Design for Social Accessibility Method Cards: Engaging Users and Reflecting on Social Scenarios for Accessible Design

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This article is an extended version of our 2018 ASSETS paper entitled, "Incorporating Social Factors in Accessible Design." In our ASSETS paper, we demonstrated the viability of the *Design for Social Accessibility* perspective through a series of user-centered workshops with professional designers. With this expanded article, we conducted a follow-up research study with a user-centered design course that examined the use of Design for Social Accessibility Method Cards over a longer design cycle, specifically as the method and cards contributed to a term-long project, rather than just a workshop. We also offer a new analysis on work leading to the development of Design for Social Accessibility, with a focus on how practical considerations in the design process influence how designers engage accessible design. We found that the concrete and real-life scenarios in the Design for Social Accessibility Method Cards helped mediate useful interactions between student designers and deaf and hard-of-hearing users. In addition, we identified how practical choices in investigating strategies for socially accessible design enabled designers to center disabled perspectives. The contributions of this work—when added to the findings of our ASSETS 2018 paper on incorporating social factors—demonstrate the viability of Design for Social Accessibility by providing: (1) empirical data showing that designers can use the Design for Social Accessibility perspective and method cards to generate accessible designs and appropriately engage deaf and hard-of-hearing users to incorporate social considerations; and (2) a summative analysis highlighting practical steps for how designers can use the Design for Social Accessibility perspective and methods cards to create accessible designs.

CCS Concepts: • **Human-centered computing → Accessibility design and evaluation methods**;

Additional Key Words and Phrases: Design workshops, accessibility, user-centered design

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1 INTRODUCTION

Many human-computer interaction design techniques emphasize user-centered design strategies to underscore diverse user experiences in technology solutions [6, 12, 14, 22, 27, 33]. Yet, technology accessibility is often not socially acceptable, if it exists at all [30], potentially impacting users' willingness to adopt and use accessible solutions [31]. To address this gap in technology accessibility, we developed the Design for Social Accessibility (DSA) perspective and Method Cards that emphasize social factors in the design process [28]. We grounded the DSA perspective on the notion that *socially accessible* technology design accounts for functional and social factors [28], toward creating technologies that are effective and appealing to use in social environments. We validated this perspective with professional designers in user-centered design workshops demonstrating that including disabled and nondisabled users enhanced the design process and designers' ability to include social considerations [32]. We found that accounting for social situations helped designers generate accessible solutions that can be used by all users, not just disabled users, and that prompting designers to facilitate multiple perspectives and reflect on social considerations is feasible in a user-centered approach [32]. However, although professional designers' use of DSA in the user-centered design process validated the design perspective as viable [32], less is known about exactly *how* the DSA Method Cards contributed to their design thinking. Therefore, we conducted a study in a design course to examine how student designers used the DSA Method Cards in the user-centered design process. Student designers indicated that the real-world scenarios were helpful in considering similar social situations when reflecting on their design ideas. They also reported the cards were helpful in mediating conversations with deaf and hard-of-hearing expert users. Students' responses were positive, and their feedback enabled us to revise and prepare the card set for eventual distribution for others to use.

This manuscript is an expanded version of our 2018 ASSETS paper entitled, "Incorporating Social Factors in Accessible Design," in which we demonstrated the viability of the Design for Social Accessibility perspective for professional designers to incorporate social and functional factors while balancing input from sighted and blind users [32]—with additional analyses across four studies that led to the conception and validation of Design for Social Accessibility. In this article, we primarily present findings from our investigation with master's students in a user-centered design course (the fourth study), bolstered by new analysis of work leading to and validating Design for Social Accessibility (the first three studies). This manuscript expands on themes from the ASSETS paper by:

(1) Adding data from a new study investigating how master's students in Human-Computer Interaction (HCI) design utilized updated DSA Method Cards in a full design cycle with deaf and hard-of-hearing users, rather than in a contrived workshop scenario with blind users.
(2) Incorporating an updated analysis of designers' use of the Design for Social Accessibility perspective and method cards, clarifying how others can make use of this work.

Contributions of this work include empirical findings demonstrating the effectiveness of the DSA perspective and Method Cards, particularly for deaf and hard-of-hearing users, and a "how to" for ways that designers can incorporate these strategies into accessible design.

2 BACKGROUND AND RELATED WORK

Despite the many strategies for technology design that emphasize the human experience as vital to creating usable software and hardware, few approaches are fully inclusive of disabled experiences. Meanwhile, approaches to technology design that focus exclusively on accessibility could result in

"special" devices that may be uncomfortable to use in social situations, resulting in limited use or abandonment rendering the device effectively inaccessible. In this section, we motivate the need for a design perspective that includes accessibility within the context of social and professional everyday experiences towards shifting general design practice to include people with disabilities as typical stakeholders.

2.1 User-centered and Inclusive Design

Design approaches that include accessibility typically focus on including people with disabilities in the design process, especially in requirements gathering and needs assessment; or on developing social rapport to encourage empathy, or to focus on ability rather than disability. In this section, we include a conceptual analysis of common inclusive design techniques in HCI.

User-centered Design. User-centered design is one of the most popular ways to design for the human experience by utilizing a series of user-centered activities, values, needs, and desires [13]. From the pillar of user-centeredness extends design techniques focused on gathering knowledge about user needs, understanding conceptual models, crafting personas, and obtaining feedback when iteratively designing. Indeed, the human aspect of HCI is what separates the field from computing writ large, and the designation of "user-centered" is often meant to inform user-friendly technology design and to incorporate diverse user experiences to robustly test and improve future technical iterations [6]. Technology designers often take this to mean that user-centered design shall account for nondisabled and disabled technology users when such users are placed at the center of the design process [18, 33]. Based on this assessment, user-centered design, on its user-centeredness alone, ought to be enough to create designs that are accessible. However, the prevalence of technologies that are not designed to be accessible to people with disabilities demonstrates that focused consideration of diverse populations is not often the case [32]. To address this gap, accessibility and design researchers have argued that a concentrated effort toward inclusion is necessary—namely, inclusive design [15].

Inclusive Design. Inclusive design is promoted as one way to facilitate inclusion by way of intentionally emphasizing the needs of diverse populations [15]. The inclusive design approach complements existing user-centered design perspectives in providing additive strategies to encourage designers to consider diverse user experiences, such as disability [20]. In contrast to the user-centered design approach, inclusive design is instructive in ensuring people with disabilities are included as part of the design process. However, we argue that without the added constraint for social consideration, such an approach may result in "special" outcomes that are usable by people with disabilities, but not for people without disabilities. As a consequence, social perceptions of technology use by people with disabilities can remain inaccurate [31].

Ability-based Design. Rather than accounting for disability in terms of impairment, ability-based design encourages a perspective that begins with what people with disabilities *can* do [35, 36]. Through a series of principles, the ability-based design approach encourages designers to leverage the power of adaptive computing to ensure customization and personalization toward better accessibility and usability. In addition, current technologies can be scrutinized for their "ability assumptions," and those assumptions can be questioned or even uprooted in favor of alternative abilities.

Other Tools and Strategies. Tools to facilitate better user-centered design are commonplace in HCI. IDEO's Method Cards and the Value Sensitive Design Envisioning Cards are two such tools that motivate diverse approaches to design. IDEO is a popular and well-known design firm with deep roots in HCI [16]. As such, IDEO's methods, tools, and strategies are well known and used across the field; examples include design thinking [4], structured brainstorming, and experience

prototyping [5]. Value-Sensitive Design (VSD) is a design philosophy that emphasizes the values that may influence or be influenced by a given design [12]. VSD requires designers to identify and outline stakeholder values, extending consideration beyond the life and direct use of a system [12]. As such, the VSD Envisioning Cards provide wide-ranging and thought-provoking prompts and scenarios that cross generations, cultures, and entire value systems [11]. A number of other tools—and, in particular, method cards—exist to support design work tangential to accessibility, including: for security [9], service design [7], or inclusive design [17, 20]. However, these tools are less applicable to accessible design or do not emphasize social considerations.

Although approaches to technology design have evolved and attempt to empathically include people with disabilities as key users, they typically include accessibility as an ad hoc consideration. Meanwhile, few resources are available to help designers learn how to address needs specific to disabled users. Furthermore, as we discuss below, the lack of accessible designs demonstrates a need for a new way to motivate inclusion in the design process. Rather than prescriptive solutions, a design perspective is needed that fundamentally shapes how designers engage design in general toward better design for disability.

2.2 Socially Accessible Technology

Despite progress in technological innovation, many new personal technologies remain functionally inaccessible to people with disabilities. For example, the recent influx of personal assistants includes devices such as Amazon's Echo and Echo Dot, Google Home, and Apple HomePod. Such technologies include voice assistants such as Apple's Siri and Microsoft's Cortana. Users speak instructions that are executed using artificially intelligent technologies. Yet, many of these technologies are not accessible to people with disabilities [1, 25]. Meanwhile, certain technologies are created with the sole aim of being accessible to people with disabilities, oftentimes with the goal to address a functional gap; for example, using smartphone camera technology to "be the eyes" for people with visual impairments [2, 34, 37]. In contrast with inaccessible virtual voice agents, assistive software apps aim to provide utility for people with disabilities and by definition are supposed to be accessible to use.

Although disability-specific apps can be useful, they enable inaccessible mainstream technologies to remain that way. Proprietary assistive and (inaccessible) mainstream technologies for the same tasks may perpetuate a "separate but equal" approach to technology design and development and uphold false dichotomies that assistive technologies are just as effective as inaccessible mainstream counterparts [26]. We consider that including social and functional perspectives in user-centered design challenges the notion that accessible technologies must be different from mainstream technologies for nondisabled users [31]. We maintain that encouraging social consideration alongside functional ones enables designers to create technology solutions for people with *and* without disabilities.

Social Accessibility. In prior work, we found that proprietary assistive technologies contribute to incorrect perceptions of the abilities of people with disabilities [31]. When people with disabilities are observed to use "special" technologies in lieu of inaccessible mainstream counterparts—even for the same functional purposes—bystanders are more likely to conclude that disability necessarily limits them to using a different tool [31]. In contrast, technology inaccessibility often contributes to the inability to complete a task, rather than a person's impairments *per se* [30]. Due to such complex personal and social forces, assistive technologies attract unwanted attention, particularly when they do not align with users' preferred social identities and social interactions [30]. Ultimately, social forces contribute to inaccessibility if, for example, a smartphone user opts not to use her phone in a professional environment if the text-to-speech functionality will be perceived as disruptive.

