Research Article

Efficacy, Intent to Teach, and Implementation of Nutrition Education Increases after Training for Health Educators

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ABSTRACT

Background: *Self-efficacy, outcome expectations, outcome value and strong intentions to teach are linked to teaching competence, curricular implementation and student outcomes.* ***Purpose:*** *The purpose of this research was to determine the effectiveness of nutrition in-service professional development to increase self-efficacy, outcome expectancies, outcome values and intentions to teach nutrition education as part of a broader health education curriculum.* ***Methods:*** *A quasi-experimental design examined teachers' self-efficacy, outcome expectations, outcome value and intentions to teach in teachers who participated in an in-service intervention (N = 30) and controls who did not (N = 29).* ***Results:*** *A significant interaction between groups over time was found for self-efficacy and outcome expectations. For outcome value and intention to teach, a significant main effect for time was observed. The intervention group scored significantly higher than the control group in both self-efficacy and outcome expectations. Furthermore, scores for intention to teach and outcome values were higher post-intervention.* ***Discussion:*** *Results of this study indicate that in-service training combined with adequate instructional resources increased both teacher self-efficacy and the number of lessons the intervention teachers intended to teach.* ***Translation to Health Education Practice:*** *Because self-efficacy has been strongly linked to teacher effectiveness, efforts should be directed at providing continual training for teachers based on risk behaviors outlined by the Centers for Disease Control and Prevention.*

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BACKGROUND

Unhealthy dietary patterns have been identified by the Centers for Disease Control and Prevention (CDC) as one of the seven behaviors that contribute to the leading causes of morbidity and mortality.[1] Most young people in the United States do not follow eating guidelines established by the Dietary Guidelines for Americans or the Food Guide Pyramid.[2] Instead, they are likely to consume too much soda or pop and not enough whole grains, dairy products, fruits and vegetables.[2] Because eating habits are established early in life and carry over into adulthood,[3] an undeniable need exists for the effective implementation of school-based health programs to promote healthy eating habits early in childhood. With over 52 million students attending school on a daily basis,[4] schools provide an efficient and convenient setting for providing quality nutrition instruction. School-based nutrition programs have demonstrated some promise in changing the nutrition of children. For example, Fahlman and colleagues[5] found that after a nutrition education intervention, students increased their intake of fruits and vegetables while simultaneously decreasing their intake of foods with low

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nutritional value. Contento and colleagues[6] found similar results as well as an increase in nutrition-related outcome beliefs and self-efficacy. Whereas an effective school health curriculum is one way to address these patterns among youth, one of the common barriers to effective instruction is lack of proper training and necessary instructional resources for teachers.

Bandura's Social Cognitive Theory guided the current study. The three essential components of Social Cognitive Theory are self-efficacy (the person's belief about their capability to perform a certain behavior), outcome expectations (that the behavior will or will not lead to a desired outcome), and outcome value (that the outcome is meaningful and worthwhile).[7] Researchers have found a direct relationship between teacher self-efficacy and time spent teaching nutrition.[8,9] Teachers with strong self-efficacy are more likely to feel in control and maintain commitment to goals despite setbacks, failures and stressors.[10] Teachers with high nutrition self-efficacy spend more time teaching nutrition than their less confident counterparts.[11,12] Adequate teacher preparation and needed resources have been shown to significantly impact teachers' self-efficacy to deliver high quality health education.[13,14] Conversely, lack of proper teacher training and resources results in low teachers' self-efficacy and subsequent inadequate curricular implementation.[10,15,16]

One portion, (i.e., intention) of Ajzen's Theory of Planned Behavior (TPB) was also used in the current study to evaluate the intervention. According to the TPB, people who have strong intentions to do something are more likely to carry out those actions than are those with weaker intentions.[17] Numerous factors influence teachers' intentions to teach, including: comfort with the subject matter, administrative support and peer support.[18] The TPB has been widely used to study various health-related behaviors such as youth physical activity and teachers' intentions to teach health-related curricula in the subject of physical education.[18-20] However, there is a paucity of research regarding teachers' "intentions to teach" health education broadly and nutrition education more specifically. One study that examined teachers' intentions to teach found that two key factors were associated with teachers' high "intention to teach" scores in nutrition: teachers' knowledge and training in nutrition, and administrative support.[20] Because teacher preparation has been identified as a critical factor for implementing health education programs that result in behavior change in students, in-service training has become one method for school districts to update teachers and prepare them to teach quality health education.[21] Teachers who participated in health education in-service training were more likely to be comfortable with the curriculum, had higher intentions to teach it, and were more likely to believe that teaching the curriculum would lead to changes in their students' health behaviors.[21] When compared to teachers with limited expertise, teachers who have more expertise in their subject area are more enthusiastic, plan for instruction better, are more organized, accommodate for a wider range of learners and better diagnose students' learning difficulties.[9,22]

PURPOSE

Given that self-efficacy, outcome expectations, outcome value and strong intentions to teach are linked to teaching competence, curricular implementation, and student outcomes, the purpose of this research was to determine the effectiveness of nutrition in-service professional development to increase self-efficacy, outcome expectancies, outcome values and intentions to teach nutrition education as part of a broader health education curriculum.

