

Scaffolding Teachers to Draw on Students' Cultures and Lived Experiences to Customize Computing Resources with "About My Students" Collage Activity

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Abstract

The last decade has seen a growth in research on computer science (CS) teacher preparation, including efforts to help teachers draw on the existing knowledge and cultural resources of students through culturally relevant pedagogy. To help CS teachers create localized, culturally relevant instructional materials for their classrooms, we designed the "About My Students" Collage to help teachers brainstorm prominent features of their students' family, school, local community, and youth cultures to incorporate into existing instructional materials. In this paper, we present the design and implementation of the collage activity using data from a week-long, online professional development with elementary and middle school CS teachers. We then describe the ways participants responded to the activity and how it impacted their ideation process for creating localized, culturally relevant lessons. We conclude with a discussion of the implications of this work.

CCS Concepts

• **Social and professional topics** → *Computing education*; K-12 education.

Keywords

K-8, curriculum customization, culturally responsive computing, teacher supports

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1 Introduction

As computer science (CS) has become an essential subject in primary and secondary education over the last decade [15], instruction must serve students with a wide range of cultures and lived experiences. Research shows that situating learning opportunities in contexts that are familiar to learners and that draw on their existing knowledge and prior experience can help them learn the desired content and increase their sense of self-efficacy [8, 22]. To foster such generative and responsive learning experiences, approaches such as culturally relevant pedagogy [17] and culturally responsive teaching [8, 30] have been developed. Informed by this work, there is a growing body of culturally responsive CS curricula [5, 6, 16, 31] and culturally responsive CS teacher professional development (PD) opportunities [3, 10]. Extending such efforts to PD context is critical as teachers are experts in their classroom, making them well-positioned to customize instructional materials to be more relevant and meaningful for their students.

Empowering teachers to create localized, customized instructional materials designed for the unique classrooms, schools, and communities is a compelling idea but also poses several challenges to teachers. Central among them is helping teachers identify themes and topics that will connect with their students. Our prior research on ways to support teachers in this task [33] has shown that teachers struggle with the theme brainstorming process in two ways: (1) brainstorming ideas from the students' perspective (rather than the teachers' perspective), and (2) attending to more diverse aspects of students' lives, including their family, school, local community, and youth cultures. Towards addressing these two challenges, here we introduce the "About My Students" Collage, a hands-on activity to help teachers identify prominent features of their students' family, school, local community, and youth cultures to inform the brainstorming of culturally relevant themes for situating CS instruction. We piloted the "About My Students" Collage as an asynchronous activity during a week-long, online PD for teachers across the U.S. This paper presents the design of the activity itself and an analysis of the collages that teachers developed as they completed the task. Our findings show the various ways the activity scaffolded teachers in considering different aspects of students' lives and communities as potential contexts to situate culturally responsive CS instruction.

2 Related Work

Aligning instructional content with students’ backgrounds and knowledge can positively impact their learning [18, 22, 23, 26]. In computing, many pedagogical frameworks [8, 17, 24, 30] and curricula [1, 6, 9] that draw on learners’ cultural identities and prior experiences have been developed. While pre-existing curricular materials provide essential support for teachers to teach with confidence and efficacy [12, 32], they must evolve to remain relevant across time, location, and population [25, 28]. Teachers are best positioned to tailor instruction to students in their classroom. Prior studies have shown positive impacts of teacher-customized lessons, including enhanced student engagement and understanding of science concepts [20] as well as helping students develop critical consciousness of their own and others’ cultures [7].

To support teachers in enacting culturally relevant teaching practices, researchers and practitioners have provided PD programs introducing teachers to related pedagogical frameworks [3, 10, 19, 29]. Research on culturally relevant and responsive CS PD has identified a number of strategies for supporting teachers, including building professional learning communities to support dialog [27], online PD models [11], and efforts to help teachers draw on students’ existing knowledge and cultural resources [3, 10, 21]. For example, the Exploring Computer Science PD model has teachers participate in debriefing discussions about research-based strategies and practices in teaching CS within diverse learning contexts [10]. The culturally responsive PD model developed by Codding et al. includes sessions in which facilitators dispel myths about underrepresented groups in computing, introduce culturally responsive pedagogy and provide examples of culturally responsive pedagogy in CS [3].

