

**Tsunami Preparedness Web-based Module  
for International Students in University of Hawai'i at Manoa**

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**Abstract:** When students from all over the world come to Hawai'i, they are not necessarily prepared with the knowledge to handle a tsunami. The purpose of this instructional design project is to develop and evaluate a web-based instructional module about tsunami preparedness for international students at the University of Hawai'i at Manoa. Participants evaluated the module for relevancy and effectiveness, and data was collected to measure knowledge gained through participation. Overall the participants found the module to be a useful one for the future. The group completed pre- and post-tests and showed significant improvement scoring an average of 64% in the pre-test and 96% in the post-test. Participants reported favorably about the images, videos and interactive applets, although results are limited by a small sample size. Data collected also suggest that revisions to the module should exclude some of the test items and include more multimedia content.

### **Introduction**

Tsunami preparedness always associates with food storage, community outreach and public awareness and presumably everyone should have had the knowledge about it when they live in coastal areas. In reality, in a city like Honolulu, not everyone has the knowledge of tsunami preparedness, especially tourists, international students and travelling businessmen.

The purpose of this instructional design project is to develop and evaluate a web-based instructional module about tsunami preparedness for international students at the University of Hawai'i at Manoa. The study focuses on the information about tsunami preparedness to enable learners to know what to do when a tsunami attacks, and transfer the knowledge to other similar natural disasters.

### **Background**

On April 1, 1946, a tsunami traveled across the Pacific to the Big Island of Hawai'i, swept more than 1,300 homes and killed 159 people; on May 22, 1960, a Pacific-wide tsunami, caused over a half billion dollars damage and 61 deaths; on December 26, 2004 a tsunami travelled through the Indian Ocean, and killed more than 230,000 people in Indonesia, Thailand, India, Sri Lanka and elsewhere and destroyed the homes and livelihoods of many more; on April 2, 2007, a tsunami in Solomon Islands killed at least 13 people; and on September 29, 2009, a 40-foot tsunami wave hit the shores of American Samoa, killing more than 100 people. On March 19, 2011, a tsunami in Sendai Japan caused more than 21,911 dead and missing (OCHA, 2011), with estimated \$235 billion lost to the nation (World Bank, 2011). Making matters worse, the coastal areas of islands are often developed and densely populated which increases the disaster when a tsunami strikes (Pararas-Carayannis, 1982). The increasing impact of the tsunami raises the attention of both public policy makers as well as educators, and the state has spent millions of dollars on natural disaster preparedness.

With the benefit of web-based education, classroom independence and platform independence, one module can support thousands of learners all over the world that are equipped with any kind of Internet-connected computer (Brusilovsky & Peylo, 2003). The language and social challenges that international students face when leaving their homeland for school in the United States make them more vulnerable in terms of the emergency events such as natural disasters, including tsunamis (Lacina, 2002). The purpose of this instructional design project is to develop and evaluate a web-based instructional module about tsunami preparedness for the international students at the University of Hawai'i at Manoa.

Previous research about web-based education in an MBA program in a large mid-western university in the United States shows that the learners prefer different kinds of interaction in online courses depending on their personality or learning style, and that the learner centered approach was recommended (Bonk, Magjuka, Liu & Lee, 2005). Another research is the LS-Plan: a system capable of providing Educational Hypermedia with adaptation and personalization, based on three main components: the Adaptation Engine, the Planner and the Teacher Assistant and provided a logic based learning objects sequence depending on the students' cognitive state and learning styles with an adaptation algorithm (Limongelli, Sciarrone & Vaste & 2008).

The value of adding video is largely dependent on how it is used. If video is used correctly, it can catch students' interest provide a nurturing value that can aid in motivation and creating positive attitudes. Motivation has been linked to attention variables (Choi & Johnson, 2005) associated with multimedia learning.

The increasing impact of the tsunami showed that there is a need to raise awareness and to educate individuals about tsunami preparedness. A multimedia, interactive web-based module with a systematic and learner centered approach geared towards international college students could provide awareness and understanding that educate this audience about the tsunami preparedness. On a larger scale this may also help this audience to be prepared for the other natural hazards.

### **Methodology**

This instructional design module was designed to provide learners with instruction on tsunami preparedness. The design ensured that by using text, video, image, and interactive applets that various learning styles were accommodated. The module required participants to have only minimal computer and Internet navigation skills and a high school English reading level.

