Mal J Nutr 10(1): 31-37, 2004

Effectiveness of Various Nutrition Education Teaching Methods for High School Students: a Case Study in Alabama, United States

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ABSTRACT

This study examined a nutrition education program consisting of two content sessions: food-label reading, and food pyramid guide. In each session two groups of nutrition interns utilized four teaching methods: role-play/video presentation/display, grocery store tour, overhead transparency and lecture, and power point lecture, among a group of (N = 29) ninth grade, high school students. The purpose was to determine the most effective method of delivering nutrition education to high school students. Analysis using the Kruskal Wallis One-way Analysis of Variance showed that the combination method of role-playing/video presentation/visual display was most effective in the food pyramid session ($\chi^2 = 8.13$, $p = .04$). While this method was given the highest rank in the food-label reading session it was not statistically significant. These results show that a combination of methods classified as the teacher's style, is more effective than a style that involves a single teaching method.

INTRODUCTION

Eating disorders have drastically increased the prevalence of chronic diseases among Americans (Dudek, 2001). However, chronic disease prevalence has been significantly greater among minority groups. In 2001, about 1.6 million out of 2.3 million African Americans were diagnosed with diabetes. Death rates from diabetes are 26.9% higher for African Americans compared to Whites (CDC, 2001). Most African Americans, however, suffer from type 2 diabetes, a type of chronic disease that is preventable through proper diet (Mahan *et al.,* 2000). Prevention efforts in terms of nutrition education programs should be started as early as possible for young people (Sizer *et al.,* 2000). In order for positive nutrition behavior to become a permanent part of lifestyle habits, nutrition education must be delivered to young persons. This is a very challenging task since most of them do not care about nutrition (Sovyanhadi, 2001). In order to accomplish the objective of good nutrition habits, the teaching methods used to deliver these messages must be tried and proven as effective. This study attempts to advance the understanding of teaching methods in nutrition, and their effectiveness for African American teenagers. The site used for this study was the Oakwood Academy Seventh-day Adventist School in Huntsville, Alabama. It is a historically Black high school with students coming from diverse geographical, cultural, educational, and socioeconomic backgrounds (Oakwood Academy Handbook, 2001-2002). This school was therefore chosen because the diversity of the student body has the potential to contribute to the external validity of the findings for teenagers

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in general, and more specifically, African American teenagers. In this setting, this study will compare results of four teaching methods on improvement of students' knowledge of nutrition, with the view of determining which method is the most effective.

Popular methods of teaching

McCarthy (1992) gives a summary of common teaching methods, with an outline of strengths and limitations of each method. The lecture method is regarded as the most basic presentation style for factual material in direct logical manner. Its limitations include the chance of having a passive audience, and its difficulty to gauge. When combined with discussion, this method has some added strengths, such as allowing the audience to ask questions, clarify information, and challenge opinions. Yet, this combination has a weakness – its tendency to limit the quality of questions and discussion.

Another method that has become popular in recent times is teaching by videotape. It is recognized as an entertaining way of teaching content and raising issues, keeping the group's attention, and giving a look of professionalism to the presenter. However this method tends to limit participation, and raise focused discussion on too many peripheral issues.

Other methods promote more interaction. The small group discussion method tends to allow a great deal of participation, promotes comfort among the participants, and ease of reaching group consensus. The presenter needs to give careful thought to preparation, to prevent the group from becoming sidetracked. The role-playing method introduces problem situations dramatically, provides an opportunity for people to assume roles of others, and allows for explorations of solutions, and gives opportunities to practise skills. The limitations are that people may feel threatened, and self-conscious. This method may not be appropriate for large groups.

Besides such broad approaches which are classified as 'methods', teachers may use different teaching 'styles'. Teaching styles refer to the procedures or processes adopted and employed by the teacher in order to achieve the day-to-day objectives of the lesson. Style includes the conglomerations of one's views, convictions, and approaches. More specifically, teaching styles are the personal attributes of the teacher (Salem, 2001). Teaching styles may be classified as: (1) visual – utilizing pictures, sketches, diagrams, graphs, and other related illustrations, (2) auditory – teacher lectures or gives explanations, (3) tactile – teacher uses hands-on activities, (4) kinesthetic – students are engaged in physical movements, (5) group – teacher adopts group interaction and discussion, and (6) individual – teacher uses recitations, individual projects and attention (Soliven, 2003).

