

## **Healthy Plate: Consuming Balanced Meals as a Nutritional Strategy to Type II Diabetes Prevention**

Francisco V. Jumawan  
Educational Technology  
University of Hawaii at Manoa  
Honolulu, Hawaii  
USA  
fjumawan@hawaii.edu

**Abstract:** Type II diabetes mellitus is a growing problem in the United States. According to the 2004 Hawaii Diabetes Report, an estimated 72,000 to 100,000 people in Hawaii currently have diabetes. These numbers include 25,000 or more undiagnosed people. The purpose of this instructional design project is to design, develop and evaluate a web-based instructional module on type II diabetes prevention using a nutritional strategy based on the consumption of balanced meals for 30-55 year old Hawaii residents. Lifestyle modifications, such as physical exercise and proper nutrition, are keys to the prevention of type II diabetes. The strategy presented in the module is just the nutritional aspect of diabetes prevention and is aimed to inform and motivate the learners to adapt this strategy into their lifestyle. Evaluation was done by administering the module to research participants to assess its effectiveness in the cognitive and affective domains of learning. Although the participants scored well in the pre-test at an average of 83%, there is an improvement of 14% in the post-test. In addition, the data from the evaluation survey shows that the web-based module is favorable in informing and motivating learners to improve their lifestyle.

### **Introduction**

Type II diabetes mellitus has been a growing problem in the United States. The Center for Disease Control “estimates that nearly 1 in 5 adults over the age of 65 years has diabetes” (Hirokawa, Huang, Pobutsky, Nogues, Salvail & Nguyen, 2004, p. 3). In addition, 80% of the individuals who are diagnosed with diabetes are overweight and obese. This suggests a strong connection between lifestyle behaviors and the development of diabetes (Hirokawa, et al. 2004). The American Diabetes Association identifies on their website type II diabetes as more common in African Americans, Latinos, Native Americans, Asian Americans, Native Hawaiians, and other Pacific Islanders (American Diabetes Association). In Hawaii, an estimated 72,000 to 100,000 people currently have diabetes. These numbers include 25,000 or more undiagnosed people (Hirokawa, et al. 2004).

Lifestyle modification is a key to the prevention of type II diabetes mellitus and involves a combination of physical exercise and proper nutrition. In this instructional design project, the strategy is to cover the nutritional aspect of diabetes prevention and to inform and motivate the learners to adapt this strategy into their lifestyle. The purpose of this instructional design project is to develop and evaluate a web-based instructional module on type II diabetes mellitus prevention through the consumption of balanced meals for 30-55 year old Oahu residents.

## **Background**

Although there is no existing web-based instructional module on nutritional strategies for type II diabetes prevention, previous studies provided some influence on the module's design. A 2005 study showed how an implementation of a nutrition education program on second-grade and third-grade students effectively increased nutrition knowledge and improved dietary behavior (Powers, Struempfer, Guarino & Parmer, 2005). This study has shown that nutrition can be learned at a younger age, something an adult also can learn. However, knowledge alone may not provide the push that the learner needs to make the change. By promoting a sense empowerment, the learner may gain a degree of control and self-efficacy, which could spark their motivation (DeCoster & George, 2005).

The instructional designer could face limitations on promoting learning motivation when developing a web-based module (ChanLin, 2009). Use of external motivators such as reminders and incentives are ways to address this limitation. Another factor to consider, as demonstrated in a 2007 study, is that adolescents and young adults depend heavily on reminders and encouragement from instructors and family members to complete their online diabetes intervention program (Gerber, Solomon, Shaffer, Quinn & Lipton, 2007).

Another study demonstrated that an interactive, web-based computer-tailored nutrition education could lead to nutrition behavior changes in adults. Nevertheless, the program was very difficult for the inexperienced Internet users (Oenema, Brug & Lechner, 2001). Therefore, it is clear that any module designed for an older target audience must incorporate accommodations for learners with minimal to no Internet experience (Sadik & Reisman, 2004). By designing a web-based module that features an ease-of-use navigation, all learners, regardless of Internet experience, will be able to understand the website structure so they can locate content, resources and learning tools (Sadik & Reisman, 2004).

## **Methods**

A web-based instructional module was designed to introduce the learner to the concept of consuming balanced meals. The plate method, a cornerstone of the balanced meal concept and successfully utilized by diabetic patients, served as the basis of this module (Rizor, Smith, Thomas, Harker, & Rich, 1998). Images, illustrations and videos were utilized to support the instruction provided by the module. Optional reading materials were added to provide the learner more information should the learner choose to explore the concepts more in depth. An interactive review was integrated to ensure that the learner understands the instruction.