#### *Module Development and Design*

The instructional module was intended for people who recently moved to Hawai'i to pursue a higher education. They have little or no knowledge about the tsunami preparedness procedures in Hawai'i and the United States. The sample population chosen to test this module was volunteers who were enrolled in University of Hawai'i system. They are both male and female and had little or no knowledge of tsunami preparedness and might be interested in learning it. This population would benefit from the module because there are clear instructions and procedures incorporated so that when tsunami warning occurs, they will know what to do. This module can also help ensure that participants know where to get additional resources for other natural disasters. Ideally, no instructor will be needed for the module and the individual can complete the module on his or her own pace.

The module was designed so that the information is presented to the learner through text, supporting video, and interactive applets created using JavaScript. Following each instructional section were self-check questions with immediate feedback for the participant based on his or her answer. Along with the self-check questions page, visual aids were incorporated, showing the participants the visual clues that corresponded with the writing of the information. Joomla, a content management system, was selected because the author feels that the system has high usability and is inexpensive. The module was created online because it can be accessed anywhere that the participants have Internet access. The Google translator was also used as a tool to support the learner who may have potential language barriers. The font-size manipulating tool is also available for the learners with visual impairments.

The instructional strategy for this tsunami disaster preparedness instructional module is based on Gagne’s Nine Events of Instruction as listed below in Figure 1. According to Gagne, Wager, Golas, and Keller (2005), the following nine processes must be activated in order for effective learning to take place.

Gagne’s Nine Events of Instruction	
1. Gaining and maintaining attention	- Visual cues, including pictures and videos throughout the module will attract and maintain students’ attention. - The user-friendly appearance of the module will encourage students to participate.
2. Inform learners of objectives	The introduction clearly states the terminal objective and the sub-skills that learners need to accomplish in the module. These sub-skills are broken down into four clusters in order to provide a manageable amount of information for learners to grasp. Each cluster will be referred as a section, with an objective to inform learners of the goal and how it relates to the terminal objective. The learners will participate in practice test to apply previously acquired sub-skills.
3. Stimulate recall	About important terms and vocabulary, the additional page or blocks will be provided at the end of the page for reference purposes.
4. Presenting the stimulus material	The module will be presented in written text, graphics, videos and interactive applets, which will help the learner to understand the information as well as maintain their attention and interest.
5. Provide the learning guidance	The examples and non-examples will be provided throughout each section, helping the learners distinguish between the correct and incorrect concepts and explain any discrepancies.
6. Elicit performance	Practice test will be provided at the end of each section for learners to practice new skills and knowledge. This will encourage learners to retain the knowledge for the posttest and transfer the acquired information from short-term to long-term memory.
7. Provide feedback	Answers will be given in the end of the practice test for students’ reference. This feedback will help the learner to identify the correct answers and provide explanations as to why answers are correct or incorrect.
8. Assess performance	At the end of the instructional module, the learner will be given a posttest, which is designed to transfer the acquired knowledge from short-term memory to application. The learner will connect the information they learned in the module to the posttest.
9. Enhance Retention and Transfer	Upon completion of the posttest, the learners will receive an information packet that includes an outline of the knowledge they acquired. In addition, a disaster preparedness pamphlet from FEMA will be given to each learner as reference.

**Figure 1.** Gagne’s nine events of instruction.

### *Module evaluation*

To evaluate the instructional module and tests, the module was reviewed by three peer reviewers during three separate one-on-one sessions, and one small group session. Information from these evaluations was used to revise the module. Each participant completed a demographic survey, pre-test, practice test, post-test and an evaluation survey. The participants were able to ask any questions if they encountered difficulties while completing the module. With the information collected from the data sets, the instructional designers evaluated the effectiveness, constraints and drawbacks of the module.

The one-on-one evaluations were conducted remotely and participants used their own computers and Internet access. A total of three one-on-one evaluations were conducted. In order to obtain evaluation from different levels of experience and backgrounds, one person was a student in the Educational Technology program at the University of Hawai'i, one person had no tsunami or instructional design experience, and one person was a subject matter expert in tsunami preparedness. The subjects for the one-on-one evaluations were asked to complete the module and note *observations such as*, grammatical errors, if the navigation through the website made sense, and if the content was appropriate and accurate. Feedback was gathered from the one-on-one sessions and was incorporated into the module.

