

Journal of Family Strengths

Volume 17

Issue 1 *Innovative Practices to Eliminate Health Disparities*

Article 6

5-10-2017

Addressing nutritional literacy in preschool learning environments

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Recommended Citation

Warren, Cynthia (2017) "Addressing nutritional literacy in preschool learning environments," *Journal of Family Strengths*: Vol. 17 : Iss. 1 , Article 6.

Available at: <https://digitalcommons.library.tmc.edu/jfs/vol17/iss1/6>

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Addressing nutritional literacy in preschool learning environments

Acknowledgements

This study was funded by the Texas Woman's University New Investigator Research Enhancement Award.

Prevalence of type 2 diabetes in U.S. Mexican and African American populations has steadily increased. Currently, 29 million people in the U.S. have this disease (Reusch & Manson, 2017). Prevention and treatment of type 2 diabetes is complex and dependent on a person's engagement in changing their lifestyle. Low health literacy has been associated among individuals with diabetes, more than any other chronic disease. Hispanic adults have been shown to have lower average health literacy compared to any other racial/ethnic group. Approximately 51% to 63% of the diabetes population is thought to have low literacy skills and low literacy skills are common among those with poor glycemic control (Rothman, Malone, Bryant, Horlen, DeWalt, & Pignone, 2004). Control of type 2 diabetes can require extensive self-care, and eating behaviors play an important role in this self-care. Maintaining glycemic control not only involves multiple daily tests of blood glucose, correct interpretation of glucose tests, and corrective action when necessary with oral medication and/or insulin but also requires consuming a carbohydrate-controlled and low-fat diet. Nutrition literacy is important in diabetes because understanding the concept of eating a carbohydrate-controlled, low-fat diet is a literacy issue itself (American Diabetes Association, 2012). Establishing healthy eating habits early in children may help in the prevention and financial burden of type 2 diabetes over the lifespan, especially in low-income families. Strengthening child health through early childhood programs like Head Start can play an important role in addressing disparities in young American children (Currie, 2005). Interventions focusing on nutrition education in Head Start schools can provide an opportunity to influence healthy behaviors while habits are being formed.

The purpose of this study was to implement and assess the effectiveness of the *Bienestar*/NEEMA Early Childhood Health Program in one Head Start school in North Texas. Input from three different groups of key informants from the Head Start learning environment (participating classroom teachers, parents of participating children, and the school district's menu planner) was collected concerning the curriculum content and how they would modify the learning activities. The assessment was requested by the program's developers, social scientists interested in health disparities in Hispanic and African American children. The author has an educational and research background in nutritional and food sciences, as well as instructional design. This interdisciplinary public health team understands the importance of teaching nutrition and food education in preschool when food preferences are formed. Findings and

suggestions from this research include input from the target audience who would be the end users of the behavior change program.

Young Children, Obesity, and Chronic Disease

Childhood obesity is one of the most urgent health care issues in the U.S. with 8.9% of preschoolers between the ages of 2 and 5 suffering from obesity (Ogden, Carroll, Fryar, & Flegal, 2015). A higher prevalence of obesity is seen among Mexican and African American populations. Presence of overweight and obesity in a child greatly increases their risk of type 2 diabetes, hypertension, heart disease, and other long-term chronic diseases. In 2010, 86% of all healthcare spending was for individuals with one or more chronic medical conditions (Gerteis, et al., 2014). These chronic diseases are associated with multiple modifiable risk factors, such as excess weight, inactivity, and poor dietary habits. Risk of chronic disease is also higher in Mexican and African American populations due to additional factors such as genetics and socioeconomic status. Teaching nutrition with a focus on disease prevention while young children attend early education programs may decrease chronic diseases when they are preventable, thus reducing health disparities.

