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Master's Thesis
Academic Year 2020

IBEUNA:
Interactive Tsunami Prevention Learning in Aceh
(Study Case in Min 29 Aceh Besar)



Keio University
Graduate School of Media Design

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A Master's Thesis
submitted to Keio University Graduate School of Media Design
in partial fulfillment of the requirements for the degree of
Master of Media Design

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Abstract of Master's Thesis of Academic Year 2020

IBEUNA:
Interactive Tsunami Prevention Learning in Aceh
(Study Case in Min 29 Aceh Besar)

Category: Design

Summary

Although Aceh has experienced numerous destructive tsunamis in recent history, when the tsunami 2004 struck, it led to devastating damage and human casualties. Many factors contributed to this lack of awareness. Children are a group at risk of disaster. They are supposed to learned early how to protect themselves from danger. As a disaster-prone country located in the Ring of Fire, children must be ready to respond the sign of the tsunami. It is important to give the knowledge of disaster preparedness to them. Learning media and content for children about disaster are also different from adults. This research is to explore the tsunami experience learning from the past and transform the data to user friendly interactive media for children in Aceh. Making a media contain lesson about tsunami prevention that can be accepted and implemented by children in everyday life. By this research, lesson learned from tsunami experience in the past can be more useful for Aceh's sustainable disaster risk reduction in the future.

Keywords:

Design, Interactive Media, Tsunami Learning, Disaster Prevention, Education

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Chapter 1

Introduction

1.1. Research Background

Aceh is the westernmost province of Indonesia. The city is located at the northern tip of Sumatra, with Banda Aceh as the capital and largest city. Aceh was the closest point of land to the epicenter of the 2004 Indian Ocean earthquake and tsunami, which destroyed much area of the western coast of the province. Around 170,000 Indonesians were died and missing in the disaster. The tsunami disaster in Aceh is not new disaster and it has happened several times. Aceh has a historical record related to the history of the earthquake and tsunami in the region. However, the tsunami 2004 was still strong enough to cause some significant destructive impacts and cause human casualties. Indeed, most people in Aceh are not aware of disasters and do not know how to respond to tsunami signals. It seems to be a recurring event from the same history that ignores lessons from the past.

The discontinuation of knowledge regarding the earthquake and tsunami history has led to a major information gap in Aceh that increased the vulnerability to disaster. There are several things that affect the breakdown of information about the tsunami disaster in Aceh. Like the war in the colonial period, the conflict between Indonesia government and Free Aceh Movement (GAM), the establishment of Islamic Sharia law and modern era. All of these things affect the mindset and behavior of the people in Aceh now.

mitigation lesson was not pass down to younger generation. Then, Aceh underwent a period of prolonged war, which perhaps shifted the focus of Acehnese people to more imminent affairs than the intergeneration transfer of tsunami history. Furthermore, education system for disaster prevention and learning is still not main concern in Indonesia until now.

One of the most effective prevention efforts to reduce the impact of disaster risk is from the education sector. Education is fundamental in shaping the character of the nation's generation. Education can provide people knowledge and skills in dealing with natural disasters. Disaster mitigation education is an essential requirement that students need to reduce the impact of natural disasters both now and in the future. Currently, disaster education materials are still minim in schools in Indonesia. Although students have been taught some ways to cope with natural disasters but they are still lacking. This is due to several factors such as the absence of special subjects to study natural disasters, less learning time and lack of disaster simulations taught in schools.

Children are supposed to learned early how to protect themselves from danger. Natural disasters in Indonesia are still considered as destiny by the community so that they do not increase the awareness and alertness of the disaster. Children are a group at risk of disaster. Based on the survey and interview I conducted, there are some problems for children awareness and understanding about tsunami. As a disaster-prone country located in the Ring of Fire, children must be ready to respond the sign of tsunami. It is important to give the knowledge of disaster preparedness to them. Learning media and content for children about disaster are also different from adults. They need attractive media for learning process. Some media use for teaching tsunami in Aceh is not easy to understand for children. The media used can only be understood by academics.

In this research, I used cultural and technology approach using local knowledge, people experience and interactive media. By this research, lesson learned from tsunami experience in the past can be more useful for Aceh's sustainable disaster risk reduction in the future.

1.3. Research Objectives

The objectives of this study are to explore the tsunami experience learning from the past and transform the data to user friendly interactive media for children in Aceh. Making a content contain lesson about tsunami prevention that can be accepted and implemented by children in everyday life. Scope limitation of this study is several area locations along the southwest coast of Aceh, which were particularly affected by the tsunami. The locations are situated at the border of the Indian Ocean sub-duction zone, which includes Banda Aceh and Aceh Besar.

1.4. Research Proposal

In this research, I am exploring story and experience from people in the past. I was a victim of the tsunami 2004. I lost many relatives and friend. I would like to give contribution for children about tsunami disaster education. The experience of tsunamis can be a lesson for young people now who will face the future. But as time goes by many things need to be changed to present more interesting lessons about tsunamis. Examining what media is suitable for children in Aceh. This research will used historical, local knowledge and technology approach

1.5. Research Goal

This research is aim to go deeper into the problem of tsunami awareness within children behavior through many sources scientific, historical, local knowledge, and hoping to create an alternative media to provide information about tsunami awareness for young generation.

1.6. Contribution

The research about tsunami awareness in Aceh can be used for further study. In this research, I did field observations, surveys, and interviews to find out the problem about tsunami awareness between children. Many things affect the mind-set of children related to tsunami awareness. Such as the influence of perception

from parents, environment, and culture. The research output about interactive media can be used to develop media suitable for the age of children today. I am trying to develop a media that is suitable for Aceh's children now but has content and information that contains experience in the past. Learning from experience is very important to minimize tsunami victims in the future. Experiential learning has significant teaching advantages. Peter Senge states that teaching is of utmost importance to motivate people. Learning only has good effects when learners have the desire to absorb the knowledge. Experience-based learning requires a direct approach to learning that moves away from only the teacher in front of the room or reading an information that provides and transfers knowledge to students [1]. Furthermore, the research output can be used to develop children media or comparison for providing children media about tsunami disaster learning.

Chapter 2

Literature Review

2.1. Historical Media for Tsunami Awareness

Aceh has a historical record related to the history of the earthquake and tsunami in the region. Although Aceh has experienced numerous destructive tsunamis in recent history, when the 2004 tsunami struck, it led to devastating damage and human casualties. It seems tsunami 2004 happened regardless of any lesson learnt from past similar events. Indeed, most people in Aceh were unaware of disaster and did not know how to respond. I was a tsunami survivor when tsunami 2004. At that time, my family and people surrounding did not respond to the signs of a tsunami. We stayed at home until the waves came. Many people at that time thought it was only flood. People near coastal even ran towards the sea to see the phenomenon of receding sea water and fish lying around. Suddenly a wave of water came and they did not have time to save themselves. It is one of sign of tsunami that should be understand

Many factors contributed to this lack of awareness. Firstly, tsunami happened infrequently perhaps once 50- 600 years. Due to its low-frequency, people tend to forget about it and lessons from past experiences were not being transferred to other community or generation. Then, Aceh underwent a period of prolonged war, which perhaps shifted the focus of Acehnese people to more imminent affairs than the intergeneration transfer of tsunami-history knowledge. The discontinuation of knowledge regarding the earthquake and tsunami history has led to a major information gap in Aceh that increased the vulnerability to disaster.

Besides, there are local knowledge related to the tsunami disaster that occurred in 1907 in Simeulue Island. At that time, it caused the loss of eight tribes on the island. This event encouraged people in the island to create a lullaby song, called Smong. It means tsunami in the local language, and is sung from generation to

generation, which reminds the Simeulue people to always be aware of the signs of tsunami. This tradition proved effective for the 2004 tsunami resulting in only seven victims on Simeulue Island” [2]. ”Oral history of Simeulue provided an extraordinarily powerful mitigation tool that saved countless lives where even a high-tech warning system with a 15-minute response time would have been of no help” [3]. Unfortunately, this local knowledge has not familiar in the other regions, even on the other side of the nearest island, for example Meulaboh city, due to language differences where peoples do not know what Smong means.

Today, there are several ways to uncover the past tsunamis record of Aceh. One of them is Paleotsunami, which combines a historical and scientific approach to create a record of the tsunami-history of a place. With Paleotsunami, scientists can access the tsunami history of Aceh over thousands of years, i.e. by using 23 carbon dating on tsunami sediment deposits, scientists can record a history of tsunami since the prehistoric period around 5000 years ago [4]. A brief of overview of past tsunami events in Aceh has been mentioned in the some of the scientific literatures base on tsunami deposit sediment carbon dating records. Five layers of tsunami deposit sediment have been found in Gua Ek Luntie (Ek Luntie cave) coastal area of Aceh Besar District. “An earthquake in the subduction zone of Aceh caused a sudden sea-level rise in Aceh resulting in sudden sea water changes with covered co-seismic subsidence and tsunami inundation” [5]. The cave was discovered by scientists when conducting research related to the existence of ancient tsunamis in Aceh. Researcher concluded Ek Luntie Cave recorded some traces of ancient tsunamis that once hit Aceh in the past, around 900, 1349, 1450, 1797, 1833, 1907, and December 26, 2004.



(Scene in Documentary film "Tsunami Purba [6]")

Figure 2.1 Traces of Ancient Tsunamis in Aceh

Ancient literature and personal prose manuscripts can provide written evidence of tsunami occurrences since 1000 years ago. The manuscripts are an invaluable record of Acehese indigenous local wisdom and could be crucial in communicating relevant lessons to current and future generations. The surviving manuscripts are preserved at some institutions and individuals. For example, Dayah Tanoh Abe, Ali Hajsmy Museum, Aceh Tsunami Museum, and Pendar museum

One manuscript related to earthquake and tsunami as indigenous Acehese knowledge was recorded in the 17th century, written in Jawi Language, which is the Malay language written in Arabic script. It said "Rajab, if earthquake happens in Dhuha time, it will cause hard wind, sea waves are loud in it" [7]. This is mentioned in the yellow highlighted sentence in the last paragraph, shows in the figure below. Most of manuscripts said that, if an earthquake happens during Dhuha, it will cause strong wind and rising sea levels (or tsunami). This knowledge is an Acehese local wisdom related to earthquakes and tsunamis.

In this case, I choose Pendar museum for interviewed because they have community that focus for young generation. I conducted interview with young generation that focus on old manuscript. He is a director of Pendar museum. Since he was junior high school, he focused on finding old manuscript. Pendar Museum is a museum located in Blang Glong, Pidie Jaya and has a branch in Punge Blang Cut, Banda Aceh. The museum was founded by Masykur Syarifuddin on June 6, 2015. The museum collects various ancient objects from Aceh's civilization, such as manuscripts, currencies, weapons, ceramics, and various other artifacts. Today, Pendar Museum has a collection of approximately 5,000 ancient objects.