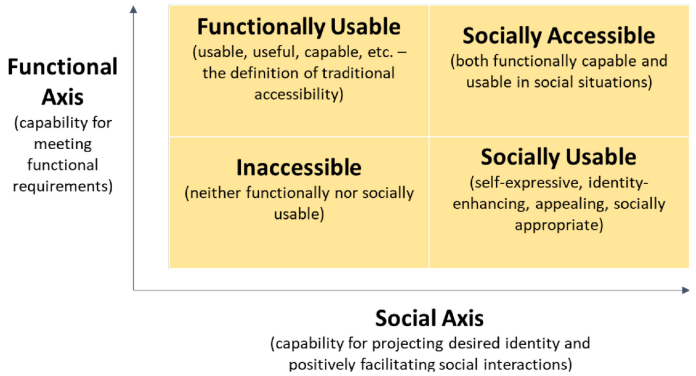


Fig. 1. The Design for Social Accessibility framework that outlines a design space composed of social and functional dimensions. Figure reproduced from our ASSETS 2018 paper [32].

Certain aspects of technology design have been found to contribute to social dimensions of inaccessibility, most notably when assistive solutions are developed that include the same essential functions as mainstream technologies [30, 31]. But, in some cases, an adaptive or proprietary design may be preferred by the user, such as refreshable Braille. If an assistive technology must be proprietary, then it is preferred that design also aligns with personal preferences, allowing for customizations, or blending to match mainstream counterparts or other common and similar technologies [30, 31]. For example, various versions of the HIMS Blaze EZ MP3 player[1] have been identified as preferred by blind users, because it plays proprietary DAISY format files while also maintaining a slim and sleek form factor [30]. Thus, a key factor in improving accessible design is to consider the preferences of users in the context of their daily personal, social, and professional lives.

Design for Social Accessibility. We leveraged the knowledge that social and functional factors are intertwined in defining "social accessibility" as a property of technology design that incorporates social situations of use and functional usability. We also defined "Design for Social Accessibility" as a guiding perspective with strategies and tools to emphasize social factors in design. We created a design space—what we called the DSA Framework—that positions social factors as important as functional ones (Figure 1). This careful consideration of social situations *benefits* design, rather than hinders it [29].

Across this body of work, we investigated what social factors determine the successful adoption of accessible technologies (When do users decide to use or not to use their technologies? What contributes to their decisions?) and how we should account for social factors in the design process. We sought ways to lower the barriers to accessible design overall.

2.3 About this Article

Altogether, four studies comprise this body of work: two design course studies leading to the development of Design for Social Accessibility [28, 29], one workshop [32], and a follow-up design course study (new results as described in this article) validating the Design for Social Accessibility perspective and method cards. We briefly describe these four studies and how we have laid out these findings and analyses (summarized in Table 1): First, we conducted an investigation with a design thinking course for undergraduate students (hereafter referred to as "Course A") that investigated how students integrated social consideration and constraints to design for users with and

[1] https://www.hims-inc.com/product/blaze-ez/.

Table 1. Breakdown of the Research to Develop and Assess the Design for Social Accessibility Perspective

Study	Brief description of study and its key findings
Undergraduate Design Thinking "Course A"	Design thinking course that required students to design for disabled and nondisabled stakeholders and where students engaged expert users with disabilities throughout the design process. Emerging themes showed that consideration for disabled and nondisabled users contributes to how social aspects of accessibility are considered [29].
Undergraduate Design Thinking "Course B"	Design thinking course that incorporated all the elements in Course A, but also added multiple expert users for student designers to work with. Emerging themes showed that students were able to engage multiple disabled and nondisabled perspectives, and that they appreciated and benefited from interacting with more than a single expert user [28].
"Workshops" with Professional Designers	Design workshops with professional designers who worked with a visually impaired and sighted user and engaged in common user-centered design tasks while using the Design for Social Accessibility Tenets and Method Cards. Findings indicated that designers were able to incorporate the DSA perspective and strategies in their own design process, and that they were able to balance the variety of perspectives raised by the pair of users [32].
Master's User-Centered Design "Course C"	A user-centered design course with HCI master's students that incorporate use of the DSA Method Cards to determine how students engaged the cards in the course of their design process. Emerging themes included that students found the specific scenarios in the cards useful for critiquing their ideas against realistic use-cases.

without disabilities [29]. Then, in the second design thinking course offering (hereafter referred to as "Course B"), we examined how students utilized design approaches, such as Ability-based Design, Value Sensitive Design, Universal Design, and a fledgling Design for Social Accessibility (that included the consideration of social factors). Based on findings from the Course A and Course B studies, we solidified the Design for Social Accessibility Tenets as a design perspective and began developing the DSA Method Cards to prompt reflective consideration for social accessibility in the design process [28]. In the third study, presented at ASSETS 2018, we conducted a series of user-centered design workshops with professional designers (hereafter referred to as "Workshops") to investigate whether the Design for Social Accessibility perspective was viable for professional designers [32]. Findings from the Workshops study validated the Design for Social Accessibility perspective as useful and appropriate for professional designers, including involving users with and without disabilities, and incorporating consideration for social factors alongside functional ones. One limitation of the Workshops study was that we were unable to effectively evaluate the DSA Method Cards due to misinterpretation. Therefore, with some re-design of the DSA Method Cards, we conducted a user-centered design course study (hereafter referred to as "Course C") with HCI master's students to validate the usefulness of the cards in a design setting.

In this manuscript, we present new evidence from Course C that details nuanced ways that DSA Method Cards help achieve design goals toward Design for Social Accessibility. Whereas findings from the Course A and Course B studies shaped Design for Social Accessibility as a possible design perspective involving users with and without disabilities, including a focus on social factors, the Workshops and Course C studies focused on validating the DSA perspective and DSA Method Cards in inclusive design practice. As a result of findings from the Workshops study that showed

Table 2. User-centered Design Workshop Participants: Professional Designers, Sighted and Visually Impaired Users

Work-shop	Designer (D) Title-Yrs. Experience	Visually Impaired User (V)	Sighted User (S)
1	D1 (F, 25 yrs) Product Designer-6 yrs	V1 (F, 20 yrs) low vision	S1 (F, 24 yrs)
2	D2 (M, 31 yrs) Senior Designer-5 yrs	V2 (F, 54 yrs) low vision	S2 (F, 29 yrs)
3	D3 (F, 54 yrs) Designer-5 yrs	V3 (F, 34 yrs) light/dark vision	S3 (F, 37 yrs)
4	D4 (M, 44 yrs) IT Consultant-5 yrs	V4 (F, 63 yrs), blind	S4 (F, 34 yrs)
5	D5 (F, 25 yrs) Technical Designer-3 yrs	V5 (M, 32 yrs), Stargardt's, no central vision	S5 (F, 18 yrs)

Table reproduced from Reference [32].

designers were uncertain how to make use of the cards, we made design and clarifying changes to make the cards easier to read and use quickly. We also added a new card, "Getting to Know You" to facilitate introductions and initial conversation.

In the following section, we briefly detail the methods used in the Workshops and Course C studies. For detailed descriptions of methods and findings for Course A and Course B studies, we refer the reader to our other papers [28, 29].

3 VALIDATING DESIGN FOR SOCIAL ACCESSIBILITY

3.1 Professional Designers and Design for Social Accessibility: Methods and Data

Our ASSETS paper reported on our findings on how designers use Design for Social Accessibility (DSA) in a series of user-centered design workshops [32]. Professional designers worked with users with and without visual impairments and created low-fidelity prototypes in response to a given prompt. Designers were instructed to develop a solution drawing on users and DSA tools as resources, including using the method cards.

Five designers with at least two years of professional user-centered, interaction, or industrial design experience led five design workshops (Table 2). Workshops were about three hours long and consisted of core phases of user-centered design research: brainstorm and ideation, synthesis, and prototyping and user-evaluation. After each phase, designers and users completed reflective questionnaires. Designers completed pre- and post-surveys about attitudes about user-centered design and about disability. After completion of the workshop, designers were interviewed about their roles as designers and about their experiences in the workshop (Figure 2 shows an overview schedule followed for all the workshops).

3.1.1 Design for Social Accessibility Method Cards. To aid designers in incorporating social factors, we developed a set of design method cards that could be used in user-centered design practice [28, 32]. The DSA Method Cards illustrate social situations of use to enable designers to engage users with disabilities appropriately and reflectively in ideating and critiquing design solutions (Figure 3 shows an example card used in the Workshops). The DSA Method Cards were created with examples originating from participant data from past studies and altered slightly for discretion. In addition, a key consideration in developing the Design for Social Accessibility perspective is to leverage designers' existing knowledge and skill, rather than dictate any given skillset or technique. Thus, the cards include prompting and suggestions, not instructive requirements.

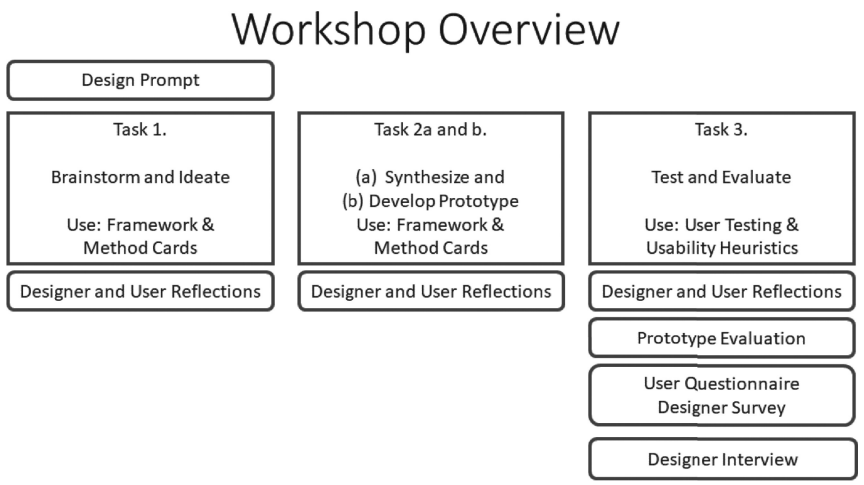


Fig. 2. Overview of the workshop tasks, including the phases of the user-centered design that were completed and when reflections and questionnaires were administered.

