

St. Scholastica's College – Manila

School of Arts and Sciences

volcaKNOWS: An Informative Website about
Safety Measures in Cases of Volcanic Eruptions

In Partial Fulfillment of the Requirements

in Capstone 1 (METRES)

ANEA ROSHYL D.S. SANTOS

BSIT – 304A

March 2015

TABLE OF CONTENTS

I.	Title Page	i
II.	Table of Contents	ii
III.	Introduction	1
	A. Background of the Study	1
	B. Significance of the Study	4
	C. Statement of the Problem	4
	D. Objectives	5
IV.	Review of Related Literature	6
V.	Study Framework	15
	A. Theoretical Framework	17
	B. Conceptual Framework	19
	C. Operational Framework	21
VI.	A. Research Methodology	23
	a. Research Design and Methods	23
	b. Variables and Measures	23
	c. Research Instruments	24
	d. Units of Analysis and Sampling	24
	e. Data Gathering	24
	f. Data Analysis	25
	g. Scope and Limitations	25
	B. Project Development Methodology	26
VII.	References	28

CHAPTER I. INTRODUCTION

Background of the Study

New technology has brought about various changes in people's lives. From manual typewriters to computers, technology has revolutionized the way they live. According to Byte-Notes (n.d.), the use of computer technology helps people do their work faster and easier, saving them not only time and effort, but also the cost to finish a task. One of the important technologies that are available to the population is the Internet.

After the telegraph, telephone, radio, and computer were invented, the Internet became a potential for world-wide transmissions, a means for the propagation of information, and an avenue for interaction between people and their computers regardless of where they are (Cerf et al., n.d.). Thanks to the internet, individuals can share almost anything, from plain texts to elaborate presentations, with anyone who has an Internet connection.

Baldivia (2013) stated that in the Philippines, there are more than 33 million Internet users, based on a 2013 report by the Southeast Asia Digital Future in Focus. The provided infographic also showed that from the 16.4 hours the average Filipino spends on the internet per month, 14.5% is spent on news and information.

Accessing information, especially about current events, through the Internet is easier than waiting for printed materials. Duffy (2000) wrote:

The advantages of the Internet over more traditional media are numerous. In this new electronic environment, flat, paper-based research articles can become multi-layered, cross-referenced, live resources with integral audio and visual material and links. Users can, from a single entry point, explore and capture numerous additional bundles of information from organizations and individuals across the world. (p. 350)

The World Wide Web (WWW), invented by Tim Berners-Lee in 1989, was “originally conceived and developed to meet the demand for automatic information-sharing between scientists in universities and institutes around the world” (European Organization for Nuclear Research, n.d.). The web now allows people to share information around the globe. News websites like Rappler and INQUIRER.net provide citizens with fresh information about events on the same day it took place. Users flock to this kind of websites especially when disastrous things happen. In the Philippines, typhoons are one of the things that the country looks out for.

Every year, the Philippines is hit by an average of 20 typhoons, causing the death of hundreds (Mangosing, 2013). Floods, landslides, lost homes and wasted crops are just some of the other devastations brought by typhoons. Due to their frequent occurrence, typhoons are usually well-prepared for. In addition, another natural disaster that brings major destruction is volcanic eruptions.

Volcanic eruptions occur “when lava and gas are discharged from a volcanic vent” (IFRC, n.d.). According to the Philippine Institute of Volcanology and Seismology or PHIVOLCS (2008), the Philippines has 23 active volcanoes. A

well-known one is Mount Pinatubo which erupted on June 15, 1991. It caused about 800 deaths, many of which were due to sicknesses and caving in of roofs (Oregon State University, n.d.).

Another famous volcano in the country is located in Albay, the Mayon Volcano. Volcanologists have been closely monitoring its state and have raised the alert level to 3 on September 2014 (Flores, 2014). Safety measures had been taken and the provincial government of Albay had required the families that live within the 6km radius Permanent Danger Zone to evacuate (Flores, 2014). According to an update from National Disaster Risk Reduction and Management Council (NDRMMC) that was released by Alexander Pama (2014), 46,421 from 58,012 people that were affected were still in 45 evacuation centers. Sun Star (2014) wrote that P61.5 million was released by the Aquino Administration to help in the relief operations of Albay's provincial government.

While the authorities and disaster relief groups are prepared in case of a volcanic eruption, are the citizens themselves ready as well?

This research focuses on the development and evaluation of an informative website titled 'volcaKNOWS'. Its target audience is children and teenagers ages 6 to 18 years old. Along with guidelines on what to do before, during and after a volcanic eruption is an animation illustrating the steps. Contact numbers of relief groups will also be posted on the website.

Significance of the Study

This study will be beneficial to elementary students, the target audience, IT (Information Technology) students, and other researchers.

1. **Elementary students:** This project can help students with their own research regarding volcanoes and volcanic eruptions. The website will be easy enough for them to access and navigate using a computer and the Internet.
2. **The target audience:** This project can help the target audience, children and teenagers ages 8 to 12 years old, in being prepared in case of a volcanic eruption even at a young age.
3. **IT students:** IT students can use the project as a reference for the websites that they will be tasked to create for their own studies.
4. **Other researchers:** This project can help other researchers that will work on the same topic by providing them with information about volcanoes and volcanic eruptions. The usefulness of the World Wide Web in spreading information will also be tackled.

