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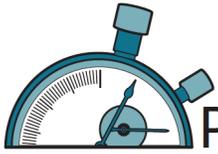
Improving the Quality of Health Care through Human-centered Design: Contextualizing Design of Biotechnology Implementation for Better Health Care and Patient Safety

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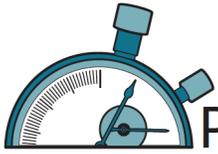
Keshab Raj Acharya

The biomedical industry has increasingly recognized the need to integrate usability into its design and development practices (Clark and Israelski; Gosbee and Lin 303; Hegde 3). Advocating for “Patient Experience Design” (PXD), Meloncon, in turn, notes technical communicators are uniquely qualified for such activities, as their skills overlap across areas central to such activities (15). However, the context where individuals use health and medical technologies can vary from culture to culture and nation to nation (Godwin 315–316; St.Amant, “Mapping the Cultural Context of Care” 111). These factors can have problematic implications for the use of such technologies in differing contexts. Biomedical materials designed for PXD thus need to address such factors in international contexts (St.Amant 64–66). This situation raises a key question: To what extent are biomedical products designed in industrialized nations contextualized to enhance health care and patient safety in underdeveloped countries that are using such products? Through my pilot study on the usability of industrialized nations’ medical devices in a different contextual setting, I found that contextual factors such as workplace settings/physical environment, technological infrastructure, economic

constraints, and users’ culturally localized experiences (the knowledge and practical skills individuals gain within their local community) must be considered during the design process. The following sections discuss usability in relation to the context of use, research method, results, and conclusions with limitations.

Review of Contextual Usability

With a growing recognition of usability engineering that focuses on user needs and expectations and end users testing of technological products (Gosbee 352), new biomedical technologies may hold a key to health care improvement and patient safety, especially in underdeveloped countries using medical devices from industrialized nations. Adoption of new technologies “has advanced rapidly in areas where it facilitates the care and cure of diseases” (Mettler 686). As Angeli et al. argue, the context in which medical practitioners interact with health information needs to be at the forefront of developing such information in ways that reflect and address users’ expectations and needs. St.Amant argues that designers should understand how contextual factors “affect expectations of use and how such



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factors can vary across cultures” (“Of Scripts and Prototypes” 114). Maguire also notes that it is incorrect to describe a product as usable without describing the context of use, i.e., where the product will be used and what it will be used for (453).

Attempts to improve patient outcomes largely focus on adopting most effective technical processes for product design by considering users’ “needs, contexts, desires, and input” (Rose 428). While St.Amant proposes the “international patient experience design (I-PXD)” approach that allows designers to develop technical materials by considering different contexts around the world (“Mapping the Cultural Context of Care” 109), Sun offers a “culturally localized user experience” (CLUE) design approach, arguing that “the local culture in which a technology is used should be investigated in a context where the collective and individual meet and where the implementation (instrumental aspect) and interpretation (social aspect) interact” (460). Designers should be aware of the fact that culture, which shapes how we view the world and through which we perceive communication and create messages, is different from one country to another (Varner et al. 10). Therefore, there is a need for an effective implementation of contextual usability approaches in designing medical devices to be used across cultures, for these devices “have user interfaces that are so poorly designed and difficult to use that they invite a variety of human errors” (Zhang et al. 23).

Method

To examine this topic, I sought to answer the overarching research question:

RQ: How effectively can healthcare providers in developing nations use health

and medical materials designed in industrialized nations?

To answer this question, I interviewed different healthcare professionals working in Nepal to determine their perceptions of usability and their ability to use medical devices developed in industrialized nations. Interviews allowed me to learn about users’ perceptions and reactions to the products, and the setting that “would otherwise be closed to [researchers]” (Weiss1). The overall details of this project were as follows.

Source of Data

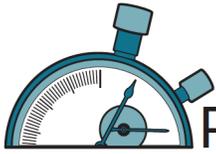
For this IRB approved study (# 909203-3), participants were recruited at a private hospital in the capital city of Nepal. The research site was chosen for two reasons:

1. The case hospital is equipped with sophisticated biomedical technology (e.g., anesthetic ventilator, blood gas analyzer, and infusion pump) from industrialized countries such as Germany, Ireland, and the USA.
2. It provides preventive services (e.g., early identification and management of diseases) and curative services (e.g., intensive therapy facilities) at an international level serving a wide range of patients from different nations.

With the latest biotechnology and a network of qualified physicians and staff, the hospital is committed to providing quality services for both domestic and international patients.

