# Generation and Evaluation of CS1 Resources Implementing Latine Culture: Perspectives from Latine and Non-Latine Undergraduate Students

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## ABSTRACT

Culturally-Relevant Computing (CRC) builds on culturally-relevant pedagogy by integrating students' identities, backgrounds, and experiences into computer science instruction. CRC enhances student engagement by making learning contexts relatable, fostering concept comprehension, and boosting students' sense of belonging. Critics argue that CRC may alienate students outside the referenced culture and potentially distract students from learning computing concepts. However, most CRC research has focused on K–12 settings, leaving open questions about how CRC materials are received in higher education. This study addresses that gap by evaluating five newly developed, Latine-centered CS1 reading resources with 19 undergraduate computing students (12 Latine and 7 non-Latine, i.e., in-group and out-group) using an adapted Cultural Relevance Evaluation and Assessment Tool and follow-up semi-structured interviews. Thematic analysis revealed distinct evaluative lenses: Latine students applied an experiential "insider" lens rooted in linguistic, and regional authenticity, whereas non-Latine students utilized a functional "outsider" lens prioritizing structural presentation and the logical interplay between culture and computing logic. Both groups shared a positive perception of the CRC resources, frequently highlighting cultural learning and exposure as added benefits, demonstrating a dual utility that simultaneously validates insider identity and broadens outsider perspectives. Concerns about stereotype threat were rare and largely hypothetical rather than personally felt. These findings help dispel concerns that culturally-grounded content alienates or distracts students, and offer design considerations, informed by both in-group and out-group perspectives, for developing culturally deep CRC resources in higher education.

## CCS CONCEPTS

• **Social and professional topics** → **Computer science education**; **Race and ethnicity**.

## KEYWORDS

Latine, Latinx, Latina, Latino, Hispanic, culturally relevant computing

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## 1 INTRODUCTION

Computer science (CS) is often perceived as culturally neutral because it is a technical field, whereas other fields in the humanities and social sciences have a more visible connection to culture. Given this perception, it is reasonable to question the role of culture in Computer Science Education (CSEd). However, the positionality and lived experience of instructors (and the authors of resources we use in the classroom) reflect and influence how instructors and authors themselves understand and perceive the subject [2]. Although CS is often viewed as culturally neutral, the discipline reflects particular cultural conventions, such as English-based programming keywords and coding left to right. Recognizing this creates an opportunity to engage with culture intentionally in support of learning

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to transfer knowledge to our students via examples, metaphors, and context.

Culturally Relevant Pedagogy (CRP) [21] and Multicultural Education [2] frameworks can be used to intentionally leverage culture to reach students who are historically underrepresented in higher education while still aiming for all students to achieve academic excellence. Within CS, these frameworks are especially important given ongoing efforts to broaden participation among students from historically underrepresented groups in CS, including Black, Latine, Native American, and Pacific Islander (BLNPI) students [20, 45]. This motivation has led to computing specific CRP frameworks that have covered both intro and higher level courses, such as Culturally Relevant Computing (CRC) [16, 24]. However, existing work provides limited explicit guidance on the process of designing CRC resources. Few studies include students' perceptions on CRC, and fewer include perspectives from students who are not part of the culture presented. Most CRC work focuses on larger programming projects or applications in the context of K–12 education [40].

Among BLNPI populations, Latine students are one of the largest and fastest-growing groups in higher education, yet remain persistently underrepresented in CS [33]. CRC has been the predominant pedagogy studied with Latine students, but there is a gap of understanding how Latine students – and their non-Latine classmates – experience CRC materials in college classrooms. Critics of CRC have also argued that centering one group's culture in coursework may alienate students outside that culture or distract from core computing content [37]; our study directly addresses these concerns by gathering both Latine and non-Latine student perspectives.

To contribute to the limited body of CRC research in higher education, we generated five Latine-centered CS1 CRC resources and evaluated the cultural depth of those resources from the perspectives of both students who share the represented culture (in-group) and those who do not (out-group) by answering the following research question: **What are Latine and non-Latine undergraduate students' perspectives when evaluating the cultural relevance of Latine CRC resources**?

## 2 RELATED WORK

### 2.1 Integrating Students Culture

Our work is grounded in the well-established framework of Culturally Relevant Pedagogy (CRP), which integrates students' cultural backgrounds into the learning process. CRP fundamentally emphasizes the importance of educators understanding, addressing, and leveraging the cultural diversity present in their classroom to achieve the following three tenets for both in-group and out-group students: academic excellence, cultural competence, and sociopolitical consciousness [5, 21].

For cultural competence, in-group students may view the cultural reference as a *"mirror"* that reflects their own culture, whereas out-group students may view it through *"window"* that provides an opportunity for cultural learning [6]. Students in the out-group may also view a cultural reference as a mirror when it connects with their lived experiences. Similarly students in the in-group may experience it through a window when they encounter unfamiliar aspects of their own culture [17]. The metaphor of *"mirrors"* and *"windows"* is used throughout this paper.

CRP has been adapted to several disciplines, including STEM and engineering education; in this study, we use its adaptation to computing, Culturally Relevant Computing.

### 2.2 Cultural Implementations in Computing

Culturally-Responsive Computing, introduced by Scott et al. [30], is grounded in the theoretical foundations of Culturally-Relevant Pedagogy, Culturally Responsive Teaching, and Culturally Sustaining Pedagogy—frameworks developed by Ladson-Billings, Gay, and Paris respectively [14, 21, 26]. Although 'culturally relevant' and 'culturally responsive' are used interchangeably in the literature [24], we use Culturally Relevant Computing throughout this paper, as 'relevant' better aligns with our goal of integrating culture.

Morales-Chicas et al. 2019 literature review identified three theories that emerged from CSEd efforts to integrate culture into CS: Ethnocomputing, Culturally Situated Design Tools, and Culturally Relevant Computing [24]. The review also identified six themes across these theories. Our CRC resources incorporate three of these themes: heritage culture through artifacts and ancestral roots, vernacular culture, and lived experiences.

A 2021 scoping review by Leonard and Sentance examined various CRC curricular approaches employed across K-12 learning environments [22]. Their findings indicate that CRC demonstrates more positive outcomes in extended interventions that fully integrate cultural elements within computing curricula. Furthermore, they highlighted the diversity of CRC studies, ranging from brief, targeted interventions aimed at underrepresented populations to comprehensive curricular implementations [22]. Most evaluations predominantly employed quantitative measures, focusing on changes in attitudes toward computing and documented learning gains.