Head Start

Since its beginning in 1965, Head Start has provided more than 30 million low-income children with early childhood education, including nutrition education (Head Start, n.d.) Head Start was developed to give low-income preschool children educational, health, nutritional, social, and emotional opportunities to succeed in life. Early child care settings, such as Head Start, provide an environment that is critical to the development of nutritious food and physical activity habits in children under their care (Story, Kaphingst, & French, 2006). This is due to the fact that approximately 65% of all U.S. children between 3 and 5 years of age attend some form of early education or child care outside the home (National Center for Education Statistics, 2016). During this crucial time of development, lifelong food habits and preferences are thought to be established (Nicklaus, Boggio, Chabanet, & Issanchou, 2004; Nicklaus, Boggio, Chabanet, & Issanchou, 2005). Early preventive measures are a promising strategy for reducing the burden of obesity and the consequences of type 2 diabetes during childhood. Young children are solely dependent on their parents, or other caregivers, for their development of healthy lifestyle behaviors. Including these adults as recipients of nutrition and health education, along with young children in their care, could be beneficial (Williams et al., 2014).

Health and Nutrition Literacy

Health literacy has been defined as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (United States Department of Health and Human Services, 2000); have in order to make informed choices about their health. Prevention in terms of health literacy includes preventing disease by maintaining and improving health, intervening early in emerging health issues, and engaging in self-care and self-management of illness. Health literacy in terms of diabetes may provide a better explanation of health disparities in individuals with this disease (Cavanaugh, 2011). Evidence indicates that individuals with low health and nutrition literacy have a harder time controlling their diabetes. Hispanic adults have been shown to have lower average health literacy compared to any other racial/ethnic group (Powell, Hill, & Clancy, 2007).

Bienestar/NEEMA Program

The Social and Health Research Center (SHRC) in San Antonio, Texas, developed the *Bienestar/NEEMA* obesity and youth-onset type 2 diabetes control programs for elementary and middle schools in Texas. The *Bienestar/NEEMA* program uses age-appropriate learning tools that target positive, sustainable health habits that are also culturally and socially relevant to both Hispanic and African American student populations. These two minorities are the focus of the program because they represent the majority of the student population in the state of Texas (Texas Education Agency, n.d.) and because they have the highest health disparities. The program was developed using social cognitive, socio-ecological, and sociocultural theories as the basis of its theoretical framework. The social cognitive theory considers the role of individual factors, such as knowledge base, as well as environment and behavior and their effect on health (Bandura, 1986). The socio-ecological theory places greater emphasis on the importance of change within the child’s environment (McLeroy, Bibeau, Steckler, & Glanz, 1988), while Vygotsky’s sociocultural theory highlights the pertinence of cultural influence (Vygotsky, 1978) in regard to growth and development. Combining the three theoretical frameworks led to the development of a program that would impact four large areas of the child’s life: increase in knowledge base through the classroom lessons, change in environment at home through take-home activities, increase in physical activities at school, and potential to change food choices at school with the help of food service staff.

The Social and Health Research Center (SHRC) has almost 15 years of experience operating the *Bienestar/NEEMA* obesity control programs in schools. The *Bienestar/NEEMA* Health Program has proven to be effective in older children. After completion of the program, elementary-aged children had reduced fasting capillary glucose levels, decreased body fat percentage, and increased fitness scores (Shaw-Perry et al., 2007). Given that development of lifelong food choice and preference occurs at a very young age, the program has been adapted for use among preschool children; however, it has yet to be tested for effectiveness. As part of the curriculum, participating preschool children are taught 10 different nutrition-themed lessons that have different activities embedded in each lesson. These activities may include stories, crafts, games, songs, and dancing. Health and nutrition knowledge scores can be evaluated following the use of a pre- and post-assessment conducted at the beginning and end of the traditional school year.

The program's school food service component focuses on educating school food service staff on nutrition; this benefits staff and their families as well as the children they serve. The family/parent component was designed to translate what is being learned in school to the home. The curriculum also aims to change health behaviors known to influence the risk of type 2 diabetes: increased physical activity and dietary fiber and decreased saturated fat and refined carbohydrate intake (Shaw-Perry et al., 2007). During the fall of 2009, a needs assessment was conducted with three- and four-year-old children attending a primarily Hispanic Head Start preschool program in San Antonio, Texas. Information collected from this study was utilized in the development of a *Bienestar/NEEMA* preschool program using the existing kindergarten version of the program. The final iteration of this program was assessed in our research study.