(Earthquake Manuscript collection of Ali Hajsmy Museum [8])

Figure 2.2 Earthquake Manuscript Collection of Ali Hajsmy Museum



Figure 2.3 Manuscript about Earthquake and Tsunami in the Past on Pendir Museum

Masykur explained Pendir museum has 12 manuscript talking about disaster. Based on the manuscript people in the past know how to respond the natural sign of disaster. They also like to write their experience into poetry, story and other type of writing. But conflict and war made many manuscript burn a lot of their works. He also has open a class for people to learn about ancient manuscript but language differences makes young generation hard to understand some manuscript that still exist. During the Dutch colonial period, Indonesian was used as a working language in government administration. Strengthened by "oath of youth" on October 28, 1928. This language change affected the young generation of Aceh, who did not care about texts written in Jawi (Malay with Arabic script), and translated into Indonesian. Termination of knowledge about the earthquake and tsunami history has led to the loss of key information in Aceh that increases the importance of the disaster.



Figure 2.4 Masykur Aceh's Antique Collector, founder of Aceh Pendir Museum

2.2. Film as a Medium to Educating Young Generation

Film is an effective alternative medium for learning about past disasters. Aceh is one of the provinces in Indonesia that does not have a cinema. Aceh has a sharia law where there is no theater or media for watching. In fact, movie theaters had been around in Aceh since the colonial era. Between the 1920s and 1940s, there were two famous movie theaters in Banda Aceh named the Rex Bioscope and

the Deli Bioscope. Then, movie theaters closed after the western Indonesian city was struck by a tsunami in 2004. The province has since been rebuilt and gained autonomy from the central government, as well as ended a decades-long separatist insurgency and introduced sharia law, which led to movie screens going dark in Aceh for the last decade. While no permits to reopen movie theaters have been issued, officials remain quiet and have not officially banned theaters either. Efforts to reopen movie theaters have been met with challenges from religious groups, such as MPU (Ulema Consultative Assembly) and local authorities. Their usual argument movie theaters are opposed to the spirit of sharia, which stipulates that men and women should not sit side by side.

Then, how is the mechanism for film screening now in Aceh. The answer is the film community. Independent film community that has an important role in driving the progress of film in Aceh, Indonesia. Film community usually hold workshops (training) about everything related to film. For example, ideas development workshops, script writing, making the screenplay, production management, cinematography, and editing. They usually consist of a group of movie lovers who have different skills. Together they worked in a compact manner to produce films, both long films, and short films. Within a year, this kind of community can usually produce one long film and 5-10 short films. Some communities work concurrently for distribution and independent exhibition. A community like this is very necessary. In addition to playing films independently, they also provide education to the public (in this case young generation).

Unfortunately, the films about tsunami that produced are only the consumption of academic people. The film is very difficult to understand by children and even adults. In addition, the average film produced does not focus on what happened during the tsunami, but how people live their lives now. Children expect visual content that can attract them and watch something repeatedly without being bored. Content that is fun and easy to understand. Content must also understand children's psychology. From my observations in the field, it is easier for children to understand languages that are close to them rather than academic languages

Previously, I mentioned about local culture called Smong in Simeulue island. People in Simeulue used to hear Smong as lullaby song since there were child. They directly respond if the situation like an earthquake or sign of tsunami and

try to save their life. There is a movie called "Nyanyian 1907". This is the first documentary film that told about what happened when tsunami in 1907. There was a tsunami survivor who experienced the Tsunami 1907 and also tsunami 2004 and she still alive. Her name is Rukiah (119 years old). She still remembers both of tsunami disaster.

Rukiah explained that at that time a large earthquake struck. During the 1907 tsunami, after the earthquake people panicked and saw that the sea was receding. They also saw the fish flounder because the sea water suddenly dried up. Her father carried her and ran to the hills because she remembered the Smong song and understood that it was a sign of a tsunami. All the residents of Simeuleu ran to the hills without being tempted to see the fish lying at sea. And many of them survived. Unlike the people outside Simeuleu who actually approached the sea and picked up the fish. Likewise, in the 2004 tsunami there were only seven victims because all the residents immediately ran to the hills.



(Source:

Documentary film "Nyanyian 1907" (Song of 1907) [9]

Figure 2.5 Picture of Rukiyah (Tsunami survivor)

Based on survey which I conducted for children in Aceh I found many student love visual. They like animation or colorful visual and eye catching scene. Meanwhile, I observe some movies produce in Aceh do not contain what the children need.

Based on interviewed with the founder of Aceh Documentary (one of big institution that focus about film in Aceh), he said filmmaker or people do not focus with how tsunami destroy everything but focus after what should they do after tsunami. So, young generation do not know about how to survive later. Film school or institution that focus about animation also still low in Aceh. Children

what media do you like in the learning process Among the choices below?
75 tanggapan

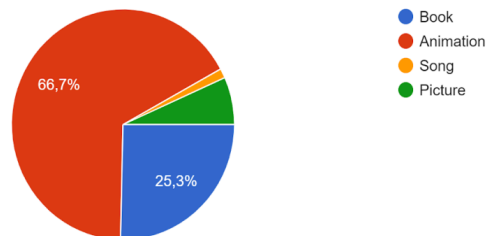


Figure 2.6 Survey about Student Disaster learning

watch animation from other country or city production which not contain what they need. Because of language difference, mindset and culture. Some children also do not concern about this disaster because the term word of "Tsunami" basically from Japan. So they think tsunami only in Japan. Children need media visual that contain cultural product and they feel close with it. The visual that can give knowledge and lesson about what should they do with the situation that will they face in the future. Smong and Iebeuna are cultural products. It is good if the product transfer to visual media like animation and combine with technology to attract children attention.



Figure 2.7 Jamaluddin Phonna (Founder of Aceh Documentary)

2.3. Aceh Tsunami Museum as a Center of Tsunami Learning

The Aceh Tsunami Museum is designed based on basic cultural ideas and traditional architectural elements in Aceh. It symbolizes the strength and patience of the people Aceh that suffered tsunami. Aceh Tsunami Museum is a museum that is used as a place to recall the sad events that have occurred in Aceh. The purpose of this building is expected to be a legacy for Aceh's generation and all the people in the world as a message and lesson. The 2004 Aceh tsunami experiences offer meaningful lessons. Aceh local knowledge must be transferred to others to mitigate future disasters.

Many factors contributed to the low awareness of the disaster. Now, many people are less interested in learning about natural disasters. Information is the most important issue in Disaster Risk Reduction (DRR). Information transfer and dissemination is needed for sustainability from generation to generation. One of the big reasons is gap information from the past disaster. Information can be delivered to the world as soon as possible by Internet and many platforms but people only feel sympathy and forget about it. They do not feel the desire to learn more about the disaster because they do not have the real feeling and experience about it. In this millennium era, the advanced technology used to deliver lessons and knowledge is needed. Technology could be one of the solution to fill in the gap information for Disaster Risk Reduction and spread it up to the world as a global information. In my previous research, I tried to use virtual reality to give tsunami experience for young generation. I designed virtual experience of tsunami experience about the feeling of Acehnese people suffered tsunami and how they passed it all by creating virtual experience of Aceh Tsunami Museum.

The design of Aceh Tsunami Museum has full of meaning and philosophy. I choose 4 spaces and turned it into VR contents. The 4 spaces are related each other. The 4 spaces are space of fear, space of pray, space of memorial, and atrium of hope. In the space of fear, users will experience how the feeling of being in the middle of a tsunami. After that, they will come to space of pray that will remind people should be strong as human and rise from adversity. Then, in the space of memorial, user will see how tsunami disaster affect and destroy the city. Last, in

the atrium of hope, people will know how people in the world help tsunami victim as symbol of peace.