METHODS

Participants

The participants in this study were 59 health education teachers certified to teach health in grades 6-12, (Table 1) from 44 different schools. Teachers in the tri-county area bordering the study site were contacted to assess their interest in participation. After identifying teachers who were interested, research assistants visited the principals at each school to determine their willingness to support the study. Participation was voluntary, but dependent on both the principal's willingness to allow researchers in the school and the health teacher's willingness to participate in the study. Health teachers would also be required to undergo in-service training in the nutrition curriculum and implement it during the study time frame if they deemed it worthwhile in meeting the broader objectives of a comprehensive health education curriculum. Due to study logistics, researchers decided to limit the study to schools in the tri-county area with plans to expand it if the initial study proved successful. The study was explained to the participants, making them fully aware that assignment into either the intervention or control groups would be by random selection.

Instrument

There are multiple instruments available that examine one or more of the constructs in this paper; however, none of them matched our study purposes. In particular, they were missing key components of the curriculum used in this study such as: healthy body image, ability to eat healthy at a fast food restaurant and the meanings of words found on food labels. Because instruments must be compatible with the curriculum they evaluate, all of the previously developed instruments had limited external validity. Thus, a decision was made to develop an instrument compatible with the current study.

The survey instrument was developed over the course of one year and involved multiple steps designed to ensure acceptable reliability and validity. A comprehensive review of the literature was conducted and a survey instrument was adapted from previous studies of self-efficacy, theories of planned behavior, and health/nutrition education-teacher interventions.[8,10,11,23,24] The instrument was reviewed for content and face validity by university professors (N = 3) high school teachers (N = 5) and employees of the CDC (N = 2) who were experts in nutrition education and/or psychological theories. Their suggestions were then used to finalize the instrument, which was pilot-

tested on a group of 15 middle school health education teachers who had experience teaching nutrition content. Following the pilot study, these teachers participated in a focus group and made recommendations for clarity of wording as well as content and instructions. The instrument was finalized after their input was included.

The final instrument consisted of 42 items. Six items addressed demographics and other descriptive information, including the number of years teaching health. One item, measuring outcome value, asked respondents to "rank the importance of the skills that students will need as an adult to function adequately in society" from 1 (least important) to 6 (most important). Sixteen questions addressed self-efficacy and 11 questions addressed nutrition outcome expectations. Eight items addressed teachers future "intentions to teach" nutrition. A five-point (1 = strongly disagree to 5 = strongly agree) Likert-style format was used for the questions addressing nutrition self- efficacy, outcome expectations, outcome value and intentions to teach.

Construct validity was established using a principal components analysis with varimax rotation. Based on an eigenvalue of 1 and a factor loading criteria of .45 or better, four distinct subscales were formed. The subscales were totaled giving a composite score for self-efficacy (16-80), outcome expectations (11-55) and intention to teach (8-40). They were then tested for internal reliability using Cronbach's alpha. Self-efficacy (.94), outcome expectations (.92) and intention to teach (.94) were found to be reliable. Because only one item assessed outcome value it was not tested for internal reliability.

To examine test-retest reliability, the test was administered to 20 health educators with experience teaching nutrition education, on two occasions, two weeks apart. The stability reliability correlation coefficient was .88 for self-efficacy, .89 for outcome expectations, .94 for outcome value and .91 for and intention to teach.

Procedures

The University's Institutional Review Board approved the study and all teacher participants provided written informed consent.

Table 1. Subject Characteristics (mean + Standard Error of the Mean)

	Intervention		Control	
	N = 30		*N* = 29	
Number of Schools	22		22	
Mean Age (SD)	45.4 ± 12.0		47.3± 7.8	
Years in Teaching	18.3 ± 3.0		16.8 ± 5.2	
Average Class Size	32		28	
	N	%	*N*	%
Gender				
Female	18	60	16	55
Male	12	40	13	45
Race				
African American	19*	63	2*	7
Asian	0	0	0	0
White	11*	37	26*	90
Other	0	0	1	3

* Indicates that there were significantly more African American teachers in the intervention group and significantly more white teachers in the control group. ($P < 0.05$)

Teacher In-service Training

Teachers who would be conducting the intervention in their classrooms participated in eight hours of in-service professional development on the Middle School Nutrition module: "What's Food Got to Do With It?" (Michigan Model®). The lessons contained material on the contents and benefits of the food groups, eating based on the food groups, reading food labels, body image, and surviving fast food restaurants and the school cafeteria (Figure 1). In an effort to determine the best teaching methods to use during the in-service, professional development specialists reviewed the literature and incorporated several best-practices that were deemed to be research-based recommendations. The following five recommendations were emphasized: (1) workshops should use active learning methods and avoid didactic lectures; (2) workshops should be conducted by personnel who are expert educators themselves with knowledge of the school contexts, but do not work for the schools participating in the project; (3) teachers should be compensated for their time; (4) programs should be supported by school administrators; and (5) teachers should be given all curriculum materials and associated instructional/supplementary resources needed to teach the full curriculum in the context of their home classrooms (e.g., in relation to class sizes, curricular time allotments, etc.).[23, 25]

The content of the in-service professional development focused on demonstrating appropriate ways to teach the curriculum using non-lecture, skill-based, active learning techniques where teachers first learned and then practiced with their peers. The workshop leader was both a certified professional development specialist in this curriculum as well as a certified health education teacher unaffiliated with the teachers' home school districts. Each teacher was provided with all of the materials necessary to teach the curriculum, as well as a modest stipend (because the training took place on Saturday, outside of contractual hours) and Continuing Edu-

Figure 1. Objectives for the Michigan Model Book, "What's Food Got To Do With It?"