Our PD employed strategies used in prior work (e.g., teachers were introduced to culturally relevant and responsive teaching and participated in debriefing discussions between each activity). With guided resources and scaffolding (e.g., brainstorming hierarchy with guiding prompts, planning sheets, facilitated discussions), teachers participating in our first PD offering created a plethora of artifacts that draw on school culture (e.g., a school tradition or event) and youth culture (e.g., gaming, a popular media character). For the second iteration of the PD, we were motivated to empower teachers to explore more aspects of students’ lives, including local community culture (e.g., a local festival) and students’ family culture (e.g., a cultural holiday they celebrate).

3 “About My Students” Collage

The “About My Students” Collage was drawn from the Spheres of Influence framework [4] and improved on a brainstorming hierarchy used in our previous PD experience [33]. The revised hierarchy (Figure 1) opens with four cultural strands. Community culture, from the previous Brainstorming Hierarchy, was split into school-based community (*school culture*) and local community (*community culture*), while *family culture* and *kid culture* remained the same. After the cultural strands, the next brainstorming level provides examples of general topics drawn from children’s spheres of influence (e.g., family culture includes food and holidays, kid culture includes sports, games, and books), followed by specific topics such as Lunar Festival (family culture/holiday) and Roblox (kid culture/game).

At the outset of the collage activity, teachers are given a Google Slides presentation to work through. The first slide shows a brainstorming hierarchy and instructions for the activity. The next four slides correspond to each of the cultural strands, asking teachers to expand on or add new general topics, followed by specific topics, and finally to create a collage of **text and images** for each. Including images serves two purposes: (1) teachers may later use these images in their customized artifacts (e.g., sprites and backdrops in Scratch projects) and (2) potentially help spark more theme ideas through the process of searching for images.

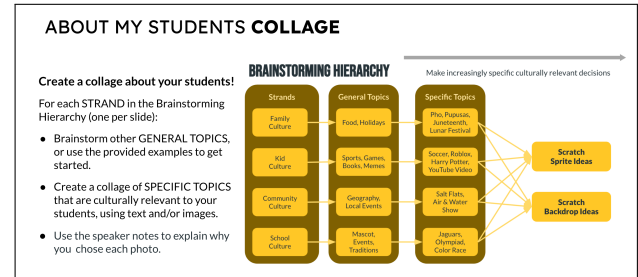


Figure 1: “About My Students” Collage instructions

4 Experience Report Context

4.1 Professional Development

We implemented the “About My Students” Collage activity in a week-long, online summer PD workshop. The goal of this PD was to provide teachers with training and supporting materials so that they could customize lesson materials from an existing Scratch-based CS curriculum [6] (e.g., sample Scratch projects, student-facing worksheets), situating them in contexts that are more relevant to students in their own classrooms.

Each day started with a 90-minute synchronous session led by a research team. Afterward, participants independently completed an asynchronous homework assignment. Daily office hours with a research team member were available for questions and extra homework support. The collage activity was assigned as homework on Day 1 and shared during the Day 2 synchronous session. Here, we provide an overview of the first two days of the PD where the collage activity was integrated.

