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Reading Across My Pyramid, a nutrition and health education curriculum, increases the health behavior knowledge of lower elementary students

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ABSTRACT

Objectives
The purpose of this investigation was to complete a formal evaluation of Reading Across My Pyramid (RAMP), a literacy promoting nutrition and health education curriculum.

Methods
To meet this need, a short survey, the *Child Survey*, based on topics covered in RAMP lessons was developed and tested for clarity in a group of children attending a school eligible to receive the California Food Stamp Nutrition Education Program (FSNEP) (N = 20). Following testing, revisions were made accordingly and the *Child Survey* was used in Northern, Central, and Southern California Schools (N = 62) to evaluate RAMP. A *Parent Survey* was also used to determine correlations between the responses of children and their parents.

Results
Data showed RAMP to be effective at increasing the importance of exercise in the minds of children ($p = 0.001$), knowledge that the heart pumps blood through the body ($p < 0.001$), and knowledge that computer use and television watching are not exercise ($p = 0.024$). Correlations were also observed between a child's knowledge of healthy foods and parent reported soda consumption ($p = 0.01$), and between child's knowledge that computer use and television watching are not exercise and parent reported hours of television watching by their child ($p = 0.03$).

Application to Child Nutrition Professionals
The results of this investigation show that RAMP is effective at increasing the health behavior knowledge of lower elementary students. Currently, this curriculum is widely used throughout California by both the FSNEP and the Expanded Food and Nutrition Education Program (EFNEP). In a time when the rates of childhood overweight have reached epidemic proportions, these findings suggest that RAMP can be an effective tool for nutrition professionals to use to increase health behavior knowledge in an effort to reduce rates of childhood obesity.

INTRODUCTION

The American epidemic of childhood overweight continues to be a leading health problem. The National Health and Nutrition Examination Survey (NHANES) estimates that thirty-one percent of children 6 to 19 years of age are at risk for overweight or are overweight and sixteen percent are overweight (Hedley et al., 2004). A recent Institute of Medicine report examined the behavioral and cultural factors, social constructs, and broad environmental issues involved in childhood obesity, identifying promising approaches for prevention efforts (Koplan, Liverman et al. 2005). The report called for collaborative approaches to improve the proportion of children meeting the Dietary Guidelines for Americans and physical activity guidelines, and established the school setting as a priority for creating a healthy environment, including coordinated changes in curricula and innovative approaches to teaching children about nutrition and reducing sedentary behaviors. Other organizations, such as the Centers for Disease Control and Prevention (CDC), also encourage creating a school environment that supports regular physical activity and healthy eating habits (Centers for Disease Control and Prevention, 1996; Centers for Disease Control and Prevention National Center for Chronic Disease Prevention and Health Promotion, 2003). It is important that the school environment is utilized to provide children with the knowledge required for them to make better decisions about diet and physical activity not only during their childhood, but throughout their lifetimes.

Unfortunately, barriers to achievement of a successful nutrition and health education program exist. Provision of nutrition and health education is often met with resistance from school teachers because they are already challenged with multiple competing demands and interests which fight for time and resources within the school. Additional time in one subject area means that time for other subjects must be reduced. Previous interventions have found time constraints to be a serious limitation to the effectiveness of their program (Luepker et al., 1996). As a result, nutrition and physical activity programs often fall by the wayside as teachers are hesitant to spend time on material outside of the core subject areas of history/social science, science, math, or

English/language arts as these are the focus of state standards tests, the outcome of which play a critical role for future school funding.

In elementary school, reading is a major focus of the curriculum, as it is well known that reading ability is closely associated with school achievement (Lyon, 1997). It is imperative that efforts are made to develop reading skills during the first years of formal education, as academic ability in the third grade impacts later academic achievement and likelihood of high school completion (Ramey et al., 2000). Furthermore, low-income children may be more likely to have low literacy skills (Huston, 1992), increasing the importance of development of these skills in this at risk population.