Lesson 1: The Five Food Groups Revisited

Objectives: Upon completion of this lesson, the student will:
- Review and share information on the Five Food Groups
- Evaluate a typical Day's food intake for the presence of the Five Food Groups
- Gather nutritional information from restaurants in their community

Lesson 2: Nutrition Think Tanks

Objectives: Upon completion of this lesson, the student will:
- Investigate information on the Five Food Groups
- Design presentations for their peers to promote the health benefits of each of the food groups

Lesson 3: Good Nutrition Sells

Objectives: Upon completion of this lesson, the student will:
- Illustrate the benefits of eating foods from each of the Five Food Groups by conducting advertising campaigns
- Decide which of the selling points are most likely to influence them to eat foods from each of the Five Food Groups
- Select new foods from each of the food groups to add to their diets

Lesson 4: Unlocking the Secrets of Food Labels

Objectives: Upon completion of this lesson, the student will:
- Interpret nutrition information available on Nutrition Facts food labels
- Differentiate between foods that ate nutrient dense and foods that are low in nutrients

Lesson 5: Advertising Claims

Objectives: Upon completion of this lesson, the student will:
- Recommend foods for specific dietary goals by using the nutrition information available on food labels
- Recognize common health claims on food packages and in advertisements
- Predict the meanings of health claims on food packages
- Distinguish which are accurate health claims on food packages and advertisements in order to identify foods that have the most nutritional value

Lesson 6: Have a Healthy Body Image

Objectives: Upon completion of this lesson, the student will:
- Recognize the range of body types
- Summarize factors that determine body weight
- Choose to have a realistic view of a healthy body image
- Formulate guidelines for eating to share with their peers

Lesson 7: Fast Food Survival

Objectives: Upon completion of this lesson, the student will:
- Share guidelines for health, fast-food eating with their peers
- Identify healthier food choices they can make when eating at fast food restaurants

Lesson 8: Nutrition at School

Objectives: Upon completion of this lesson, the student will:
- Investigate the availability of nutritious foods in the school cafeteria
- Advocate for availability of appealing, nutritionally balanced lunches in the school cafeteria

Make a plan to improve their eating habits

cation Units (credits toward maintenance of their teaching licenses). In addition, principals agreed to provide teachers with the support necessary for them to implement the curriculum in their classrooms.

Researchers administered the pre-assessment surveys with the teachers at the beginning of the workshop. Teachers were asked to give their survey a unique four-digit code (such as the last four numbers of their cell phone) to match the instruments pre to post. The teachers were taught the curriculum at the workshop, received the resources, and returned to their schools to implement the curriculum over a six-week period. Teachers had complete freedom to select the best timeframe in which to deliver the curriculum as long as they completed their instruction in six weeks or less. Most teachers completed the eight lessons in ten consecutive 50-minute sessions. While the intervention group taught the nutrition curriculum, the control group taught other aspects of the required health education curriculum (e.g., social and emotional health, alcohol, tobacco and other drugs). During the implementation process teachers maintained a detailed log of their day to day lesson implementation. The written log contained each of the lessons divided into their individual components, and teachers checked off when they completed it and the amount of time they spent teaching each particular section. At least once per week, researchers went into the schools to provide any support the teachers needed, and answer any questions about the curriculum. Both the log and the school visits were used to ensure that the implementation teachers implemented the curriculum with fidelity and that the control group teachers avoided teaching nutrition content. Two weeks after the intervention teachers had completed all the nutrition lessons, the researchers returned to their schools to administer the post-assessment surveys.

Researchers administered the pre-assessment survey to the control group in the same week that it was administered to the intervention group. Members of the control group were reminded that they were not to conduct any nutrition education until completion of the post-assessment. After six-weeks, the post-assessment was administered. As part of the assessment, control teachers were asked about the content of their health lessons over the previous six weeks and verified that their lessons did not include nutrition.

Data Analysis

Each set of questions was totaled giving a subscale score which was analyzed separately using a 2-group (Intervention vs. Control) by 2-times (pre-post) ANOVA with repeated measures on the time factor. Individual questions were also analyzed separately using a 2-group (Intervention vs. Control) by 2-times (pre-post) ANOVA with repeated measures on the time factor to provide a more fine grained analysis. The statistical package used to run all analysis was SPSS (Ver. 16.0), Chicago, IL. Statistical significance was set at 0.05.

RESULTS

The analysis consisted of 59 matched pre/post surveys for a response rate of 100%. The descriptive information from the intervention and control teachers is contained in Table 1. Chi-square tests and t-tests used to compare the descriptive information determined that the control teachers only differed from the experimental teachers in race. There were more African American teachers in the group that received the intervention and more white teachers in the control group. No other statistically significant differences were detected between the intervention group and the control group prior to the intervention.