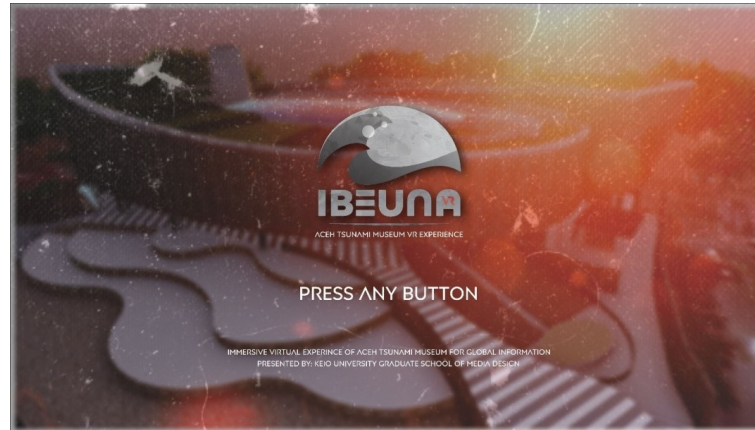


Figure 2.8 Start Menu Design Layout

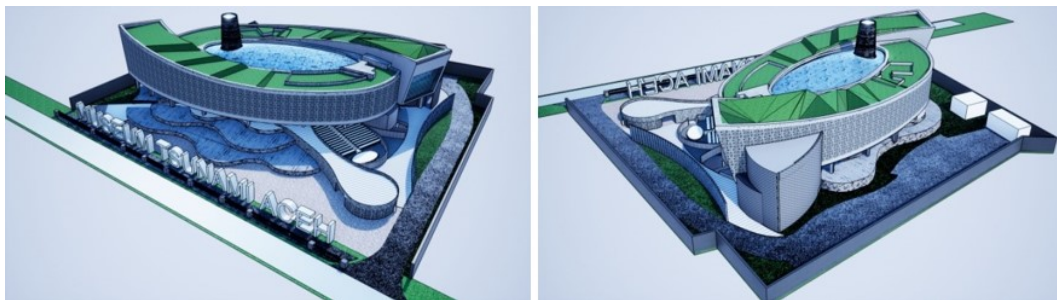


Figure 2.9 Aceh Tsunami Museum 3D building

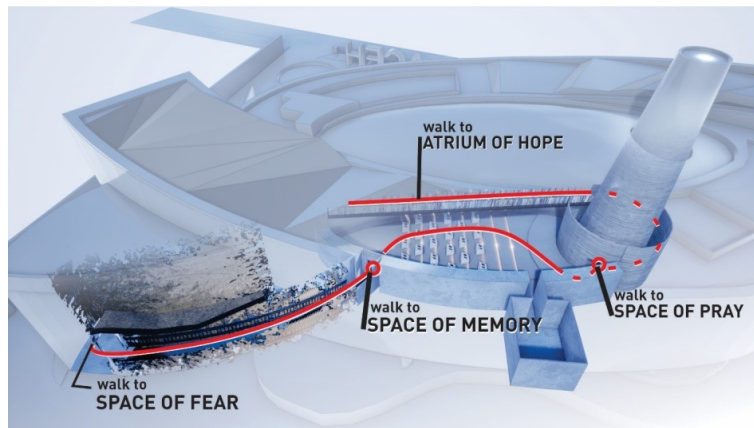


Figure 2.10 Aceh Tsunami Museum 3D building



Figure 2.11 3D Animation Space of Fear



Figure 2.12 3D Animation Space of Fear Walk Trough



Figure 2.13 Memorial Hill in Second Stage

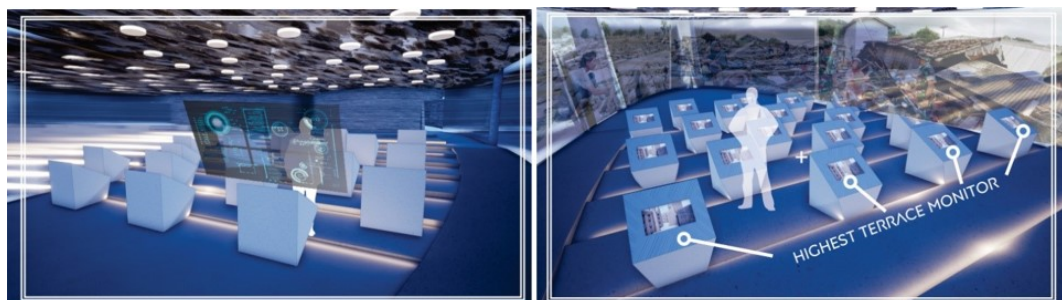


Figure 2.14 3D Memorial Hill Walk Trough

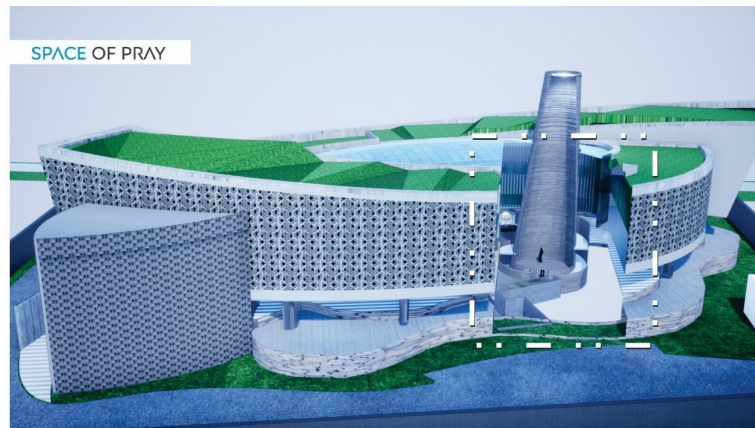


Figure 2.15 3D Modelling Space of Pray

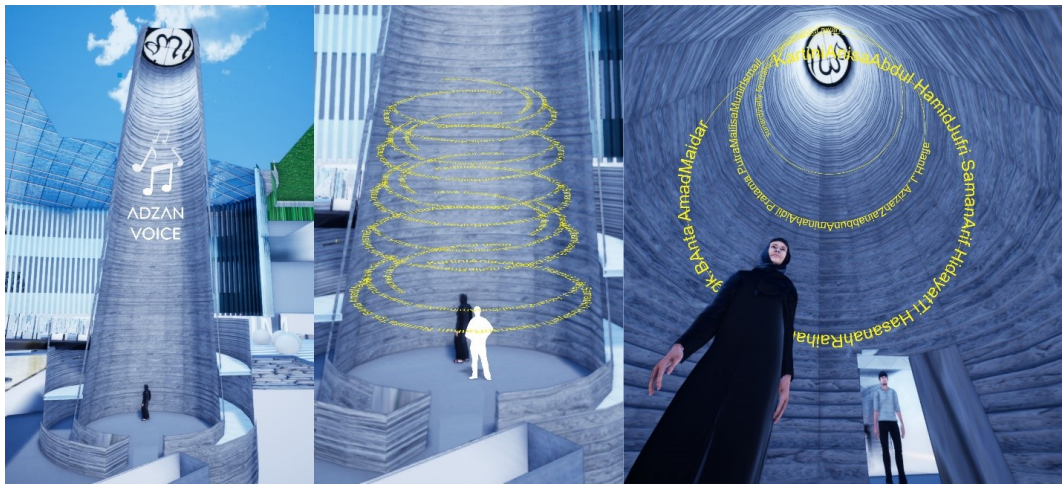


Figure 2.16 3D Modeling Space of Pray Walk Trough



Figure 2.17 3D Modeling Atrium of Hope



Figure 2.18 3D Modeling Atrium of Hope Walk Trough

Unfortunately, this experiment did not show good results. Advance technology and existing content did not have much impact for young generation. The results that I got from the virtual experience of the Aceh Tsunami Museum are not suitable as a learning medium for tsunami preparedness for children in Aceh. Children need visuals that are easy to remember and not scary. The content available at the Aceh Tsunami Museum is difficult for children to understand because it is academic type and contains a lot of philosophy.

Based on an interview with Hafni (the head of the Aceh Tsunami Museum, she told some problems faced by Aceh Tsunami Museum. First, the lack of expertise to maintenance and take care the available items in the museum. Then, there is no renewal content which suitable for young generation. Last, the awareness of visitors to take care of the museum is very lacking so many items are damaged.

Meanwhile, the interest of visitors always increases every year.

Awareness about natural disasters is also low due to people's mindset that is easy to forget what happened. This is influenced by the culture, customs and sharia law in Aceh. To change this condition, the easiest way is to start from the young generation. Children can still have a chance to develop their mind or mindset for tsunami awareness compared to adults.

However, some things that exist in Aceh society also provide many lessons for other countries including Japan. Japan itself has a good cooperative relationship in the context of disaster. Some museums in Japan have a good partnership with Aceh Tsunami Museum. Like Iwate Tsunami Memorial Museum and Kamaishi local history museum. Hafni (head of Aceh Tsunami Museum) explained that the museums in Japan have a curiosity about how people in Aceh can move on more quickly when the tsunami struck and is easy to forget. In the future, both parties want to continue to exchange lessons related to the tsunami disaster.

2.4. Related Works

2.4.1 Sona Area Tokyo

Sona Area Tokyo is located in Tokyo Rinkai Disaster Prevention Park that has some facilities for learning about natural disasters. People expected to come to this place to learn how to save themselves or just renew their memories of the skills they need in the event of a major earthquake or other natural disaster. On the first floor, visitor can see a disaster prevention experience zone facility that offers an experience program called the Tokyo Direct-hit 72 Hour Earthquake Direct Tour. It is often said that usually if a large earthquake occurs, it will take around 72 hours for the central or regional government to form a support system.

The tour program has been designed to help people learn how to survive on their own for 72 hours after a disaster. Visitors will start this tour by assuming that participants take the elevator from the 10th floor of a building. As soon as the elevator starts moving, participants hear the announcement about the earthquake that occurred. Participants get off the elevator that stops on the nearest floor. After exiting the elevator, they walked through a dim maintenance corridor



Figure 2.19 Sona Area Tokyo

without electricity and found dioramas that simulated serious damage to a city caused by a 7.3 magnitude earthquake.



Figure 2.20 After Shock Diorama

Participants are asked to take quizzes on tablet devices that they gave earlier during the tour. They will answer questions that ask how they will react or behave

in the event of a disaster. For example, they will be asked how they should act in a convenience store in the event of a major earthquake. This comparative study program has been designed to help people develop their skills to survive a major natural disaster and confirm the danger and precautions in the event of an earthquake using a tablet device.



Figure 2.21 Tablet for Taking Quiz Provide in Sona Area

In addition, on the second floors people can visit the Disaster Prevention Learning Zone, where they can learn about earthquake mechanisms while examining the possibility of maximum seismic intensity and damage expected when a major earthquake hits Tokyo Metropolitan Area. Furthermore, visitors also can learn how to reuse everyday items as emergency supplies, such as making filters from plastic bottles and using plastic bags along with newspapers as cutlery. Then, Visitors can also attend workshops where they will learn how to take slides from newspapers and raincoats from plastic bags.



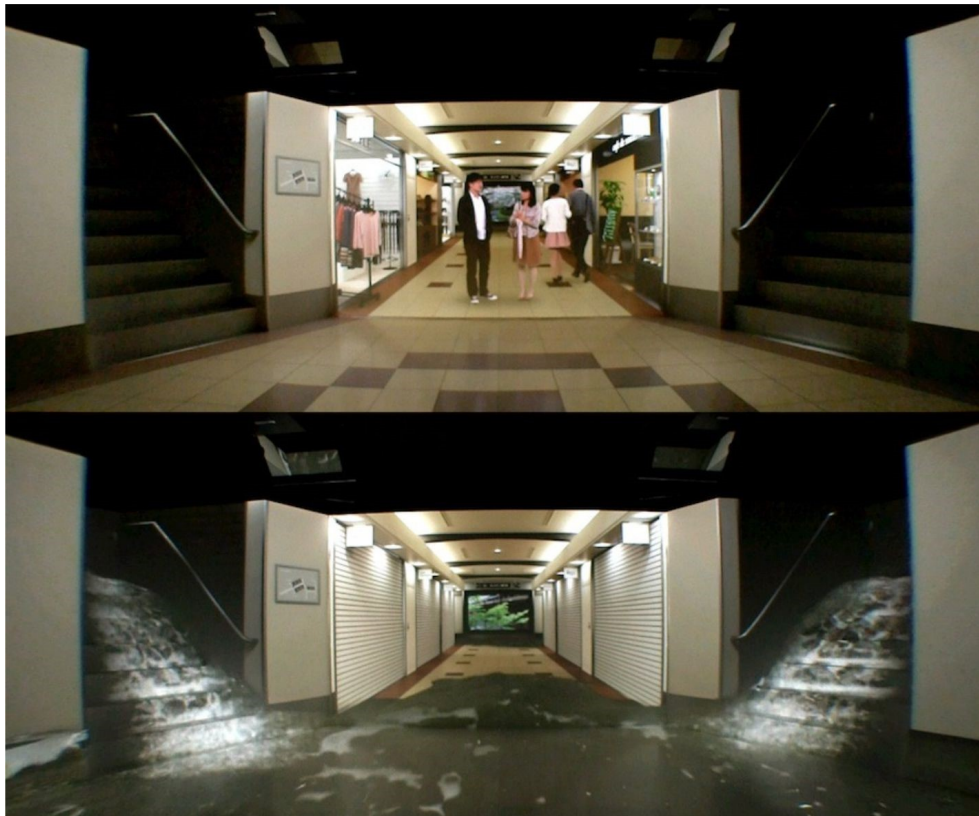
Figure 2.22 Self-Reliance Experience Area

Based on my observation, this place can provide a clear picture and understanding for visitors. Sona Area Tokyo is a good example for other areas that have the same problem. However, many things must be considered to create this kind of facility. Existing installation takes a lot of budget and experts. In my research, I tried to simplify what the place have and adjust to what are needed by children in Aceh.