Statement of the Problem

The study intends to answer the question:

1. How can the website, 'volcaKNOWS', help in promoting awareness about safety measures in cases of volcanic eruptions?

Objectives

The main objective of this research is to develop an informative website regarding volcanic eruptions, especially on ways to be prepared in case such an event occurs. The dissemination of information would be easier through a website.

The study has the following objectives:

1. To develop a website containing information about volcanic eruptions:
 - basic facts about volcanoes and volcanic eruptions
 - list of active volcanoes in the Philippines
 - contact details of disaster relief organizations
 - safety measures before, during and after volcanic eruptions
 - an animation of the listed guidelines
2. To promote awareness regarding volcanic eruptions.

CHAPTER II. REVIEW OF RELATED LITERATURE

A fast and efficient way of spreading information is important, especially if it involves the safety of many. Natural disasters can happen at any place and at any time. It is best to be prepared so that casualties and damages may be reduced.

Using the Internet for Information Dissemination

According to Duffy (2000), since the Internet has the upper hand over customary formats of communication when it comes to flexibility, speed and reach, not to mention its swift growth, it is easily seen as a way for spreading research.

Savelau (2009) stated:

Internet has brought us several new mainstream communication tools, which revolutionary saved us time in creation and delivery of messages. In several years time we have extended the tools openly accessible to everyone to hundreds of new forms of information presentation and transportation to create a feeling of a virtual presence no matter how big the distance between two communicators is. (para. 1)

One of the quickest developing parts of the Internet and the simplest one to use is the World Wide Web. You can search for information just by clicking a link to access a topic that you are interested in.

How the Internet Helps in Disaster Preparedness

According to Putnam (2002), the Internet gives references, presents a way to share information and enables people to have immediate communication across the globe. When the Internet is available, people can access the correct information that will aid them in making critical decisions, and can search for news about their loved ones that may be affected by a disaster. The Internet can also supply safety measures and training resources, a way to properly communicate across agencies and a donation system for those who are working in the government and those who belong to disaster relief groups (Putnam, 2002).

Natural Disasters

Bradley (2010) defined a disaster as “a calamitous event, especially one occurring suddenly and causing great loss of life, damage, or hardship, such as a flood, airplane crash, or business failure” (p. 7). He added that disasters have five broad classifications: natural, pandemic, man-made, war/terrorism/crime, and personal. Their effects are usually alike even though they have different causes. Bradley (2010) also defined natural disasters as "events stemming from the dynamic nature of our universe" (p. 10). A disaster only happens when a physical event affects human beings and their environment. An example of a natural disaster is a volcanic eruption.

Volcanoes and Volcanic Eruptions

National Geographic (n.d.) defined volcanoes as “manifestations of the fiery power contained deep within the Earth” (para. 1). The Philippine Institute of Volcanology and Seismology or PHIVOLCS (2013) defined a volcano as “a hill, mountain or fissure from which molten or hot rocks with gaseous materials are ejected” (para. 1). It erupts volcanic material through its vent or opening in the surface of a planet (Clements, 2009). It is responsible for the Earth’s surface’s formation and is “one of the most powerful and destructive forces on the planet” (p. 276). Volcanoes are deadly when they erupt, filling the air with ash and dust (Levy, 2009).

Classification of Volcanoes

PHIVOLCS (2008) classified volcanoes into three: active, potentially active and inactive.

1. Active volcanoes: "erupted within historical times (within the last 600 years), accounts of these eruptions were documented by man; erupted within the last 10,000 years based on analyses of datable materials" (para. 4). There are 23 listed active volcanoes in the Philippines. Among these are Mt. Mayon in Albay and Mt. Pinatubo in the boundaries of Pampanga, Tarlac and Zambales.
2. Potentially active volcanoes: “morphologically young-looking but with no historical records of eruption” (para. 6). Some examples are Mt. Apo in Davao and Mt. Isarog in Camarines Sur.

3. Inactive Volcanoes: “no record of eruptions; physical form is being changed by agents of weathering and erosion via formation of deep and long gullies” (para. 8). Mt. Abunug in Southern Leyte and Mt. Bagsak in Sulu belong to this category.

Volcanic Hazards

These are occurrences that happen as a result of volcanic activity that present possible risks to humans or property (PHIVOLCS, 2013). The U.S. Geological Survey (n.d.) stated that the following are some of the volcanic hazards: gas, lahars, landslides, lava flows, pyroclastic flows and tephra. To add to that, PHIVOLCS (2013) also listed secondary explosions and tsunami or seiche.

Volcano Alert Levels

PHIVOLCS (2011) provided alert level schemes for six of the Philippines’ active volcanoes on their website: Taal, Mayon, Bulusan, Hibok-Hibok, Pinatubo and Kanlaon.