Method

The Head Start school consisted of 12 classes, 7 of which were invited to be a part of the study at the request of the school principal. Children in participating classrooms were recruited for the study through a flyer sent home in their weekly yellow *Bienestar/NEEMA* folder. The study was approved by Texas Woman's University Institutional Review Board.

The preschool program was implemented by one nutrition doctoral student and four native Spanish-speaking bilingual undergraduate dietetics students in one North Texas Head Start school. Students with parental consent participated in the curriculum classroom activities and worksheets, while children who did not have parental consent went with a teacher to another classroom. The curriculum was taught in the morning

two times per week over a six-week period in both English and Spanish. Each lesson included a brief discussion of key nutrition topics, a short story, a daily song, a learning center activity, and “Silly Moves,” a physical activity. The children were encouraged to use kid-friendly food models during the lessons to explain to the instructor what was being taught in a particular nutrition lesson. Imaginary trips to the grocery store and a restaurant were included in these lessons. Children were also asked to build meals based on the MyPlate lesson and cut out pictures of young children doing physical activity to create collages to hang in their classroom and take home to share with their families.

Children were assessed for their nutrition and physical knowledge using a written questionnaire at the beginning of the study and after all the lessons had been taught.

The questionnaire consisted of 13 questions related to information taught within the lessons; these questions were followed by 3 answer choices in the form of a cartoon graphic. The instrument was available in both English and Spanish, and children were provided a copy of the questionnaire as well as a crayon for marking their responses. Those not taking the assessment were invited to participate in structured physical activities with classmates just outside of the classroom door. Prior to giving the instructions for each question, students were asked to identify the pictures provided as an answer choice. If pictures were action-related, the students were asked to describe what was happening. Following completion of all 12 nutrition and physical activity lessons, the questionnaire was administered again in a similar format.

Teachers whose classes were involved in the study were invited to participate in a focus group discussion (Krueger & Casey, 2009). Of the seven classes involved in the study, six teachers actively participated. The focus group was audio recorded, transcribed, and analyzed using the constant comparative method.

The nutrition coordinator, who is a Registered Dietitian Nutritionist for the participating school district was provided a copy of the *Bienestar/NEEMA* Food Service Personnel curriculum. Two weeks later, she participated in a one-on-one interview with the researcher to provide professional input on the curriculum. Parents of participating children were invited to a group discussion through a flyer sent home in their child’s folder.

Results

Participating classes included two Spanish-speaking-only classes, three English-speaking-only classes, and two English as a Second Language (ESL) classes. The curriculum was implemented over a 6-week time frame with each lesson lasting approximately 30 minutes. The entire lesson was covered each class period as planned.

When administering the questionnaire, researchers found that all of the children were capable of using the crayon to mark responses and did not require assistance from the researchers or available staff to do so. At the beginning of the study, groups of 6 to 10 children sat in their usual seats to answer the questionnaire. At the end of the classroom implementation, students answered the questionnaire in a shared area just outside the classroom. Children sat in a circle on the floor as they answered the questions using a crayon for writing as the questions were read to them.

When students were asked to identify the graphics used with each question, apparent gaps in identifying what the graphics were representing arose. This was primarily seen with graphics depicting beverages, meals, physical activity, and a candy bar. Question three on the assessment asked the children to circle a healthy beverage and provided graphics of a milk carton, Kool-Aid, which was labeled on a cup, and a soda can. A large portion of the students thought the Kool-Aid was juice and therefore a healthy drink. In question six, the graphic depicting a chocolate bar with part of the wrapper pulled back to expose the chocolate was often mistaken for a pillow or window. The action graphics were not clear at first glance and needed to be thoroughly explained to the children. The same can be said for the images illustrating meals. One of the biggest concerns brought up by the teachers during our focus group discussion was the use of graphics versus actual photographs in the nutrition education materials. Current learning theory in children encourages the use of real pictures in place of graphics so young children can easily identify and understand what concepts they are supposed to learn (Contento, 2016). When teaching young children and their families about preventing diabetes or eating healthful foods, educational materials must present their information clearly to the learner. Consumers of health information, no matter their age, gender, or ethnicity, rely heavily on whether they are able to understand what is presented to them.

