anonymization.

Availability of data and materials

The data sets generated and analyzed during this study are available from the corresponding author on reasonable request and under consideration of the ethics committee's requirement to maintain anonymity.

Competing interests

The authors declare that they have no competing interests and underlies non-financial competing interests. The first author is the product owner of the developed high-fidelity prototype We!Masomo.

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Authors' contributions

Conceptualization, Clarissa Soehnchen, Sven Meister; methodology Clarissa Soehnchen, Sven Meister; validation, Clarissa Soehnchen; formal analysis, Clarissa Soehnchen, investigation, Clarissa Soehnchen; resources, Clarissa Soehnchen; data curation, Clarissa Soehnchen; writing—original draft preparation, Clarissa Soehnchen; writing—review and editing, Clarissa Soehnchen, Anja Burmann, Sven Meister; supervision, Maike Henningsen, Sven Meister

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Non generative AI was used in a portion of the manuscript,

Authors' information

The project is a personal interest initiative of the first author, after several visits to Kenya and willingness to create an impactful contribution to empower with knowledge.

Figure

Abbreviation

Abbreviation	Word
C	Controllability
CE	Conformity to Expectations
FA	Functional
HIV	Human immunodeficiency virus
ISST	Institute for Software and System Engineering
L	Learnability
Masomo	Education in Swahili
MMH	Making More Health
NF	Non-Functional
NGO	Non-Governmental Organization
SDG	Social Development Goals
SRH	Sexual and Reproductive Health
SRHR	Sexual and Reproductive Health and Rights
TA	Task appropriateness
UN	United Nations
UR	User retention
UWH	Witten/Herdecke University

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Multimedia Appendixes

Demonstrating Case Study and Method approach as well as results.
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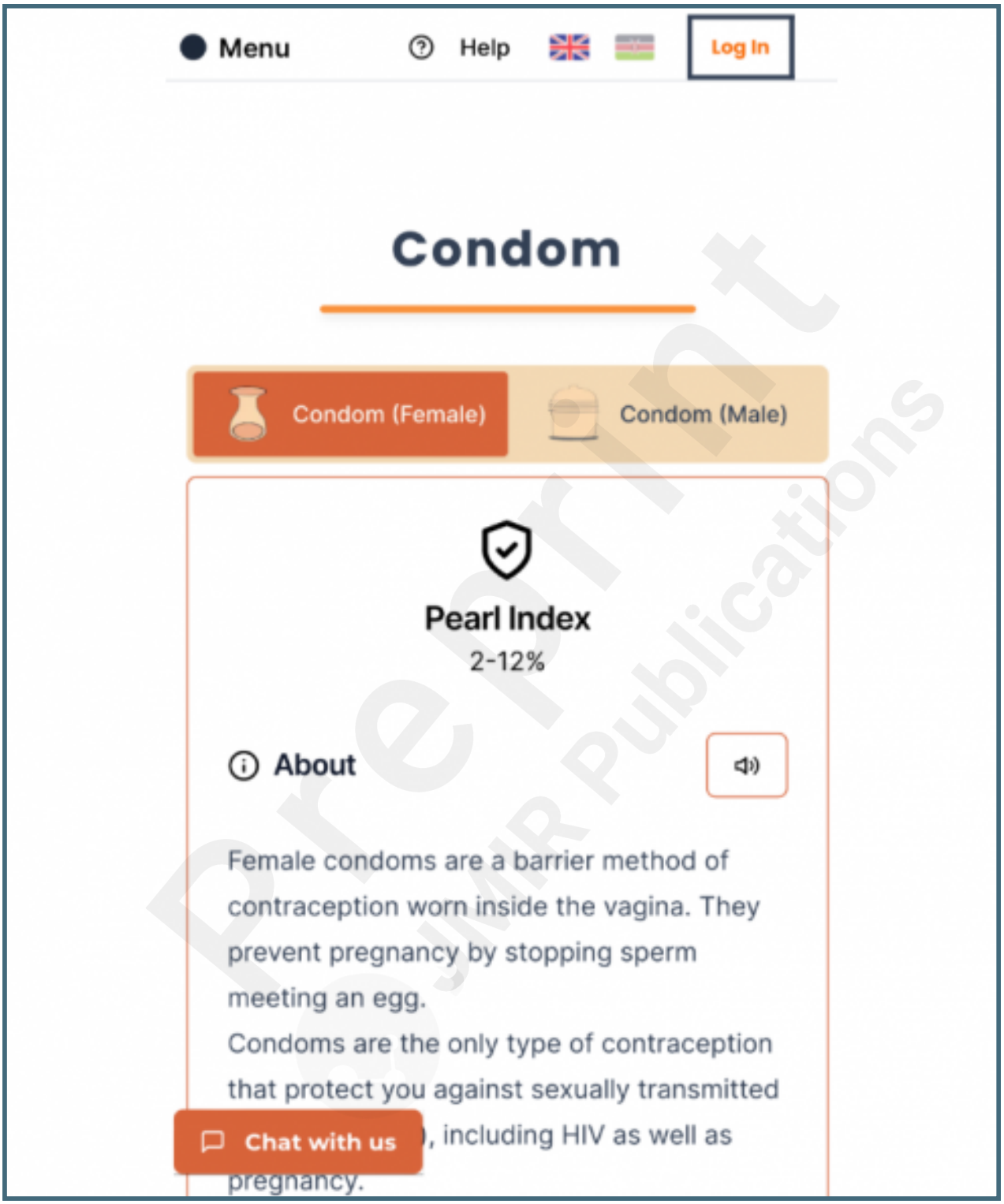