Some literature supports the notion that a combination of methods, along with the teacher's own unique talents, which translates to what Soliven (2003) terms style, can be very effective. Visual teaching can be a written lesson on the board or projector screen, while auditory aids may be given as oral instructions and directions to the students. When combined with hands-on activities, individual interaction/assignments and group discussions, this combination may further improve the quality of the student-teacher interaction (Solomon, 2003; Rosal, 2001).

Successful teaching is a complex process. It involves a good teaching style (in terms of teacher's preparation and motivation), a good learning style (in terms of students' way of learning, preparation and motivation), and an effective student-teacher interaction (in terms of a good match between teaching style and learning style). An effective student-teacher interaction includes all manner of visual and auditory support and appropriate use of instructional technology. A good teaching style, and effective student teacher interactions help to increase retention and make learning enjoyable for the students (Charles, 2003; Soliven, 2003).

Purpose

The purpose of this study includes the following:

1. To determine the most effective method of delivering nutrition education to Oakwood Academy High School students.
2. To serve as a pilot study for other preventive care agencies serving African American teens.

MATERIALS AND METHODS

The subjects for this study were selected using convenience sampling, and consisted of 29 tenth-grade students, 15 males and 14 females, aged 16-17 years. The students were informed that they would receive some small incentives for participating in this study. The subjects were randomly divided into four groups, and then received nutrition education sessions administered by teams from the 2001-2002 dietetic interns from Oakwood College Dietetic Internship Program in Huntsville, Alabama. Two sessions separated by a one-week time span were presented to each group of students. Each session lasted one week, and the actual class period lasted for one hour.

Sessions

The two sessions were titled the "Food Guide Pyramid" session and the "Reading Food Labels" session. During the "Food Guide Pyramid" session, each team of interns taught their students the basic facts about the food guide pyramid; introduced them to the individual food groups of the pyramid such as grains and breads, fruits and vegetables, meat and milk, and fats and sweets; discussed with them about the nutrients that can be obtained from each food group, informed them the advantages and drawbacks of the food guide pyramid; and showed them how to use the food guide pyramid as a guide to plan a healthy diet for people of various age and gender groups.

During the "Reading Food Label" session, the following types of information were delivered: Nutritional facts, definition of serving sizes, servings per container, amount per serving, calories and calories from fat, total fat, saturated fat, cholesterol, sodium, total carbohydrates, dietary fiber, sugars, protein, vitamins, and minerals; discussion of the label laws pertaining to those definitions, healthy suggestions regarding each definition, and presentation and explanation of "Label Lingo". The information content of each session was the same. The method of evaluation was also the same for both sessions. The students were given a pre-test before instruction, exposed to the information by the interns, and the post-test was delivered as a final evaluation.

Teaching methods

There were three class periods for each session, and each class period lasted one hour each. At each class period, four classes were taught concurrently, with one method for each class. The four teaching methods used were (I) role-playing with video presentation and display; (II) grocery store tours with discussion, (III) overhead transparencies, with a "Jeopardy-type" game; and (IV) Power Point, with "Jeopardy" game. Although the methods were different, the content was the same. The role-playing with video presentation and display method utilized a great deal of one-on-one interaction. First, the interns showed the students videos on the topics. They then set up some visual aids and hands-on displays to deliver the information, and followed this with a discussion of the displays. As students raised questions, the interns were able to give immediate feedback. In this way each student's questions were thoroughly answered.

For the method of grocery store tours with discussion, the interns taught the students through handouts, and then took them to grocery stores. At the grocery stores, the students participated in activities such as going through the aisles to find foods from various food groups, reading food labels, and participating in a healthy snack scavenger hunt.

