



# A Novel Blueprint Storyboarding Method Using Digitization for Efficient Cultural Adaptation of Prevention Programs to Serve Diverse Youth and Communities

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## Abstract

There is a pressing need for prevention programs that address increasing rates of epidemics and pandemics, including non-communicable diseases. However, many populations face substantial systemic barriers to accessing traditional prevention programs. To minimize persistent service utilization gaps for underserved populations, the field requires effective, efficient, and sustainable methods to increase accessibility and cultural relevance of prevention programming to multiple audiences. Cultural adaptation is one such strategy, but it can be daunting for many preventionists. Therefore, this paper presents a step-by-step guide to streamline the cultural adaptation of prevention programs through digitization and use of a novel application of storyboarding methodology, called “blueprint storyboarding.” This innovative approach to cultural adaptation is designed to increase systematicity through manualization, efficiency, cost-effectiveness, and adaptability for multiple cultures and developmental stages. We illustrate this novel method by describing how we applied the blueprint storyboarding approach after digitization to culturally adapt the JUS Media? Programme, a food-focused media literacy program designed to buffer media-related obesity risks for diverse youth.

**Keywords** Digital interventions · Cultural adaptation · JUS Media? Programme · Immigrant/refugee youth · Acculturation · Adolescents

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## Introduction

The increasing rates of epidemics and pandemics have national and global impacts, especially in the case of non-communicable diseases like obesity that lead to disability and death (Kluge et al., 2020). The COVID-19 pandemic has underscored the need to mitigate the impacts of such diseases through strategic prevention programs. However, many communities, including immigrant communities and communities of color, face substantial barriers to accessing health-related prevention programs (Stiffman et al., 2004). If scaled, efficacious prevention resources may reach larger and more diverse populations. Yet, efforts to meet the needs of underserved populations are limited by culturally generic or single-culture programs and by in-person presentation formats. Cultural adaptation of interventions may improve diverse communities’ access to and uptake of an intervention, since it results in a product customized to recipients’ worldviews (Bernal et al., 2009). To improve scalability and overcome practical barriers to accessing effective prevention

programs, even if culturally adapted, experts may also need to invest in the digitization of face-to-face prevention efforts. Digitization may be especially helpful for youth who are digital natives (Plaisime et al., 2020), and those living in the aftermath of COVID-19, when online interventions have become far more commonplace (Wijesooriya et al., 2020). However, cultural adaptation and digitization are generally lengthy, technical, expensive, and therefore, daunting tasks for many interventionists. To address this problem, this paper presents a step-by-step guide to streamline the cultural adaptation of a program through digitization using a novel “blueprint storyboarding” method. This innovative approach is designed to increase systematicity through manualizing, efficiency, cost-effectiveness, and adaptability for multiple cultures and developmental stages, to extend preventive health resources to youth across different cultural communities. To our knowledge, this is the first paper to provide detailed instructions from start to finish to support preventionists and interventionists wishing to culturally adapt a program using digitization.

Organized into four sections pertaining to the four stages of our cultural adaptation method, this manuscript will first describe the process of *digitization* of a face-to-face program into an animated curriculum using an efficient “storyboarding” strategy. Second, we introduce a *novel “blueprint storyboarding” strategy* for cultural adaptation whereby culture-universal components and “active ingredients” (i.e., core components of the intervention essential for changing the target behavior) are differentiated from culture-specific components in the storyboard, the latter of which are marked for systematic replacement to tailor the program to a new cultural group. Third, we use a *case study* to illustrate how the novel blueprint storyboard strategy can be used to perform efficient cultural adaptations for two different cultural communities in the United States. The case study is the JUS Media? Programme (Ferguson et al., 2019, 2021), a food-focused media literacy program originally designed for youth in Jamaica, which we have culturally adapted through digitization for use among Jamaican American and Somali American immigrant/refugee US youth. Fourth and finally, we share *lessons learned and recommendations* for other preventionists pursuing cultural adaptation through digitization.

## Digitization

The COVID-19 pandemic accelerated the implementation of digital technology to deliver healthcare around the world (Wijesooriya et al., 2020). Adolescents are digital natives whose screen time increased after pandemic onset (Jester & Kang, 2021); therefore, interventionists will find them online and willing to engage. Recently, 87% of US youth reported using social media to access health information,

primarily through “attractive” and entertaining sources, and they strongly preferred receiving support via digital media versus face-to-face (Plaisime et al., 2020).

Though potential payoff is high, there are challenges to digitization. First, scholarship on digital intervention development often fails to describe the governing frameworks used to digitize (Duthely & Sanchez-Covarrubias, 2020), making replication of successful digitization strategies difficult. Second, developing a digital intervention requires resources that may not be accessible to researchers. Third, digital programs are costly—using the industry rule of thumb for video production that each minute of high-quality video footage costs about US \$1,000, an outsourced 60-min digital intervention would cost \$60,000 (Frederiksen, 2021).