In one of their brochures, PHIVOLCS (2004) said that the Alert Level Scheme was used in disseminating information about the condition of Mt. Mayon. Updates or bulletins included the alert status in order to inform not only the disaster management agencies but also the citizens. Danger zones were also set and were used as the basis for evacuation. The Permanent Danger Zone (PDZ) is the area within 6-km radius from the peak of the volcano. The probability of

danger and the hazard involved during eruption is high in the area. Table 1 shows a condensed version of Mayon Volcano's alert levels.

Table 1. Mayon Volcano Alert Levels

ALERT LEVEL	MAIN CRITERIA
0 – No alert	Quiet
1 – Abnormal	Low level unrest
2 – Increasing unrest	Moderate unrest
3 – Increased tendency towards eruption	Relatively high unrest
4 – Hazardous eruption imminent	Intense unrest
5 – Hazardous eruption	Hazardous eruption ongoing

Source. PHIVOLCS. (2011). Mayon volcano alerts levels. Retrieved January 9,

2015, from

http://www.phivolcs.dost.gov.ph/index.php?option=com_content&view=article&id=816%3Aamayon-volcano-alerts-levels&catid=83&Itemid=500001

Mount Pinatubo Eruption

According to Bradley (2010), natural disasters bring about great property destruction and inconceivable death. Included in his list of “some of the worst natural disasters in the last 50 years” (p. 8) is the eruption of Mount Pinatubo on June 15, 1991. It blanketed 290 square miles with ash and more than 800 people died. Pappas (2011) wrote that because of vigorous observation and public information operations, at least 20,000 lives were saved.

Disaster and Volcanic Eruption Preparedness

Since people cannot prevent natural disasters, what they should and can do is to prevent natural hazards from becoming disasters. (C. Villanueva-Villamil, Geologist, personal communication, January 23, 2014). Republic Act 1121 requires the local government to have plans for disaster management. The community should be prepared and early warning systems must be established for early warnings bring early action. In the Philippines, PHIVOLCS handles disaster preparedness and disaster prevention & mitigation. Villanueva-Villamil (2014) said that PHIVOLCS monitors parameters, posts bulletins and announcements, and also conducts seminars. They choose pilot sites, communities that live close to volcanoes, and conducts case studies. In disseminating information, it must be community-based. The governor or head would be provided with a copy and would be responsible for relaying it to the public. The community would then have a sense of ownership over the information and equipment. Residents, not only the governors or leaders, should be taught using their local language. Site-specific hazard maps and also scenario-based hazard maps must be provided.

Beach (2010) enumerates the four phases of the disaster cycle as:

1. Mitigation: the precautions taken to minimize a disaster's impact.
2. Response: the measures taken during and instantly after the disaster
3. Recovery: "the effort to return to normalcy after a disaster" (page 4).
4. Mitigation of future disasters

When asked to rate the Philippines in terms of disaster preparedness, Villanueva-Villamil (2014) replied that the Philippines is indeed at par with the other countries, the main problem being lack of funding.

Safety Measures in Cases of Volcanic Eruptions

It is important to be prepared before, during and after a volcanic eruption.

Some of the guidelines before a volcanic eruption given by The American Red Cross (2015) are:

- Learn about your community warning systems and emergency plans.
- Be prepared for the hazards that can accompany volcanoes.
- Make evacuation plans.
- Develop an emergency communication plan.
- Have disaster supplies on hand. (para. 1 & 2)

Veenema (2012) listed the following safety measures to observe during a volcanic eruption:

- Collaborate with emergency management specialists as needed.
- Follow the evacuation order.
- Listen to a battery-powered radio or television for the latest emergency information.

- Individuals with a respiratory ailment should avoid contact with any amount of ash.
- Wear long-sleeved shirts and long pants.
- Use goggles and wear eyeglasses instead of contact lenses.
- Use a dust mask. (p. 279)

Here are some of the safety guidelines after a volcanic eruption according to Apolinario et al (2009):

- Listen to the latest radio updates and the alert signals. Stay in the building until the volcanic eruptions have subsided.
- Survey the damage from the impact with caution.
- Cook food thoroughly and always observe personal hygiene.
- Only the adult members of the family should be allowed to go home to inspect the house condition. The rest of the family should only return when it is safe. (p. 219-220)

Synthesis

The proper dissemination of information is important not only during natural disasters, but also when preparing for them. One of the fastest ways in order to relay information and announcements is the World Wide Web. People will be able to access the website, 'volcaKNOWS', as long as they have an internet connection.

A volcanic eruption is one of the major natural disasters. Although it does not occur often, the damages that it brings when it does are extensive. Since we cannot actually stop natural disasters from happening, we must do our best to prepare for them. The website, 'volcaKNOWS', will be listing not only the basic facts about volcanoes and volcanic eruptions and the contact numbers of disaster relief organizations, but also the safety measures to follow before, during and after a volcano erupts. C. Villanueva-Villamil (personal communication, January 23, 2014) also suggested adding the signs of impending volcanic eruptions. Being prepared can save a lot of lives, like what happened when Mount Pinatubo erupted.

After going through books and websites that listed safety measures during volcanic eruptions, the researcher found them directed mostly at adults, using bulleted formats or long paragraphs. The website will also feature an animation video presenting the various guidelines to follow before, during and after a volcanic eruption for its target audience of children and teenagers ages 6 to 18 years old. The said animation can also help users who are not that proficient in English to understand the safety measures by giving them graphical representations and examples.

