GEM No. XXX

Development of Educational Whiteboard Videos for *Head Start* Teachers on How to Implement Food-based Learning in the Preschool Classroom

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INTRODUCTION

Many preschool children (aged 3–5 years) do not consume adequate amounts of fruits and vegetables[1–3] often because of neophobia, the fear of new foods, which peaks at this age.[4,5] Decreased vegetable consumption is associated with an increased risk of chronic disease later in life.[6–8] Low vegetable consumption is particularly concerning for children from families with limited resources who are already at increased risk of developing obesity and other diet-related diseases.[9,10] *Head Start*, the federally-funded preschool program, strives to meet the nutritional, social, and academic needs of 1 million preschoolers from families with limited resources nationwide.[11] Children in *Head Start* often spend > 30 h/wk in child care, in which they consume most of their daily nutrients.[12] *Head Start* programs are required to participate in the *Child and Adult Care Food Program,* which requires child care providers to provide children with access to healthy foods, such as fruits and vegetables, as part of school meals and snacks.[13] *Head Start*'s participation in the *Child and Adult Care Food Program* also allows centers to purchase foods for educational activities when conducted outside of meal or snack time.[14] Therefore, *Head Start* is an ideal setting to intervene in preschool children's vegetable intake to positively impact long-term health outcomes such as overweight/obesity and chronic diseases.[12] Furthermore, *Head Start* teachers are ideal partners as they consider themselves the parents at school and are motivated to impact children in their care positively.[15]

Food-based learning (FBL) has been defined as follows:

> *use of healthy food as a teaching tool to provide repeated exposures to healthy foods to improve children's dietary behaviors and academic learning related to knowledge (e.g., science, mathematics, literacy) or skills (e.g., gross motor, fine, physical).*[16]

Prior research suggests that 8–15 exposures are needed to impact children's preference and consumption of new food[17,18]; however, a higher number of exposures may be necessary for children who are neurodiverse.[19] Food-based learning may positively impact children's preference and consumption of healthy foods by providing repeated exposures to healthy foods both inside and outside the mealtime environment.[20–22] While *Head Start* teachers choose topics to teach about in their classroom based on *Head Start* Early Learning Outcome Framework[23] and Teaching Strategies[24] Gold standards, they have flexibility in their respective classrooms as early childhood learning is child-led.[25] This flexibility further supports the ability of teachers to include FBL in their classroom practices. However, teachers report a lack of training on best practices for FBL in the classroom.[26–28] Teachers also report a lack of understanding of FBL-related policies in the preschool environment, which may decrease how likely they are to implement FBL.[29] Another prior study's findings suggest that less than a quarter of North Carolina *Head Start* teachers were required to review FBL policies for their center within the first year of employment.[30] Teachers have indicated a desire for additional professional development in this area.[30]

Professional development using a video-based learning format has been cited as a preferred learning method among adults as it conveys information through visual images and auditory

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signals and offers accessibility, reach, and flexibility for viewers.[31,32] Video-based learning has also been shown to increase knowledge of emphasized concepts[33,34] and change behavior among early childhood teachers.[35]