Of the 104 students who completed the pre-test assessment, 99 finished the post-test. The discrepancy in numbers is related to student absence. All of the questions showed improvement in the percentage of students who answered correctly, though only 8 were statistically

significant. Given the environment in which the assessments were conducted, it is unclear as to whether it shows an actual increase in knowledge base. Results are shown in Table 1.

Table 1

Pre-Test and Post-Test Results

Question	Response	Pretest		Posttest		<i>p-value</i>
		Mean %	SD	Mean %	SD	
1	Correct	52	18	59	25	0.182
	Incorrect	13	11	10	8	0.259
	Invalid	35	17	32	24	0.349
2	Correct	50	19	53	16	0.25
	Incorrect	16	6	16	11	0.47
	invalid	34	19	31	20	0.39
3	Correct	46	18	76	19	0.002**
	Incorrect	29	13	15	14	0.009**
	Invalid	25	17	9	16	0.02**
4	Correct	81	21	88	10	0.148
	Incorrect	4	7	1	3	0.185
	Invalid	15	19	11	10	0.269
5	Correct	76	18	80	13	0.302
	Incorrect	5	6	7	6	0.13
	Invalid	19	17	13	13	0.157
6	Correct	31	20	59	21	0.007**
	Incorrect	48	23	28	20	0.072
	Invalid	21	16	13	16	0.171
7	Correct	74	15	84	11	0.068
	Incorrect	15	16	7	11	0.048**
	Invalid	11	12	8	10	0.23
8	Correct	46	22	67	18	0.005**
	Incorrect	28	16	16	6	0.047**
	Invalid	26	22	18	18	0.144
9	Correct	19	24	41	38	0.013**

	Incorrect	52	29	48	37	0.4
	Invalid	29	33	11	13	0.044**
10	Correct	31	21	46	22	0.005**
	Incorrect	44	24	39	18	0.294
	Invalid	25	34	14	17	0.072
11	Correct	22	15	44	20	0.003**
	Incorrect	30	19	40	10	0.136
	Invalid	48	26	17	11	0.004**
12	Correct	35	26	65	26	0.033**
	Incorrect	17	11	25	18	0.21
	invalid	17	11	25	18	0.21
13	Correct	30	22	50	19	0.006**
	Incorrect	27	19	37	14	0.124
	Invalid	44	31	13	11	0.023**

* Answers deemed invalid are those that were either unanswered or had more than one answer selected.

**Statistically significant difference found between pre- and posttest answer, with a *p-value* <0.05

Lack of time prohibited some students from completing the assessment in its entirety. Many students left the last five questions blank, rendering them invalid. Due to time constraints, the posttest assessments were conducted in much larger groups of students than the pretest assessments were. The children frequently peered at their neighbor's paper and either copied their response or told them which to choose. Students often changed their own response to match the child sitting near them versus utilizing their own knowledge base. This had a notable impact on the validity of student responses. Teachers also shared their inability to do the assessment as the curriculum was written because of the time needed. During the teacher focus group discussion, teachers indicated that their responsibility for making sure students were ready for kindergarten was more important in terms of instructional time. Behavior change in terms of foods consumed while in school was another measure suggested to use in place of a knowledge test. This information was shared with the social scientists who authored the *Bienestar/NEEMA* program.

Teacher Input on the Curriculum

Of the seven classes involved, six of the teachers actively participated. Recurring themes, their description, and component examples that arose during the coding process are detailed in Table 2.