2.4.2 Kyoto City Disaster Prevention Center

This place mission is to promote knowledge among citizens of disasters and to improve citizens' abilities to address disasters. The Kyoto City Disaster Prevention Center offers half-day and one-day programs designed to provide simulated experiences of disasters. It has simulated training program such as Earthquake simulation room, Disaster education video room, Typhoon simulation room, Smoke simulation room, Fire fighting training room, city flooding simulation room, General training room, and safe-living room. This place also has self study section such as kids fire land.

The city flooding simulation room is related to my research study. This is a 4D theater room with using projection mapping. This space is set for visitor to experience how flood suddenly comes when they are in the middle of daily activity. In this room, first visitors feel as if in a shopping center. Visitors can see a flood disaster simulation begin with a warning scene that floods will occur. Then visitors are expected to evacuate themselves. They also see the surroundings environment with the condition of the shops closed. Then, electricity began to turn off and the atmosphere began to tense. Water began to enter from the direction of the stairs to the shopping center and people should ran. Finally, the city was full of flood water. Based on my observation, projection mapping in this place gives realistic image.



(Source: kyoto prevention facility [10])

Figure 2.23 4D Theater and City Flood Simulation Room

Basically, projection Mapping uses daily video projections that we usually use. The difference in making a projection mapping, instead of projecting on a flat screen, the light from the projector can be directed to any surface and turned any object in the form of 3D into an interactive display. Projection mapping has many alternative names including the original academic term "spatial augmented reality" and "video mapping." Projection mapping can be applied for various purposes, such as advertisements, events, live concerts, theater, games, computing, decoration, and more. In my research, I created animated visual content containing education about tsunamis.

Chapter 3

Research Method and Needfinding Process

This research is focusing on qualitative methodology. I also used cultural approach and technology approach for this study. These are the steps I have done for this research.

1. Comparing Tsunami Learning in Aceh and Japan through Interview and Data Analysis
2. Conducting Survey about Children Understanding Related to Tsunami Awareness
3. Testing Student Understanding about Tsunami Preparedness using Handbook from National Agency for Disaster Management (BNPB) Governmental
4. Ideation and Concept Design
5. Creating and Designing a Prototype for User Test
6. Concept Proving (User Test)
7. Evaluation

3.1. Comparison Tsunami Learning in Aceh and Japan

Aceh and Japan are two regions that have experienced devastating disasters called tsunamis. Although many other areas have also experienced tsunamis,

these two areas are the best known related to tsunami event. Aceh is known internationally when tsunami occurred on December 26, 2004. Meanwhile, Japan is the country most frequently affected by the tsunami. The word tsunami comes from the Japanese word mean "water wave". Japanese people are familiar with this word, long before it became popular after the tsunami that hit Aceh. Based on some research, it reveals that Aceh communities already have knowledge in relation to the earthquake and tsunami under their own local terminology, i.e. "Geloro", "Smong" and "Ie Beuna". Unfortunately, these term not all people in Aceh know about this. Even though Aceh has been hit by many tsunamis before. Cultural changes and some events had made the ancestors of coastal communities forgot to share the information and knowledge about the tsunami phenomena to the next generation.

In this research, I interviewed one of Acehnese people that focused on tsunami learning for children. Sarona is a participant of JICA The Knowledge Co-Creation Program (KCCP) COURSE, JAPAN 2019. She represented Indonesia to learn about museums and culture in Japan, especially about natural disaster. Based on her experience, people's mindset towards disaster influences how they respond to natural disasters. Children in Japan and in Aceh have different characteristics. People in Aceh considered disaster as fate and do not make as learning experience.

The 2011 Japan massive tsunami traumatized many children in Japan. From the devastating event, there was an interesting lesson that took place in Kamaishi, one of the affected cities. At that time it was reported that all elementary and junior high school students who were at school, managed to save themselves. Junior high school students also helped elementary school students nearby to evacuate themselves to a safe place. From total of 2,924 elementary and junior high school students in Kamaishi, only five were victims [11]. Four of them were those who did not attend school or those who left school first, and one other person was found lost in the tsunami after returning home with his family. This event came to be known as the "Kamaishi Miracle" which was associated with strong disaster education through disaster betraining that students had attended at their school since 2005, including local knowledge of "Tendenko" which meant saving themselves to higher ground without seeking relatives. "As "tendenko" means "scattered" in local language, the legend has been transferred for a long time to teach that,

when you feel an earthquake, you should not wait for a unified action but run away individually and immediately. People of cities in northeast Japan, such as Kesennuma and Kamaishi, are enthusiastic about tsunami disaster prevention. They have been very effective in this regard, by organizing workshops, education for tsunami disasters and evacuation practices over the past 20 years [12].”

Both Smong in "Simeulue" and "Kamaishi Miracle" illustrate how knowledge plays an important role in saving lives during disasters. In fact, only knowledge is not enough to save life. Like Smong, people sing smong from generation to generation as lullabies so that they are embedded in the subconscious of these children. Likewise, in Kamaishi City, the knowledge that students gain from disaster education is followed by regular drill exercises so that this knowledge can be used to save themselves.



Figure 3.1 Sarona Maisarah JICA Participant

3.2. Survey about Children Understanding Related to Tsunami Awareness

I conducted a survey and discussion about student disaster knowledge and behavior. Participants are two class of student at grade six at Min 29 Aceh Besar. This school is near disaster prone area. In this survey, total of participant were 75 students. All of them live in area which less than 1km from coast line. First, they had 10 minutes to answer the survey. Then, I did discussion session 25 minutes. This survey purpose to get information and know more about what they

are thinking about tsunami disaster learning.



Figure 3.2 Survey in Min 29 Aceh Besar

From the survey I found out some problems and got many information. First, most of them have never participated in earthquake and tsunami simulations. Only a few students have participated in the simulation and it was done a few years ago. From the discussion, they said they had forgotten the learning they got.

Have you ever participated in a tsunami simulation at school or other institution?
75 responses

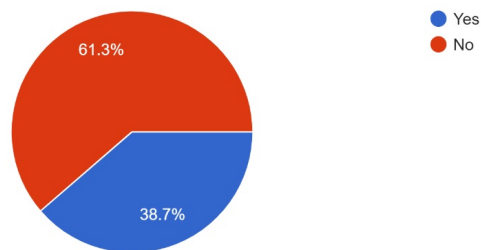


Figure 3.3 Result of Student Understanding Survey

Then, 60% of students know about the evacuation route. But when I did discussion with them, they said they did not know where to run because the board did not give clear directions. They only often see evacuation route signage around their homes. Based on my observations around the school and where students live, evacuation route signs only point towards the mountains or hills around. There is no escape building around.

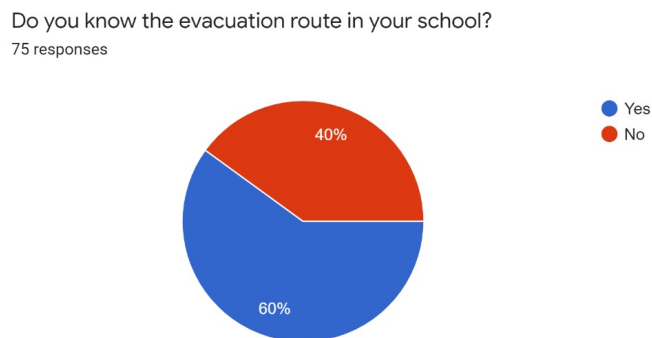


Figure 3.4 Result of Student Understanding Survey

Then, 92% from the total student said they have heard stories about the tsunami from their parents. The story they heard was how the damage happened because of the tsunami and how to survive afterwards. They were not told about the signs of the tsunami or what to do at that time.

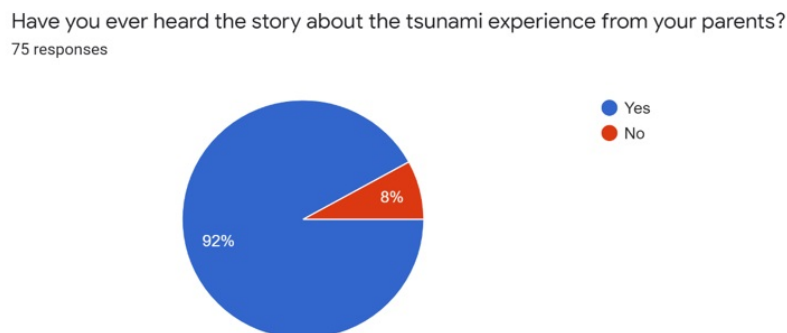


Figure 3.5 Result of Student Understanding Survey

Furthermore, 50.7% got information about tsunami preparedness only from video. While 41.3% never get information from guidebook and also video. Based on our discussion, video give information about tsunami but they easy to forget. They like visual media like animation for learning and attractive media. They love to watch video like animation and playing games. They like visual that easy to remember like animated characters. They also want a place that gives experience and learning with fun. Learning about tsunami is not interesting and sometimes too academic.

Have you ever read a guidebook or watched a video about tsunami preparedness?
75 responses

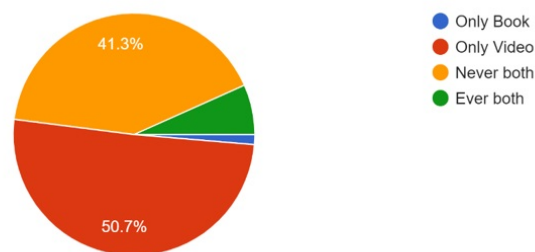


Figure 3.6 Result of Student Understanding Survey

3.3. Testing Student Understanding about Tsunami Preparedness Using Handbook from BNPB

BNPB is the Indonesian board for natural disaster affairs. One of BNPB's duties is to provide guidance and direction on disaster management efforts that include disaster prevention, emergency response, rehabilitation, and reconstruction in a fair and equitable manner. The school does not have a disaster curriculum yet and there are no specific lessons about natural disasters. During this time, teaching materials about natural disasters refer to BNPB guideline or hand book.