Reading Across My Pyramid (RAMP) is a literacy promoting nutrition education curriculum targeting lower elementary students. Through the use of nutrition and physical activity related books, RAMP aims to increase the knowledge of students while fostering the development of reading skills, thereby providing an innovative solution to the problem of time constraints faced by teachers. The RAMP curriculum is based on the experiential learning model and provides children with a variety of opportunity for hands-on learning such as cooking demonstrations and heart-rate monitoring. The authors focused on lower elementary students as there is some evidence that the dietary behaviors of young children are more easily influenced than older children (Birch, 1980). Although this curriculum is widely used throughout California by both the Food Stamp Nutrition Education Program (FSNEP) and the Expanded Food and Nutrition Education Program (EFNEP) to educate low income children, a formal evaluation of the curriculum's ability to increase health behavior knowledge has not been completed. The purpose of this investigation was to complete this assessment.

METHODOLOGY

This intervention targeted English speaking, low-income, first and second grade children attending schools eligible for participation in California FSNEP (= fifty percent of children eligible for free and reduced lunch). Parents/guardians of these children were also asked to complete a short survey (Parent Survey) which was provided in both English and Spanish. First and second grade children were targeted because it was least likely that they had previously received nutrition education lessons. Recruitment occurred at the following schools to ensure representation of children from various California regions: Stoneman Elementary School, Pittsburg (Northern California); Roosevelt Elementary School, Selma (Central California); Holland Elementary School, Fresno (Central California); and Laurel Elementary School, Oceanside (Southern California). The UC Davis Institutional Review Board approved this protocol and all parents and children completed informed consents.

After recruitment and enrollment, an initial session was held with the children during which they were asked to complete a short, ten-question, Child Survey. The Parent Survey, to be completed by parents/guardians, was also sent home at this time. Subsequently, FSNEP nutrition educators delivered three lessons to children from the Reading Across My Pyramid curriculum, each one week apart. The lessons included selected portions from the chapters covering the MyPyramid (Lesson 1: Discovering MyPyramid), fruits (Lesson 4: Fabulous Fruits), and physical activity (Lesson 9: Kids Physical Activity Pyramid). After children received their third lesson both the parent/guardians and the children were asked to complete their respective assessment material for a second time.

Description of Outcome Measures

Each participating child and his or her guardian completed the following assessment tools prior to (Pre-Test) and after (Post-Test) the intervention.

1) Child Survey: Children were asked to complete a short, ten-question Child Survey which assessed both the nutrition knowledge and nutrition related behaviors of the student. This questionnaire was based on topics covered in RAMP lessons. Pictures were used to assist children in identification of the correct response due to variability in English comprehension. The survey was read aloud to meet the needs of children with diverse reading levels and students were asked to follow along as a class. The Child Survey was tested for clarity in a group of FSNEP eligible children in Placer County (N = 20). Revisions were made accordingly and the revised version of the survey was used in the current investigation.
2) Parent Survey: The nineteen item Parent Survey collected information related to each child's dietary and physical activity related behaviors. The survey included multiple choice, yes/no, likert scale, and fill in the blank questions. This survey was adapted from one previously used by our research group (Morris, Koumjian, Briggs, & Zidenberg-Cherr,, 2002) and was tested for clarity in a group of parents/guardians of FSNEP eligible children in Placer County (N = 17). The modified survey was used in the current investigation.

Statistical Analysis

Data from the Child Survey and the Parent Survey were coded as nominal variables. The effects of RAMP nutrition education lessons on the nutrition and physical activity knowledge and behaviors of children were determined using paired t-tests. The confidence interval was set at 95%. In addition, Pearson's bivariate correlation coefficients were calculated to determine the relationship between the child's responses to questions on the Child Survey and his/her parent/guardian's response to questions on the Parent Survey. All analyses were completed using SPSS 11.5 for windows (SPSS Inc. 2004, Chicago, Illinois).

RESULTS AND DISCUSSION

Demographics

Sixty-two children and their parents/guardians participated in the evaluation. Eighteen of the participating children were from Northern California (29%), twenty-two from Central California (35.5%), and twenty-two from Southern California (35.5%). Seventy-one percent were attending first grade (n = 44) and twenty-nine percent were in the second grade (n = 18). Twenty-nine of the children were identified by their parents/guardians as female (46.8%) and thirty were identified as male (48.4%). Three parents/guardians chose not to report the gender of their child (4.8%). Eleven of the children were identified by their parents/guardians as African American (17.7%), one as Asian (1.6%), five as Caucasian (8.1%), seven as Chicano (11.3%), twenty-nine as Latino (46.8%), and two as other (3.2%). Seven parents/guardians chose not to report the ethnicity of their child (11.3%).