Even with these practical challenges, digital interventions may have a particularly optimal cost–benefit ratio when offered to adolescents. First, such interventions occur in teenagers’ well-frequented digital environments and take forms like videos and apps that adolescents find acceptable (Plaisime et al., 2020). Additionally, these apps mitigate barriers that youth, especially in minoritized populations, may face when accessing health and social support, such as transportation costs, stigma, and mistrust of service gatekeepers (Colucci et al., 2015). Digital interventions benefit from high editability, where even small-scale edits can be tested immediately, such as in Javidi and colleagues’ (2021) iterative program modifications based on focus group feedback about a digital sexual health intervention for adolescents.

## Storyboarding Technique

Storyboarding is a versatile and widely used technique for organizing audiovisual information in a way that conveys didactic content, a story, or a message (Sutherland & Maiden, 2010). Given its utility and versatility, storyboarding is a central tool for interventionists seeking to create digital interventions. The storyboard uses words or simple images (e.g., icons, clipart) to convey the plan for the final digital product. Storyboards act like a Rosetta Stone, allowing content experts, program designers, and animators to share a common language throughout planning without requiring specialized digitization knowledge. Additionally, storyboards are easier and faster to generate and edit than animated or filmed content, so agreeing on a storyboard prior to digitizing will save time and resources. We apply this technique in a novel way to support the cultural adaptation of digital programs to multiple cultural audiences.

## Cultural Adaptation

When delivering prevention or intervention programs across lines of ethnocultural difference, researchers may be tempted to prioritize empirically supported practices

validated in mainstream populations over locally suitable ones (Bernal et al., 2009, p. 362). However, it is imperative for researchers to ground behavioral interventions in the value structures of target cultural communities (Tharp, 1991) to enhance programs' ecological validity, retention, and impact (Bernal et al., 2009). Cultural adaptation also has potential to address minoritized people's experiences of systemic racism, reducing ethnic and racial treatment gaps (Nicolas et al., 2009) while addressing provider challenges like retention and uptake (Parra Cardona et al., 2009). Cultural adaptation is successful when a program elicits high engagement and perceived appropriateness in a new cultural community while maintaining the "active ingredients" responsible for its efficacy. For example, in a meta-analysis examining sexual health interventions for youth, culturally tailored interventions demonstrated significantly greater effect sizes for supporting condom use relative to untailored ones (Evans et al., 2020). However, a 2022 meta-analysis by Balci and colleagues (2022) on the efficacy of culturally adapted digital health interventions suggested mixed results when comparing the efficacy of culturally adapted versus non-adapted interventions. Because rigor is necessary for successful cultural adaptations, a standard, manualized, and efficient procedure would benefit preventionists wishing to culturally adapt interventions using digitization.

Two cultural adaptation frameworks are particularly useful for prevention and intervention sciences. The first is a cultural sensitivity framework recognizing that adaptation lies on a spectrum from surface- to deep-level modifications. *Surface-level modifications* involve changes to the examples, phrasing, and aesthetics of a program to reflect the preferences and environment of the target audience (Resnicow et al., 2000). These modifications boost the audience's initial acceptance and serve as a "foot in the door" to program receptivity. In contrast, *deep-level modifications* reflect the architecture of value and meaning pertinent to the audience's socioecological context. These modifications may determine a program's impact, since they situate both problem and solution in terms of the audience's worldview, resources, and priorities.

A second adaptation framework, compatible with the above, is the ecological validity model (EVM; Bernal et al., 1995). According to the EVM, cultural adaptations must consider the following eight elements to maximize cultural fit: comprehensibility and appropriateness of *language*; the *persons* presenting the intervention; the *metaphors* and symbols used to communicate key concepts; the match between the *content* of the intervention and the participants' values; the meaning of treatment-relevant *concepts* in the new cultural context; whether the outcome *goals* are shared between facilitators and participants; whether the *methods* used are likely to elicit the intended behavioral outcome in

the cultural context; and the time-variable *context* of an individual participant (developmental stage, time since immigration, etc.).

Empirical research on cultural adaptation, like that on digitization, has suffered from a lack of reporting and documentation of methods (Spanhel et al., 2020). Many adaptation guidelines used in the literature, including the two frameworks described above, provide broad overarching guidance without specific instructions or tools. Barrera and colleagues' (2013) five-stage model and Bender and Clark's (2011) cultural adaptation scoring system are exceptions, but these existing guidelines are rarely used. For example, only three of 13 randomized control trials included in a meta-analysis examining culturally adapted digital programs reported using theory or established guidelines to support adaptation (Balci et al., 2022), and none included a detailed description of the adaptation methods used. Given this gap in the literature, it is unsurprising that current adaptation strategies can be time-consuming (Bender & Clark, 2011), sometimes prohibitively so. To address these issues, we present a new, detailed cultural adaptation process in which digitization using storyboarding supports well-documented, efficient, and cost-effective adaptation for multiple cultural groups.