The small group testing was conducted at the University of Hawai'i College of Education Wist Hall. MacBook laptops with external mice and headsets were used for testing. There were ten participants who were recruited through mailing lists and social networking sites. All participants felt very strongly about their familiarity with the Internet and their navigation skills on computers in general. Most had also used the Internet before to learn new skills.

### **Result**

Overall the participants found the module to be a useful one for the future. The average score on the pre-test was 64% and increased to 96% on the post-test administered after the instructional module. Participants reported favorably about the images, videos and interactive applets, although results are limited by a small sample size.

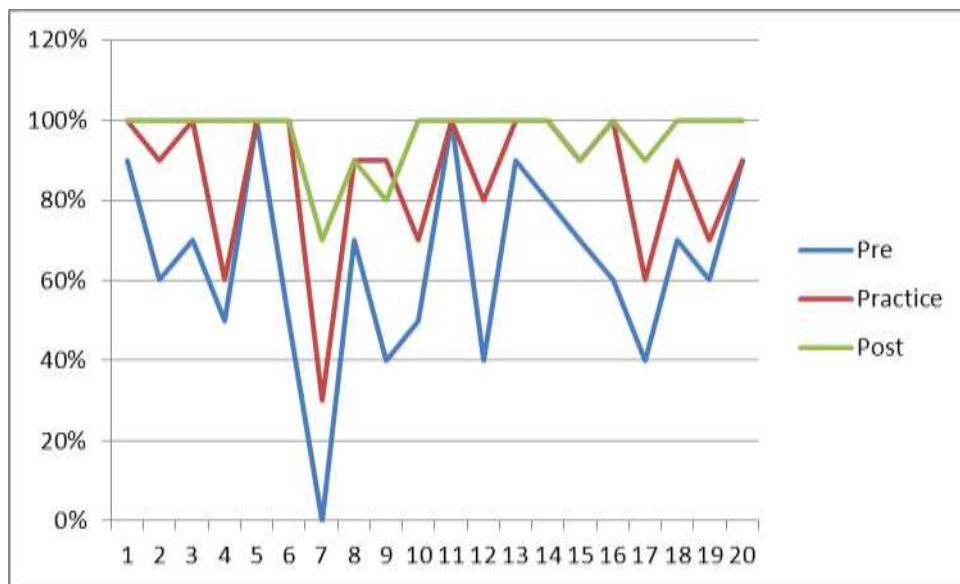
According to the demographic survey (Appendix A), nine of the ten participants are from Pacific region, including China, Taiwan, Thailand and Indonesia and one from Brazil. Three of the 10 participants (30%) said that they had previous experience with tsunami; and all of them experienced the tsunami warning in Hawai'i in February 2010. In all, six of them reported that they know how to properly prepare for a tsunami event.

Additionally, only four out of the ten did not think he/she knew anything about tsunami preparedness.

The overall data for pre-test, practice-test, and post-test questions are listed in Appendix B. Overall, there is an improvement from the pre-test to the post-test; however, the participants already had full understanding about question number five about choice of food for emergency kit, and question number 11 about identifying flood zone before taking the module.

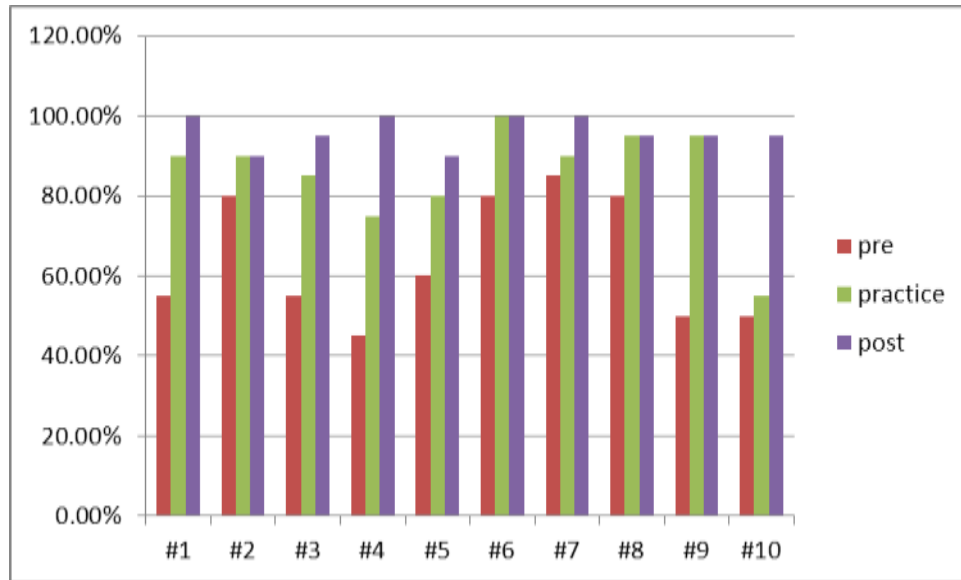
A line graph was produced to visually display and simultaneously compares the results of each test. Figure 3 shows a line graph depicting pre-test, practice-test, and post-test results by objective. The purple line in the figure represents the percentage of the correct answers in the post-test, higher than both pre-test and practice-test, which indicates that the learners have gained the knowledge throughout the module.