Child Survey

The results from the *Child Survey* show that RAMP is effective at increasing the health behavior knowledge of lower elementary students. Statistically significant increases in the *Child Survey* scores were observed (p= 0.000) (71% vs. 80% correct). Specifically, after three RAMP lessons, significant increases were observed in the number of children who knew which muscle pumps blood (p = 0.000), the number of children who knew that dancing, not computer use or television watching, was a form of exercise (p = 0.024), and the importance of exercise in the minds of children (p = 0.001) (Table 1). These findings are noteworthy given that in young children, time spent watching television is associated with increased body mass index (Proctor et al., 2003) and physical activity level is negatively associated with body fat and body mass index (Abbott & Davies, 2004). Future investigations are needed to determine if positive alterations to these health indicators would be observed in children receiving RAMP lessons in comparison to a control group.

Although not significant, there was a trend toward increased knowledge regarding foods that should be consumed less often (p = 0.090) and the importance of eating well everyday (p = 0.070) (Table 2). It should be noted that due to financial constraints, only three of the nine RAMP lessons were delivered during the intervention portion of this investigation. Given that research suggests fifteen hours of health instruction are needed to increase the knowledge of children (Connell, Turner, & Mason., 1985), it is possible that greater gains in knowledge would have been observed had the entire curriculum been delivered.

Table 1: Data from the Child Survey (N=62 children)

Multiple Choice Questions	**Pre-Test**		**Post-Test**		**Sig.**
Question	**Correct Response (%)**	**Incorrect Response (%)**	**Correct Response (%)**	**Incorrect Response (%)**	
1. Circle the types of food you should eat most.	1 (1.6)	61 (98.4)	2 (3.2)	60 (96.8)	0.321
2. Circle the food you should eat less often.	26 (41.9)	36 (58.1)	33 (53.2)	29 (46.8)	0.090
3. Which food belongs in the fruit group?	47 (75.8)	15 (24.2)	47 (75.8)	15 (24.2)	1.000
4. Which drink is made from 100% juice?	27 (43.5)	35 (56.5)	31 (50.0)	31 (50.0)	0.321
5. Circle all the healthy foods.	58 (93.5)	4 (6.5)	57 (91.9)	5 (8.1)	0.709
6. Which muscle pumps blood?	39 (62.9)	23 (37.1)	54 (87.1)	8 (12.9)	<0.001*
7. Circle the picture where a child is exercising.	53 (85.5)	9 (14.5)	58 (93.5)	4 (6.5)	0.024*

Likert Scale Questions	**Pre-Test**			**Post-Test**			**Sig.**
Question	**Yes**	**Some.**	**No**	**Yes**	**Some.**	**No**	
1. I eat fruit and vegetables everyday	46 (74.2)	7 (11.3)	9 (14.5)	47 (75.8)	13 (21.0)	2 (3.2)	0.197
Questions	**Very Important**	**I Don't Know/Not Important**		**Very Important**	**I Don't Know/Not Important**		
2. How important is it for you to eat well everyday?	44 (71.0)	18 (29.0)		51 (82.3)	11 (17.7)		0.070
3. How important is it for you to exercise everyday?	48 (77.4)	14 (22.6)		58 (93.5)	4 (6.5)		0.001*

n.c. = no calculation due to constant variable
* = significant at the 0.05 level (2-tailed).
** = significant at the 0.01 level (2-tailed).

Parent Survey

Results from the *Parent Survey* (Table 2) revealed no significant differences in the dietary and physical activity related behaviors of the children, as reported by their parents, before and after exposure to RAMP. However, a trend toward increased playing of active games (p = 0.07) and decreased soda consumption (0.11) was observed, suggesting a movement toward adoption of a healthier lifestyle by these children in comparison to their peers (Johnson, 2000).