Table 2 represents pre-intervention and post-intervention scores for nutrition self-efficacy. There was a significant interaction between the two groups across testing times for nutrition self-efficacy ($F = 6.57$, $P = 0.001$). Teachers who participated in the professional development workshop had a significant increase in self-efficacy from pre-to-post and the post scores were significantly higher than the control teacher's post scores. The intervention teachers also had higher self-efficacy in 13 of the 16 individual measures after the intervention, including their beliefs that they could do a good job teaching nutrition ($F = 6.52$, $P = 0.023$), the food pyramid ($F = 8.12$, $P = 0.018$), the health benefits of each food group ($F = 4.59$, $P = 0.030$), serving sizes ($F = 3.56$, $P = 0.026$), reading food labels ($F = 9.14$, $P \leq 0.001$), the meaning of key words on a package ($F = 8.36$, $P = 0.001$), nutritional information ($F = 4.48$, $P = 0.032$), healthy weight ($F = 4.26$, $P = 0.004$), body image ($F = 8.62$, $P = 0.001$), the role that heredity, food selection and physical activity play in weight control ($F = 7.84$, $P = 0.002$), eating healthy at a fast food restaurant ($F = 6.62$, $P = 0.016$), understanding health content ($F = 4.56$, $P = 0.027$), and knowing the steps necessary to teach health effectively ($F = 7.06$, $P = 0.013$). There was no difference between the two groups in their beliefs that they could do a good job teaching nutrient density ($F = 1.16$, $P = 0.297$), understanding health education theory ($F = 1.04$, $P = 0.105$), or stimulating students to ask thoughtful questions ($F = 1.24$, $P = 0.114$).

Table 3 represents pre-intervention and post-intervention scores for nutrition outcome expectations. There was a significant interaction. Teachers who participated in the in-service had a significant increase in outcome expectations from pre-to-post ($F = 8.62$, $P = 0.001$) and significantly higher outcome expectations than the control teachers' post. The intervention teachers also had higher outcome expectations on all 11 of the individual measures. They were more likely to believe that if they did a good job teaching, their students would maintain a normal weight ($F = 6.48$, $P = 0.023$), eat according to the food pyramid ($F = 5.58$, $P = 0.018$), eat five fruits and vegetables a day ($F = 5.65$, $P = 0.030$), read food labels ($F = 6.46$, $P = 0.026$), eat a diet low in fat ($F = 13.21$, $P \leq 0.001$), eat a diet high in whole grains ($F = 9.65$, $P = 0.001$), evaluate nutrition information accurately ($F = 6.06$, $P = 0.032$), have a healthy body image ($F = 6.57$, $P = 0.004$), select nutrient-dense foods ($F = 4.62$, $P = 0.042$), eat healthy while at a fast food restaurant ($F = 7.26$, $P = 0.002$), and change unhealthy eating habits ($F = 9.43$, $P = 0.001$).

Table 2. Nutrition Education Related Self-Efficacy

Question:	Intervention		Control		*P*
	Pre	Post	Pre	Post	
I understand health education content well enough to be effective	2.5 ± 0.8 [a]	4.6 ± 0.5 [a,b]	2.6 ± 0.8	2.5 ± 0.8 [b]	0.027
I understand health education theory well enough to be effective	2.2 ± 0.7	2.0 ± 0.8	2.6 ± 0.6	2.5 ± 0.7	0.105
I know the steps necessary to teach health effectively	2.2 ± 0.8 [a]	4.7 ± 0.5 [a,b]	2.2 ± 0.4	2.2 ± 0.6 [b]	0.013
I believe I can stimulate students to ask thoughtful questions	3.2 ± 0.5	3.1 ± 0.5	3.4 ± 0.6	3.2 ± 0.8	0.114
I believe I can do a good job teaching students about/to:					
nutrition	2.4 ± 0.7 [a]	4.8 ± 0.5 [a,b]	2.2 ± 0.5	2.3 ± 0.6 [b]	0.023
the food pyramid	2.4 ± 0.8 [a]	4.7 ± 0.5 [a,b]	2.3 ± 0.6	2.2 ± 0.5 [b]	0.018
the health benefits of each food group	2.0 ± 0.7 [a]	4.5 ± 0.5 [a,b]	2.1 ± 0.7	2.0 ± 0.9 [b]	0.030
serving sizes	2.0 ± 0.7 [a]	4.4 ± 0.6 [a,b]	2.2 ± 0.9	2.1 ± 0.8 [b]	0.026
read food labels	2.4 ± 0.8 [a]	4.5 ± 0.6 [a,b]	2.4 ± 0.5	2.4 ± 0.4 [b]	0.001
words on packages such as: "lite," "lean," etc.	2.4 ± 0.8 [a]	4.6 ± 0.6 [a,b]	2.2 ± 0.8	2.3 ± 0.4[b]	0.001
evaluate nutritional information for accuracy	2.1 ± 0.7 [a]	4.6 ± 0.5 [a,b]	2.0 ± 0.6	2.1 ± 0.2 [b]	0.032
healthy weight	2.3 ± 0.7 [a]	4.6 ± 0.7 [a,b]	2.3 ± 0.6	2.4 ± 0.9 [b]	0.004
healthy body images	2.6 ± 0.7 [a]	4.7 ± 0.6 [a,b]	2.8 ± 0.9	2.7 ± 0.7 [b]	0.001
the role that heredity, food selection, and activity level play in weight control	2.6 ± 0.7 [a]	4.8 ± 0.6 [a,b]	2.6 ± 0.5	2.6 ± 0.8 [b]	0.002
nutrient density	2.2 ± 0.8	2.2 ± 0.5	2.2 ± 0.8	2.2 ± 0.8	0.297
eating healthy while at a fast food restaurant	2.0 ± 0.6 [a]	4.3 ± 0.6 [a,b]	2.6 ± 0.2	2.5 ± 0.6 [b]	0.016
Total self-efficacy	41.6 ± 3.5 [a]	62.4 ± 7.5 [a,b]	41.2 ± 3.2	40.2 ± 3.5[b]	0.001