CHAPTER III. STUDY FRAMEWORK

When studying a subject, theoretical frameworks give people a certain view on how to do it (Trent University, n.d.). This study is based on the following theories: information theory, information richness theory and network and analysis theory.

Information Theory

Information theory, founded by Claude Shannon in 1948, is “a mathematical representation of the conditions and parameters affecting the transmission and processing of information” and focuses on the complications one may encounter during the communication (Markowsky, 2013). The message from the source must reach the receiver even if the channel is affected by noise. This theory may be connected to the study’s objective to promote awareness regarding safety measures in cases of volcanic eruptions. A website is a channel that can be easily accessed with the use of the Internet and a web browser. Through the website, the information gathered by the developer will be relayed to the users.

Information Richness Theory

Its proponents were Daft & Langel, 1948 (University of Twente, n.d.). It is also referred to as media richness theory, it gives the reasons why specific media are used in sending messages (Schiefelbein, 2012). Warters (n.d.) wrote that “the more ambiguous and uncertain a task is, the richer format of media suits it”. Since

volcaKNOWS' primary audience is children, the developer will make use of not only blocks of text, but also richer forms of media in order to aid in their understanding and to capture and retain their attention.

Network and Analysis Theory

Network analysis or social network theory is “the study of how the social structure of relationships around a person, group, or organization affects beliefs or behaviors” (University of Twente, n.d.). It is added that the theory concentrates not on the traits of people, but rather on their connections with one another. According to Prell (2011), one of the significant people that influenced the theory was Georg Simmel (1858–1918). In order to achieve the study's primary objective of spreading awareness about volcanic eruptions, it must not only be rich in content, but must also be accessed by the target audience. The better the website's quality, the more chances of it being recommended by the user to his or her peers.

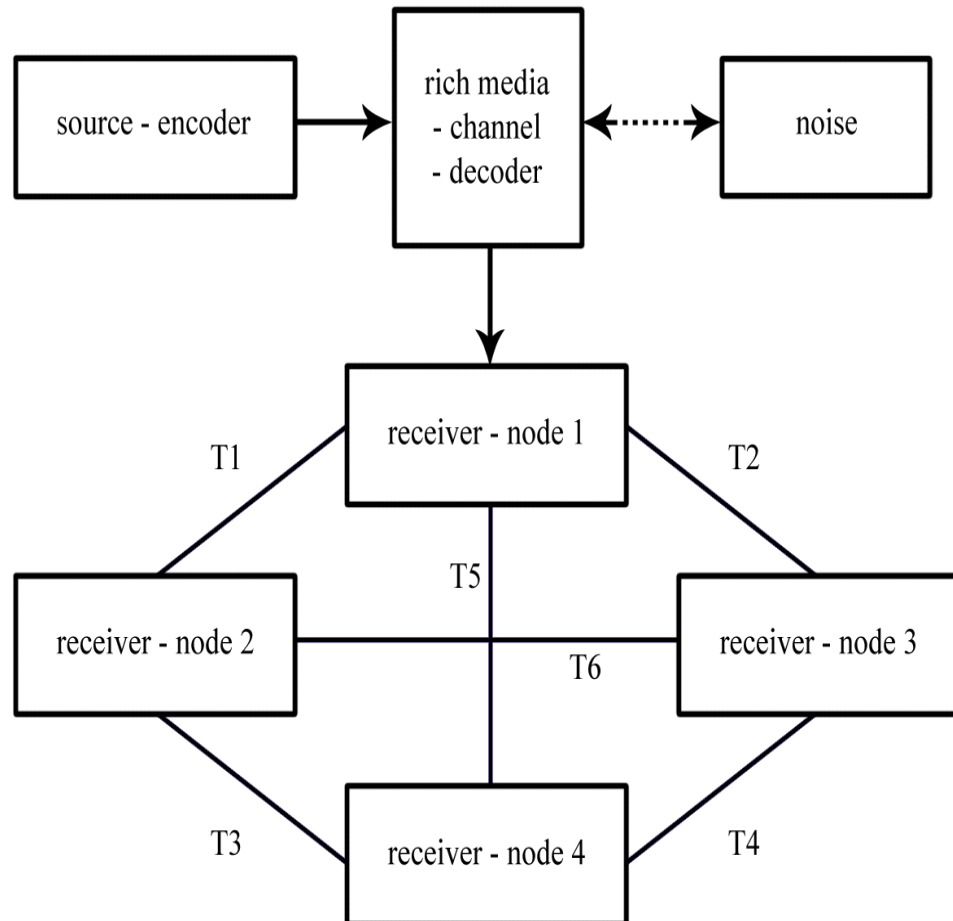


Figure 1: Theoretical Framework

Figure 1 illustrates the combination of the foundations of information theory, information richness theory and network and analysis theory. While information theory's main concern is the channel (where the message travels), the other two theories focus on the user.