A 2024 ITiCSE Working Group literature review [16] generated 25 CS1 in-class CRC examples centered on six African cultures, drawing on Banks' Multicultural Education framework and Additive Approach [16], which appends cultural content to an existing curriculum. Their work is crucial in filling the gap of documenting the generation of CRC resources and faculty evaluation of these resources. Our study contributes to this space by also documenting our process for generating Latine CRC resources and understanding students' evaluation of the cultural depth of our resources.

### 2.3 Latines in CS

The motivation behind centering our CRC resources to reflect Latine culture stems from the persistent underrepresentation of Latine students in computer science (CS) [33]. One contributing factor is the lack of early access to CS courses in K–12 schools that predominantly serve minoritized students. Despite higher interest in CS compared to their White peers, Latines have lower access to computing [44], limiting students' exposure to CS before entering higher education. Without this early exposure, Latine students are potentially less likely to consider CS as a field of study or career. Another contributing factor is the limited availability of transferable introductory CS courses in community colleges [32], which is especially significant given that Latine students make up a large proportion of community college enrollment [15]. These structural barriers restrict Latine students' access to CS pathways long before they reach upper-division coursework.

In light of these challenges, our study focuses on how to better serve the Latine students who do ultimately enroll into introductory computing (CS1) courses in higher education. CS1 serves as a key access point, often enrolling the most diverse set of students including non-CS majors fulfilling general education requirements [29]. For many, CS1 represents their first and possibly only formal exposure to computer science. We see this moment as a critical opportunity to foster belonging and engagement through pedagogical approaches that reflect students' lived experiences and cultural identities.

## 2.4 Latine Centered CRC

A literature review conducted by Villegas Molina et al. found that CRC is the predominant pedagogy studied with Latines in the K-12 setting but there were no such studies in the undergraduate level at the time of the study [40] (but has recently been expanding in the CS education space [36, 38, 39, 41]). K-12 CRC implementation spanned various themes such as bilingual education [12, 28, 42, 43, 46], culturally-relevant topics [1, 9, 28, 34], social justice [1, 8, 28, 34], family-based approaches [7, 8, 46], and community involvement [8]. CRC was found to increase computing interest [9, 12, 46], engagement [7, 28, 42], confidence [12, 46], social value towards computing [1, 12], computing comprehension [28], motivation [1], and computing awareness [7].

Prior work has shown that Large Language Models (LLMs) can generate Latine-centered CRC textbook content that is readable, linguistically approachable, and contains correct code [41]. However, the generated cultural references were primarily surface-level. The LLM incorporated topics such as geography and names, which inspired topics for some of the cultural references in our resources.

A 2025 study examined why Latine and non-Latine faculty at a Hispanic-Serving Institution were either motivated or hesitant to integrate culture into their classrooms [37]. The reasons for refraining included believing culture falls outside the scope of programming courses and worries of unintentionally offending students. Reasons faculty gave for incorporating CRC included the perception that, without culture, computing would be dry, and being motivated by their lived experiences [37].

# 3 POSITIONALITY STATEMENT

Recognizing researcher positionality is essential for transparency, as our identities and lived experiences influence how we design studies, collect data, and interpret findings [10, 23, 31], particularly within computing education research [18]. This work is grounded in the context of 21st-century North American higher education. Our team consists of academic researchers with diverse identities, including Latine, Black, South Asian, and White backgrounds, as well as men and women. The main team members in charge of creating materials, carrying out interviews, and analyzing the data are from Latine backgrounds.

Several of us have directly encountered underrepresentation in computing, especially as scholars of color and women, including those with intersecting racial, ethnic, and gender identities. These experiences inform and shape our approach to this research.

# 4 METHOD

In this section, we detail the Latine CRC resources we created, our data collection, as well as our analyses of data. We received approval from our IRB for this data collection and analysis.

## 4.1 Latine CRC Resources

*4.1.1 Resource Development.* The first two authors (A1 and A2), who both identify as Latine and have served as teaching assistants for multiple CS1 courses, developed all learning materials evaluated in this study. These materials were reviewed by a faculty member (A8, senior author on this paper) who teaches our CS1 course. Our long-term goal is to develop a Latine-centered CRC textbook for undergraduate CS1 courses. For this study, however, we selected five standalone reading resources for student evaluation. Rather than an Additive Approach of simply appending culture to an existing resource, we generated a new resource with cultural integration as the initial context using Banks' Transformation Approach [2].

Our research goal includes students evaluating the cultural depth of the generated resources. We used the Cultural Relevance Evaluation and Assessment Tool (CREAT) [17] as a starting point because it is a framework developed to evaluate the cultural relevance of curriculum materials accessed online. CREAT helps assess how well educational resources support diverse students' languages, literacies, and cultural practices. Our adapted version focused on the second criterion of the CREAT tool, providing opportunities for developing and maintaining cultural competence in relation with oneself or others [17]. Lastly, our adapted version updated the language to be 1) simpler, and 2) specific to computing by replacing *"mathematical problem solving"* with *"computational problem solving"*. Table 1 shows our adapted CREAT tool we used for evaluation.

Consequently, we were mindful of the CREAT think-aloud questions during the generation process. This allowed us to intentionally design for deep cultural relevance and later examine whether students perceived the resources as achieving that goal.

*4.1.2 Design Principles.* Our resources intentionally aimed for deep cultural relevance (see Table 1). First, A1 and A2 established a shared understanding of CRC and its tenets [14, 17, 35]. We grounded the design process in *Academic Excellence* and *Cultural Competence*.

**Academic Excellence**. To aim for all students to learn high quality computing concepts, we prioritized readability, correct code, and explanations appropriate for a CS1 audience.

**Cultural Competence**. For students who identify with the represented culture (in-group), we aimed to avoid stereotype threat by integrating meaningful cultural references rather than simply *"slapping on culture"* as a checklist item [41]. Prior work on LLM-generated Latine CRC resources represented only a limited variety of Latine countries [41]. This motivated us to intentionally incorporate references from multiple Latine cultures to maximize opportunities for students to experience cultural references as both mirrors and windows [6]. For students outside the represented culture (out-group), we incorporated footnotes to provide background information on the cultural reference so unfamiliar cultural references did not become barriers to the CS topic.

*4.1.3 Resource Generation.* We started with twelve topics ranging from print statements to dictionaries. The order of the resources reflect the order they are taught in CS1. We designed each chapter as standalone reading material intended for a textbook rather than as a programming assignment.

