The Impact of A Computerized Dietary Assessment On Nutrition Knowledge

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Abstract

English:

In recent years, many health educators have integrated computer applications into their health education program interventions. The assessment of the impact of these interventions is limited. This study assessed the impact of the Pyramid Challenge nutrition software program on nutrition knowledge levels of students enrolled in traditional personal health courses at The University of Alabama (UA). An experimental group consisted of students enrolled in two sections of the personal health course designed to relate directly to UA's "Healthy Campus" initiative. The control group consisted of students who enrolled in three other sections of personal health at UA. The integration of the Pyramid Challenge activity into a personal health course yielded no significant difference in nutrition knowledge between groups. However, this use of technology was an effective instructional methodology in that it allowed students to focus more closely on their personal eating behaviors and to design strategies to modify those eating behaviors without adversely influencing knowledge gain.

Spanish:

En años recientes, muchos educadores en salud han integrado programas de computadoras en sus intervenciones de educación en salud. La evaluación de cómo esta intervención a impactado es limitada. Este estudio evaluó el impacto del programa de nutrición computarizado del Reto de la Pirámide sobre los niveles de conocimientos de nutrición en los estudiantes matriculados en cursos tradicionales de salud personal en la Universidad de Alabama (UA). Un grupo experimental esta compuesto por estudiantes matriculados en dos secciones del curso de salud personal diseñado para directamente relacionarlo con la iniciativa de "Campus Saludable" de la Universidad de Alabama. El grupo control lo compone estudiantes que se han matriculado en otras tres secciones de salud personal en UA. La integración de las actividades de Reto de la Pirámide en el curso de salud personal no produce diferencia significativa en el conocimiento de nutrición entre los grupos. No obstante, el uso de esta tecnología fue una metodología institucional efectiva que les permitió a los estudiantes enfocar mas cerca sus conductas/hábitos de comer y de diseñar estrategias que modifiquen esas conductas/hábitos de comer sin influenciar adversamente el conocimiento ganado.

Keywords: technology, nutritional assessment, personal health

Introduction

According to the former United States Surgeon General C. Everett Koop, "…cutting edge technology, especially in communication and information transfer, will enable the greatest advances yet in public health…A generation of children raised on video games will probably be more attuned to health messages coming from interactive videos than lectures by the school nurse" (Koop, 1995). Research also indicates that games and simulations can help users personalize health information, assess risks and consequences, and make decisions in realistic situations (Dorman, 1997).

As recently as 2001, Dorman declared that professional preparation programs must emphasize technology skills preparation within their programs to show how technology can enhance instruction (Dorman, 2001). The National Council for Accreditation of Teacher Education (NCATE) also ratified new accreditation standards in 2000 regarding incorporating the utilization of technology into the preparation of future educators. The new provisions call for teacher training programs to

demonstrate a "commitment to preparing candidates who are able to use educational technology to help all students learn" (NCATE, 2000). This new standard will not only impact the way health teachers are trained, but will also greatly impact their skills and comfort levels in relaying health information through technological innovations.

Health education students need to be exposed to computers in the classroom environment (Dorman, 2001). As a result, in recent years, many health educators have integrated computer applications into their health education program interventions. Although a key function of health education research is to determine the effectiveness of instructional methodologies, the assessment of the impact of these interventions is limited (NCHEC, 2003). The purpose of this study was to examine the impact on knowledge acquisition of integrating the *Pyramid Challenge*, a computerized dietary assessment program on student knowledge, into selected personal health courses offered by the Department of Health Science at The University of Alabama (UA).

Dorman (2001) noted that health education product developers and planners should utilize a variety of innovative ways that enhance educational delivery through systematic yet creative approaches. One such technological innovation is a software program, entitled *Pyramid Challenge: The CD-ROM Healthy Eating Guide*. The *Pyramid Challenge* software program is based upon the USDA/HHS Food Guide Pyramid (FGP), and has been used as a learning tool in the experiential phase of interventions for students to record and measure their food choices (Dennison & Dennison, 2001).

The *Pyramid Challenge* project was funded ($1.1 million) in 1991 and completed by 1993. The USDA reviewed the software and all materials and instruments at that time to establish validity. The database in the software program uses a composite system, that is, the hamburger value is based upon the mean values of all hamburgers.

