

This Is Who I Am and This Is What I Do: Demystifying the Process of Designing Culturally Authentic Technology

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Abstract. The goal of this paper is to bridge the gap between existing frameworks for the design of culturally relevant educational technology. Models and guidelines that provide potential frameworks for designing culturally authentic learning environment are explained and transposed into one comprehensive design framework, understanding that integrating culture into the design of educational technology promotes learning and a more authentic user experience. This framework establishes principles that promote a holistic approach to design.

Keywords: human-computer interaction, cultural relevance, educational technology, design.

1 Introduction

Over the years, the HCI community has established universal design practices, which enable designers to create technology to fulfill users' needs by leveraging attributes, commonly referred to as affordances. In the context of designing technology, Norman [27] defines affordances to be 'learned conventions' that intuitively inform the user about how to interact with technology [29]. The phrase 'learned conventions' correlates to socio-cultural norms or behaviors attributed to users who are members of one or more communities of practice [20, 27]. Traditional design practices allude to the importance of integrating culture into the design of technology. For example, Gaver et al. [9] introduced the concept of cultural probes, user interactions with objects (e.g. using a camera to take pictures of important items in the home) to identify socio-cultural

norms of a particular population and subsequently inspire the design specifications of technology. Aykin [2] justifies developing products for international audiences (i.e. internationalization) based on understanding the specific needs of local users (i.e. localization). Bourges-Waldegg & Scrivener [7] emphasize shared context of meaning as a means of designing universal user interfaces that support culturally diverse groups of users. Grimes et al. [12] created a mobile phone application, designed to recognize the collectivist nature of African American communities, that allows users to record and share their eating routines as a method to encourage healthy dietary habits. As a result, these tools demonstrate a growing consensus in the HCI community that designing culturally-relevant technology is important. However, few guidelines exist that describe how to design technology that recognizes socio-cultural norms.

Today the demand for increased academic performance stipulates new and improved approaches to instruction delivery. Several education researchers have responded with calls for integrating culturally relevant pedagogy into classrooms as a method of student engagement, curricula development, knowledge construction, reflection, and applicability of skills learned. Therefore, the design of culturally relevant educational technology proves to be a timely and promising venue for the exploration and construction of a new framework that can be used to substantively guide the design and development of technology.

Placed within the context of education and learning, this paper describes the work of prominent education researchers and their suggested models of culturally relevant pedagogy. These models are positioned alongside those of culturally relevant educational software design principles in an attempt to create a more concise conceptual framework, *The Cultural Relevance Design Framework*, which is then introduced and explained. The goal of *The Cultural Relevance Design Framework* is to assist any design team with creating culturally authentic technology. This framework is designed to uncover the design team's beliefs and biases about their target audience, highlight aspects of about the target audience that might be unknown, and suggest cultural assets that can be investigated to provide building blocks for sound cultural representations. Overall, this framework informs decisions regarding cultural relevance at the onset of the design process as well as a method of evaluating the cultural relevance throughout production processes to help ensure goals.

2 Related Work

2.1 Socio-Cultural Learning Theory

Socio-cultural learning theory was first introduced and applied by L. S. Vygotsky [33] as he sought to explain cognitive development processes. This theory posits that all learning and cognitive development take place in a cultural context and are influenced by language and symbols. It asserts that culture and language play huge roles in the cognitive development of children [17, 33]. Vygotsky's socio-cultural learning theory suggests that new knowledge is developed, framed around, and reflected upon one's cultural knowledge and behavior. Therefore to maximize learning potential overall, this learning theory can and should be used to support the development of curricula and pedagogy to emphasize and mimic the assets of a learner's culture. *The Cultural*

Relevance Design Framework introduced here extends this learning theory to support the creation of educational technology to similarly emphasize and emulate the assets of a learner's culture. In this case, we propose that technology should be designed in such a way to build rapport with the user, thus becoming an educational artifact indicative of the socio-cultural norms attributed to the targeted group of users and situated within the user's culture.