Feedback from A1 and A2 (in-group) and A8 (out-group) was a crucial iterative step. Feedback included whether additional background information or footnotes were needed, whether the examples remained appropriate for a CS1 audience, and whether the

**Table 1: Adapted Cultural Relevance Evaluation and Assessment Tool Rubric**

| Level | Definitions | Look-for |
|---|---|---|
| -1 | Negation of any level below | Explicitly racist or praising one culture above others; cultural supremacy |
| 0 | Absence of cultural references | Cultural references not mentioned, only generic or mainstream references are present |
| 1 | Presence of cultural references for own/other underrepresented cultural groups | Meaningful objects to certain cultural groups are present, but the cultural context is not deeply embedded in the problem and can be irrelevant to the work of solving it |
| 2 | Deep and meaningful engagement with cultural references | The presence of the cultural references has a purpose and meaning behind, and they are relevant to the computational problem solving |

cultural context supported or unnecessarily increased students' cognitive load. When using Spanish within the resources, we included it inside string literals rather than variable names and provided English translations.

One challenge throughout development was balancing authentic and meaningful cultural references with sufficient background information to reduce cognitive load while ensuring that CS remained the primary learning objective. As we got more familiar with the design process, we were able to more effectively use culture as the context for learning CS thus adding culture into CS rather than teaching about the culture through CS. To mitigate the challenge of using two subjects to coexist in curriculum [11], Rich et al. [27], recommends clearly framing which subject serves as the primary learning objective and which serves as the instructional context.

*4.1.4 Final Resources.* From the twelve generated resources, we selected the first five for evaluation as they represent the topics taught at the start of a CS1 course. Each resource followed a standardized structure consisting of 1) an introduction to the CS topic, 2) a culturally relevant example, 3) a code snippet, 4) a code explanation, and 5) footnotes providing supplemental cultural context.

The CS topics are in the following order: Prints and Inputs, Booleans, Conditionals (Figure 1), For Loops (Figure 2), and Functions (Figure 3). The figures are condensed formats of the corresponding resources. Full, properly formatted versions of all resources are found here: https://bit.ly/5-CRC-Resources.

Across the resources, we represented twelve Latine countries by directly naming the country or referencing individuals whose nationality was identified in the accompanying footnotes: Indigenous Nahuatl community from Mexico, non-Indigenous community from Mexico, Argentina, Brazil, Colombia, Puerto Rico, and all Central American countries: Belize, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama.

To address another limitation identified in prior LLM-generated Latine CRC resources [41], we intentionally included the Nahuatl Indigenous name Xochitl in Resource 1. We also incorporated both vernacular culture, such as references to sports figures, musicians, and media references and heritage cultural elements, including regional linguistic preferences to represent the geographic diversity of Latine America.

## 4.2 Data Collection

We interviewed undergraduate students at a large, research-intensive public university in North America labeled an "Emerging Hispanic-Serving Institution" by the Hispanic Association of Colleges and Universities [25]. To analyze students' perceptions of the cultural depth of our CRC resources, we chose Exploratory-Descriptive Qualitative (EDQ) as our method, in which purposeful sampling is the most appropriate [19]. Thus recruitment process for these interviews was a targeted effort rather than an open call for participation – furthermore because of the low computer science Latine population at our institution (6% of computing degrees awarded to

**Figure 1: Resource Three: Conditionals**

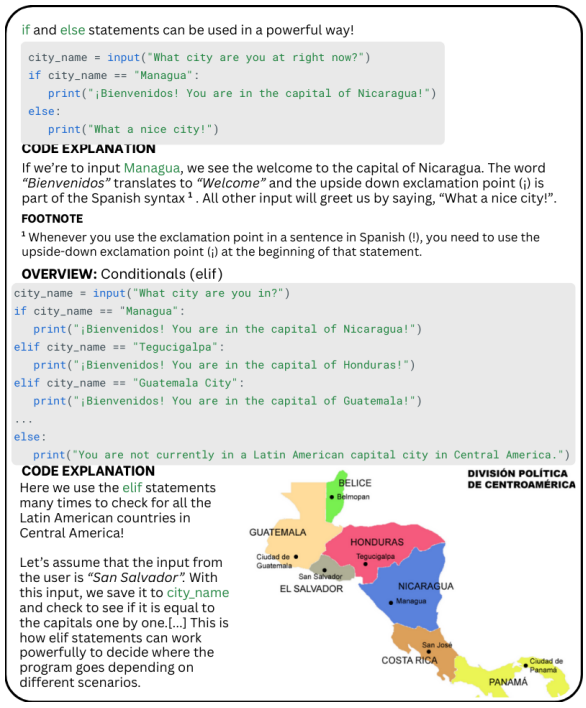



**Figure 2: Resource Four: For Loops**

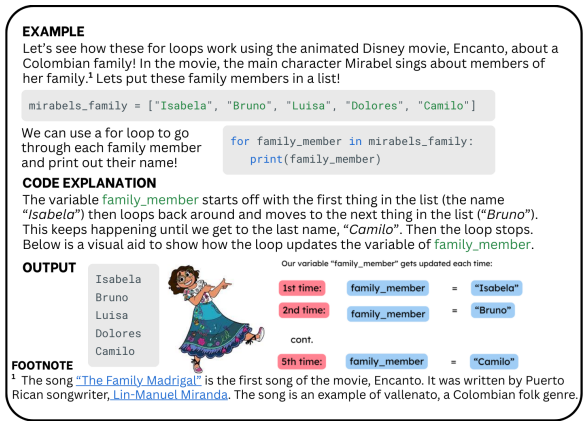


**Figure 3: Resource Five: Functions**

**EXAMPLE:** Identifying nicknames for common Latin American names
We will use two lists names and nicknames. There are 6 elements in each list, in which the the name in names[0] correspond to the nickname in nicknames[0], and so on. Think of it as matching values across both lists.

```
names = ["Alberto", "Jesús", "Antonio", "Enrique", "José María", "Moisés"]
nicknames = ["Beto", "Chuy", "Toño", "Quique", "Chema", "Moi"]
```

The use of nicknames is common in Latin America! Some of these nicknames are simply shorter versions of their formal name, but other nicknames are not as close to their formal names, such as "*Chuy*" being a nickname for "*Jesús*" [1]. Let's make a program that takes in a formal name and outputs its corresponding nickname!

```
def find_nickname(input_name):
    nickname_found = False
    for index, ind_name in enumerate(names):
        if ind_name == input_name:
            nickname = nicknames[index]
            print("People with the name",input_name,"are usually nicknamed", nickname)
            nickname_found = True
            break
    if not nickname_found:
            print("Name not found in list to provide nickname")
```

**CODE EXPLANATION**
The loop statement above uses the enumerate() function. Eventually we will check if our input_name matches our ind_name we are stopping through. We also use a variable called nickname_found to check if a nickname match was found in the list. If match is found, we display the corresponding message and change nickname_found to True. Outside the loop, we check if a nickname was never found and if so, we display the corresponding message.