This test aims to determine how far this book effective for children learning media. What should be added to make learning about tsunami prevention more

interesting for young generation. The number of participants was 39 students in sixth grade with a range of ages 11-13 years. All students have never before read and know the book. This test takes 60 minutes. Students are asked to read parts of the book that contain how to save themselves when tsunami occur.



Figure 3.7 BNPB HandBook

When the test took place, I observe their behavior towards readings. The first 20 minutes student showed their enthusiast to read the book. Then, 20 minutes later, a half student got distracted from reading. In the last 20 minutes, almost all students got distracted, they could not be focused to read the book. After reading the book, the students were given a questionnaire to answer some question.



Figure 3.8 Student Read the BNPB Handbook

The results showed all student did not understand much about the content. The sentences hard to understand because in academic format. From the discussion, they said it should be more simple sentences.

Do you understand all of the contents about tsunami in this book?
39 responses

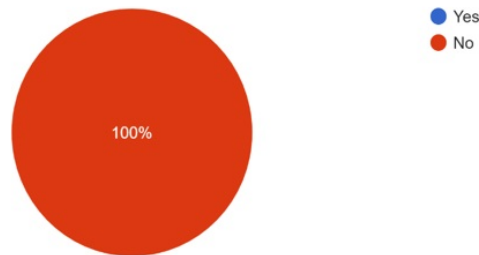


Figure 3.9 BNPB Handbook Test Result

Then, the result showed most of participants want more fun pictures and simple sentences to be added. Even though the books is full color and there are some info graphics on it, many student still hard to understand it. They want the book has more easy illustration and more pictures on it. Student said the reading materials make them boring.

What should be added to make this kind of books interesting for your learning?
39 responses

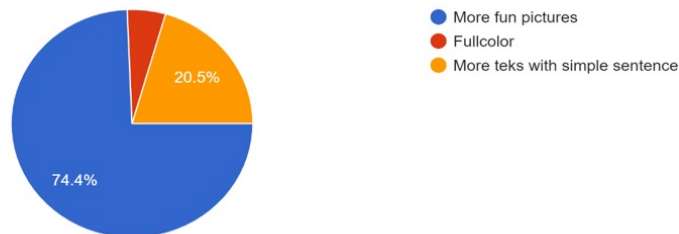


Figure 3.10 BNPB Handbook Test Result

Overall 89.7% students after reading the book they admitted that they did not get much knowledge because this book did not attract their attention to read.

Did your knowledge about tsunami learning increase after reading this book?
39 responses

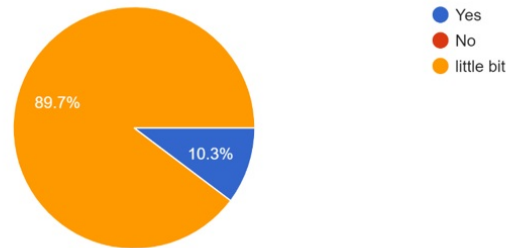


Figure 3.11 BNPB Handbook Test Result

After filled the questionnaire, there are some problems I find out during the discussion. Almost all of student said if there is something happened in the future, they only need to go to the mosque to save their life. They heard the story that many people safe when the tsunami came in 2004. Even though, there is a escape building around them. They are only thinking to go to the mosque. In the tsunami 2004, there is no escape building and tall buildings. The mosque is the only place where people evacuate themselves. In addition, the factor of trust makes the mosque one of the safest places. So many people do not believe in the security and resilience of escape building which built now. The mindset and behavior of students greatly influence what responses they will choose in the future.

After doing this test and discussion, I interviewed the principal and one of the homeroom teachers. The headmaster mentioned that the disaster education system is not yet operational in schools and is still in the planning stage. In this school, some teachers have participated in simulations and training on disaster learning, but the school cannot teach the knowledge as a school subjects. In addition, the homeroom teacher mentioned that she often tried to slip disaster knowledge into her subjects. She felt this education is very important. She was also one of the victims of the tsunami 2004, at that times she was immediately able to respond to the signs of the tsunami. Since childhoods, she was often heard about tsunami sign and how to respond. So when the tsunami 2004, she and her family survived because they immediately ran to the higher place. She also

mentioned that children today are less enthusiastic about tsunami stories, they need more interesting media to make children want to learn about tsunami.



Figure 3.12 Zaidin (Head Master of Min 29 Aceh Besar)



Figure 3.13 Laili Hafni (Homeroom and Tsunami Survivor)

Chapter 4

Ideation and Proof of Concept

4.1. Ideation

Based on the results obtained from the need finding process in the previous chapter, we can list top 3 biggest problems that experienced by children for learning tsunami awareness and preparedness.

1. There is no special media in Aceh that has children's content. Children in Aceh need media that have content with cultural approaches that closed to them. They need media with language that are easy to understand, not academic languages.
2. Children need visual media that are interesting and not boring, easy to understand, interactive, and varied. Visual language is one of the best simple language.
3. Children mindset and behavior influence how they respond when disaster strikes. They need a media that can be used repeatedly which making them remember what should they do when sign of tsunami come.

The question here is: *"How might we design and create appropriate media content which contain cultural approach and technology that helps children easily to understand about tsunami awareness and preparedness?"*

4.1.1 Base Idea

From the needfinding result, it is stated that children easily understand visual language. Visual language is the language of images. Elements in visual language include shapes, colors, lines, patterns, objects. The phrase 'one picture is worth

a thousand words' captures the essence of visual language. Visual language is a different form of communication, different from spoken and written languages, but as strong, descriptive, and emotive. This can be translated into spoken or written language but, like inter-language translation, there are limits and not everything that appears can be easily or effectively spoken or written. Based on the observation and finding process, I choose to design interactive tsunami prevention learning. I use animation as a learning tools. Animation is exciting and relatable for young children, and the process gets them engaged physically and mentally involved with what they see. They love watching animated shows and movies. Cute animated characters are easy to remember and stick in their memories. I created a fun character named Tsuna.



Figure 4.1 Tsuna original sketch

This character expected represent children in Aceh. The name "Tsuna" is taken from the the word "tsunami". Tsuna has a happy and optimistic character. The costume is designed based on traditional Aceh attire.



Figure 4.2 Tsuna Character Final Design

4.1.2 IBEUNA (Interactive Video Mapping about Tsunami Prevention Learning)

As mentioned before, the output of this idea will be video projection mapping. This visual mapping called IBEUNA. In the previous chapter, I explained that there are local term for Tsunami called Smong and Ie Beuna. In this project, I choose Ie Beuna because it is more familiar for people in Aceh Besar. Before the tsunami 2004 the Acehnese people used the vocabulary "Ie Beuna" to refer to high tidal waves of the sea. The tsunami in Aceh had happened centuries before, but the Acehnese people were unconscious and talked about it because of the information gap. The use of the word "Ie Beuna" is often found in the saga, poetry, old ancient manuscripts of Aceh. The content of IBEUNA also took from previous experience of tsunami survivor and disaster mitigation book.



Figure 4.3 IBEUNA Logo Design

4.2. Concept Design

The design of this idea belongs to category of conceptual design. Basically, conceptual design is the first of the product design process, where drawings and illustrations or other models are used. This serves to provide a description of the proposed product, in terms of updating ideas and concepts about what needs to be done, behaves and looks like a way that can be understood by the user. This is the design of interaction, experience, process and strategy.

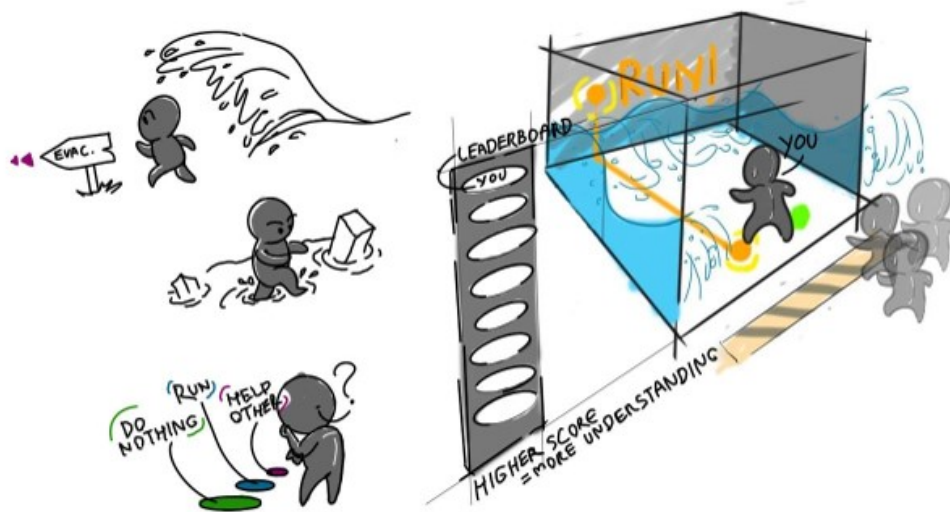


Figure 4.4 Original Sketch

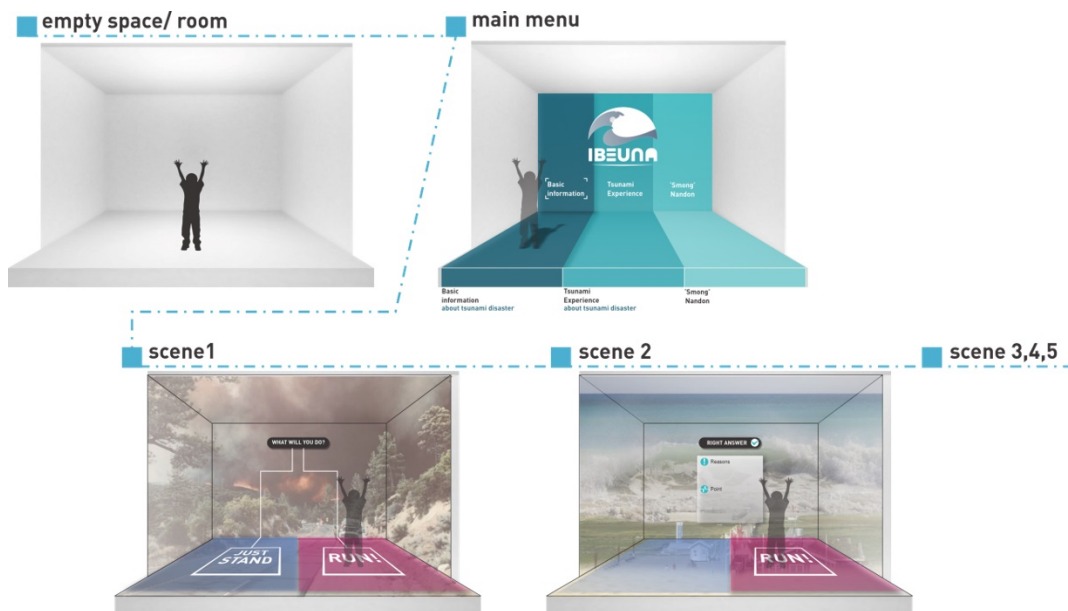


Figure 4.5 Concept Visualization 1



Figure 4.6 Concept Visualization 2

4.2.1 Learning Material and Video Concept

There are a lot of learning materials about tsunami learning. In this research, I designed three most important knowledge of tsunami learning for children. I took the material from tsunami guide book and also the experiences of previous tsunami survivors. The goal of this learning material is to give knowledge about what action they should take if tsunami happened in the future. Then, I put the material into the video concept. The video concept contains 3 parts:

1. Before tsunami disaster: They will see the signs before the tsunami, especially after earthquake such as intensity of the old earthquake and felt

strong, sea water receded, rumbling sounds from the middle of the ocean, many fish floundering on low tide beaches and other natural signs



Figure 4.7 Before Tsunami illustration

2. Tsunami Outbreak: If you have reached a high area, hang in there because second and third tsunami waves are usually larger from the first wave and listen to information from government system.