2.2 Cultural Responsiveness in Learning Environments

Culturally-responsive teaching has become a mantra for many educators and scholars concerned with the learning and academic achievement of culturally and linguistically diverse students [1, 4, 10, 19, 22, 24]. These researchers and scholars have learned that students of different cultural backgrounds process information differently. For example, researchers have consistently found that African-American and European-American children differ in storytelling styles, knowledge of print conventions, oral language, and question asking style [2828]. Applying culturally responsive strategies to reading, science, and math instruction proves beneficial for students from several cultures learning to read, expanding their engagement in reading, as well as in science and math [5, 8, 19, 30, 32].

The collective research efforts mentioned above demonstrate the potential of culturally responsive learning environments which extends to the design of educational technology. Educational technology that integrates socio-cultural norms of the targeted group of users promotes enthusiastic engagement and interaction, academic development, and nurtures cultural competencies. The latter two are present in the Cultural Relevant Pedagogy, coined by Ladson-Billings [19] during her ethnographic study of cultural responsiveness fostered by eight exemplary teachers of African-American classrooms.

2.3 Design of Cultural Relevant Software

Thinking and learning are all related to the context in which they occur, thus contextualizing the learning experience in the cultural practices of the learner, impacts the learning experience [26]. Computer software design generally follows a systematic process that encompasses design decisions known to influence learning success [11]. Culture variables incorporated into the design process serve as a vehicle for enhancing engagement via computer software tools. As the practice of incorporating culture into design becomes more widespread there is a need for guidance and instruction for those wishing to engage in culturally relevant design [11]. Numerous tools have been developed and designed in response to this need.

The Instructional Design Framework, as discussed by Herrington and Oliver [16] applies a model of instructional design based on the theory of situated learning to the design of a multimedia-learning environment. Guided by nine situated learning design characteristics, a checklist of guidelines was created, that enables these characteristics to be operationalized to provide support for authors, researchers, and theorists. Their framework supports the acquisition for complex knowledge and the means for the creation of authentic learning environments based on situated learning theory.

The Culture Modeling Design Framework presented by Carol Lee offers a structure for the design of learning environments that explicitly accounts for culture [23].

Her framework targets the design of instruction in ways to leverage everyday knowledge to support specific learning enactment of curriculum. It aims to structure learning environments that primarily focus on the kinds of problems that are generative and help learners leverage prior knowledge in order to solve new problems.

Young's Culture Based Model presents an intercultural instructional design framework that guides designers through the management, design, development, and assessment process while taking into account explicit culture-based considerations [35]. Its design factors (again, list a few of the criteria) facilitate a broad examination of culture, instruction, learning and the application of these factors to cross-cultural audiences [35]. Young's model, asks high level questions to facilitate the big picture of the management of undertaking the design process. However, this model can become difficult to navigate for software designers in need of a direct guide to support the design and evaluation of a software artifact.

3 Proposed Comprehensive Framework

Despite the prominence of the models mentioned above, a gap still exists between the models proposed by educators and the guidelines used by technology designers and other members of the HCI community. More specifically, the above models are generally theoretical in nature and are used to guide the creation of curricula, teacher worldview, and the context of lesson plans. It is difficult, however, for designers to apply such theories to the research, specifications, and evaluation required in development of software. Therefore, *The Cultural Relevance Design Framework* attempts to bridge the gap between technology designers and the culturally responsiveness recommendations of educators and education researchers by providing questions that can influence the decisions as designers begin brainstorming the culturally relevant aspects of their intended products or by developers who would like to evaluate the culturally relevant aspects of a product already produced.

Designing culturally relevant tools can become a difficult endeavor to embark upon because of the varying definitions of 'culture,' and how to account for it in design practices. The essence of a culture is often described as how the members of a group interpret, use, and perceive artifacts, tools, or other tangible cultural elements; it is the values, symbols, interpretations, and perspectives that distinguishes the interpreted embodiments of symbols, artifacts, and behaviors of a group; consisting of patterns, explicit and implicit, of and for behavior acquired and transmitted by symbols, constituting the distinctive historically derived and selected ideas, repertoires of practice, and especially their attached values; measured by participation in communities of practice and considered as products of action, and as conditioning elements of further action [3, 14, 18]. Thus, the authors define culture along two dimensions: what we do and who we are. Yet, within these two dimensions a wide range of attributes can be compiled to further capture and illustrate the concept of culture, as described above. To guide the design of culturally relevant tools we have chosen to depict these two dimensions within four themes: Practices, Ontology, Representation, and Tasks.

