

# Evaluating a web-based guide for designing digital patient experiences: preliminary results of a user test with design students

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## Abstract

We created a web-based design guide to transfer our previous research findings to better support design education in the digital health design area for improving patient experience. To seek insights to iteratively improve the design guide, we conducted a workshop with 19 MSc students who specialized in design for healthcare. The guide was perceived as having the potential to improve their understanding of digital PEX improvements, but the content clarity and information presentation need to be improved.

*Keywords: design guidelines, digital health, patient experience, prototyping, workshop*

## 1. Introduction

### 1.1. Designing design

“Doing design involves increasing complexity” as Professor Pieter Jan Stappers at Delft University of Technology stated, “it requires systematic approaches to guide and support designers and stakeholders at a time of great change” (Pieter Jan Stappers, 2023). Design expertise and education, as well as the design tools used, can affect design thinking patterns and help designers “think faster” and deal with the increased design complexity (Gero and Milovanovic, 2020, Yu and Gero, 2016). Design researchers often want to impact both design academic and practice (Beck and Stolterman, 2016, Cash et al., 2022). They aim to gain a deeper understanding of doing design, therefore guiding better design processes, producing effective design guides, shaping design education, and consequentially improving design outcomes (Gero and Milovanovic, 2020). However, academic design research knowledge does not always have the expected impact on design education and practice (Zielhuis et al., 2022a). Design researchers tend to use academic language and formats that prioritize theoretical knowledge, which can be less directly informative for design practitioners (Stappers and Giaccardi, 2017). Therefore, designing design, in other words, finding appropriate and actionable forms to convey tacit and experiential knowledge from design research to a wider audience in design education and practice, can be difficult (Zielhuis et al., 2022a), but valuable. Knowledge can be transferred in multiple formats, such as design articles, concepts, guidelines, tools, portfolios, artefacts (Höök and Löwgren, 2012, Gaver, 2012, Löwgren, 2013, Zielhuis et al., 2022b), via practice participants or by the education of future design professionals (Telenko et al., 2016). Design guides or tools can assist future designers in increasing the chance of reaching a successful solution (Fu et al., 2016, Reimlinger et al., 2019).

## 1.2. Research on digital patient experience

Along with the fact that design researchers and designers increasingly contribute to shaping future healthcare (Groeneveld et al., 2018), design knowledge transformation in this area is required. Digital health (DH) solutions are emerging to tackle varied health system challenges, such as deliver convenient, personalized, and accessible healthcare services (Gopal et al., 2019, World Health Organization, 2018). However, current patient adoption and adherence to DH solutions remain low partially due to poor design and negative experiences (Wang et al., 2022b, Wang et al., 2024). Human-Centered Design (HCD) (Carayon et al., 2020, Melles et al., 2021) has the potential to meet user needs and further improve patient experience (PEX) in DH. However, there is still very little rigorous practical guidance on how to improve DH design so that technologies have a positive impact on PEX.

In our previous research, we identified some useful design knowledge for improving digital PEX from four studies based on extensive experience and empirical evidence. The first study is an umbrella review to identify the influencing factors, design considerations, and evaluations of digital PEX (Wang et al., 2022a, Wang et al., 2022b, Wang et al., 2024). The second one is a semi-structured interview study to investigate the general DH design process, challenges, and strategies of international DH design professionals (Wang et al., 2022c). The third one is an ongoing prospective observation study in a clinical setting to investigate how patients experience VR distraction for pain management during their wound care. The last study is an ongoing patient survey, based on the national Dutch colorectal cancer screening program, to investigate how people at high risk of colorectal cancer experience a digital intake tool (i.e., a patient education website) for preparing colonoscopy. To further transfer our identified knowledge to support design education and practice for improving digital PEX, we created a web-based design guide. Since the form of websites often allows people to easily access information globally (Daniluk and Koert, 2015) and provides a convenient way of learning online (Cook, 2007), as well as many well-known design guides having digital versions, such as the evolved Double Diamond innovation framework (the Design Council, 2023), the Field Guide to Human-Centered Design (IDEO, 2023), and the Improving Improvement Toolkit (Healthcare Design Group, 2020), we chose “website” as the delivery form for initially introducing our research findings to a wider design community.