Participants and Research Procedures

I identified prospective participants through an anesthetist working in the hospital for a year. I then contacted 12 participants via emails, phone, and Viber (an instant messaging and voice over IP application). Though I initially recruited all participants



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($N=12$), two participants, who provided incomplete responses to the interview questions, were not included in this study. Participants included met the three basic criteria: a) working in a surgery ward for at least 6 months; b) fluent in reading, writing, and speaking in English; and c) users of biotechnology designed in the industrialized countries. These factors are important to determine appropriate participants who could provide thick descriptions on design requirements of a technology to be used in their concrete contexts. Demographic questions were then distributed to collect information about participants' age, education, and work experiences. These questions identified two categories of participants (ages 21–39):

- Five licensed anesthetists with MD degrees from Nepal
- Five nurses with a bachelor of science in nursing degree from Nepal

Per participants' preferences, I distributed interview questions via emails. This entry reports part of the overall research based on the written responses from the 10 participants.¹

Data Analysis Process

I used Charmaz's open-ended, qualitative, grounded theory mode of data analysis method, for it allowed me to understand participants' perceptions, standpoints, and situation, as well as their (re)actions within the setting (114). I coded data iteratively to identify a pattern or a generalization, focusing on the interrelating variables or categories. This coding process allowed me to look for trends in which themes were saturated (Charmaz 213–216). In essence, themes related to contextualizing usability of medical products used in differing cultural settings emerged from the iterative process of coding

and categorizing. As such, emergent insights were iteratively evaluated against the health care and contextual usability literature² to assess this study's contributions to the TPC (technical and professional communication) field.

I categorized data into two groups:

- Responses related to localization usability: Participants noted the need for developing usable and meaningful products by considering local users and their culture in a target country or a target market.
- Responses related to contextualized design for improving health outcomes: Participants noted the need for designing products by considering the concrete context of use (i.e., characteristics of users, their tasks, and the organizational and physical environment)

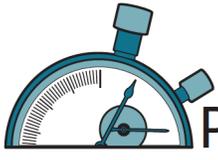
In this entry, I only report on the data related to the contextualized design for improving health care and patient safety in the case hospital.³

Discussion and Implications

Due to space constraints, I focus on how findings fit into the I-PXD usability framework described by St.Amant in "Mapping the Cultural Context of Care" (see 66–67).

Context of Use in Product Design

To investigate the contextual usability of biomedical products imported from wealthy nations (Maguire 460), participants were asked, "To what extent are the products useful and usable in your workplace setting?" Though all participants mentioned that the products were very useful and usable, they indicated some problems related to contextual usability. For instance, while one



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participant stated that “the devices contain different unfamiliar terms,” another participant was concerned with “the size of the equipment like [the] ventilator, which occupies a lot of space.” The surgery room, as indicated by the participant, had a limited space, and setting the bulky equipment in a desired place was problematic. This means that such equipment is designed to fit into the space usually found in healthcare settings in industrialized nations. So, it did not account for the fact users might need to use it in space-constrained settings in other nations. In essence, medical product developers should not only think about users’ culturally localized experiences, but they should also consider the workplace setting (i.e., the surgery room, in this case) and technology infrastructures for better health care and patient safety in resource-constrained environments.

In response to the question, “Please list the problems, if any, you have faced while using the products,” five participants indicated the problem related to what Sun calls “social affordances” that emerge due to the gap between design and the concrete context of use (78–80). Since the participants were not provided any training by the designers before using the devices, they had to work with their own culturally localized knowledge experiences. As one participant indicated, they had to “seek help from outside to fix minor problems in the monitor which was not designed with affordances.” Such affordances emerge out of operational (i.e., on the operation level), instrumental (i.e., on the action level), and social (i.e., on the activity level that arises from users’ interactions with a technology in their sociocultural and historical local contexts) affordances (Sun 78–79). As the global market grows, biotech designers should

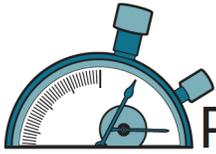
develop medical devices by addressing the locally situated use context and usability requirements of different cultures for better health care services and patient safety.

Another respondent mentioned that “these highly expensive instruments are difficult to transfer from one space to another. Because of the lack of people who know how to move them, it is difficult for us to transfer them and when something goes wrong, it is very expensive to replace the accessories.” These responses provide two key contextual usability issues that are in alignment with how another interviewee succinctly put it in responding to the question, “What factors do you need to consider when you use the product?”—“portability and cost.”

To facilitate better treatment in undeveloped countries like Nepal, designers of medical products in developed countries need to consider cost/affordability and economic constraints, as well as other various contextual-related issues, such as the design of the building, room setting, and product transferability/manageability. Certainly, if technological products are complex to operate within a given context, users may be unable to perform desired tasks effectively and thus would not be able to provide quick, quality services for patients.