At the start of the Day 1 synchronous session, teachers independently filled out a brainstorming survey in Google Forms. This survey prompted teachers to list as many ideas as they could think of that would resonate with their students and could be incorporated into Scratch projects. They then shared their brainstormed ideas with the larger PD group. Afterward, we introduced the overarching goal of the large research study and organized a discussion around how we defined and incorporated culturally relevant pedagogy into our teaching practice. We also explored different levels of educational design including designing for yourself today (introspection), designing for your young self (memories), designing for one youth (representation), designing for many youths (inclusion). We then introduced the Brainstorming Hierarchy (Figure 1) and asked teachers to revisit the brainstorming survey and expand the list of ideas they came up with at the beginning of the session. We

closed the session by assigning the collage activity for homework. At the start of the Day 2 synchronous session, participants completed a homework reflection survey comprised of five questions:

- (1) How long did it take you to complete your collages?
- (2) Which strand(s) did you find the MOST challenging to draw ideas from? Why?
- (3) Which strands did you find the LEAST challenging to draw ideas from? Why?
- (4) Describe your approach for thinking of potential ideas when going through the collage activity.
- (5) (Likert scale) How much do you think creating a collage about your students helped you brainstorm ideas for themes relevant to them to incorporate into a Scratch project?

They then shared their collages with the whole PD group and reflected on the challenges they encountered while doing the activity as well as their successful strategies. The remaining of the PD focusing on learning and practicing strategies to effectively customize the technical materials from the curriculum and evaluating the customized materials to ensure they are ready for classroom use.

4.2 Participants and Data Analysis

A total of five PD participants consented to the data collection. Three identified as female, two identified as male, two identified as White, one identified as Black/African American, one identified as Asian, and one identified as Native Hawaiian/Pacific Islander. All teachers were teaching at public schools in the Northeast, Midwest, or West regions of the United States. Their teaching experience ranged from 5-30 years with 1-7 years teaching CS specifically.

To understand how creating collages about students helped teachers expand the breadth and scope of their brainstormed ideas, we collected and analyzed 195 ideas — 80 were submitted by teachers through the brainstorming survey and 115 were extracted from the collages. The transcripts of Day 1 and Day 2 synchronous session recordings were consulted for context and supporting evidence.

Breadth of themes: We tagged each idea with the cultural strand(s) it drew inspiration from. In some cases, an idea was double-tagged. For example, a teacher came up with the theme ‘dances’ featuring a ‘ballerina’ because his students “like to dance a lot... they may scroll through TikTok and see ideas for dances and they want to try it”, so this was tagged as Kid Culture. The teacher further explained “the ballerina is drawn from our [school’s] extracurricular dance team”, so we assigned this idea a second tag, School Culture. Ideas tagged as Family Culture, Kid Culture, Community Culture or School Culture are called *student-relevant ideas*. Ideas that do not fall under the four scaffolded strands were assigned an Others tag. The Others category included ideas representing a teacher’s learning goal for students (e.g., ‘creating a quiz’, ‘steps to completing a task’), critical consciousness (e.g., ‘global warming’, ‘deepfakes / fake news’), and school values (e.g., ‘working hard’, ‘positive behaviors on campus’).

Scope of themes: To help understand to what extent are teacher-brainstormed themes relevant to different groups of students in their classroom, all *student-relevant ideas* were further analyzed using a deductively generated tagging scheme for levels of educational design. This tagging scheme captures who the ideas were designed

for and includes four tags: Broad, Representation, Inclusion, and Open-ended (more details in Section 5.3.2).

Process: Double-tagging was performed by the first three authors. Each idea was tagged by at least two authors who met afterwards to identify discrepancies and discuss until reaching consensus [13]. Any lingering uncertainties were presented, discussed, and resolved in weekly meetings with the larger research team.