1 = strongly disagree; 5 = strongly agree
Superscript (a) indicates a significant difference in the intervention group pre- post.
Superscript (b) indicates a significant difference between the intervention group and the control group at post.
P values represent overall F test.

Table 4 represents pre- and post-scores for intentions to teach nutrition content. There was a significant time main effect from pre-post ($F = 7.14$, $P = 0.001$) for the intervention teachers. Specifically, changes occurred in six out of the eight measures: interpreting food labels, the meaning of product claims, the influences on body image, factors that contribute to weight control, eating healthy in a fast food restaurant, and developing a healthy body image. There were no significant differences in their intentions to teach the food pyramid or food groups.

Table 5 represents pre- and post-scores for outcome value. Teachers who participated in the in-service had a significant increase in the importance of conflict resolution skills ($F = 6.24$, $P = 0.018$) and personal health skills ($F = 5.91$, $P = 0.026$). They also were higher in these measures than the control group at post-test.

DISCUSSION

The purpose of this study was to use Social Cognitive Theory and the Theory of Planned Behavior to determine middle school health education teachers' self-efficacy, outcome expectations, outcome values and intentions to teach a nutrition curriculum before and after a professional development intervention. Results of this study indicate that the professional development was effective at increasing all variables with the intervention teachers, and that the intervention teachers scored higher than the control teachers in nearly all areas post-intervention. This is crucial because previous research has demonstrated that teacher professional development often results

Table 3. Nutrition Education Outcome Expectations

Question:	Intervention		Control		*P*
	Pre	Post	Pre	Post	
I believe if I can do a good job teaching, the students I teach will be more likely to:					
maintain a normal weight	2.0 ± 0.6 [a]	4.3 ± 0.6 [a,b]	2.1 ± 0.5	2.2 ± 0.6 [b]	0.023
eat according to the food pyramid	2.3 ± 0.9 [a]	4.5 ± 0.6 [a,b]	2.3 ± 0.6	2.2 ± 0.5 [b]	0.018
eat 5 fruits and vegetables a day	2.2 ± 0.7 [a]	4.6 ± 0.6 [a,b]	2.1 ± 0.7	2.0 ± 0.9 [b]	0.030
read food labels	2.5 ± 0.8 [a]	3.7 ± 0.6 [a,b]	2.2 ± 0.9	2.1± 0.8 [b]	0.026
eat a diet low in fat	2.8 ± 0.8 [a]	3.8 ± 0.8 [a,b]	2.7 ± 0.5	2.6 ± 0.4 [b]	0.001
eat a diet high in whole grains	2.4 ± 0.7 [a]	4.7 ± 0.6 [a,b]	2.3 ± 0.8	2.3 ± 0.4 [b]	0.001
evaluate nutrition info accurately	2.6 ± 0.8 [a]	3.9 ± 1.0 [a,b]	2.2 ± 0.6	2.1 ± 0.2 [b]	0.032
have a healthy body image	2.5 ± 0.9 [a]	3.9 ±0.8 [a,b]	2.4 ± 0.6	2.4 ± 0.9 [b]	0.004
select nutrient dense foods	2.3 ± 0.8 [a]	3.7 ± 0.7 [a,b]	2.5 ± 0.9	2.5 ± 0.7 [b]	0.042
eat healthy while at a fast food restaurant	2.6 ± 0.8 [a]	4.9 ± 0.8 [a,b]	2.6 ± 0.5	2.6 ± 0.8 [b]	0.002
change their eating habits	2.4 ± 0.7 [a]	4.9 ± 0.8 [a,b]	2.3 ± 0.8	2.3 ± 0.4 [b]	0.001
Total Outcome Expectations	28.6 ± 2.7 [a]	51.9 ± 2.8 [a,b]	27.4 ± 2.8	27.5 ± 2.4 [b]	0.001

1 = strongly disagree; 5 = strongly agree
Superscript (a) indicates a significant difference in the intervention group pre- post.
Superscript (b) indicates a significant difference between the intervention group and the control group at post.
P values represent overall F test.

in improved student learning outcomes.[5, 26-31] We found even more support for this assertion by demonstrating that teachers may experience significant changes in their efficacies and intentions related to teaching these curricula which are logical precursors to the student health outcomes identified in previous research.