Practices. One of the best ways to develop an appreciation for the targeted group is to first identify and understand the cultural practices socio-cultural norms associated with the targeted group. This raises the question of what are the socio-cultural norms of the

targeted group. Our framework requires the designer to first become acquainted with socio-cultural norms of the target culture and then appreciate unique aspects that characterize the targeted group of users. Wenger [34] defines practices to be the widespread agreed upon activities engaged in by members of a culture entity. Rogoff et al. [31] discuss the method of intent participation; members observe and eventually begin to partake in practices (e.g. watching how someone prepares a dish before attempting to cook that same dish). Brown et al. [6] describe the cognitive apprenticeship model in which novices work with an expert to master a particular skill set. We can extend the cognitive apprenticeship model to the manner in which members come to understand and practice the broad range of activities in a particular context. Why does the context matter? The context is what makes the particular activity authentic. For example, if the activity is playing dominoes, or *bones* as they are referred to within the African American community, while constantly insulting one's opponents; the context is a recreational activity where insults are traded in the spirit of fun with no serious repercussions. Though various theories explain how members of a culture entity enculturate these practices, designers may not necessarily share the same background or experiences as those of the targeted group of users. This theme provides explicit categories (e.g. religious ceremonies, holiday traditions, indoor/outdoor recreational activities, etc.) of practices, thus, enabling designers to consider the range of practices attributed to the targeted group of users and how some of these practices can be integrated into the learning tasks in the technology.

Ontology. Within every culture there is a shared ontology, an organizational structure of knowledge, rich with language and vocabulary that is understood by participants of that culture, representing knowledge and the organization of knowledge in a particular domain, for problem solving [25]. We believe that culturally relevant software should reflect the ontology of the culture it aims to teach to. For example, the instructions given should emulate the manner in which instruction is given within the target audience's culture. In the domain of football, if one were designing a piece of software for football players, the instructions would be very brief and concise, without the use of superfluous language, much like the interaction between a football coach and his players. Similarly, the manner in which feedback is given should be representative of the ways in which feedback is generally given within the culture of the targeted audience. It is also important that the learning technology makes use of the vocabulary common to the culture of its audience. Furthermore, the learning technology should use a familiar vocabulary when discussing the main ideas, abstract concepts, as well as activities found within the tool. Generally speaking, all spoken or written words within the context of the educational software should also utilize the language conventions practiced by the target audience.

Representation. Representation, the visual and physical manifestations commonly accepted within a culture, serves as the primary sensory mode for interpreting affordances and associations. These can often be included as part of the culture's conceptual model [29]. Thus a misrepresentation of culture elements can make it difficult or become a distracter for culture participants. For example, a participant in the culture of American football might associate certain representations affiliated with a football player. It is common for American football players to wear a helmet, facemask, shoulder pads, cleats. However a misrepresentation of this culture, i.e. a player wearing a tutu holding a tennis racket, can make it difficult for a participant to connect to the message being

conveyed. Thus a designer engaging in culturally relevant design must ensure authentic representation (e.g. gestures, clothing, activities) of the targeted audience's perception of behaviors and visual cues of that culture. Designers are tasked with assuring their artifacts are respectful of targeted audience's cultures. The imagery, attitude or perspective, and graphical images, should reflect the target audiences' culture(s) (colors, background and foreground, clothing, etc.) and culture norms. In addition, the elements of sound/music of the targeted culture must also be accounted for within the design. The design must also ensure that the following aspects of appearance are culturally representative of the targeted audience: body, face, shape, ethnicity, age, clothes, gestures, and eye contact [13].