## 1.3. Research objectives

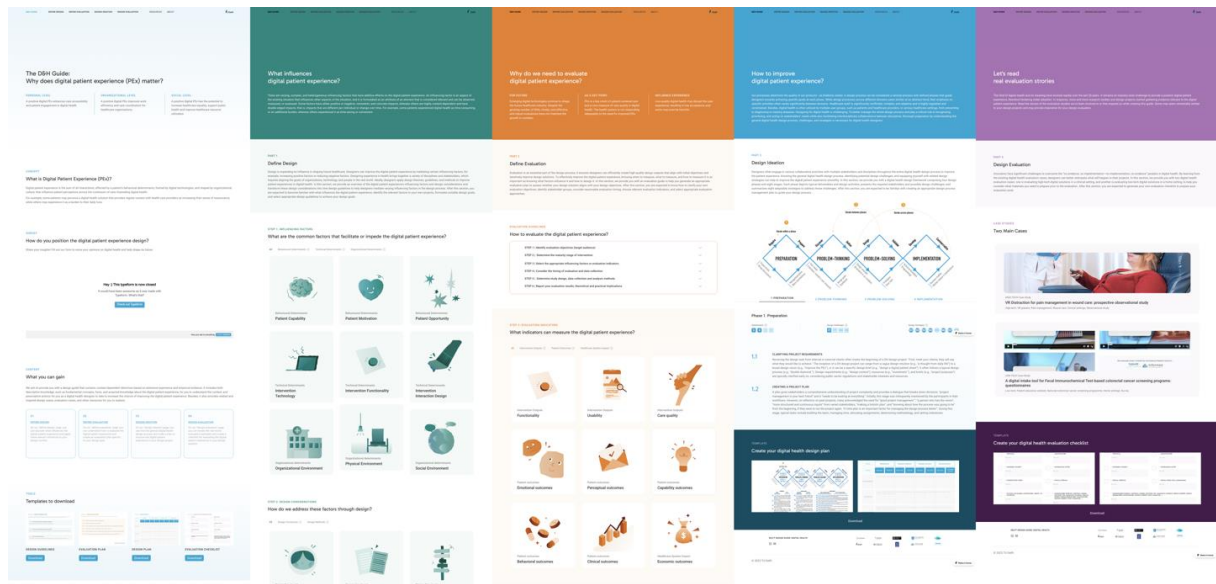


Figure 1. The prototype of a web-based guide for designing digital patient experiences

As Figure 1 presents, we created an initial prototype that aimed to educate future digital health (DH) designers of some fundamental concepts, facts, and acquired knowledge about digital patient experience (PEX) and provide prescriptive actions for them to take to further improve PEX. The prototype contains

four main webpages, including the homepage, define design, define evaluation, design ideation, and design evaluation pages (Wang et al., 2023, Yun, 2023), which were based on the digital PEx design and evaluation framework that we proposed in our previous research (Wang et al., 2022b). We assumed that the design guide would increase design students' understanding of PEx when they have limited accessibility to patients and help them embrace holistic, visionary, and strategic design leadership to establish an actionable DH design plan for improving PEx. In the current study, we aimed to seek insights to iteratively improve the design guide.

## 2. Methods

Research has shown varied approaches to measuring the impact of design guides, such as surveys, interviews, black-box experiments, and protocol analysis (Gero and Milovanovic, 2020). In the current study, we conducted a 4-hour workshop to collect both qualitative and quantitative data to generate insights for iteratively improving the design guide.

### 2.1. Participants

We recruited 19 master students from an elective course who registered the Master of Science with a specialization in Medisign (i.e., Design for Healthcare) (Medisign, 2023) in the Netherlands by using a purposive sampling (Etikan et al., 2016). The study was approved by the Human Research Ethics Committee of Delft University of Technology in September 2023.