VIDEO SERIES DESCRIPTION

We developed a series of 5 educational whiteboard drawing videos (each 3–7 minutes in length) for *Head Start* teachers as a part of the *More PEAS Please!* intervention.[36] More *PEAS Please! is* a multilevel intervention focused on improving children's dietary quality and school readiness (science knowledge and language development) through early exposure and access to healthy foods in high-quality science learning environments.[36] Teachers participating in *More PEAS Please!* watched these professional development videos focused on classroom FBL. Each video's content is illustrated on a whiteboard and features 1 of the following evidence-based classroom strategies that promote FBL: (1) exploring with the senses; (2) benefiting from repeated exposures; (3) experiencing culturally relevant vegetables; (4) strategies to support learning when using food experiences in the classroom; and (5) top 5 tips to get started with food activities in the classroom (Figure). The video series was designed to improve teachers' ability to use FBL in the classroom. The videos were modeled after the Cognitive Theory of Multimedia, which states that auditory and visual presentation are essential for learning.[37] We followed Ramsay et al[35] 6 characteristics of effective videos and Dev et al's[38] 5-step procedure for developing videos for adult learners: (1) conduct needs assessment (data collected in 2020–2021); (2) identify evidence-based practices; (3) develop video scripts based on evidence-based practices (eg, the PEAS Practices); (4) seek feedback from experts in the field of early childhood education (ECE), science education, and nutrition education; and (5) record and edit videos. In step 3, each video was sketched on a video storyboard (Supplementary Figure) and then drawn or painted and produced. We designed the videos to be representative of various identities and cultures found in the *Head Start* classroom. For example, videos feature paintings of individuals with varying skin tones ranging from natural colors to colors of the whiteboard markers (eg, blue), varying cultural and religious backgrounds (eg, individuals featured with bindis and hijabs), and varying abilities (eg, girl using a wheelchair). This study aimed to examine *Head Start* teachers' and field experts' perceptions of the video series and opportunities for future improvement. The video series can be viewed on the *More PEAS Please!* YouTube channel.[39] The Institutional Review Board at East Carolina University reviewed and approved this study under expedited review (no. 22-001590).

EVALUATION AND RESULTS

Eleven participants engaged in the video review process: 5 Head Start teachers and 6 field experts, including 2 dietitians, a pediatric occupational therapist (OT) trained in child feeding, an Extension-based food safety expert, a child health consultant, and a health department worker familiar with child care centers' FBL policies. Teachers were eligible to participate if they were aged > 18 years, spoke English, and had participated in the *More PEAS Please!* pilot study in 1 of the 3 eastern North Carolina counties.[36] Field experts from North Carolina were recruited using preexisting relationships and were eligible to participate if their expertise related to the topic. All participants provided written consent to participate. Participants watched the video series and completed a presurvey before a 30-minute in-depth Zoom interview. Participants were provided a $50 gift card to complete the presurvey and interview. A research team member was trained to collect and analyze qualitative data using the 5-Phase Goodell protocol.[40]

The presurvey had 6 questions about what participants learned, liked/disliked, or found confusing in the videos, as well as their perceptions on how accurately the videos reflected the *Head Start* student and teacher population. We reviewed presurvey responses before the interviews to formulate more personalized probes. Interview questions were open-ended and developed iteratively to encourage participants to verbalize our topic (Supplementary Table).[41,42] Before data collection, we conducted 1 mock interview (not included in the dataset) with a teacher, similar to the study participants, to improve the clarity and flow of the qualitative interview guide.[40] We recorded and transcribed all Zoom interviews verbatim. To analyze data, 2 trained research team members independently coded the presurvey responses and interview transcripts and generated initial codes using Microsoft Word's (Microsoft Corporation, version 16.86, 2024) comment feature.[43] Next, both researchers met and compared codes until a 100% consensus was reached.[44] Using tenants of thematic analysis, the 2 researchers sorted similar codes into potential themes before defining and naming the themes to create an overall story of the data. After initial thematic analysis, we merged the 2 datasets (presurvey and interview transcripts) to create final themes.[43] We identified 5 themes: (1) representation and relevant audiences, (2) discussion of video content, (3) discussion of video visuals, (4) video impact, and (5) additional suggested changes.

Representation and Relevant Audiences

Teachers and field experts shared they liked the racial/ethnic diversity represented within the videos. "I feel the *Head Start* population has been represented appropriately. *Head Start* is a very diverse group of professionals and learners and I feel the video has shown that," shared 1 teacher. Even when characters were drawn in whiteboard colors (eg, blue), teachers noted the diversity of hairstyles by saying, "I went with the hairstyle, and then I can tell which culture that hair represented." Participants appreciated that the videos also highlighted food as a way to expose children to other cultures. Participants found the videos