The *Pyramid Challenge* software program was designed for interactive use with students and adults having minimal nutrition knowledge. *Pyramid Challenge* allows the user to determine his ideal weight, record food intake, and compare his diet to recommended levels. The objectives of the interactive program are to help users identify the foods they have eaten, compare those foods and amounts with FGP guidelines, and motivate users to balance their Food Pyramid by providing them with easily understood colorful graphic printouts and personalized charts. A psychometric composite "Pyramid Score" was developed to rate daily food choices for adherence to FGP food group and serving recommendations. The food database includes 500 foods commonly eaten by school children at home, in the lunchroom, and at fast food restaurants.

Methodology

Course of Study

The *Pyramid Challenge* was embedded in two sections of a personal health course designed for freshmen and sophomore students to articulate with UA's "Healthy Campus" initiative. The stated goals of "Healthy Campus" were to:

- Support the mission of the University, the academic achievement of each student, and the quality of the campus-learning environment by removing or reducing health-related barriers to learning;
- Improve the personal health and well being of all members of the campus community (students, faculty, and staff);
- Strengthen the common health and well being of the University community; and
- Reduce the prevalence and intensity of health risk behaviors among Alabama students.

The "Healthy Campus" initiative had specific behavior goals. To address these goals, activities included in the "Healthy Campus" sections of the personal health course provided more focus on behavior change activities. The *Pyramid Challenge* is one example of such an intervention.

Experimental/Control Groups

The experimental group consisted of students who enrolled in two sections of the personal health course designed to relate directly to the "Healthy Campus" initiative. The control group consisted of students who enrolled in three other sections of personal health.

The purpose of the two experimental sections of personal health was to provide a thoughtful discussion of the individual, social, environmental and political factors that influence the health and well being of college age students. The experimental sections were designed to address the key health behavioral and risk factor concerns of college-age students. To this end, the course content focused on five interrelated modules as follows:

Module 1: Protecting Oneself and Others. An overview of alcohol and other drugs, STI's, HIV/AIDS, unwanted pregnancy, and unintentional injuries.

Module 2: Managing Stress and Coping. Integration of a variety of instructional strategies to assist students to manage and avoid stress, resolve conflict, and prevent/cope with depression, homesickness, alienation, and suicide.

Module 3: Eating Well. Skills and strategies to plan and maintain healthful eating patterns, and information on eating disorders of relevance to freshman (anorexia, bulimia, etc.)

Module 4: Adopting an Active Lifestyle. Concepts and guidelines to begin or maintain a regimen of physical activity and a discussion of

integration into other university and community activities.

Module 5: Being a Wise Health Consumer. How to make wise health decisions and a review of available UA and health related community resources.

The experimental sections included class activities to help students examine personal health related behaviors. One such activity was the *Pyramid Challenge*. In addition, students were asked to complete the following activities.

- Healthier People Health Risk Appraisal (HRA), a computerized assessment of personal health risks. Students were asked to complete a personal risk assessment inventory, analyze the results of the computer analysis, and identify a personal plan of action to reduce risk.
- Tailored Messaging on Stress. In this activity, students completed an on-line, personalized stress assessment. Based on their input, students received three tailored health/stress related E-mail newsletters which were sent directly to their personal E-mail address.
- Behavior Change Log Book. The students were asked to proceed through a systematic process to identify a personal behavior plan of action to modify a health risk behavior.

In essence, the experimental sections of personal health provided fewer didactic health lectures than the traditional personal health courses but included more individualized personal health assessments and action projects. Time saved from reduced information dissemination via lectures was directed to assisting students to understand broader health concepts and pursuing individualized behavior change activities. The text, for the experimental sections, was a condensed version of a standard personal health text, and students were required to read only those chapters that related to the five interrelated modules identified previously. In the experimental group, class attendance was taken and was one factor (16%) in the calculation of the students' grades. In the experimental sections, six 50-minute class periods were devoted to nutrition and weight control behavior change activities. Freshmen were allowed to enroll in the experimental sections prior to opening these sections to upper class students.

In the *Pyramid Challenge* activity, students were required to enter their dietary intake for a 20-day period into the computerized based program. The resulting output data provided a profile of each student's nutritional habits with specific recommendations for improvement. With these data, students were asked to develop a succinct one-two paragraph statement on how the data from the *Pyramid Challenge* program has helped them to modify there diet and eating behavior. The *Pyramid Challenge* activity was graded on a pass/fail basis and accounted for 50 points out of a possible 600 points for the course.