**FOOTNOTE**
[1] The way that "Jesús" got to the nickname "Chuy" is unknown, but most believe that it went from Jesús → Jesusito → Jeshushito → Chucho → Chuy.

Latines in the 2024-2025 academic year). A list of all potential participants (Latine and non-Latine) was aggregated by the research team via groups at the institution providing early exposure to different computing paths and opportunities to incoming first-year students (e.g., summer computing programs for incoming students, academic cohort experiences led by peers). All students in these groups were sent an email for recruitment. Latine-identifying students were sent personalized emails inviting them to participate in the study as part of our targeted efforts to gain insights of Latine students and how their culture was being highlighted in computing material.

Students submitted a form indicating their interest in participating in the study with a $15 gift card as compensation to be provided after the interviews. Participants were scheduled an interview if they were currently a student, and had previously completed a CS1 course. Recruitment for participants ended as interview responses were converging. Students were told beforehand that participation in the study included the evaluation of five CS1 resources on a scale of cultural relevance, with a corresponding interview. In total, 19 students participated.

Prior to the interview participants scored all five CRC Latine resources using CREAT [17]. All of the interviews were conducted by the co-first authors of this paper, with assistance provided by the third author for several interviews. All interviews followed a semi-structured format to allow the interviewer to ask students to elaborate on their responses. The structured interview question that was most relevant for this study was, "**Why did you give this resource a cultural score [*score from their survey submission*]?**" The full list of structured interview questions can be found here: https://bit.ly/CRC-Interview-Questions. Interviews were conducted remotely during Winter 2024. The audio was recorded, transcribed, and anonymized for analysis per our approved Human Subjects protocol. Out of the 19 students, 12 (63%) identified as Latine. There were 13 (68%) 1st years, 3 (16%) 2nd years, and 3 (16%) 3rd years. The Latine group included Mexican, Guatemalan, and Salvadorian identities, while the non-Latine group included South Asian, East Asian, European, and Middle Eastern identities. The scope of this study is to compare and contrast the experiences of in-group (Latine) and out-group (non-Latine) perspectives in highlighting cultures in computing material. In the in-group, 7 identified as female and 5 as male. In the out-group, 3 identified as female and 4 as male. Although gender remains an important focus in the larger work of inclusion, we focus specifically on the racial/ethnic makeup of students. Future work could use an intersectionality lens for a larger study.

## 4.3 Qualitative Analysis

To capture the range of student viewpoints, we used thematic analysis to analyze our data [3]. The process included 1) familiarization with the data, 2) identifying all quotes relevant to a given research question, 3) iteration and refinement of codes on quotes, and 4) defining themes existing across codes.

We conducted a two-phase qualitative analysis process to identify patterns in participant responses. The first phase of analysis focused on generating an initial codebook. Authors 1, 2, and 6 (hereafter referred to as the Phase 1 data analysis team) began by familiarizing themselves with the interviews. Phase 1 team members either participated in the interviews, took notes during them, or read the full transcripts if they had not been directly involved.

The Phase 1 team divided the same three interviews among themselves for preliminary quote extraction, then met to review the extracted quotes and determine their relevance using negotiated agreement (discussing and resolving disagreements to reach a mutually agreed result) [13]. Because our process relied on negotiated agreement rather than independent parallel coding, we did not calculate inter-rater reliability statistics; discrepancies were instead treated as opportunities for discussion and interpretive refinement, with consensus reached through iterative discussion and clarification of code definitions, consistent with qualitative practices that emphasize shared interpretation over statistical agreement [13]. The remaining interviews were then divided among the team for extraction, with any uncertainties resolved as a group.

A random subset of the extracted quotes was selected for independent coding. Team members tagged these quotes individually, then met to verify tags via negotiated agreement, developing an initial codebook to standardize naming conventions and definitions. The remaining quotes were then divided and coded individually using this codebook, with a final meeting to resolve tag-application uncertainties and finalize the codebook for Phase 2.

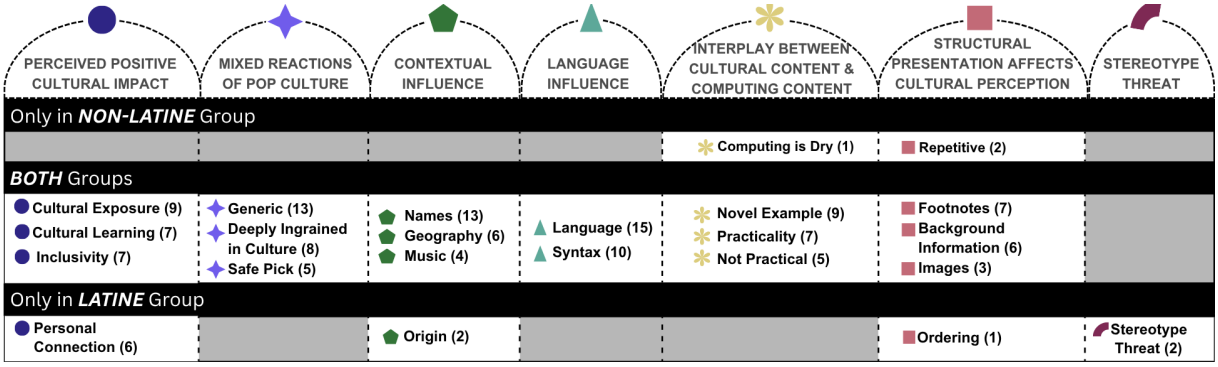
In the second phase, A1 and A3 (Phase 2 data analysis team) used the Phase 1 codebook to independently tag all quotes, updating the codebook as new codes emerged. The team then met to compare tagged quotes and reach consensus using negotiated agreement.

Finally, the Phase 2 team *collaboratively* re-tagged *all* quotes using the updated codebook to ensure consistency, then inductively identified commonalities across codes to develop themes. A1 independently reviewed the coded data to generate preliminary candidate themes, then met regularly with A3 to refine distinctions between themes, consolidating related codes into higher-order themes and returning to the raw data as needed to keep themes grounded in participants' perspectives.