5 Results

5.1 Examples of Teacher-Created Collages

Before sharing our detailed findings, we first share two examples of collages created by teachers and the customized lesson materials they created at the conclusion of our PD. Figure 2a shows a Community Culture collage created by Lucy¹, the screenshot of a Scratch project inspired by a theme coming out from her collage, and an accompanying student worksheet. The teacher is teaching at a school located in a beach town so she includes in the collage descriptions of the local town’s geography and ecology (e.g., “one-mile square along the [STATE] shoreline”, “town split in two by railroad tracks”, “several parks where trees and deer live”). She also lists and includes actual pictures of prominent local organizations (e.g., “army camp along east side of town”) and community activities (e.g., “August 5K run”, “Jr. Lifeguard Training during summer”). The teacher ultimately created a customized Scratch project representing the annual lifeguard tournament her students had competed in. The project also includes a sprite taken from one of the images in her collage (the lifeguard waving a torpedo). In a discussion with the large PD group, she shared: “Believe it or not, the entire class, my entire school, when they get to be of age, they gotta train for junior lifeguards ‘cause our town is right on the beach... The lifeguard boats actually look like this... The competitions that the lifeguards have is a big part of their summertime activity.”

The second example is a Family Culture collage (Figure 2b) in which the teacher, Jordan, draws on cultural foods, holidays, and traditions from multiple countries where her students are from. She includes pictures of samosas, lumpia, tacos, Afghan rice, and otai (representing foods and drinks enjoyed across South America, the Middle East, Asia, and Polynesia), and a picture of a person’s hand with a henna tattoo. She also writes down multiple holidays that her students’ families might celebrate including countries’ cultural holidays (e.g., United States’ Martin Luther King Jr. Day and Thanksgiving, Mexico’s Day of the Dead) and religious holidays (e.g., Christian/Christmas, Muslim/Eid, Hindu/Diwali). When sharing about her collage, Jordan said: “I got distracted [when making the collage] and started just putting in things that were happening throughout the school year. We were doing a lot of food things because students don’t really like school lunch so they’re always into trying different food... But then how do I connect with the kids? I can do a race of food [in a Scratch project], and I can sit next to someone and ask them what’s their favorite food.” Ultimately, she created a food-themed projects featuring a race between an dancing burrito and a Chinese takeout box. She also used a photograph of a neighborhood supermarket in her local town as the backdrop for the project, and named it “Neighborhood Supermarket”.

¹All teacher names are pseudonyms.



Figure 2: Examples of “About My Students” collages and the resulting lesson materials created by teachers

5.2 Teachers’ Experience Creating Collages

We now present different ways teachers used the collage activity to brainstorm themes for their customized lessons, followed by some challenges and successful strategies teachers shared.

5.2.1 Ways teachers used the collage activity. We observed three different ways teachers used the collages for their ideation process.

- (1) **Brainstorming new themes:** The collage activity successfully helped teachers brainstorm new project themes; 87% of the themes in teachers’ collages were distinct from themes in the survey responses.
- (2) **Specifying existing themes:** Some teachers used the collage activity to add details to themes they had written in the survey responses, tying existing themes more closely to students’ lives (e.g., refining survey response ‘going to a sports event’ into ‘Sox vs. Cubs game’).
- (3) **Adding contextual information:** Some teachers used the collages to collect information that was not an actionable theme but still was useful for project implementation. For example, text describing the local geography or pictures of their school could be used as project backdrops or stepping stones towards new project ideas.

5.2.2 Challenges and Successes. We gained several insights from teachers’ responses to the homework reflection survey and their whole group discussion during the Day 2 synchronous session (survey questions can be found in Section 4.1). Here, we present some challenges and successful strategies teachers reported.

Teachers found it more challenging to draw from community culture and family culture. Two teachers, Jane and Lucy, reflected on having a hard time brainstorming Community Culture ideas due to lacking knowledge about the local geography and important community events – Jane was new to the area while Lucy did not live in the same town as her school. Two other teachers, Brad and Steve, explained that Family Culture was harder to draw

from because “I don’t know their families very well” and “I wanted to differentiate between all the families which represented the school and I could not find what I wanted”. Jordan, the only teacher who said Family Culture was the easiest strand, found provided examples to be a useful starting place: “So family culture, my strategy was to take a look at what you guys had provided in the sample [(e.g., food, holidays)] and then decided that worked for my students, and maybe what they can connect with.”