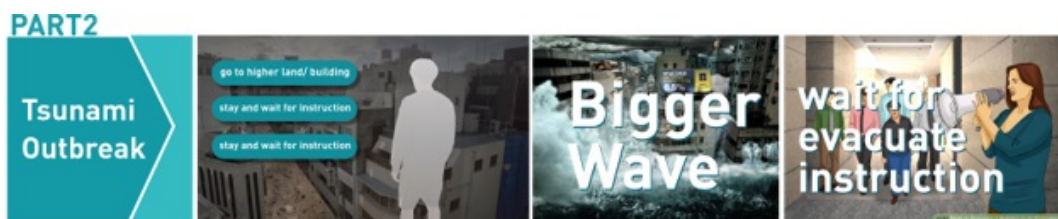


Figure 4.8 Tsunami Outbreak Illustration

3. After Tsunami: Avoid stagnant water because of possible contamination hazardous substances and electric shock. Stay away from rubble in puddles because it is very influential to the safety of the rescue boat and the people around. Listen to news or information about water conditions, as well as where get emergency tent assistance, clothes, and food.



Figure 4.9 After Tsunami Illustration

4.2.2 Interactive Tool

The concept design in this research used the tsunami simulation based on animation and implemented in the form of projection mapping with screen sizes of almost the entire room to provide more experience but still simply and combined with the controller as interactive media, so that users can feel involved in it. The user only needs to stand in the middle of the room or the specified point. Player watch the video and decide which option movement they should choose. The choice decides how many score they will get. The score will show how far they know and understand the tsunami prevention learning.



Figure 4.10 IBEUNA Final Design

In this research, I am using a Dance pad as a interactive tool. It is a flat electronic game controller used for input in dance games. This pad is divided into a 3×3 matrix of square panels for the user to stand on, with some or all of the panels corresponding to directions or actions within the game. Some dance pads also have extra buttons outside the main stepping area, such as "Start" and "Select". Pairs of dance pads are often joined side by side for certain gameplay modes. One of the famous game using this tool is Dance Dance Revolution (DDR). It is a video game by Konami that was released in the arcades of Japan in 1998 and is now available across several home entertainment systems, including Playstation, Wii, and Xbox. Players stand on a dance platform with arrows pointing up, down, left, and right. By listening to the music and watching a computer screen, players

need to tap the corresponding arrows on the beat.

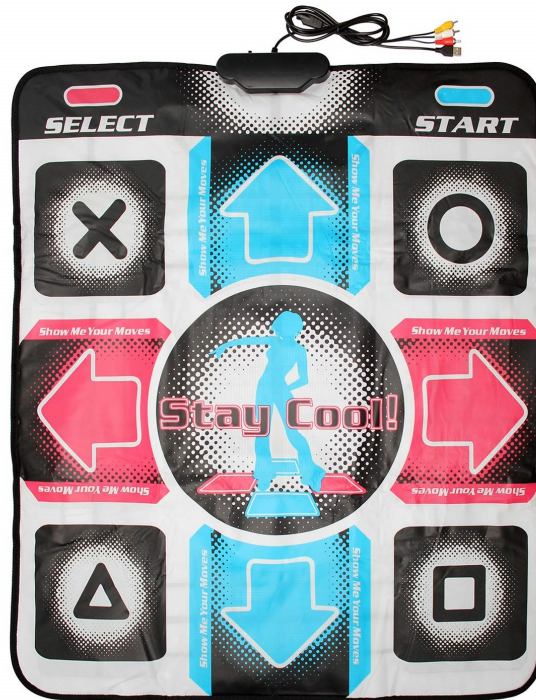


Figure 4.11 DDR Mat Product Existing

DDR is often played by many people for fun. Here I try to present content that has an element of learning so that children can play while learning. The dance mat can be customized easily as a game controller. The button can be modified based on the need and creativity. So, I changed the function of the button for my prototype. The explanation will be shown below in the table.

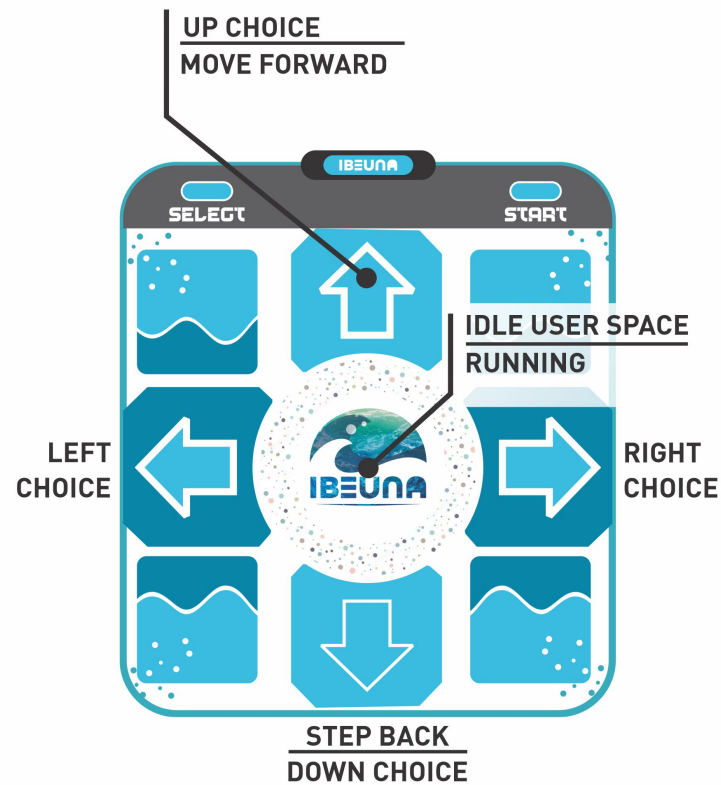


Figure 4.12 IBEUNA Controller Button

Table 4.1 IBEUNA Controller Buttons and Functions

Sign	Name of Button	Function
←	Left Button	Select direction to left
→	Right Button	Select direction to Right
↑	Front Button	Walking and Moving Forward
↓	Back Button	Step Back
∅	Center Button	Idle User Space, Running
Start	Start Button	Confirm

The use of dance pad as interactive media expected to promotes physical qualities, improves cognitive functions, improves socialization and motivation. It appeals to multiple intelligences such as visual, auditory, musical, kinesthetic, and interpersonal intelligences. This media which involve physical movement of the

player's body, are used to increase the efficiency of perception of the learning material connected with motor activity and to raise the level of motor activity of children. Last, IBEUNA also has the leader board which used to find out the highest score of the player. It functions to provide motivation to other players. User also can write comment that contains tips or personal experience.

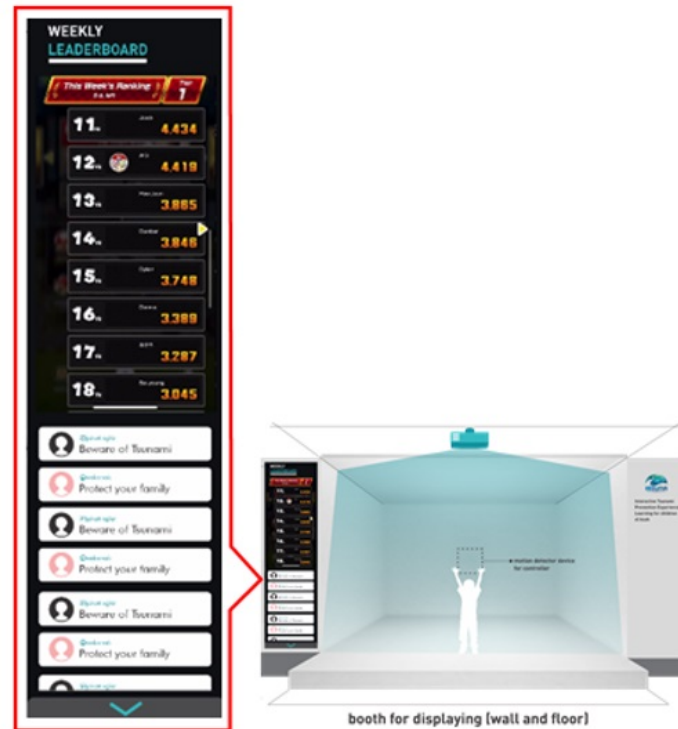


Figure 4.13 IBEUNA Leader Board Design

4.3. User Test and Evaluation

4.3.1 User Test

I did a user test in Min 29 Aceh Besar. This school located in disaster prone area which less than 1 KM from coastline. I did the user test in the classroom. The participant were 15 students. They are different students from the previous test. Before I did the test using IBEUNA, I did a pre-test using the media from the

government “BNPB Hand Book”. This book provides information about many kinds of disaster preparedness and prevention including Tsunami. In this session, they only read about tsunami section and answer some questions. This pre-test used for measure and compare how far participant got knowledge, understanding and learning about tsunami after using IBEUNA.



Figure 4.14 Min 29 Aceh Besar

After pre-test, each participant had 5 minutes for testing IBEUNA. I used projector for projecting the video and DDR mat for controller. In 5 minutes IBEUNA test, first they press the button to start the tsunami simulation experience. Then, they input their name as user. After that they select the stage or level based on location. Then, the users meet original character as guidance. They start every scene and then answer the question during the video with using moving body.