# 5 RESULTS

The following results answer our research question, **What are Latine and non-Latine undergraduate students' perspectives**

**Figure 4: Frequency of Unique Tags Within Themes Across Groups. Each theme has a corresponding color and shape. *Total* unique tags: per non-Latine student is N = 57, per Latine student is N = 91, per student across both groups N = 148.**




**when evaluating the cultural relevance of Latine CRC resources?** Table 2 shows the average culturally relevant score (CR Score) for each resource, as rated by both Latine and Non-Latine students. In this section, we present students' rationale for why they did or did not consider our CRC resources culturally relevant. We categorized their perspectives seven themes that emerged from our qualitative data analysis.

Table 3 categorizes the tags into themes from our thematic analysis and shows the frequency of unique tags for both Latine and non-Latine groups. If a student references a tag (e.g., "personal connection") multiple times during an interview, the tag is counted only once for that student. Thus, the percentages of tags on Table 3 are calculated based on the total unique counts from all Latine group responses. For example, for Latines, the theme "Perceived Positive Cultural Impact" includes: Cultural Learning (4), Cultural Exposure (6), Personal Connection (6), and Inclusivity (4), totaling 20 tags. This constitutes 21.98% of the 91 total unique tags in the Latine group. Figure 4 shows the unique tags per interviewee found in Latine, Non-Latine, and both-group student responses. Themes may exist across groups. However, certain tags within those themes might exist in only one of the groups, captured in Figure 4.

Below, we describe each of these seven themes along with their associated codes and supporting participant quotes for additional context. All participant quotes are anonymized using the following format: P#(X), where # is the participant number and X can be L or NL for Latine or Non-Latine students respectively.

**Table 2: Average Cultural Score (Scale from -1 to 2; See Table 1)**

| | CRC CS1 Resources (R#) | | | | |
|---|---|---|---|---|---|
| | **R1** | **R2** | **R3** | **R4** | **R5** |
| **Latine** | 1.25 | 1.42 | 1.92 | 1.25 | 1.83 |
| **Non-Latine** | 1.14 | 1.14 | 1.71 | 1.57 | 1.71 |

## 5.1 Perceived Positive Cultural Impact

Culturally grounded examples enhance engagement by fostering learning, exposure, and personal connection. Students described how the CRC resources had positive impacts on an educational or personal level.

**Cultural Learning:** Students described gaining a new understanding about Latine culture from reading the CRC resources. This went beyond exposure, students felt they learned something meaningful or deepened their knowledge. *"I found [RESOURCE 5] really interesting, mainly because of how it illustrated how common it is to use nicknames in Latin America. I didn't know about this fact before, so you know, learning about this was useful." -P5 (NL).*

**Cultural Exposure:** Students noted that the resources introduced them to a new cultural element they weren't previously aware of. *"I gave [RESOURCE 5] a culturally relevant score of 2 because I feel like out of all of them this was the best example because of the names, and these nicknames that are very commonly used within Latin America, but a lot of people outside of that don't know that. They probably haven't heard them. That was really good, because you're showing them. [...] they've probably heard the names themselves, but not the nicknames tied to them." -P9 (L).* When asked how their cultural relevance rating for Resource 1 might change if Messi were replaced with a less globally known soccer player, one student reflected: *"It would be a stronger 2, but maybe I don't know if people would recognize them as much. But I also feel like I don't know. Maybe it like opens up the opportunity to search him up" -P19 (L).*

**Personal Connection:** Students noted that a personal connection beyond just familiarity with a cultural reference, played a role in how they scored cultural relevance. Others highlighted how a reference reminded them of loved ones, making it personally meaningful. *"I give [RESOURCE 2] a 2, just because from my day-to-day life my sister, my cousins... they're all woman. Like all them love Karol G, and I feel like I just saw that and I just thought of them. And I was just like, Oh, yeah, I'm gonna put a 2 for that." -P2 (L).* Students also expressed appreciation when a reference included their own country, making the resource feel both relevant and refreshing. *"The first reason why I gave [RESOURCE 3] a cultural relevance score of 2 is because it mentions El Salvador, which is where I'm from [...] So for me, that was already super culturally significant. And also it helped me understand the problem that much, just because it was El Salvador. You also included a lot of other Latin American countries which I grew up, seeing that map so much as a kid so for me, that was extremely culturally significant." -P15 (L).*

**Inclusivity:** Students highlighted when cultural references reflected communities not typically represented in CS classrooms, which influenced their cultural relevance scoring. Several students appreciated when less-visible Latine countries were included, noting that this expanded Latine representation thus inclusive, *"I gave*

**Table 3: Comparison of the frequency and percentage of unique tags across themes for Latine (L) and non-Latine (NL) students; each tag was counted once per student to reflect individual perspectives.**

| Theme | Tags | L Tag Freq. $N = 91$ | NL Tag Freq. $N = 57$ |
|---|---|---|---|
| Perceived Positive Cultural Impact | Cultural Learning, Cultural Exposure, Personal Connection, Inclusivity | 20 (21.98%) | 9 (15.79%) |
| Mixed Reactions of Pop Culture | Generic, Deeply Ingrained in Culture, Safe Pick | 18 (19.78%) | 8 (14.04%) |
| Contextual Influence | Names, Origin, Geography, Music | 15 (16.48%) | 10 (17.54%) |
| Language Influence | Language, Syntax | 16 (17.58%) | 9 (15.79%) |
| Interplay between Cultural Content & Computing Content | Novel Example, Practicality, Not Practical, Computing is Dry | 11 (12.09%) | 11 (19.3%) |
| Structural Presentation affects Cultural Perception | Images, Repetitive, Ordering, Footnotes, Background Information | 9 (9.89%) | 10 (17.54%) |
| Stereotype Threat Concerns | Stereotype Threat | 2 (2.2%) | 0 (0%) |

*[RESOURCE 3] a cultural relevant score of 2 because obviously it has all of the capitals for each country. And I think honestly, there's not a lot of awareness with other countries besides like Brazil and Mexico. So I think it does good into representation for other Latino groups as well that are normally overlooked." -P7 (L).*

## 5.2 Mixed Reactions of Pop Culture

Evaluators distinguish between superficial and culturally embedded references, valuing depth over mainstream familiarity. Popularity of references were sometimes seen as generic, while other references as deeply ingrained in culture, based on its broad recognition and/or replaceability.