### Blueprint Storyboarding Technique

We introduce "blueprint storyboarding" as a novel method to create cultural adaptations of a prevention or intervention program, especially when paired with digitization. Blueprint storyboarding expands the basic storyboarding technique described above by creating a single document that demarcates portions of the storyboard that require cultural adaptation for use in a new context. This innovative approach uses the blueprint storyboarding technique to identify and "flag" aspects of the program requiring adaptations prior to digitization and cultural tailoring. It balances scalability with specificity, guiding a team to retain core program content (culture-universals) while identifying cultural considerations (culture-specifics) relevant to future recipient communities, and once established, supports rapid adaptation to multiple cultures.

### Steps to Cultural Adaptation using Digitization

By following the steps below, preventionists can culturally adapt face-to-face programs by digitizing them using the storyboarding technique, in addition to culturally tailoring new or existing digital programs using the blueprint storyboarding technique (Table 1).

**Table 1** Step-by-step instructions for cultural adaptation via blueprint storyboarding and digitization

Digitization: storyboarding technique	<p><i>Develop a storyboard</i></p> <p>Step 1: Decide if digital methods are appropriate for a specific audience</p> <p>Step 2: Determine program length and scope</p> <p>Step 3: Script your program</p> <p>Step 4: Populate the storyboard with words and images</p> <p>Step 5: Seek and incorporate feedback from content experts then the intended audience</p> <p><i>Apply the storyboard to create a digitized program</i></p> <p>Step 6: Select software</p> <p>Step 7: Record the audio</p> <p>Step 8: Digitize the program</p> <p>Step 9: Seek and incorporate new feedback from content experts and the intended audience</p>
Cultural adaptation: blueprint storyboarding technique	<p><i>Develop a blueprint storyboard</i></p> <p>Step 1: Identify culturally specific content in the storyboards</p> <p>Step 2: Replace culturally specific content with placeholders</p> <p><i>Apply the blueprint storyboard to create a culturally adapted program</i></p> <p>Step 3: Gather information about the intended new cultural audience</p> <p>Step 4: Replace placeholders with culturally specific content and add new localized content</p> <p>Step 5: Gather feedback from the intended new cultural audience</p>

## Digitization: Storyboarding Technique

The goal of storyboarding is to create an easy-to-follow manual to support the digitization of a face-to-face program. The most basic units of a storyboard are the components that make up a single scene in a video or animation: (1) the script of a narrator or character; (2) the audio, such as sound effects or music cues; (3) the visual imagery, like backgrounds, objects, or characters; and (4) animation effects or actions, such as movement or interactions between objects. A series of individual scenes are then sequenced to create a full storyboard of the project. PowerPoint slides can be used to create a storyboard, although another software like Microsoft Word, or even paper and pencil, can be used if one prefers (Fig. 1).

### Develop a Storyboard

**Step 1: Decide if Digital Methods Are Appropriate for a Specific Audience** First, consider the cultural group's access to and perception of technology resources. Although internet access has expanded globally in the past decade, digital inequality remains (Robinson et al., 2020), and motivations for using technology differ by income level (e.g., health-promotion, social support, entertainment). In making this assessment, it is important to engage community members and stakeholders from the target audience to discuss accessibility of digital resources including internet access and perceptions of digital media. Working directly with community members at this stage will support selection of the

best implementation strategies. For example, if personal access to technology and Internet are low, but trust of digital resources is adequate, schools or community centers may be promising dissemination strategies for a digital program.

**Step 2: Determine Program Length and Scope** Identify the active ingredients. These active ingredients can be identified using prior empirical investigations of the program, or through identification of mechanisms of change based on theoretical models on the constructs of interest (Cabassa & Baumann, 2013). Then, outline how these components can be conveyed in a targeted time frame ideal for the intended implementation audience and context.

**Step 3: Script Your Program** Create a script that conveys the essential topics or messages. Whereas in-person presenters may be able to use bullet-pointed notes or engage extemporaneously with participants, creating a complete script for digital programs is essential for several reasons. It allows creators to gauge length, solicit feedback from content experts, and provide voice actors guidance for recording voiceovers. When scripting, interventionists should consider participant engagement by building in dynamic elements to sustain attention.