Figure 4.15 Participants



Figure 4.16 User Test

In the test, they saw the sign of tsunami, tsunami outbreak, post tsunami and choose what should they do. They can move and choose what should they do according to their need. If they choose wrong action, there is the notification will be warning. The notification also give explanation about why it is wrong. In the end, the score will appear. Last, participant give feedback and answer some question about tsunami learning. From the answer between pre-test and user test, the result showed how far children gain knowledge and understanding from BNPB

handbook and IBEUNA. The explanation will be explained below in evaluation section.

4.3.2 Evaluation

The user test joined by 15 elementary students. I did discussion with them and got some feedback related to IBEUNA. In the discussion session, I found they like the visual and animation. The content in the video easy to understand. They also want to play more. Besides, the weakness they said the length duration of video should be more added. They want additional fun character and game approach. Participant also said the character should be more eye catching and the sound of video should be more real.

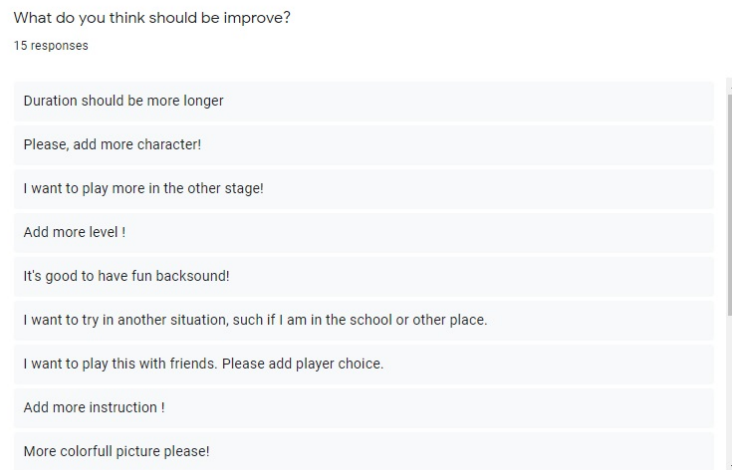


Figure 4.17 User feedback



Figure 4.18 Discussion with Participants

To measure their level of understanding participant filled questionnaires in the pre-test and user test. The answer showed different level of their understanding. From BNPB hand book pre-test, only 26.7 % of the participants knew that the roar of the sea and fish floundered are part of the signs of the tsunami. This knowledge is very important, where in the tsunami 2004 many victims were caused by people approaching the beach to see the phenomena instead of running to save themselves. In IBEUNA test, participant can see the illustration of this signs more clearly than just reading the handbook. It showed 80% know rumbling from the sea and 93.3% participants know fish floundering as natural sign of tsunami in Aceh.

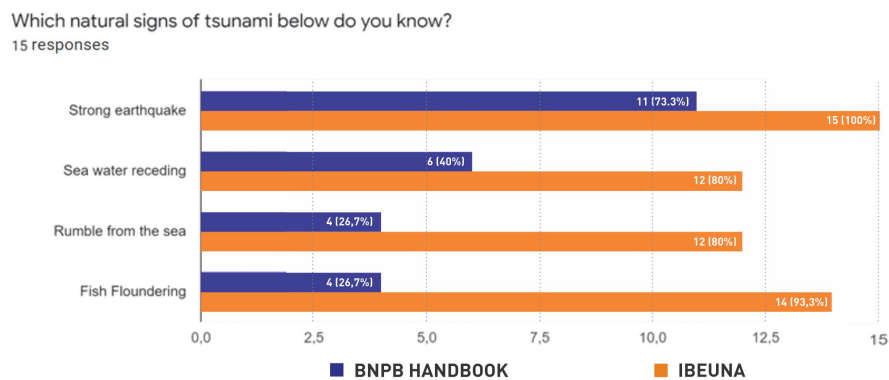


Figure 4.19 Result of Questionnaire

Usually if something happens, children immediately look for their parents or people closest to them. In case of tsunami, children are expected to be independent and understand what needs to be done and how to respond the situation. They are expected to immediately look for a higher place to save themselves when tsunami outbreak. There are increasing from 53.3% to 100% participant understand they should go to higher place if tsunami happened without thinking their relative.

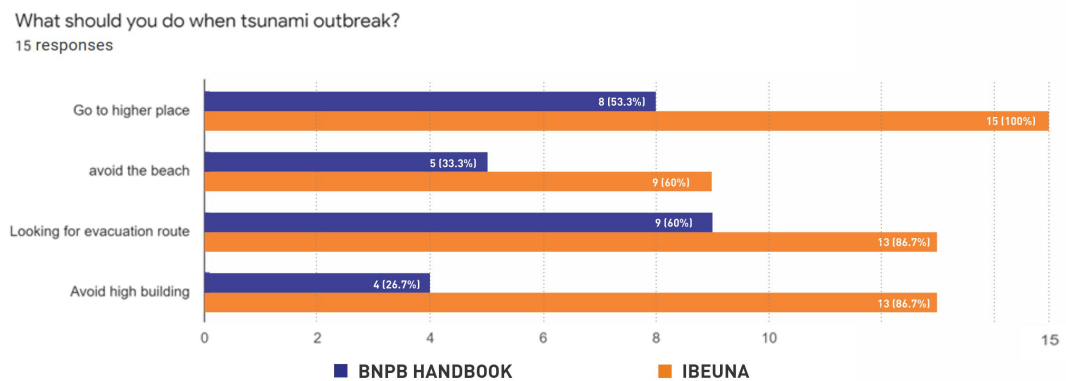


Figure 4.20 Result of Questionnaire

Based on previous tsunami event, after the tsunami receded another subsequent tsunami came. People should wait for instruction, avoid electrocuted water, and do not eat contaminated food. In tsunami 2004, many of those who survived initially become not survived because they did not know this knowledge. The result for question “what should the participant do after the tsunami recede?,” it showed only 33.3% participant in the pre-test know about it. Then it increased to 93.3% after IBEUNA test.

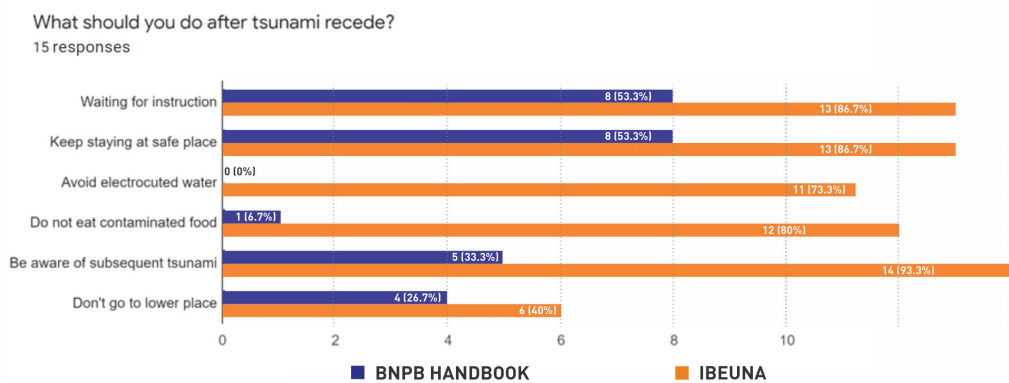


Figure 4.21 Result of Questionnaire

To simplify the evaluation results above, I compared the average percentage

of the results of the questionnaire. From the diagram below we can conclude the average percentage of participant understanding of natural sign of tsunami, increased from 27.78% to 58.88%.

Average formula

$$\text{Average} = \frac{\text{sum}(A1+A2+A3+\dots)}{n}$$

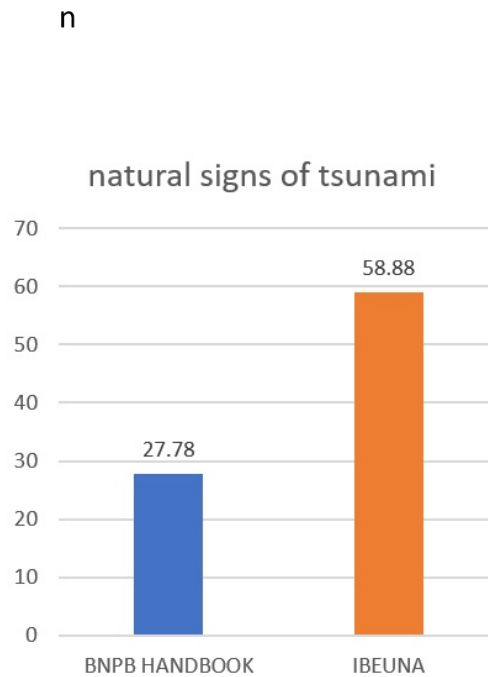


Figure 4.22 Average Percentage of Participant Understanding

The average of participant understanding about tsunami outbreak increased from 28.88% to 55.57%.

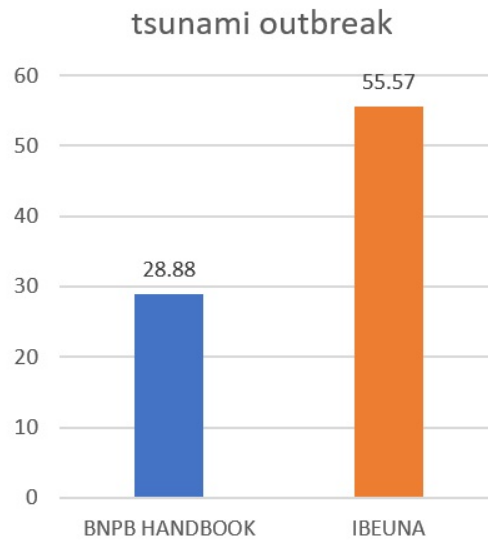


Figure 4.23 Average Percentage of Participant Understanding

We can also see an increase in the average number of participants who understand what to do after the tsunami water has receded. It increased from 26.68% to 76.67%.

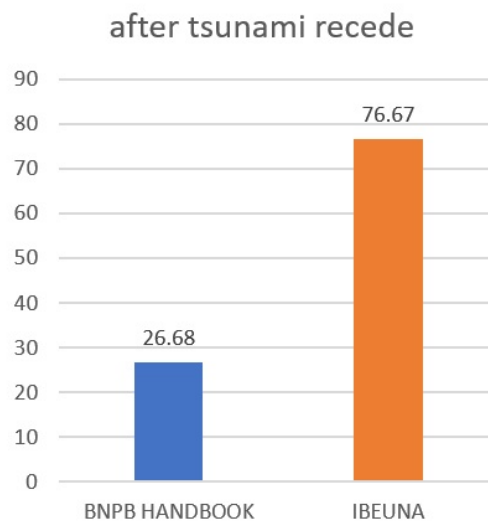


Figure 4.24 Average Percentage of Participant Understanding

Chapter 5

Conclusion and Future Works

5.1. Conclusion

The memory of the tsunami is not only meant to remember the grief-related casualties or damage and loss of property. But more important is to take lessons and prepare for possible future disasters. These memories must always be told, passed on, transmitted, and taught both horizontally (one generation) and vertically (different generations). The modern era greatly influenced the mindset of the people. The right media needed to teach about something that will happen in the future.