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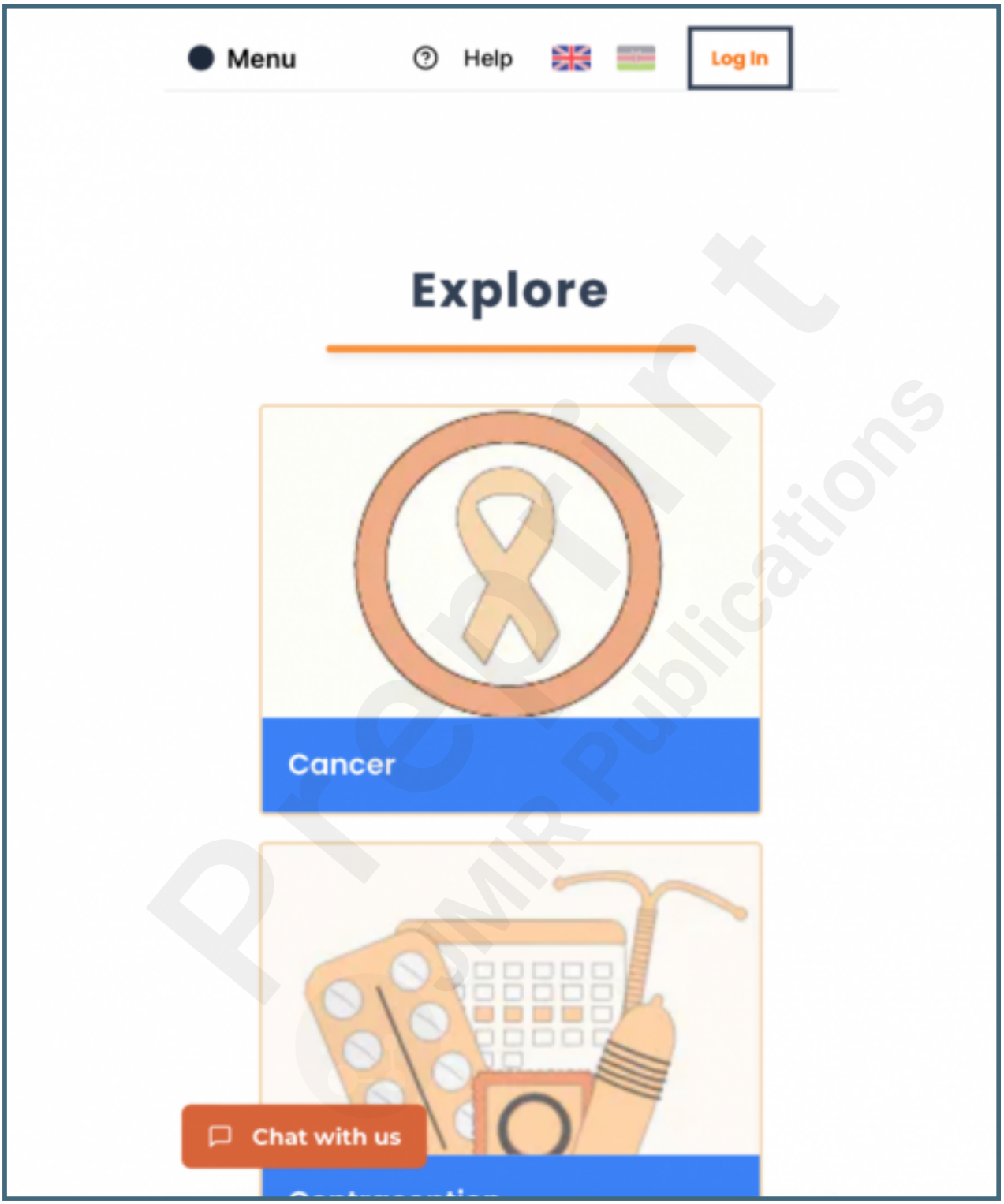