Teachers found it less challenging to draw from kid culture and school culture. Two teachers, Brad and Jane, thought Kid Culture was the easiest strand for them to work on. Jane said it was because “Kids are the kings/queens of new culture. They are constantly reinventing, being creative, and are major consumers of popular culture. They teach me new things every day!”. Lucy and Steve both found it least challenging to brainstorm School Culture ideas as they were part of that culture and thus understood it very well. Jordan was the only teacher who found Kid Culture challenging, explaining: “I had to put on a student hat. The trends change, for example I put in Fortnite but students have moved on to other games. So keeping up could be hard.”

Four teachers found creating collages about their students extremely helpful for their ideation process. Except one teacher who felt neutral about this activity, all other teachers thought the activity helped them focus on different aspects of their students’ cultures and lived experiences when brainstorming ideas for project themes. Lucy, for example, initially thought Community Culture was challenging to draw from because she “did not live in the same town” but was able to create a very rich Community Culture collage (Figure 2) and ultimately made a project about a local life boat race. Her strategy was to refer “back to things I overheard [students] saying or what they had indicated they liked to do outside of school.”

Teachers struggled to brainstorm themes for underrepresented groups. Throughout the PD, we emphasized the importance of supporting students, especially those from non-dominant

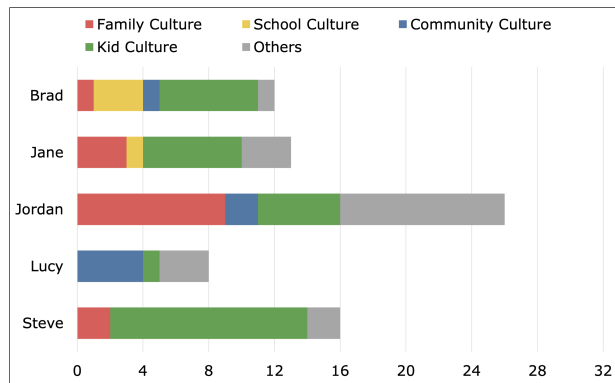


Figure 3: Themes emerged from brainstorming survey

cultures, by allowing them to see their cultural identities being recognized in the instructional materials. We observed that choosing a particular student population to draw culturally relevant ideas from was not easy for teachers. One shared: *“To think about that one kid in the corner who never has anything, I think that’s the other piece of this that I was missing. I kept thinking ‘majority’, or like the bigger group. It’s taken me a bit of time to understand it doesn’t have to be a big group. It can be that one kid who likes Star Wars.”*

5.3 Influence on Teachers’ Brainstorming

This section presents findings on how the collage activity influenced the breadth (which cultural strands they draw on) and scope (which students groups they are designed for) of the ideas teachers brainstormed. Overall, teachers came up with more ideas and more types of ideas through making collages. We found that 87% (100/115) of ideas that emerged from the collages teachers created were new (i.e., distinct from ideas submitted through the survey).

5.3.1 Breath of Themes. Figure 3 and Figure 4 show the distribution and number of brainstormed ideas, organized by strands.

The collage activity helped teachers create more student-relevant themes. While all teachers included some ideas tagged as Other in the survey responses, only 2/5 teachers (Brad and Jane) brainstormed Other ideas during the collage activity. For example, Jane included in her Community Culture collage pictures representing a food desert and explained that her previous school was in a city that *“was like food desert and kids didn’t necessarily have access to a lot of healthy food options”*. She hoped to raise student awareness through a *“walking us into your nearest neighborhood supermarket or corner store”*. This idea was ultimately tagged as Other because it was tied to a community Jane had experienced in the past and was designed to raise students’ critical consciousness, rather than directly tying to her current students’ experiences.

Teachers struggled the most to draw ideas from students’ family culture. When working through the “About My Students” Collage activity, one teacher completely skipped the Family Culture slide and one teacher only added photographs of families and wrote *“Dads and their children, moms and their children, parents and their children!!”*, with no specific ideas for project themes.