The control sections of the course reflected a more traditional didactic approach to personal health. Primarily a lecture-discussion instructional format was used in these sections. For the control section, the course of study covered a wide range of health related topics not covered in the experimental section of personal health such as: Psychological Health, Intimate Relationships, Pregnancy and Childbirth, Cardiovascular Disease, Cancer Control, Infectious Diseases, Aging, Death and Dying, Personal Safety, and Environmental Health. In the control group sections, the upper class students were allowed preference when enrolling in these sections.

The control group sections were primarily traditional, cognitive based courses, which included a limited number of class activities. Approximately six hours of instructional time was earmarked for nutrition related topics in the control group course sections. Student evaluations (and grades) were heavily weighted on objective test scores. Attendance in these sections was encouraged but not required.

Limitations

Several limitations to the *Pyramid Challenge* study need to be discussed. The study only dealt with college age students on a university campus. Therefore, the results cannot be generalized to any other population. Also, the total number of observations within the study was rather low. Out of the estimated 239 students in the experimental group and 135 students in the control group, only 189 total observations were reported for the study. There were 130 observations from the experimental group, which resulted in a 54.4% participation rate, and 59 observations from the control group, which portrayed a 43.7% participation rate. Further research should be done to examine the proposed *Pyramid Challenge* health behavior intervention, and in preparation for further research on the *Pyramid Challenge* activity, such limitations should be taken into account.

Instrumentation

The Challenge of Eating Better instrument was used as the pretest and posttest. This 10-item instrument was designed and validated by Dr. Darwin Dennison for use in concert with the *Pyramid Challenge* activity. Reliability is a non-issue for a cognitive instrument of this type. The instrument consisted of ten items. The same instrument was used for the pretest and the posttest. A copy of the instrument is included in Figure 1. Although the *Pyramid Challenge* database is not as robust as nutrient databases, it is clearly sufficient to identify direction and was validated by the NDS.

Figure 1: Pyramid Challenge: The Challenge of Eating Better Instrument

1. The USDA Food Guide Pyramid food group that has the highest recommended servings per day is the:
    a) Milk Group
    b) Meat Group
    c) Vegetable Group
    d) Bread Group
2. Two factors that are important to the determination of your "ideal caloric level" are :
    a) Appetite and hunger
    b) Glucose and amino acid concentration
    c) Activity level and weight
3. The USDA Dietary Guidelines indicate that you should not exceed:
    a) 20% of calories from fat
    b) 30% of calories from fat
    c) 40% of calories from fat
    d) 10% of calories from fat
4. The two USDA Food Guide Pyramid food groups that receive the most weight in the Pyramid Challenge score are:
    a) Meat Group and Milk Group
    b) Milk Group and Fruit Group
    c) Fruit Group and Vegetable Group
    d) Bread Group and Vegetable Group
5. A person's appetite is controlled and regulated by factors such as:
    1) Chewing and swallowing
    2) Stomach fullness
    3) Seeing and tasting food
    4) Blood glucose concentration
    5) Blood amino acid concentration

    Select one:
    a) 1 and 2 b) 1, 2, and 3 c) 1, 2, 3, and 4 d) 4 and 5
6. No one eats at his or her exact 'ideal caloric level' each day, but it is recommended that you eat within a range of:
    a) 5% (2 ½ % above and below your ideal caloric level)
    b) 10% (5 % above and below your ideal caloric level)
    c) 15% (7 ½ % above and below your ideal caloric level)
    d) 20% (10 % above and below your ideal caloric level)
7. To make certain that you achieve sufficient 'meal balance' of protein in your diet, you should make certain that you have at least one serving from which food groups at each meal:
    a) Meat Group and Milk Group
    b) Fruit Group and Vegetable Group
    c) Bread Group and Milk Group
    d) Meat Group and Vegetable Group
8. Which of the following diseases/conditions have a significant nutrition related component:
    a) Heart disease, stroke, AIDS
    b) Heart disease, emphysema, stroke
    c) Stroke, high blood pressure, certain cancers
    d) Juvenile diabetes, adult onset diabetes, high blood cholesterol
9. Which of the following are important in improving your food choice behavior:
    a) Energy balance
    b) Food group balance
    c) Meal balance
    d) All of the above
10. Even when your energy is not balanced, it is still possible to achieve excellent nutrition.
    a) True b) False