**Generic:** Resources with references known as mainstream, global (e.g., Messi, Shakira, Encanto), or easily replaceable was perceived as lacking CR. Students noted that some references, while technically tied to Latine culture, were so widely known that they no longer felt uniquely representative of the community *"It wasn't really that there's not some culture [...] it was just mainstream [...] I guess those players are still culturally relevant [but] I feel like they just represent soccer as a whole." -P2 (L).*

**Deeply Ingrained in Culture:** In contrast to generic resources, students described some references as deeply ingrained in culture, thus references that are not easily replaceable due to requiring some level of familiarity with the culture to successfully integrate it into a computing resource. *"I gave [RESOURCE 3] a 2, because [...] the syntax of the exclamation mark in Spanish, [...] isn't something you can easily replace or exchange with another thing. This is something you kind of have to pay attention to in order to be accurate." -P1 (L).* Cultural cues like nicknames were also interpreted as deep, *"It's not something that I think of often, like having these nicknames, [...] It's just automatic. So seeing it put in a visible way was nice [...] other people might not know these things -P1 (L)"*

**Safe Pick:** Unlike the generic tag, which flagged resources as overly mainstream or easily replaceable, safe pick was used when students described a cultural reference as globally recognizable yet still valid and inclusive. These references were seen as unlikely to alienate or stereotype, often because their popularity extended beyond the Latine community while still maintaining cultural grounding. *"[Encanto movie is a] good example because it's super popular [...] not only to resonate with a Hispanic Latino audience, but also [...] your day-to-day person would probably know." -P7 (L).*

## 5.3 Contextual Influence

Specific cultural markers (e.g., names, origins, geography, and music) shape perceptions of authenticity and relevance. Below we describe these four codes that constituted the Contextual Influence theme.

**Names:** Students' associated names of people with culture, especially when it was a non-American or non-English name. Some focused on how relatable the names felt, while others noted how uniqueness of the name, affected their perceived cultural relevance. *"I gave [RESOURCE 5] a 2 because I feel like nicknames, are an important aspect of my culture. I have a lot of family members who have nicknames and some of them are even [in RESOURCE 5], like Beto, Chuy, and Toño, so it's pretty accurate." -P2 (L).*

**Origin:** Students mentioned that the origin of a cultural reference influenced their cultural relevance scoring, particularly in relation to whether the reference came from within or outside of Latine cultures (e.g., the U.S. vs. Mexico or Uruguay). Both quotes below refer to Resource 4, which feature Encanto, a U.S.-produced Disney film with Colombian cultural elements. Some students noted that U.S.-based representations of Latine identity could still carry cultural relevance, *"I feel like [a non-Latine origin reference] shows how that culture is in the United States [...] I think it's very cool to see how that culture exists in the US." -P4 (L).* Others emphasized that cultural references from Latine-origin media would increase cultural relevance, such as a 'telenovela' which is a Spanish-language soap opera from Hispanic countries, *"Something that would make me move [the scoring] to a 2 would be a telenovela." -P2 (L).*

**Geography:** Students mentioned that incorporating geographic references (e.g., country names, cities) played a role in their cultural relevance scoring. Some highlighted how even basic geographic visibility can hold cultural weight, *"I give [RESOURCE 3] a 2 because it's very objective in the sense that, you're physically seeing these countries and their capitals. [...] I think just seeing the countries themselves it puts people out on the map."- P11 (L).* Others noted that including a variety of cities across Latin America, especially countries that are not commonly thought of, increased the CR score, *"When you think of countries,like at least me personally, I think about the US, UK, France, India, China, Brazil maybe [...] I know Nicaragua, Honduras, Mexico, Guatemala [but] they're not really the first few countries that come to my mind, and especially when they're mentioned together as you have in this context, it's not like a one off occurrence."-P13 (NL).*

**Music:** Student's perceived music's everyday presence and presence in various languages as a "low barrier" to use for cultural relevancy. *'This is a really good example, because songs, although they may resonate with a minority audience, are enjoyed by people of other races [...] even if you use songs that are in Spanish, you are still in the safe place [...] And I don't think there is much of a concern about Hispanic audience assuming racial intent [just] because the song is in Spanish." -P12 (L).* Students mentioned that in addition to music being culturally relevant, *"Music is a really important way for people my age to communicate. So that was like totally a good way to incorporate another person's culture into that" -P6 (NL).*

## 5.4 Language Influence

Linguistic features contribute to perceived cultural authenticity and learning. Students highlighted how language, both through specific words, cultural lingo (e.g., nicknames) and syntax (e.g., upside-down exclamation point), increased their CR scoring.

**Language:** In Resource 3, the word *¡Bienvenidos!* stood out to students because of the Spanish language and unique syntax. One student noted how the inclusion of cultural language could served them well in their computing career, *"I've never seen that symbol [...] I feel like being aware of that and how people use language is useful, because as programmers, we're going to be taking input very often." -P5 (NL).* Some students interpreted nicknames as part of the lingo in cultures, not limited to ethnic cultures. Thus, nicknames being both about names and language, increased the CR score. *"I feel like nicknames have cultural significance, as in different cultures will have different nicknames for people. It doesn't necessarily have to be like ethnic cultures. It could be cultures, as in sports or cultures as in work. So that's how I thought of it." -P10 (NL).*

**Syntax:** In Resource 5, names like Jesús and Toño were recognized for their proper use of Spanish spelling and punctuation, which added cultural authenticity. *"I like the use of the punctuation, the proper punctuation, because, even though these names are common, sometimes you don't see proper common use, because I don't think it's allowed like American names to have these special characters. So it's nice to see them written properly." -P7 (L).*

## 5.5 Interplay Between Cultural Content & Computing Content

Cultural references are valued when they are meaningfully integrated into computing tasks, but criticized when they feel disconnected or impractical. The interaction between the cultural reference and the computing concepts in the resources influences students' CRC scores. Below we describe these four codes within this theme: Novel Example, Practicality, Not Practical, and Computing is Dry.