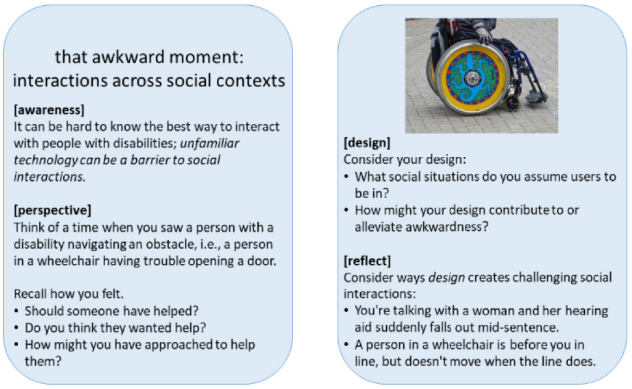


Fig. 3. An example of the DSA Method Card given to professional designers in the Workshops.

3.1.2 Data and Analysis of Workshops with Professional Designers. Data from the workshops include audio and video recordings from the workshops, transcripts of the audio from the workshops, artifacts that were created during the workshops; and transcribed audio from the post-workshop designer interviews. We analyzed data from the design workshops inductively and deductively, with explicit analysis on workshop dialogue between designers and users, and analysis on designer interviews post-workshop. An initial open-coding approach enabled us to assess emergent themes in the ways that designers interacted with blind and sighted users, and in the ways they used Design for Social Accessibility throughout the user-centered design workshop [32] (Table 3). In this inductive analysis, we focused on how interactions between people and techniques emerged in terms of the designers' reactions to individual events. For example, several designers commented on the efficiency of working with both users at the same time (i.e., coded as "Working with people…"); to these comments, we analyzed how snippets of dialogue revealed how these instances played out in the workshops (e.g., coded as "switching user focus," "pivoting ideas," "social prompts"). In our deductive analysis, we assessed how social factors helped formulate accessible solutions as an analytic check on the effectiveness of including social

Table 3. High-level Codes from the Workshops Study Analysis

Designer Interview
Prior experiences—do not design with users, working with people with disabilities, do not interact with disabled people often, do not include accessibility, initial perceptions of disability, accessibility
Barriers—in considering social factors, in designing with users with and without disabilities, to actual use, to accessibility
Working with people in the design practice, benefits to, impact of multiple users, working with disabled users
DSA tools and techniques—framework (helpful, useful, feedback), method cards (useful, awareness, ideas, misunderstanding), Working with two users, challenges
Accessibility as legal guidance/requirements
Inclusive design—attitudes, approaches, challenges
Social accessibility—defining SA for use, just like everyone else, increase diversity of ideas, perspectives on disability and diversity, idea of inclusion
Workshops
Workshop dynamics—designer led, team management, switching user focus, explanations, VI-user led, sighted-user led
Ideas—idea building and ideation, pivoting ideas, repeat/reinforce idea, considering access, considering social factor, contrasting user ideas, agreements
DSA tools and techniques—social prompts, acknowledge disability/accessibility, people with disabilities not included
Social Accessibility—for everyone, features, awkward, comfort
Disability knowledge sharing—VI-user experience, consulting VI user, sighted user.

and functional factors, and users with and without disabilities [32]. Thus, the codes as shown in Table 3 show a complementary relationship between designers' reflections and responses, the interactions that took place between all the workshop participants, and participants' responses to working through prompts about social situations.

3.2 Student Designers in a User-centered Design Course: Methods and Data

Building on findings from the workshops, we made clarifying design changes to the DSA cards—toward making them more user-friendly for busy designers—and incorporated the DSA Method Cards in a graduate-level elective HCI user-centered design course (titled "User Centered Design Methods") to further investigate how student designers engaged the cards in the user-centered design process. Thus, our research questions were: Did students find the cards useful in their design process? If not, then why not? If so, then what made them useful?

The curricular goals of the course focused on user-centered design techniques and strategies typical in the HCI tradition. Students engaged in a 15-week group project where they were tasked to design a solution to address a given prompt. As was done in past course-related research projects [28, 29], course learning goals, assignments, and in-class lectures focused on key elements in the design process, including assessing user needs, brainstorming ideas, eliciting user feedback, and low- and high-fidelity prototyping. We required that students include people with and without disabilities as "expert" users in the design process. We insisted on designating users as "experts" in their user experiences to convey deference to user preferences. We recruited deaf and hard-of-hearing (DHH) participants as expert users for the student projects, enabling us to investigate the applicability of the DSA Method Cards beyond blind and visually impaired users, as was examined

in the Workshops study. As in past investigations, we "set an expectation that accessible design was part of design overall and a requirement to design for both users with and without disabilities.... rather than designing a 'specialized' technology specifically for people with disabilities, students were to design an accessible technology usable and appealing to anyone" [28]. In contrast to past projects, we did not emphasize particular design approaches for students to employ in the design process. Instead, we maintained a general adherence to user-centered design overall and added method cards to aid the design process.

This study took place at a research institution, in an HCI master's program. This elective course was not explicitly an "accessibility-oriented" course, and topics covered user-centered design in the HCI tradition broadly; meanwhile, the project prompt required that students must include consideration for deaf and hard-of-hearing users to successfully meet the design requirements. The first author was instructor of the course. Students were not told that the DSA Method Cards were created by the instructor; students were informed that the purpose of the study was to learn about different outcomes produced by user-centered design approaches currently used in the HCI tradition, and to learn how these design strategies fare when tasked with designing accessible technologies. We acknowledge that research about these tools had already been published and that students could have become familiar with some notion of the method cards. Given this possibility, we analyzed positive and negative student responses for all method cards used in the course.

3.2.1 Curricular Elements and Design for Social Accessibility. Students engaged in a variety of assignments and in-class activities toward learning techniques common in the user-centered design tradition. As an elective course based on pre-requisites for the degree, students were familiar with core HCI concepts, such as Don Norman's design principles [24] and usability heuristics [23]. The course used Bill Buxton's Sketching User Experiences for a course text [6]. Students worked in groups of three to four and completed most assignments as a group. Students also engaged in critiquing each other's designs and incorporating feedback. As in past similar courses [28, 29], we arranged for expert users to participate in in-class activities throughout the term. Specific weeks and associated topics were:

- Week 4: Expert user initial interviews for needs assessment.
- Week 7: Receive feedback on top brainstormed ideas.*
- Week 12: Low-fidelity prototype feedback session.
- Week 14: High-fidelity prototype feedback session.

*We note that in between weeks 4 and 7 were institution-wide breaks where classes were not held, thus impacting the timing of the class sessions with expert users.

Students also wrote weekly journals in response to prompts on that week's activities or engagements with the expert users. The journals were meant to function as a reflective exercise for students to talk about their course experiences, their design ideas, and their critiques, reactions, and opinions of both.

We incorporated the tenets of Design for Social Accessibility [28]:

- Tenet 1 (design for people with and without disabilities): Students were tasked with creating a solution to a given design prompt that could be used by both deaf and hard-of-hearing and hearing users;
- Tenet 2 (incorporate social factors as well as functional ones): By virtue of the prompt itself—an automatic speech recognition tool for small group use in professional settings—students were required to consider social and professional aspects of use;
- Tenet 3 (use tools for Tenets 1 and 2): We armed students with resources, such as the DSA Method Cards, to support their process.

Table 4. The Order in Which Each Student Group Used the Method Cards During Weeks Five through Seven

	Week 5	Week 6	Week 7
G1	IDEO	VSD	DSA
G2	VSD	DSA	IDEO
G3	DSA	IDEO	VSD
G4	DSA	VSD	IDEO
G5	IDEO	DSA	VSD
G6	VSD	IDEO	DSA
G7	IDEO	VSD	DSA

Although we wove the DSA tenets within the course design, and sufficient information was given alongside the method cards by way of instruction, we did not explicitly state these as elements in the course setup. We refrained from making such declarations to avoid bias and because infusing the DSA tenets did not impact the pedagogical approach or substantive learning experiences from the students.

For the third DSA tenet—use tools to aid in working with users and including social factors—we provided students with several sets of method cards: the DSA Method Cards, IDEO's Method Cards, and the Value Sensitive Design Envisioning Cards. Student groups took the cards in round-robin fashion, spending a week with each card set toward the end of the ideation and before the synthesis phases of the user-centered design process (between weeks 5 and 7 in the 15-week term). Table 4 shows the order in which each group used the cards. We rotated cards in an attempt to avoid biasing any card sets.

Our goals in enabling use of multiple card sets were pedagogical: to expose students to the variety of different card sets that could enhance the design process; and also research-based: to understand how the different card sets—each with their own approaches to design—would appeal to students and influence their design choices. We gathered data on what students thought were useful or not useful when using the different card sets to get a broad view of how these tools aided the design process, and to gain a deeper understanding of how the DSA Method Cards, specifically, were used.

3.2.2 Course Projects. We intentionally selected a project prompt that reflected a real-world design problem and that matched potential considerations appropriate for the student population and course parameters. Prior research had established that small group communication between DHH and hearing users could benefit from speech-to-text technologies leaving open the question of what kind of design best mediates such communication [3, 19]. Thus, students were directed to create an application that facilitates small group communication using Automatic Speech Recognition (ASR) technologies between DHH and hearing users, particularly in small and professional groups:

Although some tools exist to automatically capture speech and make the text available later, research suggests that the design of these technologies—such as available customization options—may impact how DHH and hearing people communicate in real-time. Your solution will harness automatic speech-to-text, vibro-tactile, and other technical capabilities to enable fluid, real-time communication between DHH and hearing individuals on one or more mobile devices. Effective solutions will enhance communication particularly in professional environments where DHH individuals work with hearing counterparts.

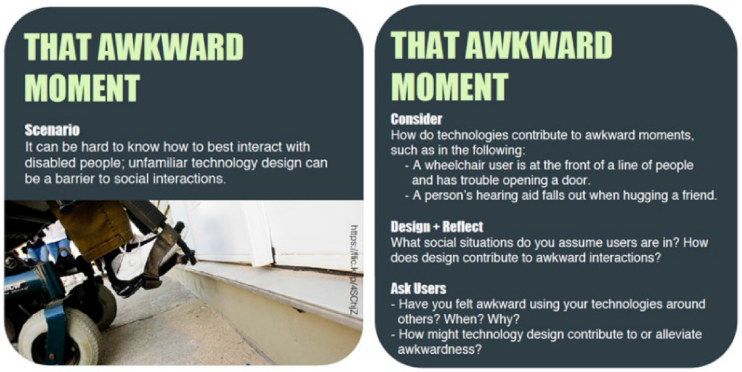


Fig. 4. An example of the DSA Method Card given to student designers in the user-centered design course. The cards were edited to reduce text and polish them for a more professional look.