1. D. 2. C. 3. B. 4. C. 5. B. 6. B. 7. A. 8. C. 9. D. 10. B.

Table 1. Descriptive Statistics of Control and Experimental Groups

		Pretest		Posttest		Difference
Group	N	Mean	SD	Mean	SD	(Post – Pre)
Control	59	5.08	1.50	5.29	1.65	+ 0.21
Experimental	130	4.50	1.50	4.98	1.51	+ 0.48

The Challenge of Eating Better instrument was designed using a multiple-choice format to measure three related dietary concepts: food groups, energy intake, and health impact. Content validity of *The Challenge of Eating Better* instrument was established by examination of the items to determine the appropriateness for inclusion. Expert review of the items determined that the instrument appeared to measure basic knowledge of these three concepts. The instrument has been used for five years in introductory nutrition courses at the college level.

Data Collection

Pretest data were collected from both the experimental and control groups during the second week in February 2003. Posttest data were gathered in the last week of April 2003. Between the administration of the pretest and posttest, all nutrition related instruction and the *Pyramid Challenge* activity were administered. Both the experimental and control groups were tested on their nutrition knowledge during this time period. It is believed that the length of time between the administration of the pretest and the administration of the posttest reduced the impact of testing effect.

Results

Due to the nature of the study, a 2 x 2 analysis of variance (ANOVA) and analysis of covariance (ANCOVA) tests were run on the data. The question of interest is if the intervention resulted in improvement in scores from pretest to posttest that proves to be greater for the experimental group than the control group.

One way to answer this question is to look at the interaction effect in a 2 x 2 ANOVA with the treatment (experimental vs. control) serving as a between subjects factor and time (pretest vs. posttest) serving as the within subjects factor. The interaction term can simply be seen as a comparison of the pretest and posttest scores within the experimental and control groups. If there appears to be an improvement from pretest to posttest that is greater in one group than the other, then an interaction is present. However, if the changes from pretest to posttest scores are identical in both the experimental and control groups, meaning there was no difference in the scores of the groups, then there is no interaction present.

The results of the repeated 2 x 2 ANOVA test run on the *Pyramid Challenge* data portrayed that both groups (experimental and control) improved their scores from the pretest to the posttest time periods. The experimental group mean increased from 4.50 (1.50) to 4.98 (1.51); whereas, the control group mean increased from 5.08 (1.50) to 5.29 (1.65) (Table 1). The overall increase of the pretest and posttest scores, without differentiating between the experimental and control groups, proves to be a significant increase at the 0.05 alpha level, with an F value of 6.37 and a p value of 0.0124. However, the results portrayed a non-significant interaction between the pretest and posttest scores when the analysis incorporated the experimental and control groups (F=1.06, p=0.3036) (Table 2). Therefore, regardless of the pretest scores or the baseline, the two groups changed between the pretest and posttest time periods at the same magnitude, resulting in a non-significant interaction.

Table 2.Repeated 2 x 2 ANOVA Results

	Mean Square	F Value	P Value
Pre and Posttest	9.60	6.37	0.01*
Pre and Posttest differenti-ated by group	1.60	1.06	0.30

* Significant at the .05 level

Another statistical test that was used to answer the aforementioned question of interest was analysis of covariance (ANCOVA). ANCOVA is a method that is also used to test for the interaction effects of categorical variables on the continuous dependent variables, while controlling for the effects of other continuous variables, known as the covariate. In this study, the baseline pretest scores are used as the covariate to control for the initial group differences. Therefore, using ANCOVA allows for the pretest scores to be adjusted in order for the analysis to be based on the posttest scores.

In adjusting the pretest scores for both the experimental and control groups, the conclusion drawn from the ANOVA test can be supported by the ANCOVA results. The posttest scores prove to be

non-significant with an F value of 0.14 and a *p* value of 0.71.

Discussion

The results from the statistical tests that were run on the *Pyramid Challenge* data indicated that the interaction effect between the experimental and control groups' pretest and posttest scores were non-significant. Although both groups improved their scores from pretest to posttest, the changes occurred at the same magnitude therefore indicating a non-significant result. Several possible factors that could have played a role in such a result have been identified.