**Novel Example:** Students described some resources as novel when they encountered cultural content in computing contexts where they didn't expect it. This tag reflects moments where students expressed surprise or interest in seeing material that departed from the standard American or "generic" examples often used in CS classrooms. The novelty came not from complexity, but from the unfamiliar pairing of culture with computing tasks. *"It's just more interesting than most of the things I've read at this level." -P17 (NL).*

**Practicality** and **Not Practical:** Students often considered how practical the cultural content was integrated into the computing concept. Not just whether culture was present, but whether it was doing meaningful work in the logic of the code. The "Practicality" tag was applied when students described cultural elements as enhancing both understanding of the technical concept and offering a real-world or personally meaningful use case. *"I definitely found it more practical ... [RESOURCE 3] goes over detecting city names and using if statements [...] I saw a connection between that and like Google Maps." -P8 (NL).* In the case of 'not practical,' students pointed to the absence of cultural elements playing a meaningful role in the logic of the resource as a reason for not evaluating the resource as highly CR. *"I don't see any explanation on how both of these examples are used to help solve the problem or how this has been used [...] to basically solve the problem." -P15 (L).*

**Computing is Dry:** Student perceives code as operating *objectively*, regardless of cultural references. Only one student, P10 (NL), expressed skepticism about the possibility of embedding culture into computing tasks, for Resource 2 *"[...] the code is simply asking what the user's name is and it's just gonna output the exact name preceding, 'Hello'. So I didn't see anything to do with cultural references to this. It's just objectively their name that they input it." -P10 (NL).* Similarly, for Resource 2, they shared, *"[...] the point of this function is to see which song has more views right? Or see if it's true that a song has more reviews or not. So I didn't associate that with any cultures [...] no matter what input you give it, it's gonna objectively give you the same answer." -P10 (NL).*

## 5.6 Structural Presentation affects Cultural Perception

How cultural content is presented (e.g., visuals, repetition, sequencing, and contextual supports) influences its perceived relevance and effectiveness. Students noted the structure and presentation of the resource impacted how culturally relevant the resource felt. This theme includes codes related to formatting and presentation features like Images, Repetitive, Ordering, Footnotes, and Background Information.

**Images:** Students described visuals as enhancing the cultural context or making the resources more engaging. *"So I think the pictures definitely helped a lot [...] those pictures convinced me to give this relevance score of 2." -P8 (NL).* On the opposite end, *"Maybe it could have been the lack of visuals [...] that played a part too." -P6 (NL).*

**Repetitive:** Some students lowered their cultural relevance scores when similar references appeared repeatedly across multiple resources. One student noted that by the time they reached Resource 5, the novelty or engagement from seeing Latine names (including capital city names) had diminished, leading to a lower cultural relevance score, *"I think it was a really good way again to get exposed to different nicknames, but at the same time it felt a little bit repetitive. I feel like after those examples that I saw, it didn't really add that much to what I already have seen before." -P6 (NL).*

**Ordering:** All participants evaluated the five resources in the same order. However, a student mentioned that the order in which resources were presented (either within or across resources) influenced their CR score. For Resource One on prints and inputs, swapping the order of the soccer reference with the Latine name reference, P12 (L) pointed out, *"If this example was placed earlier [...] it's less likely I would have made that assumption [of] maybe [RESOURCE ONE is] racially oriented"* -P12 (L).

**Footnotes:** Students credited the provided footnotes as helpful for providing clarity or cultural explanations or simply for optional cultural learning opportunity. *"For [RESOURCE 1] it included the footnotes about what it meant in case someone didn't know what it meant. It was nice to see representation of uncommon names." -P7 (L).*
**Background Information:** Students emphasized the value of brief cultural explanations in the body of the resource, especially when they helped deepen understanding. *"I just thought that if there was a little bit more explanation [...] about the significance of the songs [...] that would have made it a bit more culturally relevant." -P17 (NL).*

### 5.7 Stereotype Threat Concerns

Some evaluators express concern that cultural references could be interpreted as stereotypical, even if they do not personally find them problematic. This theme captures when students expressed concerns that a CRC resource could potentially evoke stereotype threat. While only two students explicitly mentioned this concern, both clarified that they did not personally find the resources problematic but could understand how others may negatively interpret them. In reference to Resource 1, which includes the line of code `input("Please tell me your favorite soccer player:")`, one student explained, *"I don't really have a problem with any of these [...] But I mean, I feel like [RESOURCE 1] is kind of telling the person that [...] because you're a Hispanic audience, you must have a favorite soccer player." -P12 (L).* The last comment reflected broader concerns about cultural representation in media, *"I'm gonna give [RESOURCE 4] a 0. Actually, I feel like Disney in general doesn't do a good job of representing other cultures [...] maybe some other company, instead of Disney." -P2 (L).*

## 6 DISCUSSION

The primary goal of CRC is to achieve educational equity by integrating students' cultural backgrounds as meaningful contexts for learning computing, leveraging students' funds of knowledge while supporting academic excellence and cultural competence for all students. Our discussion focuses on the proportion of unique thematic tags mentioned by each interviewee (rather than raw frequency; Table 3), offering a clearer view of the diversity of perspectives within and across identity groups, and highlights three main insights: 1) cultural competence through funds of knowledge versus resource structure, 2) the dual utility of Perceived Positive Cultural Impact as both an identity mirror and a window for global literacy, and 3) the notable scarcity of stereotype threat as a systemic concern.

The top three themes per group, revealed a clear distinction in how Latine and non-Latine students evaluated the cultural depth of the resources, reflecting the role of cultural references as mirrors for the in-group and windows for the out-group. Section 6.1 discusses the top-themes that distinguish the two groups, whereas Section 6.2 examines the shared top-theme.

### 6.1 Paths to Cultural Competence

As expected, students from the represented culture leveraged their funds of knowledge when evaluating cultural depth. Latine students most frequently grounded their assessments in *Mixed Reactions of Pop Culture* (19.78%) and *Language Influence* (17.58%). This insider perspective was particularly apparent in how Latine students reacted to linguistic and contextual nuances. For instance, the deliberate inclusion of regional naming traditions (e.g., family nicknames like *Beto*, *Chuy*, and *Toño*) and precise typographic conventions (e.g., inverted exclamation mark in *¡Bienvenidos!* or proper Spanish tildes and accents) signaled structural authenticity rather than a superficial afterthought. This finding aligns with prior work by Coenraad et al. [4], which demonstrates that learners from historically minoritized communities possess specialized cultural funds of knowledge that allow them to critically evaluate whether representation in educational media is authentic or merely performative. Because these students possess an insider perspective, they naturally evaluated the resources through an experiential lens. They did not note the mere presence of culture; they parsed its depth, explicitly distinguishing between superficial, easily replaceable mainstream tokens (e.g., globally dominant figures like Messi or Shakira) and deeply embedded cultural lingo. This finding supports one of the central motivations of CRC: leveraging students' cultural knowledge to create more meaningful learning experiences.