Contextualizing Design for Improving Health Outcomes

One of the primary characteristics of a human-centered product is the ease of use in a particular contextual setting and “*the use of technology is always embedded within a cultural context*” (Getto et al. 41). As St.Amant argues that “usability is about context” (“Context, Culture, and Usability” 31), biotech users across cultures should be



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able to use medical devices efficiently to provide quality services for patients without outside assistance. Any health and medical products or systems designed for quality of care and patient safety must “fit within the constraint of the environment” in which individuals use the products (Karsh 389).

In answering the question, “What are the reasons that make the products easy or difficult to use?” one respondent mentioned that “we occasionally face problems during the functioning of the [medical] devices and equipment such as ventilator, ICU monitor, and syringe pumps. Sometimes, they stopped working all of a sudden and we do not know what to do.” Not having immediate technical support in any workplace setting certainly inhibits the quality of medical services. More so, unavailability of such support may also incur dire consequences for patients during surgery, especially in the resource-constrained settings with “limited access to, or reduced availability of, resources” (Rose 433). Built into the design of technologies is that the user will have ready access to a phone, computer, or other technologies to contact some sort of help system—an option that might not be available in certain international contexts like in this case hospital.

Indicating the contextual usability problem of placing the devices in particular spaces within the room, another interviewee pointed out that “some of the devices having limited backup battery have short cords to plug into the power source (power outlet) and they should be positioned near the power source because such sources are available in certain spaces in the room.” This means medical devices designed for developed countries’ hospital room setup may not operate equivalently in underdeveloped countries’

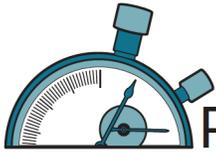
hospital room setup. I should also note that, at the time of this research study, on average, there were eight and a half hours of power outages every day in Nepal (“Load-Shedding Cut by an Hour a Day”).

A participant with more than one year’s work experience succinctly provided design suggestions for effective patient treatment, listing them as:

- Do not compromise in quality
- Do not make user interface and buttons complicated
- Design lightweight, portable, and practicable medical devices and equipment
- Develop serializable parts by common methods whenever applicable

To address these suggestions, designers should heed more effective context-focused approaches that allow them “to develop items that meet an individual’s needs and wants for use in [their] environment” (Getto et al. 30). In essence, the design of medical products should respond to the contingencies of the local context for better care and patient safety.

As the field of TPC expands internationally, technical communicators, as designers, need to know how their products are contextually meaningful for users across cultures. As my findings show, medical products initially designed in developers’ sites may not work respectively in users’ sites, and, thus, may need to be redesigned for a, in Øvretveit’s word, “quality system” (301). This study suggests designers in industrialized countries perform contextual inquiry⁴ to identify characteristics of the use environments in the era of postmodern technology-transfer culture.



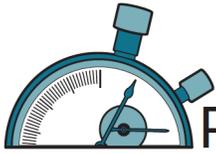
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Conclusion and Limitations

This study sheds new light on the need for the implementation of contextual usability in industrialized nations' biotech products to be used by resource-constrained, underdeveloped countries to enhance quality of care and improve health outcomes. Though this entry provides insightful findings, one case study's results cannot be generalized in other heterogeneous contexts across cultures. So, more research regarding the design of technology implementation for better health care and patient safety in underserved, underdeveloped countries is needed.

Notes

1. I should note that though ethnographic approaches such as contextual observations would provide richer qualitative data, the researcher was not permitted to do so in the highly sensitive place (i.e., the surgery ward) for privacy and security reasons.
2. The sources I consulted to do this comparison were from scholarly journals (such as *Information Systems Journal*, *Connexions • International Professional Communication Journal*, *Communication Design Quarterly*, and *Quality and Safety in Health Care*), the magazine of the Society for Technical Communication (i.e., *Intercom*), and books (such as *Intercultural Communication in the Global Workplace*, 5th edition and *Cross-Cultural Technology Design: Creating Culture-Sensitive Technology for Local Users*).
3. Research findings concerning localization usability of biotechnology imported from wealthy nations to be used in an underdeveloped country are already reported elsewhere (Acharya).
4. Like other user-centered design approaches, contextual inquiry is a technique to test product usability by interviewing and observing actual users' tasks as situated and contingent at their regular workplaces as they do their own work (Mirel 14).



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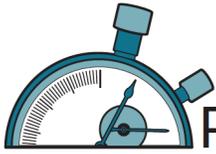
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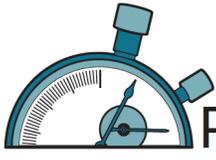
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About the Author



Keshab Raj Acharya is a faculty at the University at Buffalo—The State University of New York where he teaches technical communication courses in the Department of Engineering Education. His research interests in technical and professional communication include inter/cross cultural and international technical communication, usability studies, rhetoric of health and medicine, and social justice and human rights.