One possible factor contributing to the results was the differences in the instructional styles of the two groups. The instruction method of the control group was cognitive based, the traditional instructional approach used in most personal health and college classes. Within this traditional teaching style, the students were exposed to a lecture-discussion format of teaching. The students' grades were determined by their performance on objective style tests, which was the format of the "Challenge of Better Eating" instrument used in this study. On the other hand, the experimental group was an action-oriented or activity based approach where the class was involved in several health and personal assessment activities, throughout the semester, that related to the "Healthy Campus" initiative. Therefore, the health materials for the experimental class was presented in a fashion that included fewer health topics and less didactic lectures, but stressed class activities to help the students focus more on their personal health behaviors.

Another factor that could contribute to the results ending in a non-significant interaction is the fact that the control group utilized a different text than the experimental group. A listing of the nutrition related topics included within each of the text used can be found in Figure 2.

Finally, the last factor that has been identified as a possible player in the results of the study is that the experimental group was comprised of more freshmen and sophomores than upper classmen (juniors and seniors); whereas, the control group enrolled more upper classmen. The overall differences in age between the students in the experimental and control groups could play a role in the non-significant results of the study. The upper classmen obviously had survived one or more years of college academic life at the university, and therefore were accustomed to gleaning factual information from lecture and text materials, and passing knowledge based multiple choice exams. The experimental group was less experienced in the cognitive based test taking process.

Conclusion

The integration of the *Pyramid Challenge* activity into a personal health course yielded no significant difference in nutrition knowledge. At first glance, one may take a look at that result and deem the usage of *Pyramid Challenge* as unsuccessful. However, this particular study demonstrates that the utilization of technology, in this particular case, produced the same knowledge level increase in students as a "traditional" didactic approach. Also, it should be noted that through utilization of this technology the experimental group gained valuable insight into their diet which the control group did not obtain via their method of instruction.

Taking a broad view, the use of *Pyramid Challenge* was an effective instructional methodology in that it allowed students to focus more closely on their personal eating behaviors and to design strategies to modify those eating behaviors without adversely influencing knowledge gain. In other words, the integration of the *Pyramid Challenge* in a personal health course fostered both increased cognition and the design of individualized strategies to change behavior.

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Figure 2. Comparison of the Topics Covered in the Experimental Versus Control Texts

Experimental Text	*Control Text*
Assessing Eating Behaviors	Nutritional Requirements: Components of a Healthy Diet
Eating for Health	Proteins
The Food Guide Pyramid	Fats – Essential in Small Amounts
A Call for a New Pyramid	Carbohydrates – An Ideal Source of Energy
Today's Dietary Guidelines	Dietary Fiber – A Closer Look
Making the Pyramid Work for You	Vitamins – Organic Micronutrients
Eating "Nutrient-Dense" Foods	Minerals – Inorganic Micronutrients
The Digestive Process	Water – Vital But Often Ignored
Water: A Crucial Nutrient	Antioxidants
Proteins	Phytochemicals
Carbohydrates	Nutritional Guidelines, Planning Your Diet
Fiber	Dietary Reference Intakes (DRIs)
Fats	The Food Guide Pyramid
Reducing Fats in Your Diet	Dietary Guidelines of Americans
Trans-Fatty Acids: Still Bad?	The Vegetarian Alternative
Vitamins	Dietary Challenges for Women and Men
Minerals	A Personal Plan: Making Informed Choices About Food
The Medicinal Value of Food	Reading Food Labels
Antioxidants: Finding the Right Balance	Reading Dietary Supplement Labels
Folate	Organic Foods
Gender and Nutrition	Additives in Food
Different Cycles, Different Needs	Food Irradiation
Changing the "Meat and Potatoes Man"	Food Allergies and Food Intolerances
Recommended Dietary Allowances – Adequate Intake	
Daily Values, RDIs, and DRVs	
Vegetarianism: Eating for Health	
Improved Eating for the College Student	
Eating on the Run	
Food Safety: A Growing Concern	
Food-Borne Illness	
Responsible Use: Avoiding Risks in the Home	
Food Irradiation: How Safe is it?	
Food Additives	
Food Allergies: On the Increase	
Organic Foods	