### 2.2. Materials

Eligible participants were asked to work on a design proposal within the context of their pre-determined course assignments (i.e., Consultation Room 2030 or HollandPTC projects) to create a DH solution with an enhanced PEx. Both projects required students to analyze the current or ideal patient and healthcare professional journeys, workflows, and care paths in terms of the project contexts. The web-based design guide was introduced to all participants at the beginning of the workshop to guide them complete the design proposal. All participants were asked to bring their laptops to use the design guide during the workshop. Besides, we printed four templates that we downloaded from our website, which convey the main content of the design guide and help the participants engage with the website better. Participants were allowed to use the digital versions by downloading them from the website. These templates refer to four design tasks: frame design goals and select design guidelines; create an evaluation plan; create a design process management plan and create an evaluation checklist. Furthermore, two questionnaires were generated based on previous studies to collect quantitative and qualitative data from participants before and after using the design guide, including demographic information, digital health (DH) design experiences and expectations, pre- and post-DH design self-efficacy adapted from (Bandura, 2006, Holden et al., 2017), design guide content evaluation based on (Cash et al., 2023, Fu et al., 2016, Frey and Dym, 2006, Bandura, 2006), website System Usability Scale (SUS) (Brooke, 1996), and overall experience of participating the workshop and using the design guide. An outline of focus groups with semi-structured questions was developed to enquire participants' experiences and perceptions of the design guide, templates, and workshop.

### 2.3. Procedures

The workshop was scheduled for 4 hours, containing four main sections and 30-minute breaks.

- Section 1 (40 minutes): workshop and design guide introduction and pre-questionnaire (demographic information, design experience and expectations, pre-DH design self-efficacy).
- Section 2 (120 minutes): learning by doing (complete four design templates by following the DH design guide website).
- Section 3 (20 minutes): post-questionnaire (post-DH design self-efficacy, design guide content evaluation, SUS, overall experience).
- Section 4 (30 minutes): focus group interviews.

## 2.4. Analysis

Statistical analysis was performed with SPSS (Statistical Package for Social Sciences, version 28.0.1.0(142), Chicago, IL, USA) to analyse quantitative data collected through questionnaires. A *p* value below 0.05 is considered statistically significant. Descriptive statistics was used to analyse all descriptive variables in questionnaires, such as the social demographic information (e.g., age, gender) and SUS score. Within subjects repeated measures were used to compare the differences between pre- and post-DH design self-efficacy. For qualitative data in focus group, all audio-recordings were automatically transcribed and deidentified for data analysis. Based on the context mapping method (Stappers and Sanders, 2003), we extracted key directional insights by following a deductive and inductive analysis (Azungah, 2018) process that involves gathering statements, analysing and categorizing them, and then synthesizing these categories based on the five user experience design elements (Garrett, 2022, Omar, 2016).

## 3. Results

19 design students were involved in and worked in 11 groups on their previous course assignments. 11 participants chose A. Consultation Room 2030 (6 groups), and 8 students chose B. HollandPTC (5 groups). Each group worked in pairs, except for groups A4, and B2, B3, and B5, who worked alone, and group B4, which had three members. Notably, for students who didn't provide certain data, we excluded their invalid data in the related analysis.

### 3.1. Descriptive information

Among the 19 participants involved, aged 22-30 ( $M=25$ ,  $SD=2.64$ ). Female ( $n=10$ , 52.6%) and male ( $n=9$ , 47.4%) were almost half and half. Almost all participants ( $n=18$ ) had bachelor's degrees. Their current majors were integrated product design ( $n=11$ ), strategic product design ( $n=5$ ), design for interaction ( $n=2$ ), and biomedical sciences ( $n=1$ ). Participants relied more on design rationality ( $M=3.28$ ,  $SD=.96$ ) than design intuition during the design process.

### 3.2. Design experience and expectations

Most participants ( $n=14$ ) chose healthcare as one of their focused design themes; some of them wanted to further explore healthcare design in hospital ( $n=11$ ) or home settings ( $n=8$ ). More participants were interested in designing non-digital ( $n=12$ ) than digital ( $n=8$ ) healthcare solutions. Less than half of the participants ( $n=8$ ) have been involved in healthcare design projects. Most participants have used general design toolkits ( $n=16$ ), such as the Delft Design Guide, and healthcare-specific design tools ( $n=14$ ), such as the patient journey map. They used them for different design contexts, including design practice ( $n=13$ ), education ( $n=9$ ), or research ( $n=6$ ). However, a few of them routinely tried new design toolkits ( $n=7$ ) or healthcare-specific design tools ( $n=5$ ). The most common ways that participants learned about a design toolkit or tool were through education activities ( $n=19$ ), such as lectures, speeches, and workshops, followed by teamwork ( $n=11$ ), search engines ( $n=6$ ), and online self-learning courses ( $n=5$ ). Participants reported that a design toolkit with clear instructions, context, structure, approach, and outcomes that ensure certainty, usability, flexibility, and creativity would facilitate their use. Conversely, a toolkit with unclear aims, excessive information, academic language, and time consumption that limit practicality, learnability, adaptivity, and credibility would impede them from using it. Digital or paper-based design tools ( $n=15$ ) that provide templates ( $n=14$ ), card decks ( $n=3$ ), checklists ( $n=2$ ), instructions ( $n=3$ ), and examples ( $n=2$ ) were reported as most useful to participants. In general, participants ( $n=19$ ) reported a moderate interest ( $M=3.39$ ,  $SD=1.09$ ) in having a design guide that helps them develop DH solutions in ways that improve PEx. Participants expected the design guide to clarify its scope, explain when to use it, provide required knowledge, and offer design actions, steps, and directions, as well as real-life case studies. Besides, they expected to get more inspiration from using the design guide and be informed of the pros and cons of using some design methods. They would like to increase their design performance or capability, such as understanding the context better, facilitating creativity, keeping focus, improving work efficiency, and saving time and money, by using the design guide.