Table 1. *The Cultural Relevance Design Framework*

	<i>Definition</i>	<i>Investigative Question</i>	<i>Criteria</i>
<i>Practices</i>	Shared socio-cultural conventions that emerge and evolve when people who have common goals interact as they strive towards those goals	Does the technology emulate the practices and "ways of thinking" of the targeted culture?	Gender, Family & Community Roles Religious & Other Holidays Family Gatherings and Rituals Music and Dance Interaction with Community, Elders, Peers Play activities Food
<i>Ontology</i>	The shared or understood vocabulary of a culture or community of practice	Does the language demonstrated in the technology reflect the language of the targeted audience?	Native language Idiomatic expressions Slang and other Vernacular characteristics Sentence Composition Style of writing
<i>Representation</i>	The way in which the visual cues and symbolic thought reflect the patterns, values, knowledge and beliefs of a group	Does the technology reflect the appearance of the targeted audience?	Aspects of appearance: (body, face, shape, ethnicity, age, eye contact)
<i>Tasks</i>	The set of actions or functions prescribed to accomplish a goal or objective	Does the technology reflect who would typically do this task(s) in the targeted culture?	young vs. old male vs. female expert vs. novice maternal society vs. paternal society

Tasks. Tasks include the familiar actions and goals associated with a culture. With respect to the technology being designed our framework views tasks as the activities that users engage in while completing the overall goals of the technology. For example, the tasks can be the basic actions within a treasure hunt game such, as characters walking,

climbing, or reading while trying to find the treasure. We suggest that an understanding of tasks common to the target audience's culture can lead to the design of technology that is consistent with the end users cultural tasks. We view the tasks with respect to who the target audience is by considering the tasks typically associated with users' age, gender, etc. as well as what they do (e.g. teacher, student, parent, child). We believe that the nature of the tasks exhibited in the technology should reflect the culture of the end users. For example, does the person doing the task in the technology (e.g. a mother or father, a young or older person) mirror who is doing the task in the technology? In addition to understanding who engages in these tasks, the actions users engage in should allow users to apply skills and information from their culture to their interactions with technology.

These four themes form *The Cultural Relevance Design Framework* to engage designers in the practice of culturally relevant design. The framework is organized such that each of the themes are presented in Table 1 with a definition, an investigative question, and suggested criteria to help the designer explore and better understand the culture of the target audience.

4 Proposed Application of Framework

Recommended steps towards applying The Cultural Relevance Design Framework to any design effort are described here and illustrated in Figure 1. Once the target audience(s) of a design effort has been determined, the design team should:



Fig. 1. Illustration of steps towards applying The Cultural Relevance Design Framework

Step One: Examine beliefs and biases about the targeted culture(s). These overall beliefs and biases may fall within the themes presented here as well as throughout other aspects of the targeted culture. This step may also uncover cultural aspects of the target audience that are unknown or that may need further investigation.

Step Two: Determine the themes within the framework (Practices, Ontology, Representation, Tasks) that are applicable to the design effort and review suggested criteria. The criteria presented here are intended to serve as suggestions and do not represent an exhaustive list. Other appropriate and meaningful criteria can be added.

Step Three: Use the suggested criteria to identify authentic socio-cultural norms of the target audience and devise strategies for the acquisition of additional information as needed.

Step Four: Incorporate what has been learned into the design effort, continuing to use the framework as an evaluation tool throughout the entire production process to ensure successful accomplishment of cultural relevance goals.

5 Conclusion

The aim of this paper is to introduce a software design framework that facilitates the creation of culturally authentic technology, providing designers of educational technology with concrete criteria that correlate to the socio-cultural norms of the targeted group of users. Based upon pre-existing yet disjointed culturally responsive models situated within multiple disciplines such as education, computer science, psychology, and anthropology, we present The Cultural Relevance Design Framework, a cohesive framework for integrating the practices, ontology, representation and tasks of potential users into the design of educational technology. The Cultural Relevance Design Framework initiates discussion and reflection among designers, but from the perspective of potential users. Future work includes using the Cultural Relevance Design Framework to design, implement and evaluate educational technology for its cultural authenticity.

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