**Step 4: Populate the Storyboard with Words and Images** Divide the script into discrete slides of the storyboard, each of which will become a scene in the animation. Each storyboard slide transitions to the next whenever the didactic content changes (e.g., when a speaker would naturally pause

Image/s:	Script:
	Audio or Music:
	Animation or Action:
Notes/Changes:	

**Fig. 1** *Storyboarding template.* The storyboarding template depicted was created using Microsoft PowerPoint. This storyboard can be used to support the digitization of a face-to-face program by detailing the

content in each scene including images, script, audio or music, animation or action, and any notes/changes important for the scene

between making separate points). *Choose the visuals* that best represent each section of the script. The image box can include written descriptions, samples (e.g., an icon that represents a more elaborate graphic), or the final image to be used. Consider images in the context of the broader program; for example, will all visuals be photographic/realistic or cartoons/icons? It is important to balance continuity with novelty to create a cohesive program and to attend to copyright law when selecting media. *Describe how the visuals should move* in the scene including how text, images, or characters enter, exit, and interact.

**Step 5: Seek and Incorporate Feedback from Content Experts and Then From the Intended Audience** It is easier to adjust storyboards than digital products. Therefore, first, seek and incorporate feedback on the storyboard from content experts to ensure that the core components of the program are accurately communicated. Next, seek and incorporate feedback from the program’s intended audience to ensure acceptability before beginning digitization.

### Apply the Storyboard to Create a Digitized Program

**Step 6: Select Software** Once the storyboards are finalized, identify the preferred software for digitization, whether a video editing platform or a video animation tool. When selecting a software, consider the pricing, opportunities for collaboration, capabilities for processing/editing audio recordings, and availability of training materials. The primary storyboarder should become familiar with the software’s capabilities.

**Step 7: Record the Audio** At this stage, provide the script to each actor for recording. If any of the scenes include talking heads or actors, the visuals for these scenes can be recorded as well. Once audio clips are recorded, trim and splice them together to create seamless speech or to simulate conversations between characters.

**Step 8: Digitize the Program** When approaching a new video project, a separate “scene” should be created for each

slide of the storyboard. Then, voiceovers are uploaded to each scene. Visuals like animated characters, icons, photos, graphics, and text should be added next since it is easier to match visuals to existing audio than the reverse.

**Step 9: Seek and Incorporate Additional Feedback from Content Experts and the Intended Audience** Seeking feedback on the storyboard is a necessary but not sufficient step for creating a culturally responsive program. Feedback on the digital product from the target population follows as an integrative process requiring several rounds of review before finalizing.

### Cultural Adaptation: Blueprint Storyboarding Technique

The goal of blueprint storyboarding is to identify culturally specific content within the storyboards and replace them with placeholders for future cultural adaptation, thereby providing a novel, efficient, and rigorously documented approach to adaptation of a digital program. Preventionists may find that most of the program content is culturally universal and is therefore carried over from the original storyboards. Steps 1–2 create the blueprint storyboard that maps the adaptations needed, and steps 3–5 apply them to execute the adaptations. These steps can be repeated to facilitate cultural adaptations for multiple cultural communities. Using a digitized version of the program as a foundation provides a high degree of efficiency when pursuing cultural adaptation for multiple communities, since only culturally tailored aspects of the program need to be changed in subsequent versions of the program.

#### Develop a Blueprint Storyboard

##### Step 1: Identify Culturally Specific Content in the Storyboards

To create the blueprint storyboard, first identify culturally specific content within the program's original storyboard according to the cultural sensitivity framework (Resnicow et al., 2000) and the dimensions of the EVM (Bernal et al., 1995). Placeholders should mark content that falls along a spectrum of surface- to deep-level cultural adaptations (Resnicow et al., 2000). Surface-level adaptations will involve flagging content that requires one-for-one matching of intervention content (e.g., replacing a photograph), while deep-level adaptations can be marked in the notes section to be discussed with content experts and cultural insiders during the adaptation process (e.g., developing new modules). Both audio and visual information should be reviewed.

**Step 2: Replace Culturally Specific Content with Placeholders** Once culturally specific information is identified, mark

it with placeholders noting required cultural tailoring for future adaptations. Clear annotation will communicate to the cultural adaptation team the focus of each slide (see Fig. 2). Maintain a copy of the completed blueprint for subsequent adaptations.

#### Apply the Blueprint Storyboard to Create a Culturally Adapted Program

##### Step 3: Gather Information About the Intended New Cultural Audience

Select a culturally diverse team to undertake cultural adaptation, including both members of the group for whom the program is adapted and members outside of that group (Haarlamert et al., 2017). This process should include identification and consideration of positionality—the reflection of how one's own identity interacts with and shapes cross-cultural work (Qin, 2016)—and we recommend team trainings on social positionality. Cultural competence—the awareness of values, beliefs, and behaviors of a cultural community—of cultural outsiders involved in cultural adaptation is a key component of this process (Kirmayer, 2012). The pursuit of cultural competence should include consultation of literature, along with historical, social, and contextual considerations, and consultation with cultural insiders on the team. While cultural competency is important, cultural humility—an openness to identifying cultural biases and receiving feedback from cultural insiders—is essential for cultural adaptation work (Yeager & Bauer-Wu, 2013).