### 3.3. Quantitative results

#### 3.3.1. Design templates rating

11 groups were asked to rate the usefulness of each template. Template 2 (i.e., create an evaluation plan) was rated less useful ( $M=2.21$ ,  $SD = .081$ ) than the other three templates by 8 groups; template 3 (i.e., create a design process management plan) was rated the highest score ( $M=3.44$ ,  $SD=1.237$ ) by 8 groups; followed by template 1 (i.e., frame design goals and select design guidelines) ( $M=3.36$ ,  $SD=.929$ ) which was rated by 10 groups; and template 4 (i.e., create an evaluation checklist), which was rated by 7 groups ( $M=3.07$ ,  $SD=1.018$ ).

#### 3.3.2. Digital health design self-efficacy

17 participants completed both pre- and post- design self-efficacy Likert Scales. On a scale of 0-100 (0 = “cannot do at all” to 100 = “highly certain can do”), their design self-efficacy changes in performing DH design and improving the digital PEx were measured. The within subjects repeated analysis revealed a positive significant effect of the design guide on participants' confidence of understanding digital PEx ( $F(1, 16)=8.864$ ,  $p=.009$ ), creating and carrying out a practical DH design process management plan ( $F(1, 16)=5.515$ ,  $p=.032$ ), creating and carrying out an actionable DH evaluation plan ( $F(1, 16)=25.316$ ,  $p<.001$ ), and creating an effective evaluation checklist to prepare themselves for the design evaluation ( $F(1, 16)=8.145$ ,  $p<.001$ ). However, there was no significant effect on participants' confidence in creating digital PEx improvements ( $F(1, 16)=3.073$ ,  $p=.099$ ), identifying influencing factors and design considerations to generate an effective design goal for improving digital PEx ( $F(1, 16)=2.749$ ,  $p=.117$ ), creating effective DH design concepts ( $F(1, 16)=.005$ ,  $p=.946$ ), or generating evidence of an improved digital PEx ( $F(1, 16)=.529$ ,  $p=.478$ ).

#### 3.3.3. Design guide content evaluation, website system usability, and overall experience

On a scale of 5 (1= “strongly disagree” to 5 = “strongly agree”), 17 participants evaluated the design guide content, website system usability, and reported their overall experiences of participating in the workshop and using the design guide. The descriptive statistical analysis revealed that the content of the provided workshop tasks was perceived as related to the digital PEx ( $M=3.88$ ,  $SD=.781$ ). Participants believed that they possessed the necessary design expertise and knowledge ( $M=3.47$ ,  $SD=.874$ ) and adhered to the design guide ( $M=3.35$ ;  $SD=.996$ ) to successfully complete the templates. They reported that the design guide was trustworthy and could be believed in ( $M=3.59$ ,  $SD=.772$ ) and enhanced their efficiency in developing design and evaluation solutions, allowing them to complete tasks without detours and ensuring smooth progress ( $M=3.29$ ,  $SD=.849$ ). However, the content efficacy of leading participants to achieve the intended design and obtain the anticipated evaluation results was perceived as not good enough ( $M=2.65$ ,  $SD=.786$ ). The content clarity of the design guide was perceived as not clear, coherent, and easy to understand enough ( $M=2.29$ ,  $SD=.772$ ). Furthermore, participants didn't perceive significant value and were dissatisfied with the impacts on their design process ( $M=2.76$ ,  $SD=1.033$ ).