As a third method, the interns taught the students with the use of overhead transparencies to present the information, and a "Jeopardy-type" game to review the material with the students and see how much information they retained. The fourth method used by the interns was teaching with a Power Point presentation and then reviewing and assessing the students through the "Jeopardy" game.

The Program Director and the interns designed a uniform pre-test that was administered to all subjects before the sessions, and a post-test that was administered immediately after all sessions were completed. On the final day of the study, the students participated in a cooking demonstration coordinated by the Program Director and all of the dietetic interns. At this time, students who scored highest on their post-test for each method were given prizes.

While there was no student evaluation of the teaching method, the students' performance, as measured by the score difference between the post-test and pre-test, was accepted as a proxy measure of the effectiveness of the method. The statistical difference among the four teaching methods was analyzed using Kruskal Wallis One-Way ANOVA by Ranks Test. The pre-test scores were first analyzed in order to determine if there were differences among the four groups of students regarding their pre-existing knowledge about each topic.

RESULTS

Pre-test score analysis

Results of the analysis of pre-test scores are shown in Table 1.

Table 1 shows that the ranking of the label reading scores ranged from 14.13 to 18.17. The chi-square value of this range of ranking was not significant at the .05 level. The ranking of the food

pyramid group was likewise not significant. This indicated that before the presentations were given, there were no differences among the four groups of students in terms of their pre-existing knowledge of the Food Guide Pyramid.

Improvement of students' performance

Although our main interest was not whether or not there was improvement in students' knowledge on the topics in which they received information, we nevertheless investigated this notion. Table 2 shows results of the comparison of pre- and post-test scores, using the Wilcoxon Matched-Pairs Signed-Ranks Test.

Table 1. Kruskal Wallis One-Way ANOVA by Ranks Test showing mean ranking of raw scores among groups on pre-tests

	Label reading			Food pyramid		
Method	N	Rank	χ^2	N	Rank	χ^2
Role play/video	8	14.13		6	16.17	
Grocery tour	6	14.08		7	18.29	
Transparency	6	18.17		7	12.93	
Power Point	9	14.28	1.09^{NS}	9	13.28	1.99^{NS}
Total	29			29		

The Wilcoxon Signed-Ranks Test uses rankings instead of means. However, means were supplied for ease of interpretation. The Wilcoxon Signed-Ranks Test shows that all methods resulted in significant knowledge gains, in that the post-test scores were significantly higher than the pre-test scores for all methods, across both sessions (all methods $p < .05$). The total row shows an even more significant difference (for both sessions $p < .001$). This is possibly a function of larger sample size.

Comparison of teaching methods

Since all the teaching methods were effective in improving students' knowledge, the perspective used in this analysis is that the comparative effectiveness of any single method lies in its ability to show a statistically significant effect above and beyond any other method or methods. In this regard, the post-test score differences, or improvements in the post-test scores over the pre-test scores, were compared among the groups represented by the different teaching methods. Table 3 shows the results of this analysis.

This analysis indicated that for the Food Label Reading session, there was no statistically significant difference in the post-test score differences among the teaching methods used by the interns ($\chi^2 = 5.12$, $p = .16$). This result indicates that there was no statistically significant difference in any single method used in the Food Label Reading session. However, it should be noted that the ranking of the role play/video/display combination method is somewhat higher than the other methods, although the range of the difference is not great enough to be considered significant at the .05 level of significance.

Table 2. Showing means, differences, and Wilcoxon Matched-Pairs Signed-Ranks Test

Method	Label reading					Food guide				
	N	Pre-Test Mean	Post Test Mean	Diff.	Wilcoxon z	N	Pre-Test Mean	Post Test Mean	Diff	Wilcoxon z
Role play/vid	8	39.7	96.5	56.8	2.5*	6	48.6	86.5	37.8	2.5*
Grocery tour	6	40.9	77.2	36.3	2.2*	7	54.1	78.8	24.7	2.0*
Transparency	8	48.5	93.9	45.4	2.2*	7	42.5	55.7	13.1	2.2*
Power Point	8	41.4	82.8	41.3	2.5*	9	44.5	74.1	29.5	2.4*
Total	29	42.3	87.7	45.4	4.6***	29	47.2	73.3	26.1	4.4***

Note: *p< .05, ***p< .001.