##### Step 4: Replace Placeholders with Culturally Specific Content and Add New Localized Content


Exchange placeholders with culturally relevant content that communicates a culturally comparable concept and develop any new content necessary for the new cultural community. The blueprint storyboards should guide conversations with members of the cultural community of interest as they advise on appropriate content to fill the blueprint storyboard placeholders.

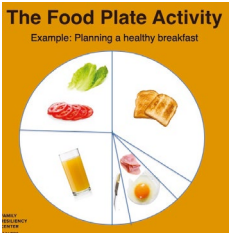
##### Step 5: Gather Feedback from the Intended New Cultural Audience

Once cultural adaptations to the blueprint storyboard are completed, gather feedback from the intended audience to assess the cultural relevance and appropriateness of the selected content.

### Case Study of the JUS Media? Programme

To demonstrate an application of the methods described above, we reference our own team's work culturally adapting the J(amaican and) U(nited) S(tates) Media? Programme (JUS Media? Programme) using digitization to create the *JUS Media? Global Classroom*. This is a food-focused



<p>Image/s: Title: “Example: Usain Bolt’s Healthy Breakfast”</p> <p><b>Start with a blank plate that represents guidelines of the target culture’s country</b></p> <p>Add in foods from the Usain Bolt example</p> 	<p>Script:</p> <p>If you were to take the diet that Usain Bolt talked about, this is what his breakfast would look like. Remember he ate an egg sandwich. That means he had some bread with a little butter from the <b>[culturally relevant]</b> food group, some eggs and <b>[ham/turkey depending on cultural preference]</b> from the food group called <b>[culturally relevant food group]</b>, and some lettuce from the vegetables food group. Maybe he also had a glass of orange juice to represent the fruit food group.</p> <p><b>[Mention what he didn't eat from the target country's nutrition recommendations.]</b> He could have eaten this later in the day.</p> <hr/> <p>Audio or Music: <b>Nutrition Expert Voiceover</b></p> <hr/> <p>Animation or Action: Begin the scene with a blank food plate representing the target culture’s nutrition guidelines. Food from each food group should appear on the plate as it is read in the script.</p>
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**Notes:**


Cultural adaptation: **We will need to adapt the plate background/script to each dietary recommendation. Script needs to be adjusted to reflect target country's food groups and then rerecorded.**


**Blueprint marking key:**


[ ] = Insert culturally specific language


Purple text = Audio placeholder

Blue text = Visual placeholder

 = Script/audio adaptations

 = Visual adaptations

 = No revisions needed

 = Needs culturally specific content

**Fig. 2** *Blueprint storyboarding example.* The blueprint storyboard depicted was created using Microsoft PowerPoint. This blueprint storyboard can be used to support the cultural adaptation of a prevention or intervention program by marking culturally specific content with placeholders for future adaptation. Blue text is used to indicate

visual placeholders, purple text is used to indicate audio placeholders, brackets identify lines in the script that require rewording, icons and colored boxes quickly indicate whether adaptations are needed, and the type of adaptation required

media literacy program that was originally developed to address the role of US junk food advertising as a dietary risk factor among remotely acculturating Americanized adolescents and mothers living in Jamaica (Ferguson et al., 2019). Research demonstrated that higher levels of media literacy buffered the association between US media consumption and poor diet, presenting a target for prevention and intervention (Ferguson et al., 2020). Therefore, JUS Media? Programme promotes healthy eating habits through developing the core skill of food-focused media literacy, which helps students to question the messages they see in unhealthy food advertisements. In a randomized controlled trial of the original face-to-face program in Jamaica, adolescents and mothers who received the intervention had higher nutrition knowledge, vegetable consumption, and media literacy at follow-up than did the control group (Ferguson et al., 2021). The efficacy of this face-to-face program for Black youth and parents in Jamaica motivated the use of digitization to scale up the program for school-based delivery across Jamaica and the Caribbean and to extend the program through cultural adaptation to Jamaican American and other immigrant-background youth with African heritage living elsewhere who are exposed to similar acculturation-related health risk factors.

The core skill of food-focused media literacy is also relevant for the health of Black immigrant and refugee youth in the USA, who are at dietary risk for obesity and are disproportionately exposed to unhealthy food advertisements (Harris et al., 2019). Therefore, using the digitization and adaptation methods described above, our team created culturally adapted digital versions of JUS Media? Programme for two US Black immigrant communities.