Other specific requirements that students were given included:

- The solution's form factor must be mobile, but can be a creation of your own or created with something that is currently commercially available, such as tablets, laptops, mobile phones, wearables, and so on.
- The solution must be easy to use and allow customization on a variety of interface elements while supporting seamless user interactions.
- The solution supports communication in real-time and provides users with various forms of feedback, such as (but not limited to) visualization or vibration.
- The sound-capturing capabilities of the application may be limited to current realistic environments and directional microphone capabilities (it is probably not possible to hear a person that is more than 50 feet away in a loud crowd). Assume current automatic speech recognition accuracy rates.
- The solution must be able to capture and convey one-on-one and small group interactions.
- The solution must be appropriate for use in professional contexts.

3.2.3 Design for Social Accessibility Method Cards. We incorporated a renewed version of the DSA Method Cards based on feedback from designers in the Workshop study. Specifically, one of the limitations of the Workshops study was that some designers were unsure how to apply the method cards when confronted with them. Some designers chose not to use the cards after a passing glance. Thus, despite receiving good feedback on how helpful the cards were for some designers, we were unable to get an overall sense of the effectiveness of the cards in the course of the Workshops. Therefore, our goals with the graduate user-centered design course was to incorporate feedback from the Workshops study and investigate whether the cards facilitated effective design thinking about accessibility within the process for students. To that end, we substantially edited content to reduce text on the cards, such that a quick glance would provide sufficient details on how to use the cards, rather than be off-putting. We also redesigned the cards for a more polished look and feel (Figures 3 and 4). We added a card on "Getting to Know You" as a way to expedite formalities and encourage smooth discussion between designers and users. Finally, we edited instructions given to designers in the Workshops study, reformulating them as companion "instructions" as seen in similar card sets to provide some guidance on how to use the cards. The full set of cards given to students is shown in Appendix I. The instructions for the DSA Method Cards included the Design for Social Accessibility framework (as shown in Figure 1) and a brief description of the framework and social accessibility (see Appendix II).

Table 5. Groups, Students, and Expert Users

Group	Students	Expert Users
G1*	S02, S10, S15, S18	E1
G2*^	S01, S06, S21	E6
G3^	S03, S05, S14, S16	E4
G4^	S08, S09, S17	E5
G5	S04, S11, S13	E2
G6	S12, S20, S22	E7
G7^	S07, S19, S23	E3

Groups denoted with * indicate those with DHH student team members, and those with ^ indicate those with online students.

Although we were not able to replicate the Workshops study with professional designers, we maintain that the course setup enabled us to focus specifically on the usefulness of the cards for the students as they tackled a design project. In addition, we presented our cards alongside two other sets of commonly used design cards (IDEO and VSD) in an attempt to not inadvertently emphasize the usefulness of any one set of cards, but to show students the variety of tools that exists and to gain a sense of their reactions to all the cards. The instructions we distributed with the DSA cards provided guidance for use and matched the instructive material included in the IDEO and VSD card sets.

In our ASSETS paper [32], we focused on how the Design for Social Accessibility perspective encourages consideration for socially accessible design elements. In our student designer follow-up investigation presented in this article, we focused on how the DSA Method Cards orchestrated inclusive design thinking that centered the disabled experience.

3.2.4 Participants. There were 23 students enrolled in the course. Most students were in their second year in the HCI graduate program and had little prior design experience; two students were enrolled from a visual design master's program and had some graphic design experience, and one student was a computing PhD student. Three students identified as deaf or hard-of-hearing and four students were enrolled online and participated exclusively via remote technologies (more information on these technologies in Section 3.2.5); of these, one student was remote and DHH. All class sessions were accompanied by American Sign Language interpreters and a remote captioning service. All class sessions were live-streamed and recorded, interpreted, and captioned.

Students were randomly grouped into seven groups of about three to four students per group. Groups were composed of a mix of online, in-person, hearing, and DHH members. We refrained from creating exclusive groups of online-only or DHH-only groups to extend the in-class activities and learning experiences across teams. The mix of student groups ensured that online and DHH students benefited from any and all in-class activities and course assignments.

Each group was paired with a designated DHH expert user throughout the term (Table 5). We instituted "round robin" session for weeks 12 and 14 where groups worked with different expert users. Although we made every attempt for students to consistently meet with their designated expert user, sometimes scheduling or illness required that we recruit substitutes. Finally, we encouraged students to seek DHH and hearing users outside of class to expand the data they drew on for their designs.

We note that students in this Course C study differed from participants in prior work in several ways. In the first two course offerings (Course A and Course B), students were primarily undergraduates with little experience in any technology or design fields. Meanwhile, designers in the

Workshops study were professionals with at least three years of experience in technology design. In the final study, we offer a different perspective by involving master's students who bring a variety of backgrounds to an intensive course on user-centered design. Although the students in Course C differed from students in the first two studies, the course content was fundamentally maintained across the three Course studies. In addition, despite Course C including master's students, few had prior professional experience and few had backgrounds in design or computing. Given these distinctions, we offer our observations with some awareness that students in Course C approached complex material with some maturity in contrast with students in Course A and Course B. Meanwhile, we also appreciate their novice foray into user-centered design, specifically. Finally, although findings about design outcomes based on research with students is limited by their expertise, we analyze their reactions and reflections to using method cards as a novel tool—in particular, by examining how it affected their thinking through the process—with those of the professional designers as documented in the Workshops study.

3.2.5 Course Technologies. Due to requirements of the curricular program, this course blended together online and in-person students in a single course offering. To facilitate engagement across online, in-person, DHH, and hearing students, the entire class used the Slack communication tool, with individual groups assigned to a dedicated private channel for group communications. Student groups used Google Drive, Docs, and Hangouts to conduct in-class activities with expert users and to collaborate on group assignments. Online students used Adobe Connect to attend live streamed lectures, and all lecture recordings were posted on the course learning management system.

3.2.6 Data and Analysis of User-centered Design Course. Data from the user-centered design course included students' individual and group assignments, journal entries, and final designed artifacts, as well as design specifications, process books, and photos. Students' responses to a "Method Card Mix" assignment contributed data on how students used specific cards and indicated whether they thought use of the cards was helpful in their overall process. Students were required to consider the cards as they related to their design, but they were not required to use all the cards in any given set. Rather, students were given freedom to select cards they felt were interesting or relevant to their project. Although the instructor was a member of all student groups in the Slack tool, the tool was reserved for in-group communication, and such interactions were not recorded or included as data.

We analyzed data from the user-centered design course inductively, focusing on student experiences and reactions to using the method cards to address the given design prompt. Students wrote journal entries weekly throughout the term; however, for this analysis, we focused on journal entries written in response to prompts specifically about how the method cards were used. In this prompt given between weeks six and seven, we asked students: "How have method cards so far impacted your individual experience on the design project? How have you personally been using the cards? How do you think they contribute to (or take away from) your learning experience about design? What ideas and considerations have you added to your project because of your use of the cards?" We also focused on data collected through the "Method Card Mix" assignment to inform what cards students used and how each group used them. We specifically focused on students' use of the cards to complement the findings from the Workshop study, which provided ample findings about the feasibility and appropriateness of the DSA perspective in the user-centered design process.

The first researcher primarily led inductive coding with regular discussions with the second researcher. Analysis focused on how students used method cards and on their reflections on how method cards impacted their design process and outcomes. Through the "Method Card Mix" assignment, we recorded which cards students chose to use and reflective responses they shared. For

Table 6. User-Centered Design Course C – Codes About How Students Used Method Cards

Method Cards (in general) - experience with, how they were used, useful/not useful, teamwork
DSA Method Cards - useful/not useful, considerations (empathy, social consideration, how to talk to people with disabilities), scenarios, and practicality (realistic, concrete)
IDEO Method Cards - useful/not useful or usable, divergence, convergence, better earlier, not suitable for project
VSD Envisioning Cards - useful/not useful, ideating, values and considerations, considering key values

example, Group 6 recorded using IDEO's "Role Playing" card, "We tried a situation where someone is asking about a meeting they missed. The activity makes us think about how can we tell if someone is available?" They then reported how this activity contributed to their design consideration, "This made us realize that we need to restructure how we want our users to use the system.... We decided to take away the feature of publicly making announcement or how the system will find people. Instead our system allows people to come together first and then start a conversation rather than starting a conversation and finding people to converse with." Thus, we analyzed how specific cards influenced design decisions, if at all. We also documented which cards were used across groups or that resulted in similar discussions. We analyzed journal responses for individual student reactions to using the cards, focusing on how useful students felt the cards were and what outcomes actually resulted from using the cards, if any (Table 6).

A third-party researcher was consulted to review the code set before axial and selective coding. The codes were updated based on their suggestions and clarifying questions. The researchers discussed the codes iteratively, clarifying and updating the codes as needed. Axial coding and analysis focused on commentary about usefulness and considerations across different cards, if and how cards informed design decisions, and when students felt the cards were useful. Thus, codes shown in Table 6 present a compilation of student reactions and responses to using the method cards as part of their user-centered design project. These reactions ranged from appreciating the value of prompts for divergent thinking, to criticisms about how useful the cards were with brainstorming or with respect to the limitations in available resources for students. For example, some students commented that, as students, they were unable to undertake large-scale ethnographic investigations, as was sometimes suggested by the IDEO cards. Under these terms, the students felt such cards were less useful than others. Thus, most of the student reactions to "usefulness" are in direct response to the cards' usefulness to the students' specific project, and not necessarily about usefulness to thinking about design overall. Other codes show how students interacted with the method cards. Specifically, we can see that the DSA cards elicited reactions about empathy and social consideration, while the VSD cards elicited discussion about values. These codes validate the ways in which students applied the cards for their design work (i.e., empathy and social consideration for the DSA cards, divergent brainstorming for the IDEO cards, and value consideration for the VSD cards).