The information theory model starts with the source, then the encoder, the channel, the decoder and lastly, the receiver (International Association of Communication Activists, n.d.). The noise is connected to the channel with a double-headed arrow and broken lines to show that there may or may not be noise present and that the noise may bounce back if not resolved properly. In Figure 1, the source and encoder, plus the channel and decoder, have been merged together because they have the same function in the diagram.

According on the diagram provided by Warters (n.d.), In information richness theory, the medium used or the media can be classified as either rich or lean (Warters, n.d.). The channel will be using rich media since it is more effective.

Some of the elements of the network and analysis theory are the nodes and ties. Nodes are the actors, organizations or events that make up the network and ties are the relationships between the nodes (Burris, 2012). The receiver and node have been combined for they have the same role. The ties are marked with T1 to T6. Since the ties connect the nodes in both ways, the arrowheads may be excluded (Bandyopadhyay, Rao, & Sinha, 2011).

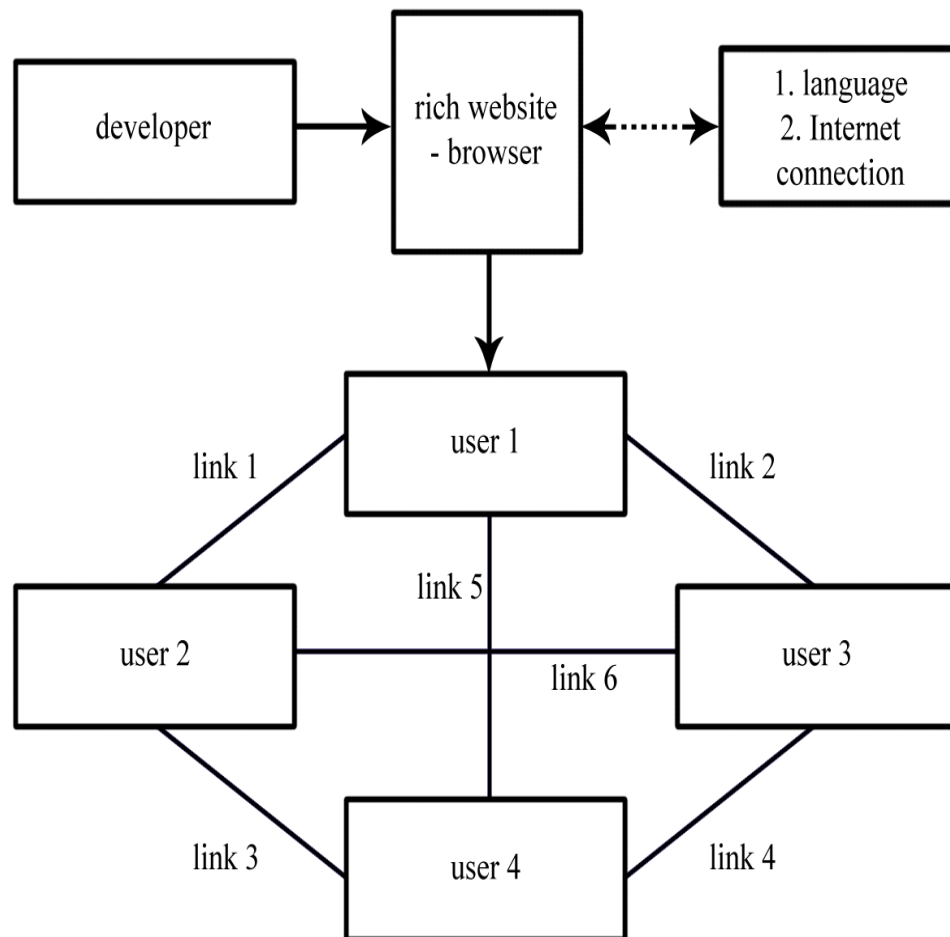


Figure 2. Conceptual Framework

The elements used in Figure 1 are replaced with concepts in Figure 2. The developer acts as both the source and the encoder. They gather the information and prepare them using different software so they can be sent or put up on the channel, which is a rich website. It will be decoded or viewed on the user's, previously receiver's, chosen browser. Two possible noises that can be encountered are the language that is used on the website and the user's internet connection.

The ties (T1 – T6) are now links 1 – 6. Link 1 is between users 1 and 2. Link 2 is between users 1 and 3. Link 3 is between users 2 and 4. Link 4 is between users 3 and 4. Link 5 is between users 1 and 4. Link 6 is between users 2 and 3.