The most reoccurring theme uncovered in the focus group was the concept of time in relation to teaching the program: how much time could be allotted to teach the curriculum each day, the period of time in which the entire curriculum could be taught and the point in time during the school year in which the curriculum could be implemented (teaching it all at once or in both the fall and spring semesters). Teachers appreciated the flexibility of the curriculum because they could teach it any time of the year or could teach it twice a year (fall and spring) to reiterate the concepts. In terms of children understanding the lessons taught, teachers suggested the cartoon graphics of food and different types of physical activity were not recognized by many of the children. The children were often confused about what they were supposed to be learning because they didn't know what the graphic was in a lesson. Actual photographs, such as stock photos, were recommended by the teachers instead of some cartoon graphics depicting foods and activities in the curriculum and assessment instrument. This is important in terms of literacy and preschool children learning about nutrition and their health. The teachers thought the materials were at the appropriate cognitive level of the students and reiterated several key concepts throughout the program. Teachers also shared that the curriculum was relatable to their students, who were from different cultures and ethnicities. The various types of activities in each lesson helped to maintain the young children's attention.

In this Head Start school, general learning concepts are constantly taught in one way at the start of the year and reviewed in a different manner during another point in time. Teachers felt that the nutrition concepts taught throughout the *Bienestar/NEEMA* curriculum would be no different, especially since there are a multitude of opportunities throughout the day to review. As one teacher explains:

And of course, we review as we go because every time we have lunch, every time we have snack, every time we have breakfast, they are talking about the different food groups they have.

Table 2

Teacher Focus Group

Themes	Description	Component
Time	Time frame or point in time in which the curriculum is to be implemented.	Period of time in which the entire curriculum would be implemented. Amount of daily time that would be allotted for curriculum teaching. Point in time during the school year in which the curriculum would be implemented.
Components of instructional design		Concepts taught within the curriculum. Reiteration of ideas and learning concepts. Repetition of ideas and learning concepts. Activities used to teach curriculum.
Age appropriateness	Curriculum designed to meet the needs of 3- to 4-year-olds.	Cognitive level. Learning style observation. Literal sense. Alternative methods of learning provided. Understanding of learning concepts. Occasional lack of understanding.
Flexibility	The concepts within the curriculum are easily transferable to other learning units and skills.	Incorporates other learning concepts. Incorporates developmental skills.
Knowledge transfer	Statements and actions of students that indicate evidence of learning and understanding of curriculum concepts.	Student learning. Teacher acknowledgement.
Efficacy barriers	Issues and concerns that would affect the effectiveness of this curriculum.	Excessive information provided to the parents. Language barriers between educator and student. Lack of parental involvement. Low socioeconomic status of the students. Lack of student engagement.
Implementation barriers	Issues and concerns that would affect the potential implementation of this curriculum.	Language barriers between educator and student. Cost of materials. Money allocated to other curricula.
Communication	Teacher communication with	Teacher communication with parents. Teacher communication with students.

	others and how others communicate with them. Communicative interactions between teacher, student, parent, and school.	Student communication with teacher. Parent communication with teacher. School communication with parents.
Curriculum	Comments and suggestions pertaining to aspects of the implemented curriculum.	Accessibility. Relate to current industry standards. Alternative materials to include. Comprehensive package. Incorporation of options. Structure. Content. Effectiveness.

After the students began to participate in the *Bienestar*/NEEMA lessons, the teachers reported evidence of student learning and understanding of the curriculum’s nutrition concepts. Throughout daily meals and activities, the students began to identify and question the foods they were consuming:

Every lunch they’ll have to tell me which, every food that is a fruit and a vegetable, they’ll point it out. I don’t even have to give them a cue or anything. They are already saying: “this is a vegetable!” “this is a fruit!” If they are unsure, they’ll ask me: “what group is this in?” you know, so I know that they are using that information.

Participating teachers shared that students not only questioned their own dietary habits but also began to unabashedly observe and comment on individuals around them, including teachers, parents, and fellow students. One student was even concerned that her father was going to die because “he never eats healthy.” According to the teachers, frequent comments from parents regarding transfer of information to their home life were also reported.