3.3 Findings: Validating DSA Method Cards

Our overall goal across the span of the four studies (Course A, Course B, Workshops, and Course C) was to develop and validate design strategies that motivated technology designers to include accessibility in their everyday design work. We demonstrated that social consideration and including disabled stakeholders influences design thinking [29], and that framing these efforts as the Design for Social Accessibility perspective [28] is a viable and usable framing for designers [32]. We

present here practical considerations and justification for employing a Design for Social Accessibility perspective in technology design. First, in this section, we present data from Course C, our latest course in this research, which demonstrate that the DSA Method Cards are appropriate tools for supporting these inclusive perceptions for designers. Then, in Section 4, we discuss our empirical contributions and practical considerations from across all four studies in implementing these approaches, towards suggestions on how others can make use of this work.

3.3.1 Method Cards in a User-centered Design Course. Students in Course C, the user-centered design course, reported using the different sets of method cards in a variety of ways toward finalizing their design solution. Overall, method cards expanded how students approached different dimensions of their design. Students reported that the cards helped them reflect concretely on how ideas work in context, and that learning about and using the cards would be useful for their professional and career goals. Students reported that the DSA Method Cards helped to promote empathy and social consideration and were used to place design reflection within real-world scenarios. In a few cases, students felt the cards overlapped in their overall purposes (i.e., VSD and DSA cards initiated similar reflections). Meanwhile, students reported that though the IDEO cards were influential in early ideation, they required more time and resources to execute (particularly as students, not professionals), limitations that prevented them from using some cards. Students found the VSD cards useful in considering broad tensions and values, but they reported difficultly understanding how to apply some of the tensions to their particular design problem. In our analysis, students made several comparisons of the IDEO cards to DSA cards, and VSD to DSA cards (Group 2 observed, "The Envisioning (VSD) cards and DSA had a lot of similar cards; we quickly skimmed through DSA and we felt that the concepts were reasonably similar, and we didn't change much. Our approach slightly modified, as we appreciated the advice for dealing with test users.") However, we documented almost no direct commentary discussing IDEO and VSD cards in the same spirit, which was surprising (the few comments about IDEO and VSD included discussion about DSA).

Overall, students felt positive about using the DSA Method Cards for their projects and reported that the cards were appropriate for working on accessible solutions. Students appreciated the strategies for effective interactions with their expert users: The cards prompted them to empathetically consider each design choice, as it might appeal to their expert users in real-world scenarios. Students found the cards most useful after the initial ideation stage, and they reported that the cards enabled opportunities for reflection and refining ideas. The real-world scenarios in the cards helped students consider social implications (e.g., thinking about awkward moments) and provided them with detailed and actionable considerations, such as asking appropriate questions.

3.3.2 DSA Cards Prompt Social Consideration and Empathy. Students indicated that the DSA Method Cards reminded them to consider how their design was inclusive of their DHH users. Specifically, students reported that the cards encouraged empathy, that diverse scenarios prompted broader consideration of different possibilities, and that the cards encouraged and enabled useful interactions with their expert users.

In the needs assessments and early brainstorming sessions, students gathered information and learned about how DHH expert users communicated with others. Students commented in journals and assignments that the DSA Method Cards prompted them to account for social conversational dynamics between hearing and DHH technology users. For example, although the premise behind using automatic-speech recognition in conversation is to improve and make communication efficient between hearing and DHH people, technological lag and social signals could nuance the quality of a mediated conversation between two users as S17 indicates:

> *We also thought about how DHH people are inherently disadvantaged when in conversations with other hearing peers, even with an automatic speech recognition accessibility tool. Their understanding of the conversation typically lags behind hearing peoples' (they have to wait for words to be translated and then read them on the application), so they typically have difficulty matching humans' emotions with what they are saying, especially since they cannot hear things such as tone or voice volume. That was one of the reasons we decided to focus on ensuring the conversation flows naturally and to try to give DHH people more access to information about voice properties (tone, emotion, sarcasm, etc.). – S17, Journal 6*

Although students had already engaged in interviews with their expert users and had spent some time brainstorming and thinking about the design problem, the cards prompted them to consider situations they previously did not:

> *We did feel the cards had great probing topics and forced us to think about situations that we were not considering, like alternative accommodations or social perceptions. – Group 3, Homework 6*

Furthermore, the specific language to consider issues like awkwardness in social settings enabled students to identify and label social issues they uncovered, to break down design elements and user experiences, and to analyze how both ought to influence design decisions.

> *I was aware that certain technologies and devices can make a DHH person feel awkward in social settings where they draw unnecessary attention, but it was interesting to know the breakdown and categorization of these difficulties. These categories expanded my understanding into how a deaf user can actually fe[e]l when using one of these devices. – S19, Journal 6*

As we can see in S19's comment, using the cards to dissect possible issues in user scenarios gave students a way to categorize different situations. S02 comments below that the cards gave a language with which to address and tackle these socio-technical interactions.

> *However, I think it was during the second week when we used the DSA method cards, where I was really able to articulate not only the potential solutions that I wanted to explore, but the rationale behind it. Prior to using the DSA methods, I never really identified social accessibility as a concept, but was highlighting aspects of it during my team's brainstorming as something that was key to our final design. Now, after using the cards, I can see that this was the ultimate goal that my team and I was trying to identify and accomplish.… I think the DSA method cards were definitely more appropriate to address the problem area that I was more focused on, and really helped me verbalize my rationale behind certain ideas that I pitched to my teams during our meetings. – S02, Journal 06*

In particular, the examples on the cards helped students to break down specific issues as adjusted by broader social implications. For example, S22's group brainstormed different ways that technology use and social situations might spark an awkward moment, evaluating their design choices via the social filter of what is appropriate and could affect users' "willingness" to use their design. Subsequently, the group asked how their design could avoid such situations.

> *With the card "Awkward Moment." It made me think about different scenarios that users might encounter which could make them feel uneasy such as speaking to a phone in a public place with people walking by or the system mistakenly interpret*

> *into profanity. These circumstances could probably lower users' willingness to use the product. What can we do to recover from the situations or even avoid them in advance? – S22, Journal 6*

The cards also encouraged students to be considerate of their expert users' time and contributions. Students focused on asking about relevant issues related to their design, and they made an effort to avoid asking unnecessary questions:

> *The most important point that we got from the DSA cards is respecting the user's time by asking them un-conventional questions instead of repeated ones that they're probably tired of answering (we got a bit of that from our interview with a DHH user). – Group 5*

3.3.3 DSA Cards Help Reflect on Concrete and Practical Scenarios. In creating the DSA Method Cards, we sought to raise awareness of social accessibility by using examples drawn from prior research. Students commented on the diversity of these scenarios, indicating that the broad range of scenarios was useful, because of their realism and because they addressed social issues.

> *The DSA cards helped us think about issues that we would otherwise probably have not thought about before. Some examples include not thinking about [how] "obvious" the product or software is, especially if users don't want to be noticed by other people, or about the impact of users' professional lives at work. – S17, Journal*

More specifically, the cards helped students to identify and consider "awkward" or "uneasy" social scenarios in the different interactions they envisioned in their design. We recall S22's comment above that "different scenarios that users might encounter which could make them feel uneasy" prompted them to ask, "What can we do to recover from the situations or even avoid them in advance?" in reference to these potentially awkward social scenarios.

Students indicated that the DSA Method Card example scenarios aligned with their goal to design a solution that would enable DHH users to express themselves in "most social environments." For example, Group 1 triangulated the design prompt's overall goal with users' needs, finding that the DSA Method Card scenarios addressed the "pain points" they had uncovered thus far.

> *We choose the DSA method cards because it highlights key scenarios and considerations that we are trying to address in our final design. Many of the pain points that users have stated in previous interviews, stem from many platforms being socially inaccessible. Our main goal is to design a product that can offer DHH and hearing users a platform to fully express their emotions without misunderstandings in most social environments without technology being a burden. – Group 1, Homework 6*

These findings about how students used the cards and what key considerations emerged for them emphasizes the effectiveness of the cards and the utility of the cards to help students get the most out of their meetings with expert users.

Students also indicated that the DSA cards' emphasis on practical scenarios was useful, because it helped them reflect on realistic use cases. The concrete use cases provided a focused set of situations that students also incorporated as constraints to help them assess the feasibility of their ideas within realistic contexts of use that were important to their target user base.

> *We reviewed many of our ideas with the card "my professional life" and "just like everyone else" to make sure that our design could be used in a professional occasion and prevent DHH people from doing more work to do the same thing. Ultimately, our design goal was not only making the conversation between DHH and hearing people*

> *more natural but also could accommodate users to different types of conversation. After using the method cards, we redesigned and clarified the customization features in our primary page in our application. We probably have made significant progress in our application because I had a clearer vision in our product and how it could solve the problems we had identified. – S15, Journal*

Thus, students indicated that the specificity of the examples were relevant, but also that they appropriately emphasized interactions that emerged as important.

> *Later on in the pipeline, a more narrow focus would be needed. The DSA cards provided that for us. We were able to think about the situations presented in the DSA cards, which were fewer in number than the IDEO cards, and apply it towards our project concept (making sure conversations between deaf or hard of hearing and hearing people flows as naturally as possible, that the conversation is structured, and that emotions are conveyed clearly and accurately). – S17, Journal*

As shown in S17's comment above, we recognize the importance of students' ability to extract key values from concrete examples, as doing so enables students to apply the cards to appropriate situations while understanding why such considerations are beneficial to their design.

3.3.4 IDEO and VSD Use Highlights Benefits to DSA. We did not intend to explicate comparisons between the IDEO, VSD, and DSA card sets, because they are all so different. Our initial aims were to provide variety with the IDEO and VSD sets and to examine how students used method cards overall. Thus, our reflection questions to students focused on what cards they used and how cards influenced their decision making, if at all. However, students did offer some commentary juxtaposing the different card sets. Interestingly, and without prompting, students commented on the appropriateness of IDEO *vs.* DSA, or VSD *vs.* DSA cards for their design work, but did not comment on VSD *vs.* IDEO. We analyzed these responses for what they revealed about students' perceptions of the different sets.

Students appreciated the "abundant" methods offered in the IDEO cards and the various different ways the cards prompted them to think critically about different dimensions of user experiences. S03 reflected on how the many different methodologies introduced in the IDEO Method Cards helped them consider which were most appropriate for the task at hand.

> *As for the IDEO cards, I am really impressed with the abundant methodologies it introduced, like the social network mapping, the still photo survey, the personal inventory, the anthropometric analysis, the historical analysis, the extreme user interviews, and the cognitive maps. These novel means let me think about which kind of methods would contribute to developing design ideas, and would be the most suitable ones for our design process. – S03, Journal*

Similarly, students found the VSD cards helpful in thinking through complex and broad-reaching effects of design. For example, Group 3 commented on the insightfulness of thinking through bigger issues and value tensions.