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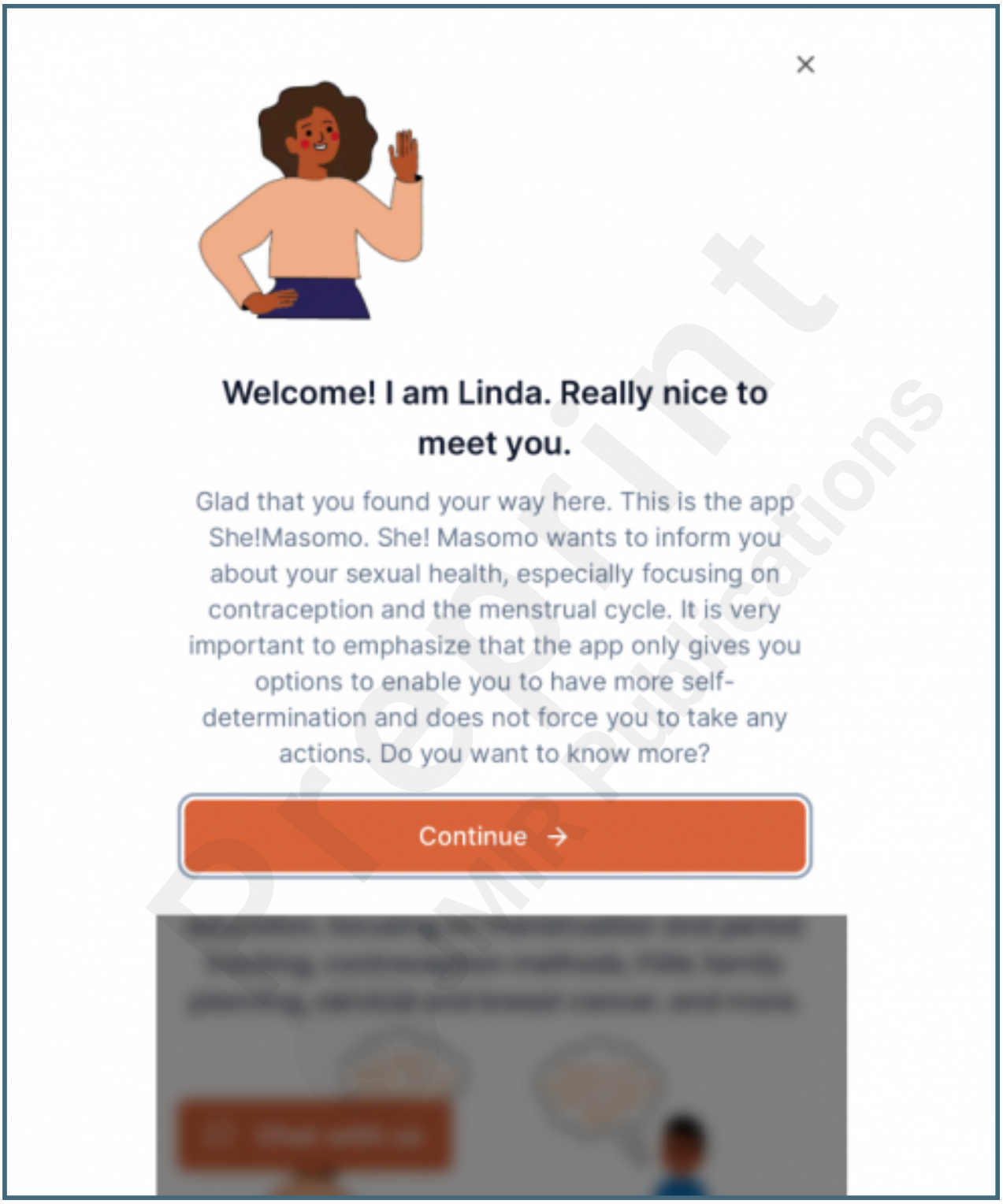
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