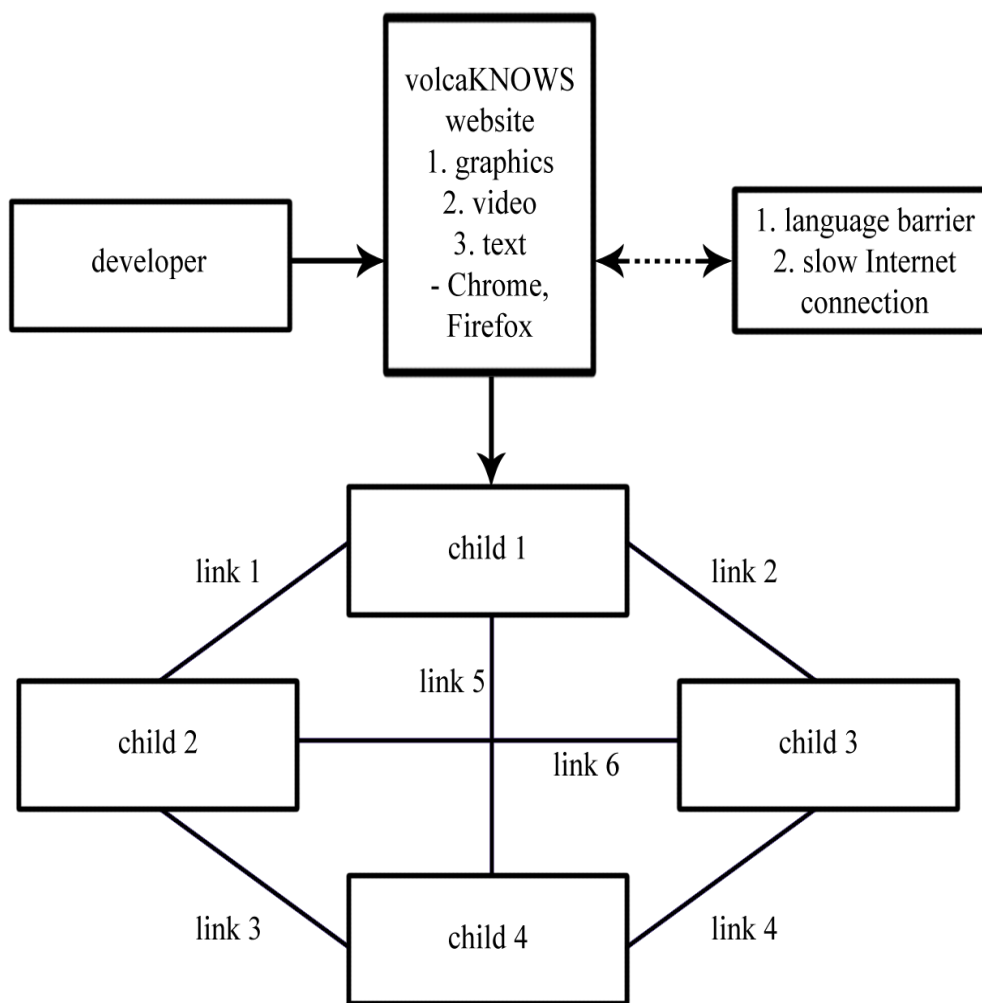


Figure 3. Operational Framework

In Figure 3, the concepts are more specific. The source and encoder is still the developer while the rich website is now 'volcaKNOWS'. Listed are the main types of rich media that is found on the website: graphics, a video and text. Two examples of web browsers that the user may use to view volcaKNOWS are Google Chrome and Mozilla Firefox. The content of the website will be in English, which will be a problem to those who do not know the language. A slow internet connection can also hinder the loading of the graphics and video. The links between the website's primary audience, children, are retained.

CHAPTER IV. METHODOLOGY

The researcher will be selecting samples of the target audience to determine the areas of the subject that need to be focused on and the way that they will be presented on the website.

A. Research Methodology

Research Design and Methods

In this study, the researcher will be conducting a quantitative research through a survey. The first will be used in order to measure the current knowledge that the respondents have regarding volcanoes and volcanic eruptions, and also to determine the forms of media that they would prefer to see on the website, ‘volcaKNOWS’.

Variables and Measures

As shown in Table II, variables and measures will be used in a quantitative research.

Table II. Variables and Measures

<i>Variables</i>	<i>Measures</i>
Age	8 to 12 years old
Sex	Male or female
Internet Connection	May or may not have Internet connection
Experience	Has or has not experienced a volcanic eruption
Preference	May prefer graphics, animation or text

Research Instruments

The researcher will be conducting the survey using printed questionnaires. Since the target audience is elementary students, it will be more favorable for them to answer printed ones instead of using an online questionnaire since they may not have access to a computer or an Internet connection at the time of the survey. It will also be easier for them to reach the researcher if ever they have any questions about the questionnaire.

Units of Analysis and Sampling

The unit of analysis that will be used in the study is individuals since each has their own experiences and preferences that can aid in the construction and designing of the website. Thirty elementary students between ages 8 to 12 years old that are studying in St. Scholastica's College – Manila, regardless of whether they are in the same class or not, will be selected using purposive sampling. The selection of the respondents will be limited to the said college as it will be more convenient to the researcher who is studying at the same school.

Data Gathering

The first survey will be administered on August 2015. After selecting the participants, the researcher will hand out the questionnaires to the respondents. After a week, the completed questionnaires will be collected by the researcher for tabulation and examination.

Data Analysis

The data will be examined using descriptive statistics. After tabulating the responses to each question, the frequency and percentage of the variables will be calculated. The results will be affecting the information shown on the website and also its way of presentation.

Scope and Limitations

The study will focus on safety measures in cases of volcanic eruptions. The guidelines will be obtained from various sources, including some from the American Red Cross' website. An example of a warning system and basic facts about volcanoes will also be provided. Different kinds of media will be used on the website. Based on the survey results, priority will be given to the type that gets the highest percentage. The website will be designed using a fun combination of colors and will not only contain blocks of text but also graphics to catch the attention of children. A webpage will contain contact details of organizations that people may contact in cases of volcanic eruptions. The users will be able to contact the researcher through e-mail.