Following this in-service, teachers in the intervention group not only increased their self-efficacy scores but scored significantly higher than the control group teachers. Teachers in the intervention group had higher efficacy than their peers in multiple areas including, but not limited to: their beliefs they could do a good job teaching about nutrition; the food pyramid; the health benefits of each food group; and healthy eating habits at fast food restaurants. This group also had higher efficacy in both understanding health content and knowing the necessary strategies to effectively teach health. This is critical, as previous research has demonstrated that self-efficacy is directly related to time spent teaching nutrition,[8, 9] and that teachers who received training are more likely to both implement a curriculum and continue teaching it in the future.[15]

In the past three decades, the adolescent population has experienced a decrease in foods eaten in the home paired with an accompanying increase in food consumption away from home.[24] Consumption of food away from home has been associated with increased consumption of empty calories in the form of soft drinks, saturated fats and sodium.[32] In adult females, the consumption of one additional fast food meal per week resulted in weight gains of 1.6 pounds over a 3-year period.[24] This increase in away from home eating resulting in undesirable food intake is also associated with decreases in desirable food intake such as fruits, vegetables and fiber.[32] Increased teacher efficacy, outcome expectations and outcome values, leading to both increased intentions to teach nutrition education (as shown in this study) and corresponding increases in students' nutritional behaviors, attitudes and knowledge (as demonstrated in similar studies), may be a key factor in changing some of these poor nutritional habits in adolescents. In fact, documentation of this trend is already emerging.

Fahlman and colleagues[5] provided in-service training in a nutrition curriculum, and after implementation, students in the intervention group proved less likely to eat non-nutritious foods and more likely to eat fruits and vegetables than control group students without nutrition education. Similar results are reported by other authors investigating the effects of nutrition education on the eating behaviors of school-aged children. Powers and colleagues,[33] for example, reported significant changes in

Table 4. Intentions to Teach

Question:	Intervention		Control		*P*
	Pre	Post	Pre	Post	
I intend to teach students:					
about the food pyramid	4.0 ± 0.6	4.3 ± 0.6	4.1 ± 0.5	4.2 ± 0.6	0.123
about the food groups	4.3 ± 0.9	4.5 ± 0.6	4.3 ± 0.6	4.2 ± 0.5	0.218
to interpret food labels	2.2 ± 0.7 [a]	4.0 ± 0.6 [a]	2.1 ± 0.7	2.0 ± 0.9	0.030
what product claims such as: "lite," "low fat," etc., mean	1.5 ± 0.8 [a]	4.7 ± 0.6 [a]	1.2 ± 0.9	1.1 ± 0.8	0.026
about the influences on body image	2.8 ± 0.8 [a]	4.8 ± 0.8 [a]	1.7 ± 0.5	1.6 ± 0.4	0.001
about the factors that contribute to weight control	3.4 ± 0.7 [a]	4.7 ± 0.6 [a]	3.3 ± 0.8	3.3 ± 0.4	0.001
how to eat healthy while in a fast food restaurant	1.6 ± 0.8 [a]	4.9 ± 1.0 [a]	1.2 ± 0.6	1.1 ± 0.2	0.032
how to have a healthy body image	1.5 ± 0.9 [a]	3.9 ± 0.8 [a]	1.4 ± 0.6	1.4 ± 0.9	0.001
Total Intention to Teach	18.2 ± 3.2 [a]	33.2 ± 2.6 [a]	17.6 ± 1.6	17.9 ± 2.2	0.001

1 = strongly disagree; 5 = strongly agree. Superscript (a) indicates a significant difference in the intervention group pre- post.
P values represent overall F test.

Table 5. Outcome Value

	Intervention		Control		*P*
	Pre	Post	Pre	Post	
Rank the importance of the skills that students will need as an adult to function adequately in society					
Computer Skills	5.4 ± 0.7	5.8 ± 0.5	5.8 ± 0.5	5.3 ± 0.6	0.232
Conflict resolution skills	3.4 ± 0.8 [a]	4.7 ± 0.5 [a,b]	3.3 ± 0.6	2.2 ± 0.5 [b]	0.018
Math skills	1.0 ± 0.7	1.5 ± 2.5	1.1 ± 0.7	1.6 ± 0.9	0.056
Personal health skills	2.0 ± 0.7 [a]	4.4 ± 0.6 [a,b]	2.2 ± 0.9	2.1 ± 0.8 [b]	0.026
Reading skills	5.4 ± 0.8	5.5 ± 0.6	5.4 ± 0.5	5.4 ± 0.4	0.231
Writing Skills	2.4 ± 0.8	2.6 ± 1.6	2.2 ± 0.8	2.3 ± 0.4	0.061

1 = least important; 6 = most important
Superscript (a) indicates a significant difference in the intervention group pre- post.
Superscript (b) indicates a significant difference between the intervention group and the control group at post.
P values represent overall F test.

the dietary behavior of elementary school children following the implementation of a new curriculum. Specifically, after teacher professional development and new curriculum implementation, students in the intervention group significantly increased their consumption of fruits, vegetables and dairy products.