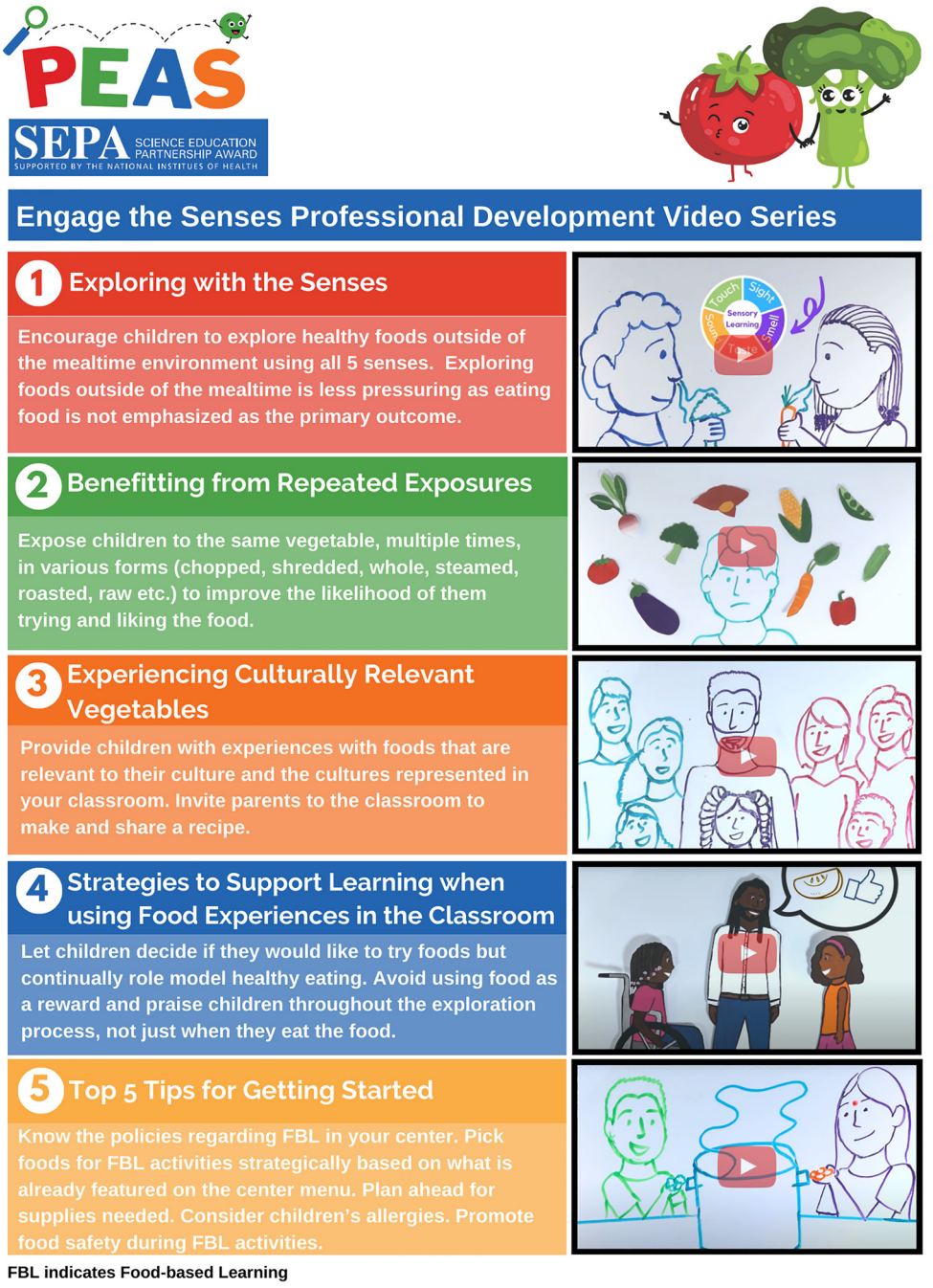

Figure. Engage the senses professional development video series overview.

relevant to *Head Start* teachers, citing references to *Head Start* menus, policies, and program performance standards. Three field experts shared that these videos would also be relevant for other types of child care providers, OTs, and county Extension staff, such as the Farm to ECE initiative. Some participants reported that the visuals could be even more representative by including a larger range of ages and family structures, such as grandparents as caretakers.