## Digitization: Storyboarding JUS Media? Global Classroom

### Developing the Storyboard

After consulting stakeholders in the Jamaican Islander, Jamaican American, and Somali American communities, we determined that digitization was an appropriate strategy to increase the accessibility and reach of the JUS Media? Programme for these cultural groups (Step 1). To begin the storyboarding process, we first identified the key components of the intervention: nutrition, identifying advertisements, acculturation, media literacy, and subvertising (a strategy used to encourage participants to think critically about advertisements; Nelson et al., 2020). In consultation

with community stakeholders, we determined that implementation of the program in a school-based setting would serve as a key dissemination strategy. Therefore, our target length was guided by our goal to fit the curriculum into a typical class period. We distilled the original JUS Media? Programme content into five modules aligning with the key components of the program, each with its own storyboard, for 5-min standalone videos (step 2).

Next, we converted the existing face-to-face program content into a spoken script divided between animated characters and voice-over content experts. The original JUS Media? Programme relied heavily on face-to-face conversation between the presenters and the participants. To simulate this experience, our storyboard scripts focused on delivering much of the program's content through dialogue between the animated teacher and student characters (step 3). Simultaneously, we facilitated efficient adaptations at future stages by strategically placing culturally specific content in the teen and teacher characters' scripts to reduce the required rerecording for future culturally adapted versions of the program. For example, the teen character script includes placeholders for culturally specific food examples, while the teacher character script includes placeholders for the target audience's local nutrition recommendations.

As we storyboarded, our team created a digital folder that held the highest quality versions of each image, with a code for the corresponding storyboard slide (step 4). When digitizing, animators used this folder to upload visuals to the animation software. During this step, we maintained awareness of copyright laws by back-tracing visual content to its source to either confirm that visuals were in the public domain or to purchase a copyright license. Representatives from the digital innovation center at our university provided guidance on storyboarding and software and reviewed our initial storyboards for clarity and accessibility. The final storyboards were used to seek feedback from all members of our team before beginning the digitization process: content experts, cultural insiders, and animators (step 5).

### Applying the Storyboard

Once the storyboards were finalized, we selected Animaker as our digitization software. Animaker is an online, point-and-click, collaborative animation software that can be easily learned and applied by novice animators. Our team's animators included undergraduate students who became proficient in the program with support of the software's training resources (step 6). We provided the adapted scripts to our voice actors to record the audio for the animated videos (step 7). Voice actors included content experts who provided audio content and talking-head videos (e.g., anchor author/principal investigator), along with community members on our team with culturally appropriate voices who served

the teen and teacher animated characters (e.g., fourth and sixth authors). Once all audio clips were collected, our team began the animation process. Sometimes, the storyboard provided clear instructions on an image or animation, but other times, the animator had creative license to interpret the written instructions, providing helpful constraints and guidance, while still allowing for creative inspiration (step 8). After the digital version of the program was complete, we sought additional feedback from content experts and cultural insiders (step 9). Feedback was obtained both through "watch parties" with the greater project team to gain in-the-moment feedback/reactions, as well as individually with key stakeholders and cultural experts. There were a few instances when nonverbal dynamics were only apparent in the animated version, necessitating revisions at this stage. For example, in first draft of the Jamaican Islander version of the program, the teen spoke directly to the teacher character when sharing information about nutrition. However, cultural insiders on the team pointed out that this direct style of communication from a pupil would not be considered respectful in Jamaica. Based on this feedback, we adapted these scenes so that the teen character delivered information directly to the audience (i.e., breaking the invisible fourth wall between the character and audience: [Auter & Davis, 1991](#)) instead of to the teacher.

## Cultural Adaptation: Blueprint Storyboarding JUS Media? Global Classroom

### Developing the Blueprint Storyboard

Our team used the Jamaican Islander version of the storyboards described above to create a blueprint storyboard of the program. We identified culturally specific content outlined in the storyboards (step 1) and replaced this content with placeholders for future adaptations (step 2). We found that much of the original program content was culturally universal; therefore, a significant portion of the original storyboard was maintained in this process. Once the blueprint storyboard was created, we began the process of culturally adapting the program for Jamaican immigrant and Somali refugee adolescents in the United States.