Our results revealed that participants found the website was easy to use ( $M=3.76$ ,  $SD=1.091$ ), and didn't need extra technical support to use the website ( $M=1.76$ ,  $SD=1.147$ ). They found the various functions in the website were well integrated ( $M=3.65$ ,  $SD=.702$ ), perceived less inconsistency in the website ( $M=2.29$ ,  $SD=.920$ ), believed that most people would learn to use the website very quickly ( $M=3.59$ ,  $SD=1.121$ ), perceived that the website was not very cumbersome to use ( $M=2.47$ ,  $SD=.800$ ), and felt very confident to use the website ( $M=3.41$ ,  $SD=1.004$ ), and no needed to learn a lot of things before they could get going with the website ( $M=2.24$ ,  $SD=1.393$ ). However, they were less likely to use the design guide frequently ( $M=2.59$ ,  $SD=1.121$ ), and found the website was unnecessarily complex ( $M=3.00$ ,  $SD=1.369$ ). The result of the overall system usability scale score (SUS) was 63 which slightly below the average score of 68.

Overall, participants felt that they tried their hardest to do a good job during the workshop ( $M=3.88$ ,  $SD=.928$ ) and had moderate interest in using the design guide ( $M=2.94$ ,  $SD=1.144$ ). They reported that they had a moderate possibility of using the design guide in the future ( $M=2.82$ ,  $SD=1.131$ ) or recommending it to others ( $M=2.71$ ,  $SD=.849$ ). However, they believed that they gained valuable

knowledge from the workshop ( $M=3.41$ ,  $SD=1.004$ ) and were satisfied with the workshop instructors ( $M=3.82$ ,  $SD=.728$ ).

### 3.4. Qualitative results

13 participants attended the focus group section and were separated into 3 groups. Each group had one investigator to ask pre-defined open-ended questions. Participants' comments were systematically categorized into five aspects for further improving the design guide.

#### 3.4.1. Surface

This theme refers to how participants evaluate the interface of the design guide, such as layout, typography, and colours, and whether the visual appearance of content and controls gave a clue of what users can do and how to interact with them (Garrett, 2022, Omar, 2016). Most participants commented on the surface positively; some mentioned that “the graphics are nice and useful” and “I do like the visuals of the website”. Besides, one participant suggested we revise the color of a logo because it “lacks color contrast on a blue background”, and two participants pointed out that “the margin, padding, and pictures on the website are too large”.

#### 3.4.2. Skeleton

Skeleton refers to how participants evaluate the navigation of the design guide and whether they can move through the information intuitively (Garrett, 2022, Omar, 2016). Some participants felt a lack of control over the amount of content on a single webpage and were unable to discern their current location within the website. Some pointed out that the current navigation lacked a strong chronological order; others suggested the design guide should be more intuitive and act as a flexible resource.

#### 3.4.3. Structure

Structure refers to how participants evaluate the hierarchical information architecture of the design guide (Garrett, 2022, Omar, 2016). A few comments related to this theme, they were positive, such as “I think the website went quite well” and “Surfing the website is quite easy in my opinion”.

#### 3.4.4. Scope

Scope is about how participants evaluate the fulfilment of the functional and content requirements, such as functions, features, information like text, images, audios, and videos (Garrett, 2022, Omar, 2016). Some participants complained that the text in the design guide and templates was too much and was written in an academic way. For example, one participant said, “I do think that the website is too much text and no one's going to read all of that”. Besides, they suggested avoiding abbreviations and typos and downloading materials in a separate window to reduce confusion. Providing more visualizations, such as “it's very text-based; it should be more visual-based”. Furthermore, some participants wished the design guide not only focuses on a patient perspective but also others' perspectives: “I want to have a doctors' view”. A clear “instruction”, “filter”, and “search button”, as well as “a brief version” design guide was suggested as well.

#### 3.4.5. Strategy

Strategy refers to whether the participants find the design guide meet their needs (Garrett, 2022, Omar, 2016). Some participants mentioned that the web-based design guide and paper-based templates had some overlap information, which made them a bit confused about when to use which. Besides, they suggested to provide a paper-based design guide, such as “a small booklet”, which may be assist them to learn the knowledge. A balance between providing fixed steps and flexible resources was suggested.