### *Target Audience*

The module is targeted for learners who are Hawaii residents 30 to 55 years of age, who are at risk for type II diabetes, and are English speaking, although a number of these learners converse in Hawaiian Creole English, commonly known as Pidgin English. Most of the learners may have children; therefore, the module will provide them an opportunity to be a strong influence on living a healthy lifestyle. Although the education levels vary from high school to college master's degree, 29.1% of Hawaii residents 25 and over have earned at least a Bachelor's degree

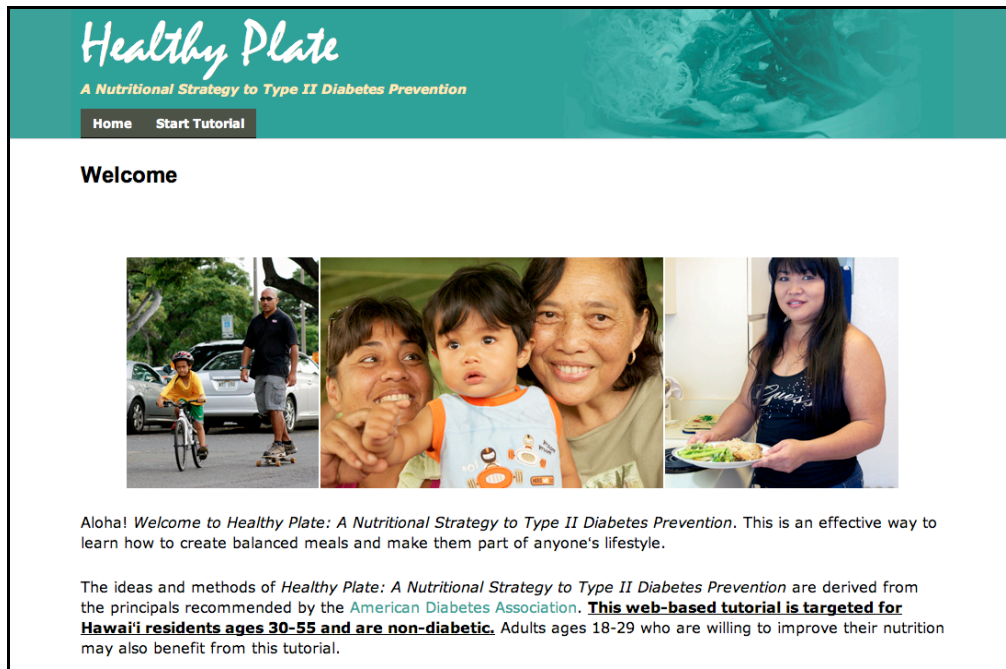
(U.S. Census Bureau, 2011). In terms of technical ability required to use the web-based instructional module, all of the learners should have familiarity with Internet browser use.

### *Design and Development*

The target audience analysis influenced the instructional design of the module and its desired learning outcomes especially within the cognitive and affective domains. Gagne's Nine Events of Instruction (Gagne, Wager, Golas, & Keller 2005), a proven method based on external events to initiate the internal processes that lead to effective learning, is utilized for the instructional design of this module.

Navigation and usability were the guiding elements for the design of the module. A clean and simple website layout must be designed to accommodate the inexperienced computer user. Wordpress, with its easy modification of content and a plethora of software plug-ins to enhance functionality and engaging multimedia objects, was used as the web framework.

The development of the module required three weeks customization to the Wordpress framework. Web content was then inserted for prototyping and peer feedback. The module was finalized after several revisions were made based on peer feedback. Throughout the design process, a Registered Dietitian who specializes in diabetes nutrition was consulted to ensure content accuracy. The introduction page of the web-based module is shown in Figure 1.



**Figure 1.** Introduction Page

### *Evaluation*

The web-based module went through three phases of evaluation. The first phase included individual feedbacks from three peers and an educational technology advisor via online class forum. Revisions were made prior to the next phase of the evaluation. The second phase involved one-on-one evaluations that were done via email and Skype from the subject matter

expert and a male and female participant that qualifies as a target audience. Further revisions in the content and navigational areas of the module were made prior to the implementation of the small group evaluation. The third phase of evaluation ran for a two week period that began with calls for volunteer research participants done via email and Facebook to family members, friends and acquaintances. The participants completed the module individually online at their convenience. Contact information was made available to the participant if there were any questions or issues that arose. Revisions were made between phases of evaluation.