### Applying the Blueprint Storyboard

Several team members were Jamaican American, including the principal investigator (anchor author), and Somali American (co-investigator). However, the rest of the team invested time building cultural competence by learning about these two Black immigrant groups in the United States through readings, conversations, and brief cultural immersion experiences (step 3). As voluntary migrants, Jamaican immigrants moved to the USA in pursuit of increased



economic opportunity and were welcomed as change in US immigration policy in the 1960s favored skilled professional workers. The traditional Jamaican cultural diet is rich in Caribbean fruits, vegetables, cassava, fish, and meat (Higman, 2008). In contrast, as involuntary migrants, Somali refugees fled Somalia to the USA to escape civil unrest and oppression, in addition to seeking employment and education (Kaptejns & Arman, 2004). The Somali migration history includes drought and famine, which has influenced a cultural diet that includes energy-dense food staples like pasta and rice in addition to sweet pancakes, meat, maize, fruits, and vegetables.

Cross-cultural similarities across the two immigrant/refugee groups include a type of acculturation called tridimensional acculturation in which Black immigrants must navigate three cultural worlds and dietary norms (their own ethnic culture, African American culture, and mainstream White American culture; Ferguson & Bornstein, 2012). A second similarity is that youth from both groups are targeted by junk food advertisers who disproportionately market their products to Black and Hispanic youth (Harris et al., 2019). However, a healthier heritage cultural diet serves as a shared protective factor for nutritional health in both groups (Satia, 2010). These shared risk and protective factors align with the target components of the JUS Media? Programme, making it an ideal prevention program to culturally adapt for these groups.

The cultural adaptation for both the Jamaican American and Somali American versions of JUS Media? Global Classroom was based on the EVM framework (Bernal et al., 1995). Using the blueprint storyboarding methodology allowed us to systematically implement deep-level adaptations as we culturally adapted the intervention from remote acculturation theory (original version for youth in Jamaica) to tridimensional acculturation theory (culturally adapted version for Jamaican/Somali immigrant/refugee youth in the USA). The blueprint also supports adaptation of interventions for more complex cultural identities which may include two or more cultures as is the case in tridimensional acculturation. This is important because a cultural adaptation process that centers ethnic-racial identity alongside the intersecting experiences of acculturation and immigration history may further enhance uptake and empowerment (Ellis et al., 2010). See Table 2 for cultural adaptations across program versions.

Our team completed culturally adapted versions of the program for two cultural groups by using the blueprint storyboard. We focused on selecting culturally specific content to replace the pre-identified placeholders in the blueprint storyboard, while maintaining the program's culturally universal core components (step 4). After culturally relevant content was selected, we sought feedback from teens from each cultural group to ensure developmental considerations were

appropriately addressed (step 5). Teens appreciated providing feedback in a short conversational format. Understanding the program's goals, being treated as equal collaborators, and feeling supported by other teen advisors helped them to feel comfortable sharing their thoughts and experiences. Taking teen advisors' views into account helped improve the program design and ensure that the core components resonated with each cultural group.

After the Jamaican version of the digital program was complete in Animaker, we used this as the foundational animation structure. For each additional adaptation, animators only needed to replace culturally specific content, which was clearly marked in each adapted storyboard, to create each new culturally tailored version of the program (Fig. 2). As such, we were able to adapt JUS Media? Global Classroom for two additional cultural groups (Jamaican American and Somali American) in just over 1 year, compared to multiple years that are typical to complete a single culture adaptation (Simenec et al., 2022). These adaptations and animations were also significantly more cost-effective: they were completed by undergraduate research assistants for course credit, led by one graduate student at a 25% FTE appointment (i.e., 10 h/week for 12 months) costing US \$13,000 (up to \$25,000 with fringe benefits), with consultation from cultural community insiders (some volunteer, some paid \$50 total), using two 1-year animation software memberships costing around \$1,200, with a grand total of \$14,250 for 60 min of video intervention time, which is less than ¼ of the standard industry cost of \$60,000 for the same product (\$26,250 with fringe benefits, still less than half).

## Discussion

### Recommendations and Lessons Learned

Our approach leveraged transdisciplinary team science by structuring cross-cultural conversations among cultural insiders to the Black communities being served (youth advisors), content experts from diverse disciplines (faculty researchers, cultural outsiders, etc.), and digital artists (student researchers) (Ferguson et al., 2019). Transdisciplinary approaches to cultural adaptation equip teams to identify the unique challenges and strengths of each community of interest to inform tailored and relevant solutions. Involving teen advisors in this process was a particularly useful way to gain insight into metaphor-, content-, and concept-related adaptations, and it ensured the program content was grounded in this developmental period. Furthermore, by including both cultural insiders and outsiders in all steps of the adaptation process, teams can skillfully integrate cultural considerations while gaining perspectives that might have been overlooked. Including information