The teachers in the intervention group in this study also experienced significant increases in their outcome expectations. They were more likely to believe that if they did a good job teaching nutrition, their students would eat according to the food pyramid, eat five fruits and vegetables a day, eat a diet lower in fat, eat more whole grains and eat healthier at fast food restaurants. Current research has found that only

22.3% of adolescents eat the recommended servings of fruits and vegetables and only 14.5% meet the recommendations for dairy product consumption in the previous week.[1] While self-efficacy is more directly linked to time spent teaching nutrition,[8, 9] researchers have consistently demonstrated that professional development increases and improves teacher' instruction.[13, 14, 22] Increased and improved instruction has been linked to positive changes in adolescent nutrition behaviors, efficacy and knowledge.[5, 34-37]

There is limited research linking intention to teach with subsequent student behavior change. However, this current research indicating that in-service teacher education influences intentions to teach and comfort with curriculum, combined with multiple previous studies linking quality teaching with positive student behavior change, [5, 20, 26-28, 31, 33] is the beginning of an effort to link teaching to student behavior. Clearly, more research in this area is necessary. In short, our study has begun examining the link between teachers' professional development, indicators of efficacy, expectation, instructional intentions and behaviors in the classroom related to nutrition education. The evidence is mounting that teachers who have strong intentions to teach, coupled with administrative support and a high self-efficacy regarding teaching, are more likely to teach effective nutrition education.

Limitations

Three study limitations need to be acknowledged. First, teachers' willingness to participate in the study may have biased the findings towards success. Second, due to the small sample size, generalizations from this study to teachers at large need to be made with caution. Finally, this study only addressed teachers' nutrition self-efficacy a few weeks after the training session thus no conclusions can be drawn regarding a long-term impact.

TRANSLATION TO HEALTH EDUCATION PRACTICE

Whereas this study has some degree of relevance for pre-service teacher education programs, it provides specific direction for school districts about how to set up a professional development system that will boost a host of important psychosocial teacher variables. In turn, this may translate into more and better nutrition education classroom instruction and enhanced student outcomes. Altering children's nutrition, whether it be their eating practices, knowledge about healthy eating, or efficacy toward eating well, is clearly best achieved through a comprehensive school approach that has policy/environmental (e.g., school lunches, vending access and stocking, food as rewards, food served at classroom celebrations) and educational (e.g., formal health and physical education curriculum, educational posters in the lunchroom, healthy cooking demonstrations on parent nights) components.

This in-service training included a number of components designed to enhance the experience for teachers: (1) the training was focused on giving teachers the skills they need to use, specifically non-lecture, active learning methods; (2) the training was conducted by personnel not working for the school; (3) the teachers were compensated; (4) the program was supported by school administrators; and (5) teachers were given all curriculum materials and associated instructional/supplementary resources needed to teach the full curriculum in the context of their home classrooms (e.g., in relation to class sizes, curricular time allotments, etc.).[23, 25] In turn, the teachers successfully implemented the curriculum in their schools.

Professional development is essential, especially as teachers proceed across their careers, amid often dramatic changes in disciplinary research (e.g., nutritional guidelines), student populations and population trends, and advances in curriculum design. In short, the content of the professional development that is offered to teachers is absolutely essential in determining whether substantive shifts in the logical flow of education improvement from teacher learning, to teachers' psychosocial variables, to classroom instruction to student outcomes will be maximized. This study provides support for the fact that improvements to the formal curriculum component are not only possible, but, in fact, likely if engineered properly.

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REFERENCES

1. Center for Disease Control and Prevention. Youth risk behavior surveillance—United States, 2009. *MMWR*. 2010;59(ss-5):1-142. Available at: http://www.cdc.gov/HealthyYouth/nutrition/index.htm Accessed November 10, 2010.

2. United States Department of Health and Human Services: *The obesity epidemic and United States students.2009*. Available at: http://www.cdc.gov/HealthyYouth/yrbs/pdf/us_obesity_combo.pdf Accessed November 10, 2010.

3. Birch L, Fisher J. Development of eating behaviors among children and adolescents. *Pediatrics.* 1998;101:539-549.

4. National Center for Educational Statistics. *Participation in education*. U.S. Department of Education, 2010. Available at: http://nces.ed.gov/programs/coe/2010/section1/indicator02.asp. Accessed November 10, 2010.

5. Fahlman MM, Dake J, McCaughtry N, Martin J. A pilot study to examine the effects of a nutrition intervention on knowledge, behaviors and self-efficacy in middle school children. *J Sch Health.* 2008;78(4):216-222.

6. Contento I, Koch O, Lee H, et al. Enhancing personal agency and competence in eating and moving: formative evaluation of a middle school curriculum-choice, control and change. *J Nutr Educ Behav.* 2007;39:179-186.

7. Bandura A. *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs: Prentice-Hall, 1986.

8. Brenowitz N, Tuttle CR. Development

and testing of a nutrition teaching self-efficacy scale for elementary school teachers. *J Nutr Educ Behav.* 2003;35:308-311.