> *Identifying the key values at stake helped us put into perspective the significance of our application. It would build trust between hearing and DHH colleagues as well as promote teamwork, inclusivity, and self-efficacy. – Group 3, Homework*

Whereas students found the IDEO Method Cards useful for brainstorming and ideation, they also found the plethora of suggested uses and strategies to be overwhelming and beyond the scope of their expectations for course work, or beyond their abilities as students with access to limited

resources. Students articulated there were limits to how useful the cards would be within the capacity of the course. For example, S04 highlights that while the cards were straightforward and easy to understand, they were yet a bit far from helping to form a conceptual model that would be useful for their purposes.

> *Probably it is because the concepts on the IDEO cards are pretty basic, straightforward and broad, and it is a good card set to inspire me thinking how we are going to conduct the study but not for building the conceptual model for this project. – S04, Journal*

In their assessment, Group 3 commented that the IDEO set was more useful than the DSA cards, but that the IDEO cards did not seem to help with divergent thinking as much as expected:

> *[We] found the IDEO card set to be more useful than the DSA method cards, but we thought that the IDEO cards made us think inside the box. – Group 3, Homework*

And S03 commented that though the VSD cards were abstract, they were helpful.

> *The envisioning cards is much more abstract from my point of view. The values cards [are] really helpful and original to me. I like how the cards guide us to write down the key values our project can provide to the user and then guide us to think about the value tensions in the key values we [wrote] down. – S03, Process Book*

Thus, despite the VSD cards helping to prompt deep thinking about value tensions, some students report not using them as much in making specific design choices. Similarly, although the IDEO cards were easily implemented and helped to broaden ideas in the brainstorming phase, students also noted that the card set was very large and overwhelming in the context of their focused design needs.

> *Unfortunately, most of the ideas on the cards involved either inconveniencing myself in terms of acquiring resources or required me to take time I didn't have to go through steps I wasn't familiar with to produce a single idea. I decided to try a few of these that seemed feasible within the time I had, but was generally disappointed in the results. – S11, Journal*

In contrast, students commented that the DSA Method Cards, while less generative than IDEO's, were suitable for the project, with relevant scenarios from which to kickstart ideas.

> *Although we might generate less new ideas compared to using IDEO methods cards, the DSA cards are more helpful in making the idea practical. – S15, Group 1, Homework*

Ultimately, the perceived feasibility of the IDEO cards was impacted by students' limited time and resources, even though they admitted the cards would be useful in early stages of the design process. Group 5 acknowledged that the IDEO cards were undoubtedly useful and good to know about, but perhaps were better for professional use.

> *The methods on the IDEO cards most likely help these teams, but they are not as applicable to graduate students in a class during a short brainstorming session with fewer resources on hand. Graduate students will not necessarily be able to have the working and thinking space necessary to realize many of the activities on the IDEO cards, and being that this is the case, it was most efficient to thin the herd and only choose method cards from this collection that were feasible given the constraints of our environment. – Group 5, Homework*

Meanwhile, S15 indicated that the IDEO cards were "comfortable"—perhaps understandable—and appropriate, but that they appeared to require more time than was available for this project.

> *Moreover, it is not a complex or difficult method. The only things I have to do is think about the scenario on the cards and ask questions unlike the usage of IDEO methods cards. I felt comfortable of the layout of IDEO method cards since it has appropriate content and space on one card making it easy to read. However, most of the methods required lots of time and involvement of our users. – S15, Journal*

Students stated that the IDEO Method Cards and VSD Envisioning Cards would be more useful for the beginning stages of the design process, even prior to the ideation phases where the method card module was introduced in the course. We note that although students were not asked to compare card sets, some of their comments reported on the usefulness of the DSA cards as compared with the other cards, i.e., IDEO cards were useful for brainstorming, but DSA cards were appropriate for specific scenarios useful for this particular project. Ultimately, students' responses to using the different card sets highlighted benefits of using DSA cards: They were ideally suited to addressing concrete issues for disability and accessibility in design.

4 PRACTICAL CONSIDERATIONS FOR DESIGN FOR SOCIAL ACCESSIBILITY

In this research, we investigated what strategies motivate and support accessible design. We found that social aspects of technology use can impact accessibility overall and—when working with disabled users—can be leveraged as a key consideration that shapes how designers approach disability in design. Thus, we emphasized stakeholder involvement and social factors as essential elements in developing the Design for Social Accessibility (DSA) perspective. In our first two studies (Course A and Course B), we demonstrated the effectiveness of working with multiple stakeholders with and without disabilities and we defined the DSA perspective [28, 29]. In the work presented in our ASSETS 2018 Workshops paper, we showed that professional designers could use DSA to include social considerations and work with visually impaired and sighted users toward accessible design [32]. In Section 3.3 of this manuscript, we showed that the DSA Method Cards enabled student designers (in Course C) to develop empathetic considerations for, and facilitate sensitive interactions with deaf and hard-of-hearing (DHH) users.

4.1 Data Analysis across Four Studies

At the conclusion of the study with Course C, we conducted a re-analysis across the studies comprising this body of work to place the findings from Course C in context with prior findings. To do this re-analysis, we re-examined all the codes from each study (Courses A, B, and C, and the Workshops), filtering out the intentional research choices made across all the studies (i.e., students and designers worked with people with and without disabilities). We refer the reader to our prior work for the methodological details and original findings for Course A [29], Course B [28], and Workshops [32]. Examining codes from prior analyses filtered through our research study design choices, we investigated how interventions influenced designer choices and design outcomes. For example, across all studies, we required accessibility to be a part of the designed solution. In our re-analysis, we evaluated how this aspect of the study design influenced project outcomes as they emerged across all studies: When accessibility was required, students and designers alike did not wrestle with it as a choice or pushback on the requirement, but took it as a given. Despite some challenges in envisioning what accessible design might be, students and designers were able to develop solutions that met user needs and project requirements (Table 7).

Thus, our re-analysis across the four studies focused on how core elements essential to the DSA perspective facilitated accessible design thinking within the user-centered design process

Table 7. High-level Themes That Emerged from Re-analysis of Data across Four Studies Comprising this Work, Filtered through Research Study Design Choices That Were Made across All Four Studies

Accessibility is required - removes choice; despite pushback enabled creative growth; does not impede learning design; shows what is possible; shapes expectations
Include multiple stakeholder users / real examples and scenarios - emphasizes importance of accessibility; relevance; gives credibility to accessibility requirements
Balance disabled/nondisabled social views - incorporate social factors efficiently and effectively

effectively and efficiently. We deliberately made choices about the design process: including people with and without disabilities, and including social factors. Our analysis on the impact of these intentional choices revealed that, given these tenets, accessible design is a feasible epistemological approach for technology designers that results in accessible design outcomes.

4.2 Findings for Practical Considerations for Using a Design for Social Accessibility Approach

In our findings, we show how making it mandatory to consider accessibility and interact with multiple stakeholders—including disabled users—enabled designers to center the disabled user perspective for accessibility in design overall.

4.2.1 Accessibility First and Always. Across all our investigations, we required that final designs should be accessible and meet expert users' needs and preferences. We set the requirement for accessibility as a no-nonsense, common expectation. For example, when presenting design prompts and project requirements, we presumed an attitude that accessibility was an everyday usability expectation. Some students initially pushed back on the idea of including disability, but over time, many acknowledged that it did not impede their ability to learn about design. By comparison, none of the professional designers in our Workshop study resisted accessibility, although they admitted they were unlikely to include accessibility if their project managers did not budget time and resources for it. In fact, our data show that mandatory accessibility consideration shaped students' expectations of accessibility overall and showed designers its feasibility and importance.

We note that students rarely considered accessibility prior to the course (this finding emerged across all courses, A, B, and C), but that it became a key consideration of design overall.

> *Throughout all three meetings, I have learned a lot about accessibility. I learned that devices need to be designed so that everyone can use them. A lot of thought goes into the process of figuring out the accessibility on devices. A lot of questions must be asked. In general, my whole perspective on accessibility has changed because I had no prior perspective. I never took the opportunity to think about how visually impaired people might use their phones or how they navigate around a city. – Course A, S22, Journal 8*

As S22 indicated above, one of the core aspects of the accessibility requirement was that compulsory accessibility made explicit the issue that it is rarely ever included in design. This realization highlighted a taken-for-granted assumption that someone else would or should take the responsibility for accessibility. We recall that early findings presented evidence that students did not care about accessibility or that they considered it outside the scope and skill level of their abilities and learning objectives. However, these views are exactly why compulsory accessibility had such an impact:

> *My perspectives have changed tremendously. I often believed that accessibility design work would inherently be something people consider when designing, but it's very obvious people have set tracks of when designing that is often hard to sway. – Course C, S01, Journal 13*

Making accessibility a requirement made the issue visible. When required to think about accessibility, students became aware of how prevalent inaccessibility was:

> *Accessibility has never been something that I gave a second thought about. I never really needed to go out of my way to use accessibility options, whether it's digitally on a phone or physically like the elevator. In fact, I've never really noticed it around me. However, now that I've realized how important it is for disabled people to have the options offered to them, I'm starting to notice it a lot more. – Course B, S35, Journal 10*

Corroborating prior work about perceptions of assistive technologies [31], the requirement to include accessibility in design made clear that the choice to design inclusively often impacts the technologies that are available, not a person's impairment. For example, as S25 from Course B indicated below, they believed accessibility could not be in their purview as a designer, because "purpose built apps" already existed to cover tasks. They did not understand that such apps existed because other everyday technologies were not accessible:

> *As said before, I believed that it was not too important to incorporate accessibility to every app because I believed those with disabilities used purpose built apps on purpose built devices to accomplish tasks. After seeing how strong accessibility technologies are, and, to be blunt, how easy it is to incorporate them into an app, I believe there are few excuses to not make an app accessible to those with disabilities. – Course B, S25, Journal 10*

Along these lines, in including accessibility as part of their larger design task, students learned to engage accessibility as another design requirement. For example, S2 in Course A likened the course experience to a challenge in terms of designing: having to design for users who are not the same as the designer or the developer requires some stakeholder consideration:

> *I really like that we are designing for people with disabilities. It makes the design process much more necessary because we cannot relate directly to our users. Making a design that focuses on accessibility really emphasizes the requirement of research and frequently checking in with your target audience. It has also just made the process more interesting because I am learning about areas and uses of technology that I wasn't familiar with previously. –Course A, S2, Journal 7*

However, they also could see the feasibility of including accessibility. The challenge was not so high—after all, they were meeting the expectation within the context of a course.