Table 2: Reponses to the Parent Nutrition Survey (N= 62 parents/ guardians)

Yes/No Questions	**Pre-Test Response**			**Post-Test Response**			
Question: My child eats...	**Yes (%)**	**No (%)**	**No Response (%)**	**Yes (%)**	**No (%)**	**No Response (%)**	**Significance**

1. Apples	58 (93.5)	1 (1.7)	3 (4.8)	57 (92.0)	1 (1.5)	4 (6.5)	n.c
2. Candy	54 (87.0)	4 (6.5)	4 (6.5)	56 (90.4)	1 (1.5)	5 (8.1)	0.26
3. Oranges	57 (91.9)	2 (3.2)	3 (4.8)	56 (90.3)	2 (3.2)	4 (6.5)	n.c.
4. Other Fruits	58 (93.5)	1 (1.7)	3 (4.8)	58 (93.5)	0 (0.0)	4 (6.5)	0.32
5 Cookies	56 (90.4)	2 (3.2)	4 (6.5)	56 (90.4)	2 (3.2)	4 (6.5)	1.00
6. Soft Drinks	49 (79.0)	8 (12.9)	5 (8.1)	48 (77.4)	7 (11.3)	7 (11.3)	0.60
7. Peas	39 (62.9)	20 (32.3)	3 (4.8)	38 (61.3)	20 (32.2)	4 (6.5)	1.00
8. Radishes	13 (21.0)	45 (72.5)	4 (6.5)	14 (22.5)	44 (71.0)	4 (6.5)	0.74
9. Carrots	51 (82.3)	7 (11.2)	4 (6.5)	54 (87.0)	4 (6.5)	4 (6.5)	0.32
10. Broccoli	40 (64.5)	18 (29.0)	4 (6.5)	43 (69.3)	15 (24.2)	4 (6.5)	0.48
11. Other Vegetables	54 (87.1)	5 (8.1)	3 (4.8)	53 (85.4)	4 (6.5)	5 (8.1)	0.16
n.c. = no calculation due to no difference							

Likert Scale Questions	**Pre-Test Response**						**Post-Test Response**						
Question	Never (%)	Rarely (%)	Some. (%)	Often (%)	Always (%)	No (%)	Never (%)	Rarely (%)	Some. (%)	Often (%)	Always (%)	No (%)	Signi.
1. My child chooses fruit for a snack	2 (3.2)	6 (9.7)	21 (33.9)	18 (29.0)	12 (19.4)	3 (4.8)	2 (3.2)	6 (9.7)	21 (33.9)	19 (30.6)	10 (16.1)	4 (6.5)	0.88
2. My child chooses vegetables for a snack	14 (22.6)	11 (17.7)	19 (30.6)	12 (19.4)	2 (3.2)	4 (6.5)	8 (12.9)	18 (29.0)	17 (27.4)	12 (19.4)	3 (4.8)	4 (6.5)	0.31
3. My child enjoys playing active games	2 (3.2)	2 (3.2)	10 (16.1)	10 (16.1)	35 (56.5)	3 (4.8)	1 (1.6)	1 (1.6)	5 (8.1)	10 (16.1)	41 (66.1)	4 (6.5)	0.07
4. My child drinks soda	2 (3.2)	1 (1.6)	19 (30.6)	29 (46.8)	5 (8.1)	3 (4.8)	4 (6.5)	24 (38.7)	20 (32.3)	10 (16.1)	0 (0.0)	4 (6.5)	0.11

Fill in the Blank Questions	**Pre-Test Response**	**Post-Test Response**	
Question	**Hours / Day**		**Signi.**
1. Approximately how long does your child watch television each day?	2.19 (1.22)	2.21 (1.26)	0.87
2. Approximately how long does your child play on the computer each day?	0.42 (0.64)	0.43 (0.76)	0.96

n.c. = no calculation due to constant variable
* = significant at the 0.05 level (2-tailed).
** = significant at the 0.01 level (2-tailed).

Correlations

Correlational analyses were used to make associations between responses of children to selected questions on the *Child Survey* and the responses of parents to selected questions on the *Parent Survey*. Previous research using focus groups of second and fifth grade children and their parents suggested that a disconnect between a child's nutrition and physical activity related knowledge and their corresponding behaviors may exist (Hesketh, Waters, Green, Salmon, & Williams, 2005). We were interested in investigating this relationship further. A statistically significant relationship was observed between a child's knowledge of healthy foods and parent reported soda consumption ($p = 0.01$) and between a child's knowledge that computer use and television watching are not exercise and parent reported hours of television watching by their child ($p = 0.03$) (Table 3). These findings suggest that the knowledge gained by children receiving RAMP lessons had a positive impact on their diet and physical activity related behaviors; however, controlled investigations are needed before definitive conclusions can be made.