Discussion of Video Content

Participants were largely satisfied with the video content, noting that it was important to their work. They liked the emphasis on major points and step-by-step, easy-to-understand explanations. They described the videos as informative and felt the practical and realistic examples anticipated potential FBL barriers teachers might encounter. For example, the food safety expert appreciated the information presented on food allergies and safe food preparation. She commented that these videos may be the only food safety education that teachers receive. The OT liked the focus on exploring foods as a first

step, removing pressure from the child, and implementing the hierarchy of eating through food chaining. Many participants also appreciated the focus on family engagement through food and recipe sharing, as well as not using food as a reward or punishment. There were conflicting views on the level of new information presented in the videos, with some teachers expressing they learned something new. In contrast, 1 teacher and the health department policy expert shared that they did not learn anything new because of their preexisting knowledge. Overall, teachers felt the content was good but suggested that videos be shortened because of teachers' lack of time. One field expert commented that the first video sets the tone and that being > 6 minutes long may discourage viewers from watching the rest of the series.

Discussion of Video Visuals

In general, both the teachers and field experts described the videos as engaging, professional, detailed, and visually appealing. Participants indicated that the video graphics and drawings were universally recognizable. Participants enjoyed the combination of static and moving graphic styles in the series. While most comments were positive, 1 participant indicated that the speed of the moving graphics was, at times, distracting and may impede information retention or bother individuals with visual sensitivities. In addition, the food safety expert commented that the steaming broccoli drawing looked more like boiling broccoli, which could confuse viewers, and that the cutting board featured was too worn down to be considered safe for food preparation.

Video Impact

Teachers shared that they have used several strategies covered in the videos, which made them feel more confident in their ability to implement FBL. One teacher commented that video 1 helped "make [FBL] a little bit more real to them. And smelling it and feeling it and touching it. So the senses really helped." Participants also liked the practical examples, particularly how to incorporate culturally relevant foods into the classroom. The health department representative with expertise in food-related policy shared that the videos taught them how to better interact with children in *Head Start* centers, stating, "I think it gave me some tools on how to interact and do some of those positive praises when it comes to them trying things."

Additional Suggested Changes

Participants identified several nuances with the terminology and images. The food safety expert recommended using more specific and accurate terminology; for example, disinfecting is more accurately termed sanitizing, cross-contamination (related to microorganisms) is termed cross-contact (related to allergens), and allergies are termed food allergies. In addition, the OT and 1 dietitian commented that the videos' information may not apply universally to children, especially those with specific health or developmental differences. For example, the dietitian recommended adding content to remind teachers to keep children's health conditions (eg, diabetes) in mind when planning food activities. Relatedly, the food safety expert recommended that the video series encourage obtaining raw produce from grocery stores or educating teachers on risk reduction steps when purchasing local produce because of a lower risk for microbiological contaminants when purchased from a grocery store compared with local suppliers. This lower risk lessens the chances of foodborne illness for everyone, including those with weakened immune systems, such as children. In another example from the OT, the number of repeated exposures needed for a child who is neurodiverse may be significantly higher than those of their peers:

> *Many times, 5–15 exposures of 1 food is not enough. Many children who are picky eaters are also developmentally delayed. For a child who is not typically developing, the exposure number can be anywhere from 15–30.*

Therefore, the OT recommended removing the specific number of exposures a child may need and adding a line recognizing that all children differ and encouraging teachers to refer any children presenting with extremely picky eating, gagging, or oral motor concerns to a specialist. The OT also disagreed with the recommendation that food should not be manipulated in an activity in any way that renders it inedible; however, they acknowledged the issue of food waste. The OT further requested additional emphasis on verbally praising children at every step of the food exploration process, not only when trying food. While participants did not want to increase the video lengths, they suggested linking additional resources (eg, Extension resources) to the videos for teachers with questions or interests in a particular topic.