Due to lack of experience and limited knowledge, the researcher will be developing a website instead of a mobile application. For the editing of graphics, the researcher will only be using Adobe Photoshop and not Adobe Illustrator. For the video or animation, the researcher will be using Adobe Flash and Sony Vegas Pro, not Adobe Premiere or Adobe After Effects. Only one table about warning systems will be given, just to inform the users that there is a way of monitoring

volcanoes. The researcher will not be able to visit communities in the provinces that live near volcanoes due to restrictions.

B. Project Development Methodology

Certain hardware, skills and software will be necessary in order to build the website and its contents. A desktop computer or a personal laptop will be needed for the whole duration of the project, since it will be used in compiling the data gathered and for the making of the website and its contents. In producing back-up copies of the work, having a USB (Universal Serial Bus) flash drive or an external hard drive is recommended. A pen tablet will also help in the illustrating process.

Some of the essential skills are: drawing skills for the illustrations and scenes in the animation, video editing skills for further polishing of the animated video and audio editing for the background music that will be used in the video. It will also be important to have experience in graphic design for the images that will accompany the text and web design for the construction of the website, ‘volcaKNOWS’.

Experience in the following software will be required: Adobe Photoshop for graphics editing as well as illustrating, Adobe Flash for animating, Sony Vegas Pro for video editing and Adobe Dreamweaver for web designing.

The researcher will be gathering the necessary information that shall be used on the website. Basic facts about volcanoes and safety measures in cases of volcanic eruptions will be taken from brochures provided by The Philippine

Institute of Volcanology and Seismology (PHIVOLCS), books and websites. A survey will then be conducted. The results will aid the researcher in choosing the information, including the way it will be presented on the website, that needs to be focused on. During the planning and construction of the website, its design and layout must suit the taste of the target audience, which is children ages 8 to 12 years old. Considering the design of the website and the results of the survey, the contents of the website will then be planned. Drafts of the graphics will be produced before saving them in a JPEG or GIF format. A storyboard for the animated video will also be created before the actual animation process. If necessary, the rendered animation will then be edited using a video editor. The finished contents will then be placed on the website, 'volcaKNOWS'.

The testing of the website will be important. If needed, changes to the contents and layout of the website will be done. Any bugs that will be found must be noted and fixed in order to ensure that the website will run smoothly.

References:

- American Red Cross. (2015). Volcano Preparedness. Retrieved January 5, 2015, from <http://www.redcross.org/prepare/disaster/volcano>
- Apolinario, N., Fallaria, R., Ronquillo, J. (2004). *Science spectrum* 6. Quezon City: Rex Printing Company, Inc.
- Baldivia, N. (2013). The state of Philippine Internet usage 2013. Retrieved March 10, 2015, from <http://www.forward.ph/blog/the-state-of-philippine-internet-usage-2013-infographic/>
- Bandyopadhyay, S., Rao, A R., & Sinha, B. (2011). *Models for social networks with statistical applications*. USA: SAGE Publications, Inc.
- Beach, M. (2010). *Disaster preparedness and management*. Philadelphia: F.A. Davis.
- Bradly, A. (2010). *Handbook to practical disaster preparedness for the family*. USA: Arthur Bradley.
- Burris, V. (2012). A brief introduction to network analysis. Retrieved February 12, 2015, from <http://darkwing.uoregon.edu/~vburris/whorules/network.htm>
- Byte-Notes. (n.d.). Advantages and disadvantages of computers. Retrieved January 8, 2015, from <http://www.byte-notes.com/advantages-and-disadvantages-computers>
- Cerf, V., Clark, D., Kahn, R., Kleinrock, L., Leiner, B., Lynch, D., Postel, J., Roberts, L., & Wolff, S. (n.d.). Brief history of the Internet. Retrieved January 8, 2015, from <http://www.internetsociety.org/internet/what-internet/history-internet/brief-history-internet>

Clements, B. (2009). *Disasters and public health: Planning and response*.

Massachusetts: Butterworth-Heinemann.

Collins, L. (2000). *Disaster management and preparedness*. Florida: CRC Press

LLC.

Cook, D. (1995). Travel the information superhighway: A college student's guide to the Internet. *Black Collegian*, 26(1). 91.

Retrieved January 5, 2015, from

<http://search.proquest.com/docview/195708880/2683AB85CED248B0PQ/12?accountid=34320>

Duffy, M. (2000). The Internet as a research and dissemination resource.

Health Promot. Int., 15(4). Retrieved January 8, 2015, from

<http://heapro.oxfordjournals.org/content/15/4/349.full>

Edwards, A. (2009). *Preparedness now!: An emergency survival guide*. USA:

Feral House.

European Organization for Nuclear Research. (n.d.). The birth of the web.