> *I really find it hard to understand why so many designers find designing things that facilitate users with different abilities a difficult task. I find that it's the same as designing for any other user; by simply talking to the users, having them test out your product and using their feedback to iterate your design. – Course C, S2, Journal 14*

Indeed, without making accessibility compulsory, we argue that some students may not have come to realize the impact they could have, as designers themselves, to create accessible technologies, and they may not have realized they have the ability to design inclusively:

> *I wouldn't have considered the ways blind people, or any other type of disabled user, would interact with a device like a modern smartphone beforehand. Now I know that with the proper design and accessibility features, it isn't at all impossible for technology to be accessible for people with any sort of ability level. I am now much more appreciative of accessibility in general. Even though it may not directly affect me, I now realize its importance in a world where every type of user of any sort of technology may have different levels of ability. – Course B, S24, Journal 10*

Professional designers in the Workshops study could compare the requirement for accessibility in the context of the study with expectations (usually not to include accessibility) in their day job. They noted that accessibility was a matter of direction that usually was not their choice; meanwhile, they reflected on the benefits of including accessibility from the beginning:

> *So, if you design for someone who has a disability, that there is design insights that can be taken and brought to products, a mass product launch that affects—that can help, you know, come up with new design insights that affect people who don't have that disability, but you know, can—come up with a better product. – Workshop, D4*

We were able to make accessibility a requirement in our investigations, and our findings show how designers changed perspective when they had no choice but to give accessibility a chance. We posit that had we not insisted in accessible outcomes (and not enabled interactions with disabled users, as we discuss further in the next section), some of their reflection of the importance and feasibility of accessible design would not be realized. Alongside our expectations for accessible solutions, our insistence on face-to-face interactions with real-life people with disabilities meshed these requirements with the applicability of real-world challenges. In the next section, we discuss how working with multiple stakeholders with and without disabilities gave credibility to the work student designers were doing, showing them how impactful small decisions could be and how much accessibility matters.

4.2.2 Real Examples from Multiple Stakeholders with and without Disabilities. The experience of working with people with disabilities and finding that accessible design is feasible led students to realize its importance. Engaging real stakeholders lent relevance to the greater world, not just to the course or workshops requirements, because it lent credibility to the need for accessibility. Combining the course requirements for accessibility with the involvement with their expert user, S25 from Course A discusses how the culmination of activities contributed to their perspective of accessibility:

> *Having E6 as my group's expert user has really opened up my eyes about accessibility. I find that it's an issue I not only care about in this class, but I also apply its importance to other classes I am in, like web programming. Prior to the class, I wasn't cognizant of how necessary accessible technology is in our daily lives, and since then my perspective has completely changed. As someone with very low vision for my age, I feel like I was internally able to empathize with my expert user, and it motivates me to work even harder on our team's design execution. From in class discussions and readings we've done, I'm very much aware now that accessibility isn't just an item that gets checked off a to-do list when design. If this is the assumption, chances are it will be of limited use to the specific user. People with disabilities needs have to be met throughout the entire design process. – Course A, S25, Journal 8*

Interacting with real stakeholders lowered the barrier to understanding the experience of disability. People with disabilities are just like any other user, each with their own particular needs

and desires, yet students initially approached disability as some outside consideration. They were surprised to realize that excluding disability in design is rooted in shortsighted perspectives drawn on pre-conceived assumptions. In contrast, including disability involved looking past such assumptions and asking "what people want," as S12 from Course A explains:

> *I recall my apprehension when it first came time to meet our expert user what would working with a blind person be like? That apprehension was definitely misplaced, our time with E1 has turned out to be very enjoyable and stress free (aside from our time constraint issue). Perhaps what I learned the most from interacting with E1 is to look past preconceptions I have about accessibility design (which were mostly wrong) and just ask what people want. – Course A, S12, Journal 8*

S3 from Course B characterized their understanding of disability as having a "huge restriction" from using technology. Despite requirements to include accessibility in the course, it was exposure to people with disabilities that enlightened students to realize "even people with disabilities can use a design":

> *From the beginning of this course I always had this idea that "disability" meant a huge restriction from a lot of things, including technology. After working with expert users, I now see that even people with disabilities can use a design like ours in an optimal man[ne]r, just like any other person. Although they may use it differently, as long as the design allows it, people with disabilities are just as technological[ly] inclined as others. – Course B, S3, Journal 10*

Thus, as these comments show, working face-to-face with expert users highlighted how much people with disabilities are "just like everyone else." Although this conceptualization of people with disabilities seems practical, all too often, students had had little direct engagement with anyone with a disability. The tendency to "other" disability, from this lack of experience with it, mystified the design process to create accessible solutions. In contrast, our requirement to work with people with disabilities closed the gap on disabled users as someone else, demystifying the disabled experience:

> *I guess the biggest thing that changed was this stupid preconception I had with "disabled" people. I'm so dumb, for some reason I think I was expecting somebody fundamentally different than me, but when we got to talking it was just another person. – Course A, S4, Journal 4*

Furthermore, beyond providing an opportunity to learn directly from people with disabilities, students' encounters with stakeholders reinforced the notion that accessibility is about incorporating diverse human needs. These perspectives helped students to develop empathy by observing firsthand how inaccessible technologies impacted users.

> *I think through the interview, I've learned more than knowledge but respect, respect people that are different than us. I will carry on this respectful attitude when I design my product and make it more inclusive and accessible for people with disability. – Course A, S36, Journal 3*

The combination of the students' exposure to expert users and the requirement to create an accessible solution coalesces practical knowledge. On the one hand, it helped emphasize the importance of user-centric design strategies; getting to know users is an important aspect to developing a solution that is effective:

> *My perspective on accessibility has definitely changed. Talking to the expert user and getting his perspective (and more importantly, his extensive insights) really helped me understand his needs and setbacks with existing applications. It allowed me to fuel my design process with a heavy user-centric approach. – Course C, S13, Journal 13*

On the other hand, using design concepts to address accessibility as part of the expected design solution tempered the perceived challenge of designing for disability and was supported by the information and knowledge gained from interacting with expert users. For example, S9 from Course B describes how watching E8 demonstrate using technology helped show how possible accessibility in design is:

> *My perspective on disabilities has changed in that accommodating to users with disabilities is not as difficult as I had imagined. Initially, I had no idea how an application can possibly be made for someone with a visual impairment; now that I received demonstrations from E8 on how they work, I now realize that these applications are quite simple and effective. – Course B, S9, Journal 10*

These perspectives remained true even when multiple expert users were consulted for design.

> *The difference between our users helped us get different perspectives, which is really important in designing widely acceptable application. Simple things such as understanding how differently a dog user and cane user navigate was helpful in thinking of possible navigation solution. – Course B, S15, Journal 6*

Meanwhile, for professional designers, understanding the diversity of users was less surprising than the fact that it took far less time than expected to incorporate multiple perspectives:

> *I think definitely having both of these users' input helped a lot. Um, in regards to thinking about things like the height of our concept, since it was a kiosk and you had to be able to walk up to it and use it. But then there's the consideration of ok, what if you're in a wheelchair, to be able to adjust the height of it. Uh, and then, I think, V1 also mentioned, like tactile feedback, like what if you can't hear things? So yeah, like, our device, the smart device would have to give you some other kind of indicator besides this visual or audio. – Workshops, D1*

Including multiple stakeholders bolstered aspects of accessibility, driving home the real-world applicability of accessibility (rather than from requirements alone), and was considered efficient and effective in design decisions.

4.2.3 Balance Disabled and Nondisabled Views in Social Consideration. The distinction of the Design for Social Accessibility objective to incorporate social factors in accessible design consideration can be addressed without significantly adding time and resources when disabled and nondisabled perspectives are weighed equally in the process. Specifically, including both perspectives helped emphasize when social situations played a key role for disabled users. Meanwhile, including nondisabled users allowed nuanced similarities to emerge where appropriate: Truthfully, people with and without disabilities have a lot in common.

> *I was surprised at how much the two stakeholder groups actually had in common. We were able to represent the non-disabled population, as well as other classmates who critiqued our design, and then we met with the expert users. – Course B, S2, Journal 10*

In particular, workshop designers noted how including multiple considerations was also a move in efficiency, helping them to address several issues in a short period of time. We note this impact is dependent on access to people and their cooperation.

> *And so we—I think we more quickly got there … and again if it was, uh, just us two (non-vi), we might have gotten to a completely different place than we would have then—than user testing on people who are visually impaired—you know, learn all these things that we would then need to go back and fix, or go back and change, or go back and modify. – Workshops, D4*

We presented evidence of how practical considerations impacted design thinking and incorporating social accessibility that emerged across four studies. In the next section, we summarize these contributions and how they can be translated for real-world design settings.

5 DISCUSSION

Across our studies, it became apparent that a key barrier to considering accessibility for a nondisabled designer is the perception that designing for disability is either too difficult or someone else's job. In addition, many designers also approached disability as an "other"—initially taking the perspective that people with disabilities were users with completely different needs and desires; designers initially assumed they were so different from disabled users. Indeed, our studies showed that true barriers are mainly that designers lacked awareness and knowledge about how to interact with people with disabilities to include it as something they should care about and take responsibility for. In our work, we showed that providing designers with opportunities to interact with disabled users face-to-face and reflect on real-life examples could be effective, although, we acknowledge that finding and connecting with people is challenging. Drawing on concrete examples when working with users with disabilities is effective, because prompted conversations (e.g., with an example or realistic scenario) empowers designers to draw out topics that might otherwise be hard or feel awkward to broach. We do not advocate for accessible design strategies that do not include people with disabilities; instead, we created strategies to make user interactions effective and efficient in small bursts or short time frames.

5.1 Best Practices and Design for Social Accessibility

Our goals overall were to develop strategies that enable designers to include accessible design in their everyday design work and to demystify how to work with people with disabilities. Below, we present our practical considerations, framed by Design for Social Accessibility's three tenets, with added suggestions for how to use the DSA Method Cards based on findings from the Course C study. Specifically, we recommend that designers use the DSA Method Cards with users with disabilities to maximize user expertise especially when limited with time and resources, and to ask appropriate questions that address the given design prompt.