**Table 2** Evolution of cultural adaptation across versions of JUS Media? Programme

<i>EVM<sup>a</sup> dimension</i>	<i>Original face: face JUS Media? Programme (Jamaican islanders)</i>	<i>Digitized original program (Jamaican islanders)</i>	<i>Program blueprint (with placeholders for content to be culturally adapted)</i>	<i>Jamaican American digital adaptation (U.S. immigrants)</i>	<i>Somali American digital adaptation (U.S. refugees)</i>
<i>Language</i>	Delivered in person in local phrasing and accent	Teen/teacher characters played by voice actors in local phrasing and accent	Teen and teacher scripts marked with placeholders for recording	Animated teen/teacher characters played by voice actors in local phrasing and accent	Animated teen/teacher characters played by voice actors in local phrasing and accent
<i>People</i>	Delivered in person by local Jamaican facilitators partnering with Jamaican American and White American content experts	Jamaican teen/teacher animated characters (e.g., Black woman teacher wearing professional attire reflecting Jamaican national colors)	Use animated characters and voices relevant to the cultural group	Jamaican American teen/teacher animated characters (e.g., Black teen boy wearing Jamaican national colors)	Somali American teen/teacher animated characters (e.g., Black woman teacher wearing hijab)
<i>Metaphor</i>	Metaphors or symbols used to communicate key concepts. For example, “Emancipate yourself from mental slavery.” – Bob Marley, Jamaican Reggae Icon	“Emancipate yourself from mental slavery.” – Bob Marley, Jamaican Reggae Icon	Teen character script marked with placeholders for recording culturally relevant metaphor	“Emancipate yourself from mental slavery.” – Bob Marley, Jamaican Reggae Icon	“Aqoonla` aani waa iftiinla` aani: The absence of knowledge is the absence of light.” – Popular Somali Proverb
<i>Content</i>	For example, “... ham from the food group called foods from animals.”	For example, “... ham from the food group called foods from animals.”	For example, “... [culturally acceptable food] from the food group called [culturally relevant food group].”	For example, “... chicken from the food group called protein.”	For example, “... turkey from the food group called protein.”
<i>Concepts</i>	The module on acculturation presents information on remote acculturation <sup>b</sup>	The module on acculturation presents information on remote acculturation <sup>b</sup>	The module on acculturation revised to include appropriate acculturation concept based on context	The module on acculturation presents information on tridimensional acculturation <sup>c</sup>	The module on acculturation presents information on tridimensional acculturation <sup>c</sup>
<i>Context</i>	In-person, family-based workshop	Animated classroom-based video	Digital adaptation to increase accessibility	Animated classroom-based video	Animated classroom-based video

<sup>a</sup>Ecological validity model (Bernal et al., 1995); <sup>b</sup>remote acculturation (Ferguson & Bornstein, 2012); <sup>c</sup>tridimensional acculturation (Ferguson et al., 2012)

about the positionality of the cultural adaptation team can be useful to include in both the program itself (e.g., in a credit reel with photos of the team), dissemination materials (e.g., flyers, commercials) or in written documentation of the adaptation to enhance transparency and trust with the target cultural audience.

While the blueprint storyboard served as a useful tool for facilitating communication between members of the team, it is important to acknowledge that no blueprint storyboard can have perfect content coverage of all dimensions of a targeted health behavior. Often, programs require cultural adaptations that address topics outside of the scope of the original intervention. For example, in the adaptation of the program for Somali American youth, our team identified the need to include information for eating healthily while fasting during the Muslim holy month, Ramadan. Again, this emphasizes the need for cultural insider consultation at each step in the adaptation process to identify additional content areas specific to each community.

Finally, we note that cultural adaptation and digitization are iterative rather than linear. While the stages of adaptation outlined by Barrera and colleagues (2013) are helpful guidelines, learning and revising occur at each stage, including reconsidering work from prior stages. Flexibility, adaptability, and, above all, cultural humility, are essential for cultural adaptation.

## Conclusion

This paper describes an innovative cultural adaptation approach utilizing digitization and a novel “blueprint storyboard” for preventionists and interventionists seeking to improve the cultural relevance and reach of their programs. This new method provides greater systematicity, efficiency, cost-effectiveness, and adaptability for multiple cultures and developmental stages. The blueprint storyboarding technique streamlines adaptation by retaining cultural universals while allowing preventionists to address cultural specifics that need tailoring. This differs from other cultural adaptation approaches by (1) providing step-by-step guidelines to support preventionists in creating and using a manual for cultural adaptation through digitization from start to finish and by using a blueprint storyboarding method that is (2) efficient and (3) cost-effective and which (4) enables preventionists to adapt a program for multiple cultures. Importantly, our approach leverages transdisciplinary team science by using the unique skills of all team members (including youth from the target audience) rather than hiring external services. This novel approach to cultural adaptation can be readily used to extend and tailor preventive health interventions to other communities to promote health equity.

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**Consent to Participate** Not applicable.

**Conflict of Interest** The authors declare no competing interests.

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