Retrieved March 10, 2015, from <http://home.web.cern.ch/topics/birth-web>

Flores, H. (2014). Evacuation ordered as Mayon threatens to erupt. Retrieved

March 10, 2015, from

<http://www.philstar.com/headlines/2014/09/17/1369958/evacuation-ordered-mayon-threatens-erupt>

International Association of Communication Activists. (n.d.). Models of

communication. Retrieved March 12, 2015, from

<http://www.iacact.com/?q=models>

International Federation of Red Cross and Red Crescent Societies (IFRC).

(n.d.) Geophysical hazards: Volcanic eruptions. Retrieved January 8, 2015, from <http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/volcanic-eruptions/>

Levy, J. (2009). *World's worst volcanic eruptions*. New York: The Rosen Publishing Group, Inc.

Mangosing, F. (2013). Deadliest typhoons in the Philippines. Retrieved January 8, 2015, from <http://newsinfo.inquirer.net/523393/deadliest-typhoons-in-the-philippines>

Markowsky, G. (2013). Information theory. Retrieved February 12, 2015, from <http://www.britannica.com/EBchecked/topic/287907/information-theory>

Monitoring Philippine active volcanoes (a general view on the surveillance techniques): Mayon Volcano [Brochure]. (2004). Quezon City: Philippine Institute of Volcanology and Seismology

Oregon State University. (n.d.). Deadliest eruption. Retrieved January 8, 2015, from <http://volcano.oregonstate.edu/deadliest-eruption>

National Disaster Risk Reduction and Management Council. (2014). SitRep no. 35 re monitoring activities on the alert status of Mayon Volcano. Retrieved January 8, 2015, from http://ndrrmc.gov.ph/attachments/article/1294/Mayon_Volcano_Situational_Report_No_35_as_of_21OCT2014_0800H.pdf

National Geographic. (n.d.). Volcanoes. Retrieved March 11, 2015, from
<http://environment.nationalgeographic.com/environment/natural-disasters/volcano-profile/>

Pappas, S. (2011). Pinatubo: Why the biggest volcanic eruption wasn't the deadliest. Retrieved January 5, 2015, from
<http://www.livescience.com/14603-pinatubo-eruption-20-anniversary.html>

PHIVOLCS. (2008). Active volcanoes. Retrieved January 8, 2015, from
http://www.phivolcs.dost.gov.ph/index.php?option=com_content&view=article&id=57:activevolcanoes&catid=55&Itemid=114

PHIVOLCS. (2008). Inactive volcanoes. Retrieved January 5, 2015, from
http://www.phivolcs.dost.gov.ph/index.php?option=com_content&view=article&id=59:inactive-volcanoes&catid=55&Itemid=116

PHIVOLCS. (2011). Mayon volcano alerts levels.
 Retrieved January 5, 2015, from
http://www.phivolcs.dost.gov.ph/index.php?option=com_content&view=article&id=816%3Aamayon-volcano-alerts-levels&catid=83&Itemid=500001

PHIVOLCS. (2008). PHIVOLCS volcano monitoring.
 Retrieved January 5, 2015, from
http://www.phivolcs.dost.gov.ph/index.php?option=com_content&view=article&id=50&Itemid=86

- PHIVOLCS. (2008). Potentially active. Retrieved January 5, 2015, from http://www.phivolcs.dost.gov.ph/index.php?option=com_content&view=article&id=60:potentially-active&catid=55&Itemid=115
- Prell, C. (2011). *Social network analysis: History, theory and methodology*. London: SAGE Publications Ltd.
- Putnam, L. (2002). By choice or by chance: How the Internet is used to prepare for, manage, and share information about emergencies. *First Monday*, 7. Retrieved March 11, 2015, from <http://firstmonday.org/ojs/index.php/fm/article/view/1007/928>
- Savelau, D. (2009). What are the main online communication tools?. Retrieved March 11, 2015, from <http://youthguide.iearn.org/index.php/get-ready-for-global-environment/communication-tools.html>
- Schiefelbein, J. (2012). Media richness and communication in online education. Retrieved February 12, 2015, from <http://www.facultyfocus.com/articles/online-education/media-richness-and-communication-in-online-education/>
- Sun Star. (2014.) P61.5M released to help Mayon evacuees. Retrieved March 10, 2015, from <http://www.sunstar.com.ph/breaking-news/2014/10/26/p615m-released-help-mayon-evacuees-373096>
- University of Twente. (n.d.). Media richness theory. Retrieved February 12, 2015, from http://www.utwente.nl/cw/theorieenoverzicht/Theory%20Clusters/Mass%20Media/Media_Richness_Theory/

University of Twente. (n.d.). Network theory and analysis in organizations.

Retrieved February 12, 2015, from
http://www.utwente.nl/cw/theorieenoverzicht/Theory%20Clusters/Organizational%20Communication/Network%20Theory%20and%20analysis_also_within_organizations/

Veneema, T.G. (2012). *Disaster nursing and emergency preparedness: For chemical, biological, and radiological terrorism and other hazards, third edition*. New York: Springer Publishing Company.

Volcanoes and volcanic hazards [Brochure]. (2013). Quezon City: Philippine Institute of Volcanology and Seismology

Warters, B. (n.d.) Media richness theory. Retrieved February 12, 2015, from
http://www.campus-adr.net/ODRmodule/media_richness_theory.html