9. Schempp PG, Manross D, Tan SKS, Fincher MD. Subject expertise and teacher's knowledge. *Journal of Teaching in Physical Education.*1998;17:342-356.

10. Parcel GS, Edmundson E, Perry CL, et al. Measurement of self-efficacy for diet related behaviors among elementary school children. *J Sch Health.* 1995;65(1):23-27.

11. Brandon DP. Self-efficacy: gender differences of prospective primary teachers in Botswana. *Res Educ.* 2000;64:36-43.

12. Rossiter M, Glanville T, Taylor J. School food practices of prospective teachers. *J Sch Health.* 2007; 77(10):694-700.

13. Everett SA, Price JH, Telljohann SK, Durgin J. The elementary health teaching self-efficacy scale. *Am J Health Behav.* 1996;20(3):90-97.

14. Smith DW, McCormick LK, Steckler AB, McLeroy KR. Teachers use of health curricula: implementation of Growing Healthy, Project SMART, and the Teenage Health Teaching Modules. *J Sch Health.* 1993;63(8):349-354.

15. Britten P, Lai MK. Structural relationships among elementary teachers' training, self-efficacy, and time spent teaching nutrition. *J Nutr Educ* 1998;30(4):218-224.

16. Stang J, Story M, Kalina B. Nutrition education in Minnesota public schools: perceptions and practices of teachers. *J Nutr Educ.* 1998;30(6):396-404.

17. Ajzen I, Madden TJ. Prediction of goal directed behavior: attitudes, intentions, and perceived behavioral control. *J Exp Soc Psychol.* 1996;22:453-474.

18. Kulinna PH, McCaughtry N, Maratin JJ, et al. The influence of professional development on teachers' psychosocial perceptions of teaching a health related physical education curriculum. *Journal of Teaching in Physical Education.* 2008;27:289-304.

19. Hausenblas HA, Carron AV, Mack DE. Application of the theories of reasoned action and planned behavior to exercise behavior: A meta-analysis. *Journal of Sport & Exercise Psychology.* 1997;19:36-51.

20. Probart C, McDonnell E, Achterberg C, Anger S. Evaluation of implementation of an interdisciplinary nutrition curriculum in middle schools. *J Nutr Educ.*1997;29(4):203-209.

21. Telljohann SK, Everett SA, Durgin J, Price JH. Effects of an inservice workshop on health teaching self-efficacy of elementary school teachers. *J Sch Health.* 1996;66(7):261-265.

22. Everett-Jones S, Brener ND, McManus T. The relationship between staff development and health instruction in schools in the United States. *Am J Health Promot.* 2004;35(1):1-10.

23. Chen W, Dorman S, Rienzo B. Impact of continuing health education inservice programs on teachers' competencies. *Health Education.*1990;21(6):8-11.

24. French SA, Harnack L, Jeffrey RW. Fast food restaurant use among women in the Pound Prevention Study: dietary, behavioral and demographic correlates. *Int J Obes.* 2000; 4:1353 - 1359.

25. Hutson HM. Inservice best practices: the learnings of general education. *Journal of Research and Development in Education*. 1981;14(2):1-9.

26. Harris KJ, Andrews-Paine A, Richter KP, et al. Reducing elementary school children's risk for chronic diseases through school lunch modifications, nutrition education, and physical activity interventions. *J Nutr Educ.* 1997;29(4):195-202.

27. Luepker RV, Perry CL, McKinlay SM, et al. Outcomes of a field trial to improve children's dietary patterns and physical activity. *JAMA.* 1996;275(10):768-776.

28. Lytle LL, Stone EJ, Nichman MZ, et al. Changes in nutrient intakes of elementary school children following a school-based intervention: results from the CATCH Study. *Prev Med.* 1996;25:465-477.

29. Miles G, Eid S. The dietary habits of young people. *Nursing Times.* 1997;93(50):46-48.

30. Ross JG, Luepker RV, Nelson GD, et al. Teenage health teaching modules: impact of teacher training on implementation and student outcomes. *J Sch Health.* 1991;61(1):31-34.

31. Watt RG. Stages of change for sugar and fat reduction in an adolescent sample. *Community Dent Heath.* 1997;14:102-107.

32. St-Onge M-P, Keller KL, Heymsfield SB. Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights. *Am J Clin Nutr.* 2003;78:1068-1073.

33. Powers AR, Struempler BJ, Guarino A, Palmer SM. Effect of a nutrition education program on the dietary behavior and nutrition knowledge of second grade and third grade students. *J Sch Health.* 2005;75(4):129-133.

34. Centers for Disease Control and Prevention. Guidelines for school health programs to promote healthy eating. *MMWR.* 2008;45(rr-9):1-33.

35. Levine E, Orlander C, Lefebve C, et al. The team nutrition pilot study: lessons learned from implementing a comprehensive school-based intervention. *J Nutr Educ Behav.* 2002;34:109-116.

36. Lytle LA, Fulkerson JA. Assessing the dietary environment: examples from school based nutrition interventions. *Public Health Nutr.* 2002;5(6a):893-899.

37. Perez-Rodrigo C, Aranceta J. School based nutrition education: lessons learned and new perspectives. *Public Health Nutr.* 2001;4(1a):131-139.