In contrast, non-Latine students evaluated the resources through a predominantly pedagogical and structural lens. Their highest-ranked themes were *Interplay between Cultural Content & Computing Content* (19.30%), *Structural Presentation Affects Cultural Perception* (17.54%), and *Contextual Influence* (17.54%). Without the same experiential lens for validating the cultural references, these students evaluated how effectively the cultural context supported the computing concepts.

During resource development, we intentionally incorporated background explanations, footnotes, images, and other supporting elements with the hope to reduce the cognitive load possible associated with unfamiliar cultural references. Our original motivation was to support academic excellence by ensuring that unfamiliar culture did not become a barrier to learning CS for the out-group. Interestingly, our findings suggest that these design decisions also contributed to cultural competence. Rather than simply using the scaffolding to understand unfamiliar references, non-Latine students frequently relied on these structural and contextual elements when evaluating the cultural depth of the resources.

For the in-group students, cultural competence emerged by leveraging their existing funds of knowledge. For the out-group students, cultural competence was facilitated through intentional structural elements. This finding also speaks to concerns previously raised by educators who are hesitant to integrate culture because they worry students outside the represented culture might not identify with the cultural references or could feel excluded [37]. Our findings instead suggest that, when supported with appropriate contextual information and instructional scaffolding, students outside the represented culture also develop cultural competence while continuing to learn the intended computing concepts.

### 6.2 Affirming Insider Identity While Expanding Outsider Awareness

*Perceived Positive Cultural Impact* emerged as a prominent, high-ranking theme for both Latine (21.98%) and non-Latine (15.79%) students, showing that these CRC resources serve a dual utility: operating as an identity-affirming "mirror" for insiders and an educational "window" for outsiders.

For Latine students, this positive impact was rooted deeply in *Personal Connection* (see Figure 4). Crucially, this impact moved beyond broad, monolithic representation. When the materials featured

less-represented Central American geography (such as explicitly mapping cities in El Salvador, or Nicaragua), students from those specific backgrounds expressed a profound sense of institutional welcome. Seeing their specific heritage physically placed inside a programming prompt directly combated the flattening effect often found in mainstream media representation, where diverse Latine subcultures are frequently condensed into a single stereotype. As one student put it, *"You also included a lot of other Latin American countries which I grew up, seeing that map so much as a kid so for me, that was extremely culturally significant" – P15 (L).*

For non-Latine students, the positive impact manifested as genuine *Cultural Learning* and *Cultural Exposure*. Rather than feeling alienated or excluded by unfamiliar Spanish syntax or regional naming conventions, outsider students frequently noted that the materials sparked curiosity and broadened their global literacy. As a non-Latine student put it, *"I like this example a lot. Because I actually [didn't know] how important nicknames were in Latin American countries. And [...] the cultural role they play as well" – P17 (NL).* Learning about the structural use of nicknames in Latin America turned a standard technical exercise into a space for cultural competence.

Latine students also reported learning about Latine culture through the resources, suggesting that mirror and window experiences are not fixed. Even within the represented culture, students encountered unfamiliar cultural references that broadened their understanding of the diversity within Latine communities. This shared benefit strongly reinforces the core tenets of culturally sustaining pedagogy [21], which argues that responsive curricula should not only sustain the identities of underrepresented students but also enrich the cultural competence of *all* learners. By designing CRC materials that avoid flat, generic tropes, educators can simultaneously cultivate a restorative space of belonging for minoritized students while offering an engaging, intellectually stimulating environment for the broader classroom community.

### 6.3 Scarcity of Stereotype Threat Perception

Stereotype Threat was the least mentioned theme across all interviews, appearing only twice within the Latine cohort (2.2%) and not once among non-Latine students. Notably, in both instances, the participants clarified that they did not personally feel targeted or harmed by the prompts; rather, they were thinking critically about how a broader audience might interpret the data. For example, one student cautioned that an introductory input prompt asking for a favorite soccer player could inadvertently imply that a Latine audience must inherently care about soccer.

Out of these two nuanced critiques, only one instance culminated in an actual negative rating (-1), which represents the solitary negative evaluation recorded across all five resources and all 19 participants. The overall scarcity of this theme strongly indicates that these CRC resources successfully avoided the pitfalls of reductive or tokenistic framing.

## 7 LIMITATIONS

One of the limitations of our study was that our learning materials did not incorporate aspects of social justice (a key tenet to culturally-relevant pedagogy [21]). This was partially due to the promotion of consciousness about social and political issues in computing being a potential cause of controversy [24]. Future studies should actively implement social issues facing U.S. Latines in order to be in line with the goals of culturally-relevant pedagogy.

Additionally, a limitation to this study is that the resources were generated by two members of our research team. Future work should work alongside Latine professors in CS education to receive and iterate on feedback. A similar limitation is that the interviewer was Latine, possibly influencing interviewees to give mostly positive feedback to please the interviewer. Future work could incorporate anonymized surveys for students to provide more honest feedback.

Our work was an exploratory qualitative study, and the findings reflect participants' subjective perceptions. Therefore, the findings are bounded by the methods inherent limitation, while contributing to the growing exploratory work on CRC. For example, when students expressed that the CRC resources helped them understand the CS topic, this cannot be interpreted as direct evidence to learning gains as this paper is focused on student perceptions rather than quantitative gains. Although this study was conducted at a single institution, at a single point in time, and in the U.S., where Latine students remain underrepresented in CS, sharing our process for generating the resources and students' evaluation of its cultural depth can inform future work. Key directions include implementing CRC resources in diverse classrooms, expanding to multicultural CRC resources, generating culturally deep CRC resources, and collecting data to examine its effect on student performance.

## 8 CONCLUSION

This study explored how Latine and non-Latine undergraduates evaluated the cultural relevance of five Latine-centered CRC resources for CS1. Using an adapted cultural-relevance rubric and follow-up interviews, we found that students across groups rated the resources as culturally relevant, with average scores ranging from 1.14 to 1.92 (on a −1 to 2 scale). Latine students evaluated the resources through an experiential "insider" lens, valuing linguistic and regional authenticity over surface-level familiarity, while non-Latine students valued the structure, clarity, and integration of culture into computing logic. Both groups highlighted the positive impact of culture, expressed moments of learning, personal connection, and cultural exposure. Concerns about stereotype threat were rare and expressed hypothetically, not as personal objections. Overall, students reported that CRC helped them understand both the computing concepts *and* the cultures represented. These findings support the thoughtful use of CRC in CS1 as culturally affirming and pedagogically effective for a broad range of students. Together with the design process we document, this work offers one of the first evaluations of CRC in higher education and a practical starting point for instructors and researchers developing culturally relevant computing resources for their own student populations.

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