However, the data also shows that the sample population was very knowledgeable. A year before the module was distributed there was a tsunami warning in the State of Hawai'i, which contributed to the result of this high level sample population, as more than 80% participants answered the item 1, 5, 11, 13, 14 and 20 correctly.



**Figure 2.** Line Graph Depicting Pre-test, Embedded, and Post-Test Scores by Objective.

Figure 3 represents the score changes for individuals. Each section represents the scores for each participant; you can see that everyone clearly improved over the pretest scores. The posttest scores are high which suggests the instruction did not confuse the learner. Instead, the learners learned and improved the score.



**Figure 3.** Bar Graph Depicting Pre-test, Embedded, and Post-Test Scores by Participants

The demographic survey provided participants to identify their background, including age, gender, major, education, nationality, tsunami knowledge, and time stayed in Hawaii. All the participants are pursuing the higher education, with two females and eight males. Nine out of ten participants are from Asian Pacific region, including China, Taiwan, Thailand and Indonesia, except one from Brazil. Half of them said that they didn't know what to do when tsunami occurs.

The evaluation survey (See Appendix C) allowed the participants to provide candid feedback for the instructional module. The attitude survey results are shown in Figure 4. The survey included questions about the content and layout of the module and tests. Overall the responses were positive. Many of them commented that the module was well-organized, easy to understand and easy to follow through. Two students commented the website interface as user-friendly. One student really liked underlined/bolded text and highlights, and said that they helped him to follow through. One student suggested including more videos in the module.

Comparing survey data and demographic data to the test results, the person who stayed in Hawai'i less than one year had the lowest average score. One participant, identified as "#10", was scored 50% in pre-test, 55% in practice-test and 95% in post-test, among which was below the average. Another participant identified as "#5", stayed in Hawai'i only one year, also scored lower than the average, with 55.00% in pre-test 85.00% in practice-test and 95.00% in post-test. The other participant, "#3", moved to Hawai'i a year and half ago, scored 55% in pre-test, 85% in practice-test and 95% in post-test, with the scores lower than the average.

Survey Items		Participants										
		1	2	3	4	5	6	7	8	9	10	Average
1	Easy read	5	5	4	4	4	5	5	5	5	4	4.6
2	Easy navigate	5	5	4	5	5	5	5	4	5	4	4.7
3	Flow well	5	5	4	5	5	5	5	5	5	4	4.8
4	Clear	5	5	4	5	4	5	5	5	5	4	4.7
5	Examples	5	5	3	5	5	5	5	4	5	4	4.6
6	Non-examples	5	5	3	5	4	3	4	5	3	4	4.1
7	Sufficient feedback	5	5	2	4	5	4	5	4	4	4	4.2
8	Relevant scenarios	5	5	5	4	5	4	5	5	5	5	4.8
9	Chapter size	5	5	2	5	4	5	5	5	2	3	4.1
10	Sequence	5	5	5	5	4	5	5	5	5	5	4.9
11	Picture quality	5	5	5	5	5	5	5	5	4	5	4.9
12	Question is understandable	5	5	5	5	3	5	5	5	5	3	4.6
13	Helpful in the future	5	5	5	5	5	5	5	5	5	5	5
14	Sufficient for future	5	5	4	5	5	5	5	5	2	5	4.6

**Figure 4.** Data from content and evaluation survey item 1 - 14.

## Discussion

Based on the test results, there is one test items can be eliminated from the module, as the participants were well informed about the topic. The item about what kind of food one should prepare for emergency situation, 100% participants got it right, which proves that it is common sense and there is no need to repeat it in the module.