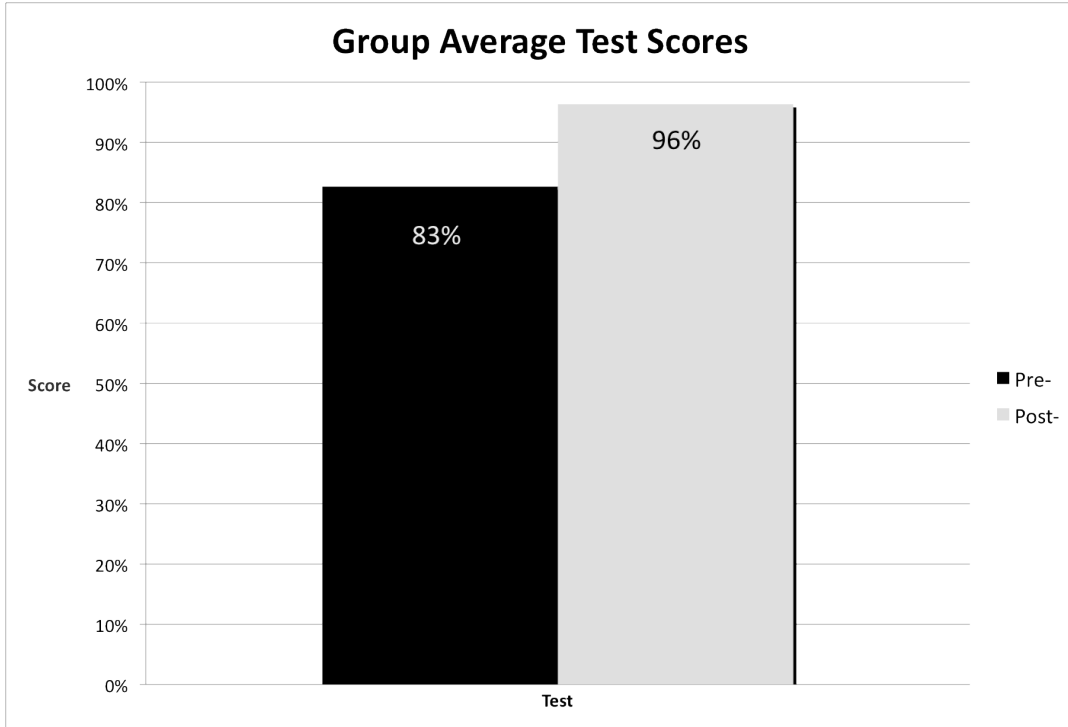
For the one-on-one and the small group evaluations, each participant was required to complete the demographics and evaluation surveys in addition to the pre- and post-tests. The pre- and post-test scores are used to determine the effectiveness of the module. The demographics survey gathered qualitative and quantitative data on the participants' backgrounds. The evaluation survey consists of 14 Likert-scale items and 3 open ended questions. The 14 Likert-scale items were derived from Keller's Instructional Materials Motivation Survey (IMMS) (Keller, 2010) measuring motivation with respect to the module. These items reflect on the participant's attitude after completing the module and are divided into the categories of attitude, relevance, confidence and satisfaction. Each item allows participants to respond to a five-point scale where 1 indicates strongly disagree and 5 as strongly agree.

## **Results**

A total of 20 participants completed the tutorial during the two-week module implementation. Average age of the participants was 35; the oldest participant was 53. Six of the participants, between the ages of 25 to 29, were outside of the targeted age range. Of the subjects, 35% male while 65% are female; 18 participants reside on Oahu, while two are former Hawaii residents currently living on the mainland.

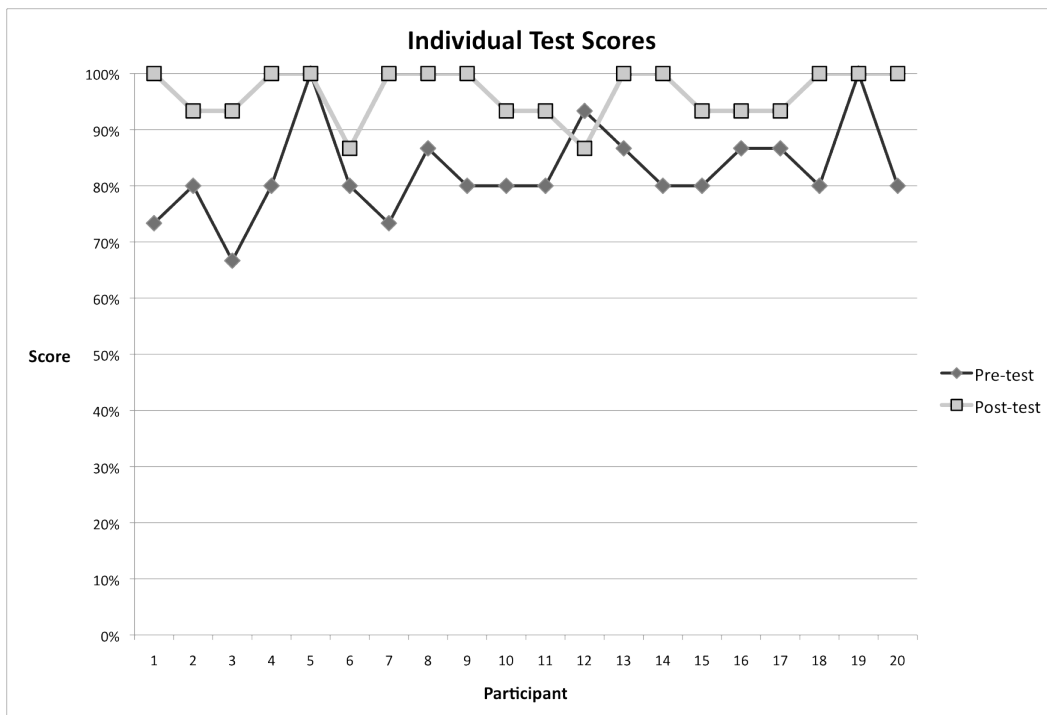
Participants were asked to rate their computer use frequency and computer knowledge on a scale of 1 to 10, where 1 is low computer use and low knowledgeable to high computer use and high knowledge, respectively. The mean for computer use was 8.1 and computer knowledge was 6.5 out of a maximum of 10.