1. **Include users with and without disabilities as stakeholders throughout the design cycle.** Engage them throughout the design process: Interview and observe them during needs assessment, invite them back to give feedback on brainstorm ideas, conduct low-fidelity feedback sessions with them, and have them help evaluate high-fidelity prototypes. Furthermore, try to engage different multiple users for the same project. We agree that it is tempting, and perhaps less resource intensive, to work with either people with disabilities or people without, but probably not both. However, we caution against isolating one group, because it is the inclusion of both perspectives that fundamentally addresses issues in social situations of use for people with disabilities.

2. **Consider both social and functional factors in the design process.** An intentional awareness of how design might function in social situations is an unaddressed key factor in inaccessibility.
3. **Use tools, such as the DSA Method Cards, to address tenets 1 and 2.** Use the DSA Method Cards to maximize user involvement and to prompt consideration and reflection on how social situations might impact technology use. Our findings from Course C showed that the DSA Method Cards helped student designers adopt appropriate perspectives toward how to interact with users, what questions to ask, and what social situations to examine. We emphasize: These method cards are designed to be used alongside user engagement.
   3(a) **Use the Cards with Users to Maximize their time and knowledge.** Use the DSA Method Cards to ask useful questions and to help users lead you through their ideas and pain points. It is well known that engaging disabled users can be time- and resource-intensive, particularly because it may be hard to find and recruit users.
   3(b) **Leverage scenarios grounded in real-world experiences to understand how design impacts technology use in everyday situations.** The DSA Method Cards employ examples derived from participants in past studies. The real-world scenarios provide content that may be helpful in initializing conversation in reflecting on how technology use may manifest in social situations. The method cards have thus been designed to assist in expanding brainstorming or serve as a launching point to ask appropriate and in-depth questions of users.
   3(c) **Use the cards in any stage of the design process, but definitely in ideation and iterative prototyping.** Our findings from Course C indicate that the cards enabled students to use real-world scenarios in discussion with their expert users in brainstorming similar situations that their expert user may have experience in. At the same time, students reported using the cards to leverage what they learned from expert users to critique their ideas. The cards helped students to understand and put into language some of the concerns uncovered through expert user interviews.
   3(d) **Use One for All, or All for One.** Although all the cards represent different facets of social accessibility that may arise in technology design, designers would not be required to use them all, and we argue that using just one is better than using none. Thus, there is no expectation or requirement that any one designer must use all the cards. However, at the same time, all the cards describe different situations of use that could be considered in the design process. Therefore, we strongly recommend that designers use as many cards as time and resources will allow.

We emphasize that though it may be tempting to rely on a single tool or individual's perspective to simplify the process toward accessible design solutions, such an approach is not recommended and may not be possible toward successfully achieving accessible design. For one, the experience of disability is diverse. No one person's experience will ever represent any community as a whole. And, if designers are nondisabled themselves, then they ought to seek out others' perspectives and gain some understanding and empathy if they are to create solutions that are comfortable and desirable to use by people with disabilities.

5.2 Contributions of This Work

The findings across this body of work suggests that including a Design for Social Accessibility perspective complements efforts to create accessible designs. Specifically, collocating designers with users with disabilities, emphasizing social consideration alongside functional ones, and—as

confirmed with Course C—using tools, such as method cards, can help (student) designers to reflect on social and personal factors that contribute to overall technology accessibility.

In our earlier studies, we showed that working with people with and without disabilities and including social consideration in the design process elicited productive discussion and reflection between designers and users. Working with multiple different users with and without disabilities helped (student) designers to disentangle and work through complex and sometimes contradictory needs and wants, despite their initial perception that it would be more difficult [29, 32, 35, 36]. Engaging users directly in conversation about how accessibility impacts social interaction was also efficient and complemented designers' inclinations, with professional designers reporting that they arrived at plausible solutions faster than without such discussion [8, 21, 32]. These earlier findings show that considering social situations of use and engaging with users can be effective and efficient, provided resources enable contact with stakeholders.

Findings from our Course C study build on prior work by focusing on the effectiveness of other tools to bolster social consideration and working with people with and without disabilities. Specifically, we demonstrated that students were able to use the DSA Method Cards to elicit information about how users felt about using technologies in social situations, in such a way that effectively informed students' design outcomes. Although these findings are presented in the context of a graduate level course—and necessitate further investigation with professional designers—our observations of students' abilities to draw on the cards toward relevant solutions for their design prompt indicate that the cards aligned with their needs as creators of novel technologies, i.e., complemented their design thinking process [8, 21]. We also showed that including information about how to interact with expert users helped students to know how to start conversations and guide them toward productive discussions. Our hope is that these tools help to lower the barrier for technology designers and developers to directly engage people with disabilities, toward gaining a better understanding of the experience of using inaccessible technologies when stakeholders are inadvertently left out [10].

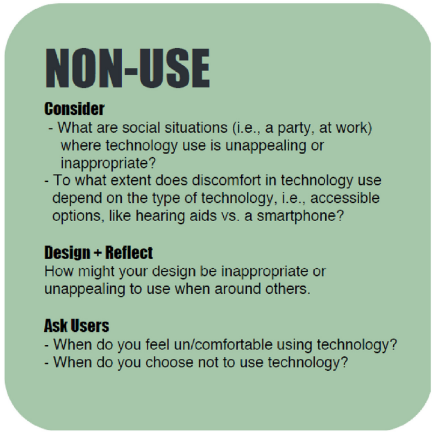
We have made the cards publicly available online at: https://cair.rit.edu/projects.html#tools. They are free to download and use under Creative Commons license BY-ND 2019 University of Washington and Rochester Institute of Technology.

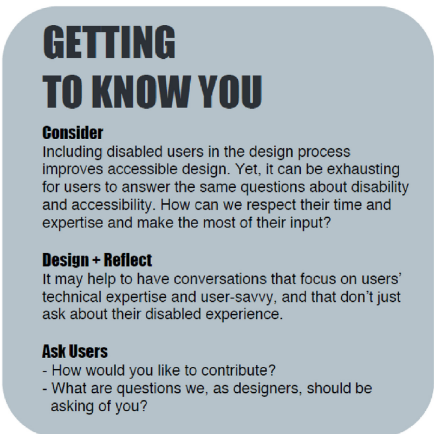
6 CONCLUSION

In this article, we have expanded on themes from our ASSETS paper entitled "Incorporating Social Factors in Accessible Design" by updating and investigating how the DSA Method Cards could be used by HCI master's students in a user-centered design course with deaf and hard-of-hearing users. We investigated how students used the cards during the course, showing that students found the cards useful in considering real-world scenarios where social accessibility might be an issue, and in gaining some empathy about how disabled users might interact with their designs. We also included an updated analysis on the body of research comprising this work, toward distilling practical considerations for how others can use the DSA perspective and Method Cards for accessible design.

APPENDIX

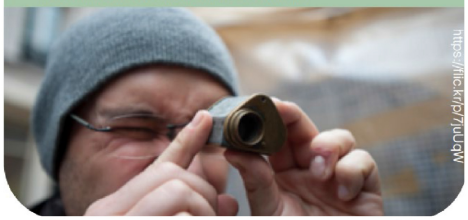
Appendix I Design for Social Accessibility Method Cards Revised version for Course C.





PERCEPTIONS OF "SPECIAL" TECHNOLOGY

Scenario
"Special" technologies used by people with disabilities may attract unwanted attention. For example, unfamiliar monoculars allow people with low-vision to magnify text (such as on street signs) but can attract negative attention.



PERCEPTIONS OF "SPECIAL" TECHNOLOGY

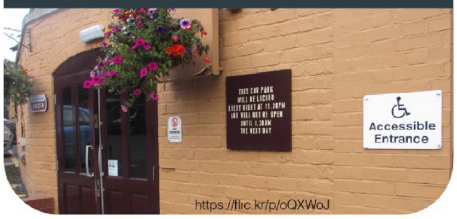
Consider
- How are unfamiliar technologies perceived in public places?
- How do nondisabled people react to accessible technologies (like the monocular)?

Design + Reflect
What aspects of your design might attract negative attention?

Ask Users
- Are you aware of bystanders that make incorrect assumptions about your technology?
- How do such assumptions change how you use your technology?

JUST LIKE EVERYONE ELSE

Scenario
Alternative accommodation does not always mean access is the same for disabled people. For example, sometimes there is only one accessible entrance to a building and it is in the back.



JUST LIKE EVERYONE ELSE

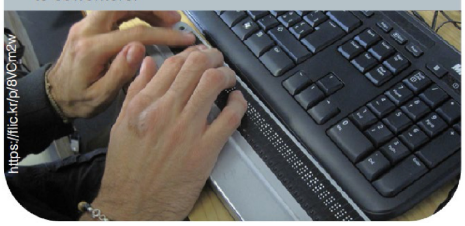
Consider
Different modes are often used to increase access, such as text-to-speech. How might modes be used to:
- Find directions using Google Maps?
- Browse an "accessible" version of a webpage versus "the original"?

Design + Reflect
How do different modes (e.g., voice vs. touch input) result in differences in access?

Ask Users
- When have different modes not provided equal access?
- Describe a time when an accommodation required more work for you to do the same thing as everyone else.

MY PROFESSIONAL LIFE

Scenario
Work accommodations for disabled people may lead to different perceptions of ability or professionalism. For example, assistive software or hardware, or extra time or space, may give negative impressions to coworkers.



MY PROFESSIONAL LIFE

Consider
How are negative messages about workplace values (i.e., professionalism) conveyed?
- A user's phone loudly announces messages during a meeting with respected colleagues.
- An assistive device's bright orange headphones distracts conversations off-topic.

Design + Reflect
How might your design convey negative or unwanted messages about the user?

Ask Users
- How do you desire to present your self professionally in the workplace?
- How can design align with your professional priorities and preferences?

Appendix II Companion instructions that accompanied the DSA Method Cards given to user-centered design master's students,

- The Design for Social Accessibility Framework, with its functional (y) and social (x) axes, shows the relationship between functionally and socially usable aspects in socially accessible design. Designs considered functionally and socially usable are socially accessible (top right). When using this framework and corresponding method cards, the goal is to maximize functionality and socially accessible consideration.
- The framework is meant to help designers think through possible scenarios for their designs, and it can also be used to critique existing technologies. However, it matters who decides what has utility and social appeal, and this judgment ought to reside with the user. Therefore, these tools should be used with design approaches centered on the users' experience.

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