Table 3. Kruskal Wallis One-Way ANOVA by Ranks Test showing mean ranking of score differences among groups on post-test

Method	Label reading			Food pyramid		
	N	Rank	χ^2	N	Rank	χ^2
Role Play/video	8	20.31		6	21.50	
Grocery Tour	6	10.67		7	13.86	
Transparency	6	14.75		7	8.50	
Power Point	9	13.33	5.12^{NS}	9	16.61	8.13*
Total	29			29		

* p <.05, ^{NS} not significant p >.05

For the Food Pyramid session there is a significant difference among the rankings of the score differences (χ^2 = 8.13, p = .04). A comparison of these rankings indicates that the highest is the role play/video/display combination display method. This analysis therefore shows that the role play/display method is more effective than one or more of the other teaching methods in terms of the results it has yielded in student performance in the Food Pyramid session.

DISCUSSION

Teens are naturally at greater nutritional risk (Whitney, 2001). Therefore, any method which may promote a better nutritional status among teenagers should be actively pursued (Grodner, 2000). Administering a nutrition education program is an effective way to introduce healthy eating habits to these teens. In this case, as educators have agreed, teaching methods play important roles in positively affecting teens' behavioral changes (Kubik, 2001). This study shows that there was a definite increase in knowledge after one week of nutrition education. We consider an increase in knowledge as the first basic step in improving the nutritional status of teens.

In the effort to identify the most effective of the four teaching methods used in this study (role play/video/display, grocery tour, transparency and power point) statistical evidence points to role play as the most effective. This method was statistically higher ranked than at least one other method used in this session. With the food label-reading session, this method was not statistically higher, but approached significance.

The role play/display group was allowed to dialogue, ask questions, and get immediate feedback to their queries. In such one-on-one interaction, more attention can be focused on helping the student to understand the topic under discussion before moving on to the next step. According to the classification of Soliven (2003), this method contains visual, tactile, kinesthetic, and group teaching styles. Throughout their lessons the interns who utilized this combination method, used video, which contains pictures and illustrations; they also allowed group discussion, and provided students with opportunities to do hands-on activities, which allowed the students to move and interact while learning.

The other methods may not have been able to hold the interest of these students. Interest in the study of dietetics among this group was very low. In fact a previous study at this school showed that that almost all students from this group did not intend to be professionals in dietetics/nutrition (Sovyanhadi, 2001). In the context of these students therefore, the other methods may not have promoted the most positive learning environment for them. The Power Point method might have induced sleepiness by creating a dark environment for what may have appeared like a long time to the students. Taking the students to the grocery stores for educational purposes might have been greatly affected by the store environment that easily distracted their attention.

CONCLUSION

While we are cautious in applying the findings of this study to African American students at large, we feel that these findings begin to help us understand the ways in which high school students may be motivated to learn nutrition facts, and move towards implementing better nutrition lifestyles. The results of this study suggest that in order to address nutritional topics to high school students, teachers should cleverly use a variety of teaching methods to gain students' interest and to relate to the various learning styles of the students. The importance of finding an effective method or style of teaching nutrition to high-school students can further be related to its potential for long-term benefits. The habit of maintaining a proper diet can prevent the occurrence of chronic diseases. This will allow young persons to look forward to a longer life of better quality, and more energy to pursue their own happiness and serve humanity better.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the 2001-2002 interns; Jennifer Dennis, MS, RD, Rebecca Faulkner, RD, D'juan Jenkins, BS, Julie McMillin, RD, Sarah Olds, RD, LD, Voletta Perkins, RD, Jennifer Roberts, RD, Mary Rooney, MPH, RD, LDN, and Tresea Williams, RD, LD for their dedication and contribution to this project.

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