The collage activity helped teachers draw many more ideas from school and community culture. While School Culture

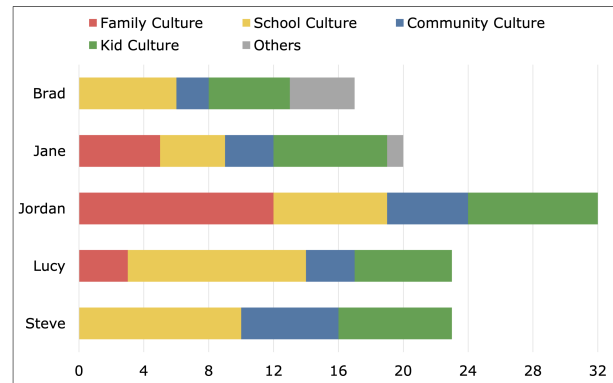


Figure 4: Themes emerged from collages

and Community Culture themes were only brainstormed by two and three teachers, respectively, in the survey responses, all five teachers brainstormed ideas under both of these strands during the collage activity. The total number of School Culture ideas and Community Culture ideas also increased, specifically from 4 to 38 and from 7 to 19, respectively.

The collage activity expanded the number of strands that teachers drew on for ideas. In the collage activity, most (4/5) teachers brainstormed ideas for at least one strand that was not covered in their survey responses. The four teachers who added categories used different categories when rounding out their existing list of ideas: Jane added Community Culture, Jordan added School Culture, Lucy added Family Culture and School Culture, and Steve added School Culture and Community Culture. The one teacher who did not add a category, Brad, brainstormed themes in all four cultural strands in the survey responses but only brainstormed in three cultural strands during the collage activity.

5.3.2 Scope of Themes. We now present several examples of themes under four levels of design before reporting some notable trends.

Broad themes connect to a large group of students regardless of their cultural background and knowledge. For example, *‘TikTok dances’* was Broad because the teacher shared *“I know TikTok was a pretty big thing with the kids doing dances and stuff, and I always have a handful [of students] that are still into that”*. This reflection shows that this theme was not tied to any specific group of students; it was a shared interest the teacher observed among many students in her classrooms. Another example was *‘skating’*, which was inspired by the teacher’s concern that some of their students might not have access to certain things within their local community. They shared, *“We’re from [CITY]. I was writing things down and putting the pictures up, and started thinking, do my kids actually know where the bridge is at... Not everybody has access, not everybody gets to go to different things just within their own city... So I put ‘skating’ because we did a skating field trip. I know they have access to that ‘cause all my 7th graders were able to go last year.”*

Representation themes target students from a specific demographic group. For example, a teacher talked about their students’ interests, *“I know my students are really interested in beyblades and makeup”*, and wrote down the theme *‘putting on makeup’* in their survey response. This theme was Representation because

it was likely to represent an interest of female students. Another example is the theme *‘staying as fly as we can with our hair’* from a Kid Culture collage where the teacher specifically added pictures of multiple hairstyles for African American kids.

Inclusion themes target students from a specific demographic group but are presented in a way that students outside of that group can connect to. For example, *‘African American food’* and *‘Hispanic food’* themes were tagged as Inclusion because the teacher wanted to represent two underrepresented groups of students in her school, choosing the context of food so that other students could also relate. They shared, *“Last year in my school, we found the kids were having conflicts with each other. So we started a lunchtime activity. The point of that was just to bring food and an activity so that all the kids could start to understand each other’s culture. That’s where I went to ‘food’ because middle school kids or most kids, they love food and they’re willing to try something different... Maybe we can do something about food then students can upload their own pictures or what is their favorite thing and share it out.”*

Open-ended themes are in a prompt format, asking students to personalize the project by adding their own knowledge or preferences. This is a new category that emerged from our data, and is relevant for Create projects rather than Use-Modify projects. Some Open-ended themes teachers came up with were *‘holiday you celebrate’*, *‘what do you do in summer time’*, *‘favorite clubs’*, and *‘things I do in my neighborhood’*. While open-ended themes are not specific enough for teachers to incorporate in Use-Modify projects (projects they give to students), they may be used as prompts for Create projects (projects students create from a blank page by themselves after exploring a Use-Modify project).