Another major concern expressed by teachers was the issue of cost of the program’s materials. School districts are undergoing budget cuts, and nutrition related curriculums such as *Bienestar*/NEEMA are deemed a luxury, not a necessity. Therefore, money that may have once been available for auxiliary materials may quickly get allocated elsewhere. In order to help offset the cost of materials, teachers offered suggestions such as offering materials online for schools to print as needed. This

would allow Head Start schools and other child care settings to purchase the most cost-effective version. Another concern includes the role of the parents and their involvement in student learning and activities at the school. The level of interest within the parents of students differs from year to year according to the teachers:

The only thing I would worry about is the parent, the parent component of it is, especially, I mean, with us here sometimes it depends on the year. Sometimes you have a lot of parent involvement, and then sometimes you don't have any.

Often, even though a parent may be involved with their child's education, they are overloaded with information from the school and other extracurricular activities. Eventually, parents may begin to ignore some of the information that comes home. According to the teachers, providing clear and simple nutrition information would be the best way to help parents understand the material and encourage healthy habits in their children. The overarching goal of *Bienestar*/NEEMA is to change the food choices and activity behavior of young children in order to decrease the prevalence of obesity and reduce the risk of related diseases like diabetes. If these behavior changes are not endorsed in the home as well as the schools, then the students will not be able to maximize the benefits of this curriculum.

Nutrition Literacy in Head Start Food Service

The nutrition coordinator reviewing this portion of *Bienestar*/NEEMA felt that it was appropriate from both a cognitive and content level. One of the greatest benefits discussed was the empowerment that would come in time as the knowledge base of curriculum users increased. The nutrition coordinator interviewed discussed the behavior changes that would hopefully result due to the information learned as food service personnel work through the nutrition curriculum. As the school nutrition food service staff changed their personal behavior, they would then be able to become role models for students and help guide them in their food selections. As with the student classroom *Bienestar*/NEEMA curriculum, cost and time involved could prove to be large barriers for implementation. The cost of purchasing the curriculum was not as much of a concern as the cost of training the food service staff. In this particular school district, participation in reading the curriculum and working through the questions after each segment would have to be solely on a volunteer basis for the food service personnel. Motivation for participating would have to be simply personal

increase in knowledge about nutrition. While this may be enough incentive for some individuals, others may not want to spend extra time at work without pay. Given that only one nutrition coordinator was interviewed in one school district, these findings cannot be generalized across all districts and child care settings.

Nutrition Literacy in Head Start Parents

Six parents attended the Saturday morning lesson and discussion, which lasted 50 minutes and both of which were conducted in Spanish. The morning began with a lesson about lifestyle and diabetes prevention given by native Spanish-speaking dietetics students. Parents were then provided a copy of the *Bienestar/NEEMA* Family Times, a family workbook, while eating breakfast. After breakfast, parents provided input on the workbook during a group discussion. Parents appreciated the information contained in the workbook but considered the workbook to be too technical for their understanding. They were also interested in learning more about ways to decrease their family's risk of diabetes, increase physical activity as family, plan meals, and include more healthful foods on a budget using store coupons. Parents want to eat healthy foods, even with limited resources. They were also interested in how to take family favorite recipes and make them healthier and in learning how to get their families, especially their children, to eat more vegetables and fruits. Lack of time to attend classes due to their working schedules was also shared.

Conclusion

Prevention of type 2 diabetes can begin when young children begin developing their food preferences. Educating families, caregivers, educators, and school food service staff about diabetes and its prevention through the Head Start learning environment can target the multiple levels of influence in a young child's life. The *Bienestar/NEEMA* early childhood program curriculum incorporates personal, behavioral, and environmental factors to influence dietary and physical activity behavior change in young children and their families. Involving the target audience in this assessment of the curriculum guided revisions of the program's content, design, structure, and delivery. The findings of this study conducted with Head Start preschool children, their classroom teachers, parents, and the school district's nutrition coordinator were shared with the authors of the *Bienestar/NEEMA* preschool program. The lessons were rewritten by an instructional designer and nutritionists focusing on selected critical behaviors, using concrete examples with visuals the learner could

understand and decreasing the complexity of information taught. When focusing on educating low-literacy populations about diabetes knowledge and care, involving members of the target population in the development of the educational materials is critical.

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