The overall results of the pre- and post-test scores indicate that although the participants did fairly well on the pre-test at 83%, there were improvements after completing the tutorial. Figure 2 illustrates that the group's overall score improved by 14% suggesting that the module was fairly successful in achieving the learning outcomes.



**Figure 2.** Group Average Test Scores Based On 20 Participants

In the individual test scores, as illustrated in Figure 3, 55% of the participants scored perfect in the post-test. Although the participants in the group had an overall improvement, participant 12 is the only participant who fared better in the pre-test than in the post-test.



**Figure 3.** Individual Test Scores

Overall group motivation as a result of completing the module, as shown in Table 1, illustrates participants feedback from the 14 Likert-items derived from Keller's IMMS. The group rated a five, or strongly agree in the categories relevance, confidence and satisfaction, with standard deviations of .42, .42 and .58 respectively. However, the group rated a four in the attention category with a standard deviation of .48.

**Table 1.** Group Motivation After Completing Module Based On 20 Participants

Category	Mean	Standard Deviation
Attention	4	0.48
Relevance	5	0.42
Confidence	5	0.42
Satisfaction	5	0.58

Summarizing on the three open-ended evaluation questions, 65% of the participants found that the web-based module was quick, very user-friendly, easy to read and easy to navigate. Also, 40% stated that the module does not need any improvements. Finally, 25% stated that they learned about the plate method and the concepts in the module were not difficult to do.

## Discussion

Overall, the tests and evaluation gave indication that the web-based module is effective in informing and motivating the participants; there were areas in the module that worked very well such as navigation, overall layout and content. Majority of the participants gave favorable feedback in navigability and usability. Of the participants, a handful stated that the module gave them awareness and knowledge on diabetes prevention.

The participants did fairly well in the pre-test, a result that may be because attributed to the fact that 70% of the participants' education level was at least a 4-year bachelor's degree. The education level of the participants is more educated than the intended target audience whose education level is mainly high school to some college. Further studies are needed to involve more participants who have some or no college education.

The biggest obstacle in the developmental process of the module was the integration of the evaluation sections. The quiz and survey plug-ins could not be incorporated because of its incompatibility with the most recently updated version of Wordpress at the time. The test questions, originally written with images and illustrations, had to be rewritten and reworded to text only format since Google Forms does not accommodate images. The revised tests and surveys were then embedded into the evaluation sections. Unfortunately, the extra navigation buttons within the embedded Google Form; it may have caused uncertainty with the participants upon completing the tests and surveys. Two participants reported that they became confused when they saw an unrelated Google Form links after the submit button was pressed. As a result, of the unintentional omission of the submit button on the embedded Google Form caused the missing evaluation forms from participants. The navigation instructions in the evaluation section were then re-written during module implementation to ensure that the participants properly submitted all of the evaluation forms. From the data that was gathered from Google Form

submissions, there were a total of 34 participants, indicating 43% of the participants were missing at least one evaluation form for the tests and surveys.

### **Conclusion**

Type II diabetes is a chronic disease that can be prevented through lifestyle modification. With the advancements in technology today, it is possible to design, develop and implement an effective web-based module to inform and motivate an audience to take action on diabetes prevention. Despite encountering technical difficulties in the plug-ins and navigation in the evaluation sections, the web-based instructional module on type II diabetes prevention through the consumption of balanced meals is shown favorable in informing and motivating learners to improve their lifestyle.

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