## 4. Discussion and conclusion

To seek insights to iteratively improve the design guide, we conducted a workshop with 19 design master students and summarized their comments into five directions. Our results showed that the design guide had the potential to improve design students' performance during the design process by increasing their

DH design knowledge and skills, but we found limited evidence on promoting a better DH design outcome directly. The usability of the design guide requires further improvement, especially in the content-related aspects. As the Improving Improvement Toolkit pointed out “systems that work do not just happen—they have to be planned, designed, and built” (Healthcare Design Group, 2020). We believed that neither learning nor educating new DH design knowledge and skills would just happen themselves; they had to be researched, designed, and improved. Therefore, our research contributed to both theoretical and practical implications. It not only gathered insights to inform a wider research community on how to generate and evaluate a web-based design guide but also provided directions for iteratively improving the web-based design guide to better support DH design education and practice in the future.

#### 4.1.1. General findings

Our results revealed that template 2 (i.e., create an evaluation plan) was rated as having the lowest usefulness among the four templates. Except for the problems of content clarity and information presentation itself, we assume that design students were less familiar with design evaluation, especially in a healthcare context full of medical terms. This aligned with previous research which stated that evaluation of design solutions was difficult for designers (Bonnardel and Sumner, 1996). Besides, our participants just started to work on their given design projects; therefore, they might lack a holistic view of what concepts they would create and how to evaluate these concepts. They had to work on template 2 according to their imagination. The four templates required further improvements to simplify their contents and clarify their usage scenarios in terms of different design stages, especially template 2.

The comparative analysis of participants' DH design self-efficacy before and after using the design guide revealed that participants perceived the design guide could help them perform better in their design processes but could not guarantee their design outcomes. For example, their understanding of digital PEx significantly increased, but their confidence in creating digital PEx improvements remained unchanged. We assume that although participants perceived the value of the design guide as increasing their knowledge or skills in performing design, they also felt that increased design knowledge and skills alone from the design guide did not lead to a better DH design solution. Indeed, there were many other factors, such as policy regulations and business investment (Wang et al., 2022b), that would limit the success of a DH solution in the real world. Besides, as we mentioned earlier, participants were still at the very beginning of their design projects; they couldn't gather enough evidence to anticipate what hadn't happen. Therefore, we believed that our claimed impacts of the design guide should focus on increasing designers' performance during the design process instead of better design outcomes directly. Participants found the content was relevant to the given context, trustworthy, and can be useful; the website itself was easy to use; they gained valuable knowledge from the workshop and were satisfied with the workshop instructors. However, the content unclarity and excessive information presentation resulted in a bit lower usability and further impeded their understanding of the design guide and interest in using it in the future or recommending it to others. Combining with the qualitative results, we summarized five actionable directions for improving the usefulness and usability of a web-based design guide in general:

- Surface: using more visual elements instead of text on the website to attract users' attention and simplify information presentation.
- Skeleton: making the website navigation more intuitive to use by avoiding a strong chronological order (i.e., more usage flexibility) and informing users of their current locations.
- Structure: using hierarchical information architecture to organize information presentation.
- Scope: simplifying content, avoiding using academic language and abbreviations; providing a clear scope, usage contexts, and instructions; clarifying the impact of using the design guide.
- Strategy: using websites as flexible information resources; providing simple templates as step-by-step guides.

#### 4.1.2. Limitations and future research

The first limitation is participants' engagement; not all participants showed a strong interest in DH design, and some had little design experience in this area; a few were even distracted by their final

examinations and other project deadlines. Second, participants just started their simple and conceptual design projects and might lack understanding of the whole design context, which limited their usage of the design guide. The last is the number of participants, which might limit the statistical analysis. However, we collected both qualitative and quantitative data, which could help us gain a deeper understanding of the participants. To address the above issues, we conducted a follow-up user test workshop study, which will be reported in another article. It took longer, followed a stricter participant recruitment process to assess participants' motivations, and recruited more participants. Furthermore, we recommend that future research investigate how design guides influence collaborations within or between design stakeholders.

#### 4.1.3. Conclusion

Our workshop results revealed that the design guide has the potential to improve design students' digital health design knowledge and skills, but the content clarity and information presentation of the design guide needed to be further improved. Participants provided suggestions referring to surface, skeleton, structure, scope, and strategy for further improving the design guide.

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