Based on open-ended responses in the evaluation survey, the researcher would like to add more pictures and videos to increase engagement. The module should also be tested under both Windows and Mac systems with multiple types of browsers before delivery to make sure it is compatible for different environments.

Although this project has found instruction on tsunami preparedness delivered through a website with multimedia to be effective, more research should be done to determine if this module's success may be repeated for other types of natural disasters. As most of the participants are from Asian Pacific region, a larger and perhaps more diverse sample population must be tested.

## Conclusion

Using web-based module to teach the audience about tsunami preparedness can be efficient and successful. This web-based instructional module on tsunami preparedness gave participants an opportunity to learn about tsunami preparedness. It successfully incorporated multimedia to meet the needs of different types of learners. All the participants had a significant improvement from the pre-test to post-test scores. Furthermore, they all found the module to be useful for the future. The researcher hopes that the findings of this paper will be useful to the local tsunami preparedness agencies in selecting instructional design strategies and media selections in order to reach out to the larger community in Hawai'i.



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Appendix A

Demographic Survey

Email: \_\_\_\_\_ Age: \_\_\_\_\_

Gender :  Female  Male

Major: \_\_\_\_\_ Degree Acquired: \_\_\_\_\_

Graduation Date: \_\_\_\_\_

Where are you from? \_\_\_\_\_

What is your ethnicity? \_\_\_\_\_

How long have you been in Hawaii? \_\_\_\_\_

Have you experienced Tsunami?  Yes.  No.

If yes, where and when did the tsunami event take place?

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Do you know what to do if a tsunami happens?  Yes.  No.

---

If yes, tell us one or two things you would do to prepare.

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Appendix B

Raw Data for Pre-test, Embedded, and Post-Test Questions (Overall)

**I. Number of People Answering Correctly**

Test item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<b>Pre</b>	9	6	7	5	10	5	0	7	4	5	10	4	9	8	7	6	4	7	6	9
<b>Practice</b>	10	10	10	7	10	10	4	9	9	7	10	9	10	10	10	10	6	10	9	10
<b>Post</b>	10	10	10	10	10	10	7	9	8	10	10	10	10	10	10	10	9	10	10	10

**II. Percentage of people answering correctly**

Test item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
<b>Pre (%)</b>		90	60	70	50	100	50	0	70	40	50	100	40	90	80	70	60	40	70	60	90
<b>Practice (%)</b>		100	100	100	70	100	100	40	90	90	70	100	90	100	100	90	100	60	100	90	100
<b>Post (%)</b>		100	100	100	100	100	100	70	90	80	100	100	100	100	100	90	100	90	100	100	100
<b>Pre to post</b>		10	40	30	50	0	50	70	20	40	50	0	60	10	20	20	40	50	30	40	10

Appendix C

Evaluation Survey

Thank you for your time and for participating in our instruction. The last thing that needs to be done is an evaluation survey about this module. The survey is based on a 5-point scale. **1= highly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.** Please read and respond to each statement carefully.

1. The module was easy to read.

1 .                      2 .                      3 .                      4 .                      5 .

2. The module was easy to navigate.

1 .                      2 .                      3 .                      4 .                      5 .

3. The instruction flowed well.

1 .                      2 .                      3 .                      4 .                      5 .

4. The directions in the module were clear.

1 .                      2 .                      3 .                      4 .                      5 .

5. There were appropriate examples.

1 .                      2 .                      3 .                      4 .                      5 .

6. There were appropriate non-examples.

1 .                      2 .                      3 .                      4 .                      5 .

7. There was sufficient feedback.

1 .                      2 .                      3 .                      4 .                      5 .

8. The scenarios provided were relevant.

1 .                      2 .                      3 .                      4 .                      5 .

9. The chapter size was adequate.

1 .                      2 .                      3 .                      4 .                      5 .

10. The chapters were appropriately sequenced.

1 .                    2 .                    3 .                    4 .                    5 .

11. The pictures were easy to read.

1 .                    2 .                    3 .                    4 .                    5 .

12. The questions were easy to understand.

1 .                    2 .                    3 .                    4 .                    5 .

13. This module will help me in the future.

1 .                    2 .                    3 .                    4 .                    5 .

14. The knowledge and skills gained from this instruction is sufficient enough for me if there is a tsunami warning.

1 .                    2 .                    3 .                    4 .                    5 .

15. Did you use the translation tool at the top of the website? If so, how do you like the it?

16. What did you like about the module?

17. Do you have any suggestion for improving the module?

Appendix