IMPLICATIONS FOR PRACTICE AND RESEARCH

Videos are an increasingly popular form of professional development, yet producing high-quality educational videos can be difficult.[45] Participants in this study appreciated the videos' realistic scenarios and simple messaging, which research suggests are 2 foundational components of effective educational videos.[35] Prior research also suggests that educational videos are most effective when < 6 minutes long and use signaling to emphasize key elements,[46] which we attempted to incorporate.

Prior research highlights a steep disparity in the gender and racial/ethnic backgrounds of teachers and children represented in educational materials.[47–49] Representing individuals of different backgrounds within culturally responsive educational materials can provide windows into communities outside of one's own and mirrors into one's own life and community.[50–52] Participants in this study appreciated the diversity of individuals featured in the videos. Ensuring that the viewers identify themselves in the educational videos is critical for the effectiveness of these resources.[35] Multicultural

educational tools demonstrate and model acceptance of and genuine interest in celebrating differences.[52] This research supports the importance of detailed attention to diversity of all kinds when developing educational videos.

This study also emphasizes the value of feedback from not only teachers but also a variety of experts in related fields.[38] These individuals, such as OTs, dietitians, food safety experts, and public health employees, often collaborate closely with early childhood teachers.[53] However, additional efforts may be needed to establish standardized FBL practices across disciplines. In some instances, best practices in 1 field may conflict with those of another. For example, this study highlighted that a common OT practice to decrease picky eating might involve encouraging children to play with food (eg, painting with berries) to promote nontaste sensory exposures.[6,54,55] While this may improve picky eating and consumption of healthy foods,[55] food waste is a concern for children in *Head Start* who may experience food insecurity.[56] In addition, the OT recommended removing the specific number of exposures likely needed to impact children's preference/consumption of healthy foods because of the wide variation of children's needs. Other OT research supports alternative approaches to use progressive exposure to reduce food anxiety,[57,58] rather than focusing on a specific number of exposures. However, in the nutrition field, it is common practice to cite a general number needed to impact food preference.[17,18] Additional research may be needed on how to better standardize FBL best practices across early childhood and *Head Start* environments. Similarly, Farm to ECE aligned programs such as *More PEAS Please!* often encourage sourcing local foods for FBL to support local farmers and connect children to their community.[59] Prior studies suggest this connection to local foods may even further positively impact children's willingness to try and eat healthy foods.[60–62] However, the food safety expert pointed out the increased risk of food safety concerns that local food systems, like farmers' markets, may have.[60–62] Additional food safety resources and training may benefit local food system providers, as well as education for the purchaser (eg, inquiring about the quality of safety practices used) so that community members and partners alike can continue supporting child care centers safely.[63,64] Finally, this study highlights the opportunity for collaboration to use educational videos as a liaison between early childhood teachers and local Extension offices. Participants in this study suggested linking Extension resources, such as a handout on how to wash and prepare local produce, in the videos properly. Connecting ECEs to Extension resources and nearby county Extension staff may positively impact the sustainability of our work by integrating research-based knowledge into practice within our communities.[65,66]

Our study highlights the importance of following evidence-based frameworks and eliciting feedback from multiple types of professionals to improve professional development content. Feedback from the present study will be used to improve the development of current and future education *More PEAS Please!* videos and may also be used to create other educational content relevant to ECE and *Head Start*.

NOTES

The Institutional Review Board of East Carolina University approved all study protocols (UMCIRB 21-001272). Participants were recruited to participate in the evaluation of the videos and were informed of the study purpose, what types of questions would be asked, the consenting process, and incentives. All participants provided written consent before participating. The *PEAS* program materials are available for free on the *More PEAS Please!* website. Whiteboard training videos can be found on the *More PEAS Please*! YouTube channel. The research reported in this manuscript was supported by the National Institute of General Medical Sciences Science Education Partnership Award within the National Institutes of Health under award no. R25GM132939. The authors would like to thank L. Suzanne Goodell, Dipti Dev, and Valerie J. McMillan for their technical assistance with this project. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

SUPPLEMENTARY DATA

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