Because this is not a research paper, our data collection did not capture enough evidence to identify the level of design for every teacher’s ideas. In many cases, we could not differentiate Representation and Inclusion themes due to missing teacher quotes. Still, we found some notable trends:

- Open-ended themes became significantly less common when teachers created collages. More than half (29/54) of the student-relevant survey themes were Open-ended, compared to only 3/109 (3%) of student-relevant collage themes.
- Broad themes became the most popular category when teachers created collages. Specifically, 18/54 (33%) of student-relevant survey themes were Broad, which increased to 83/109 (76%) in the collages.
- Representation and Inclusion themes remained less common. Only 7/54 (13%) student-relevant themes came out of the survey and 23/109 (21%) that came out of the collages were either Representation or Inclusion.

6 Discussion

Through this experience, we found that teachers could easily brainstorm ideas related to contemporary kid culture even with and without scaffolding. However, with the collage activity, teachers could also come up with a plethora of school culture and community culture ideas when prompted to do so. As revealed in the synchronous PD discussion, this may be due in part to the fact that teachers are naturally familiar with their school and community culture as members themselves – even the teachers who mentioned struggling

with these strands were able to brainstorm a number of actionable project themes through the collage activity. However, scaffolding teachers to draw on students’ family culture to brainstorm was still a challenge: in the collage activity, only 3/5 teachers were able to come up with actionable themes under the family culture strand, and those who didn’t cited a lack of knowledge about their students’ families. One strategy emerged to work around this lack of knowledge: the majority of family culture themes brainstormed through the survey were open-ended (e.g., *‘what are your favorite family meals’*, *‘favorite holidays’*). These open-ended project ideas may serve a dual purpose, acting as immediately actionable family culture projects as well as providing a starting place for teachers to learn more about their students’ family cultures.

One larger takeaway from this work is the consideration of different types of engagement patterns, activity structures, and media to scaffold brainstorming. In this case, creating collages was used as a way to help teachers brainstorm culturally relevant themes that could be used to customize instructional materials. The result was that the collage-making activity spurred more and different ideas from teachers beyond conventional surveys. This suggests that exploring other activity structures and artifacts may also be generative, like creating short videos or audio tracks, or possibly even using Scratch itself as a way to bootstrap ideation.

Reflecting on our experience, we plan to continue refining and using the collage activity in our next PD offerings. Additionally, as we acknowledge that what is meaningful and relevant from the a teacher’s perspective can be very different from the students’ perspective [2, 14], a logical extension to this work would be following teachers into the classroom to understand (1) how students respond to instructional materials with a culturally relevant theme teachers choose and (2) how teaching such materials impacts teachers’ practices. This is the next step of our larger project.

7 Conclusion

With this experience report, we hope to provide insights and inspiration for CS educators and those who support them in designing and implementing curricular materials and learning experiences tailored to students’ cultures and lived experiences. Though the “About My Students” Collage activity was intentionally designed to help teachers in our larger research study brainstorm themes relevant to their own students to incorporate Scratch-based curricular materials, it can be used beyond the context of our study. First, any educator can employ this activity as a reflective tool. By systematically thinking about their students in this way, teachers may be able to deepen their understanding of their students’ cultures. Second, PD providers can integrate this activity into their offerings to enrich training on culturally relevant pedagogy. This activity offers a more tangible, hands-on scaffolding for teachers to develop the skills and dispositions necessary to translate theoretical knowledge of culturally relevant teaching into actionable themes and practices to incorporate into their instructional content.

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