Table 3: Pearson's Correlations Between Parent and Child Responses to Selected Questions

Child Survey	*Parent Survey*	*Significance*
2. Circle the food you should eat less often.	My child eats candy.	1.00
	My child eats cookies.	0.92
	My child drinks soft drinks.	0.47
	My child drinks soda.	0.40
3. Which food belongs in the Fruit Group?	My child eats apples.	0.58

	My child eats oranges.	0.39
	My child eats other fruits.	n.c.
	My child chooses fruit for a snack.	0.77
4. I eat fruit and vegetables everyday.	My child eats apples.	0.12
	My child eats oranges.	0.47
	My child eats other fruits.	n.c.
	My child chooses fruit for a snack.	0.69
	My child eats peas.	0.30
	My child eats radishes.	0.09
	My child eats carrots.	0.97
	My child eats broccoli.	0.19
	My child eats other vegetables.	0.47
	My child chooses vegetables for a snack.	0.15
5. Which drink is made from 100% juice?	My child drinks soft drinks.	0.19
	My child drinks soda.	0.18
6. Circle all the healthy foods.	My child chooses fruit for a snack.	0.11
	My child chooses vegetables for a snack.	0.27
	My child drinks soft drinks.	0.46
	My child drinks soda.	0.01**
7. How important is it for you to eat well everyday?	My child chooses fruit for a snack.	0.74
	My child chooses vegetables for a snack.	0.49
	My child drinks soft drinks.	0.80
	My child drinks soda.	0.12
8. How important is it for you to exercise everyday?	My child enjoys playing active games.	0.92
	Approximately how long does your child watch television everyday?	0.17
	Approximately how long does your child play on the computer everyday?	0.84
9. Which muscle pumps blood?	My child enjoys playing active games.	0.93
	Approximately how long does your child watch television everyday?	0.86
	Approximately how long does your child play on the computer everyday?	0.30
10. Circle the picture where a child is exercising.	My child enjoys playing active games.	0.68
	Approximately how long does your child watch television everyday?	0.03*
	Approximately how long does your child play on the computer everyday?	0.42

n.c. = no calculation due to constant variable
* = significant at the 0.05 level (2-tailed).
** = significant at the 0.01 level (2-tailed).

CONCLUSIONS AND APPLICATIONS

The experiential learning cycle, developed by David A. Kolb, is continuous and consists of four components: concrete experience, observation and expression, forming abstract concepts, and testing in new situations (Kolb & Fry, 1975). In the field of nutrition education, this model has been used previously as a framework for developing garden based learning programs (Desmond, Grieshop, & Subramaniam, 2004), some of which have been shown to be effective at improving the nutrition knowledge and behaviors of elementary school students (Morris,et al., 2002). This model has also proved to be effective at positively altering nutrition behaviors in non-garden based programs. Indeed, previous investigations with elementary school students have found that lessons based on the experiential learning model can result in a significant increase in their consumption of low-fat foods in comparison to a control group (Demas, 1998), suggesting that this is an effective model to use when designing nutrition education curricula for use in multiple school environments.

In this article, we have described a novel curriculum based on the experiential learning cycle that aims to improve the nutrition and health knowledge and behaviors of lower elementary students while fostering the development of reading skills. Furthermore, during the development of these lessons, efforts were made to create activities that met the requirements set by the California Department of Education Content Standards. Therefore, teachers faced with time constraints should find it easy to incorporate

these nine nutrition and physical activity promoting lessons into their daily activities. The use of this curriculum by teachers throughout the state of California participating in the FSNEP and EFNEP programs suggests this to be true. Other nutrition and health professionals may find their outreach efforts to be more effective if they use a curriculum such as RAMP that takes these factors into consideration.

In conclusion, RAMP, a literacy promoting curriculum, is effective at increasing the health behavior knowledge of lower elementary students and can therefore be used by nutrition and health professionals in their efforts to educate low income children. Further research, which would allow for the delivery and evaluation of the entire curriculum, is needed to determine if RAMP can have a positive impact on nutrition and physical activity related behaviors as well. In a time when the rates of childhood overweight and obesity threaten to create a national health crisis, it is critical that every effort is taken to provide American children with the tools to make better choices about their dietary and physical activity behaviors.

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