Sona Area Tokyo and Kyoto City Disaster Prevention provide good and effective examples for dealing with natural disaster issues. But many things must be considered to build a place like these. However, existing concepts and designs can be simplified and implemented in disaster prone locations or areas in developing countries. Meanwhile, media such as the BNPB handbook has accurate information about self-rescue. However, this book cannot be comprehended comprehensively by children.

In this research, I used media based on what children need in Aceh. Video projection mapping is one of alternative can be used for teaching tsunami prevention. The most important the content should be appropriate for children. Moreover, children's mindset and behavior influence what content should be serve for children. Different country has different treatment. The use of technology is also as needed. The content presented at IEBEUNA is in accordance with the demographics, culture, and experience of tsunami survivors in Aceh.

In conclusion, IBEUNA is quite helpful in providing understanding of tsunami learning for children. The result showed that children are interested to learn about tsunami prevention while they also can have fun. They are easier to understand

visual language. They can have clearly explanation about what respond they should take if tsunami happened in the future.

5.2. Future Works

In the future, this research can be taken further for these following:

- The design can be used for comparison to other media that can be implemented in others city in Indonesia.
- Research finding in this study can be used for further research to find out how to give appropriate media for children learning about disaster.
- Hopefully, the design also can be used for others place depend on demography, culture, and community behavior.

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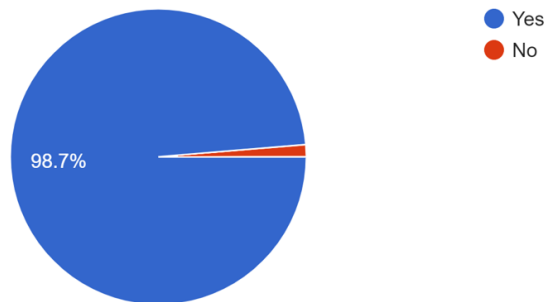
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Appendices

A. Result of Student Understanding Survey

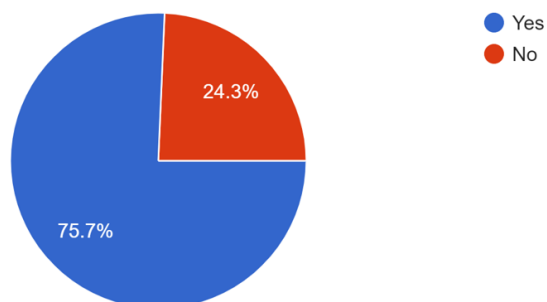
Do you know what is Tsunami?

75 responses



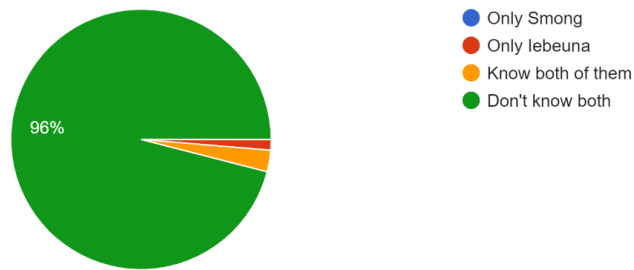
Do you know the signs of a tsunami?

74 responses



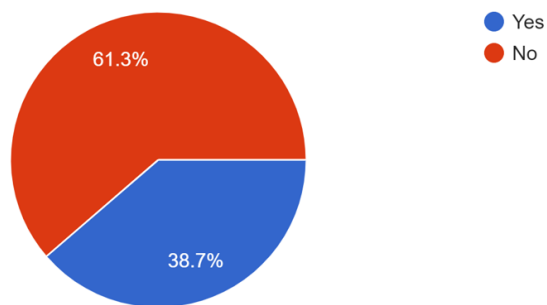
Do you know other terms of tsunami such as "Smong" or "lebeuna"?

75 tanggapan



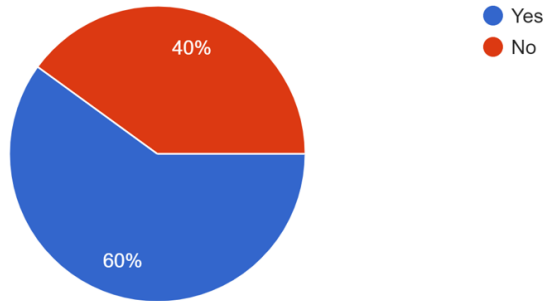
Have you ever participated in a tsunami simulation at school or other institution?

75 responses



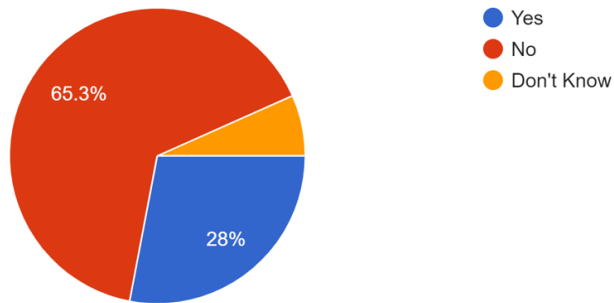
Do you know the evacuation route in your school?

75 responses



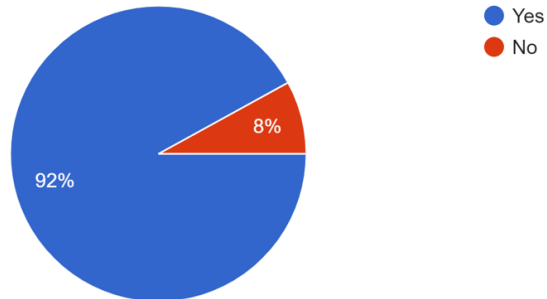
Are your parents victims of the tsunami 2004?

75 responses



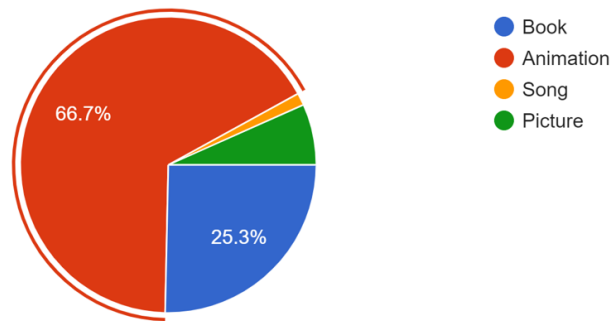
Have you ever heard the story about the tsunami experience from your parents?

75 responses



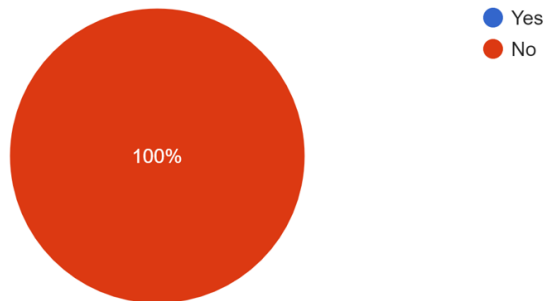
what media do you like in the learning process Among the choices below?

75 responses



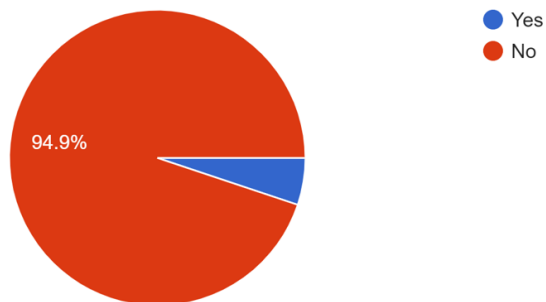
Do you understand all of the contents about tsunami in this book?

39 responses



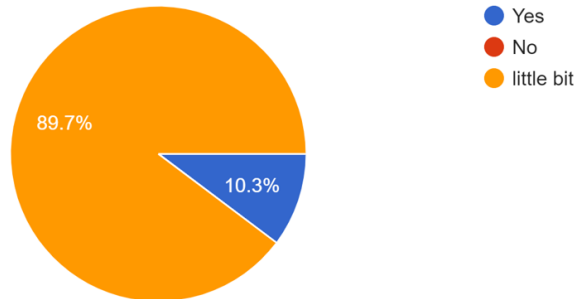
Do you think the visual of this book interesting to read?

39 responses



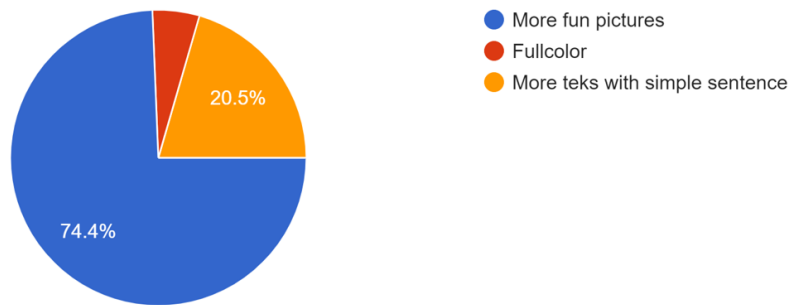
Did your knowledge about tsunami learning increase after reading this book?

39 responses



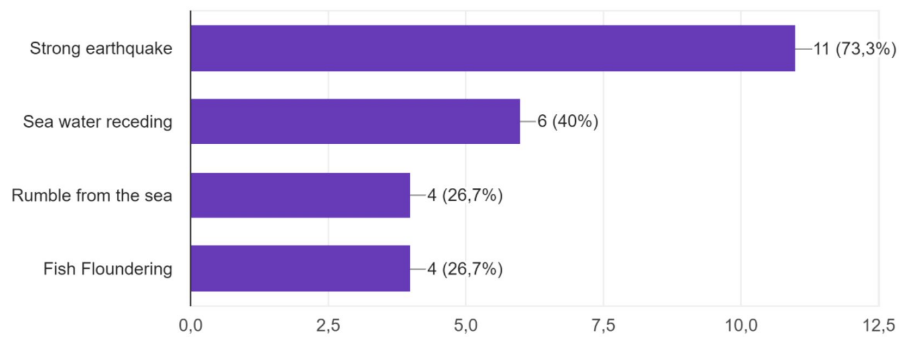
What should be added to make this kind of books interesting for your learning?

39 responses

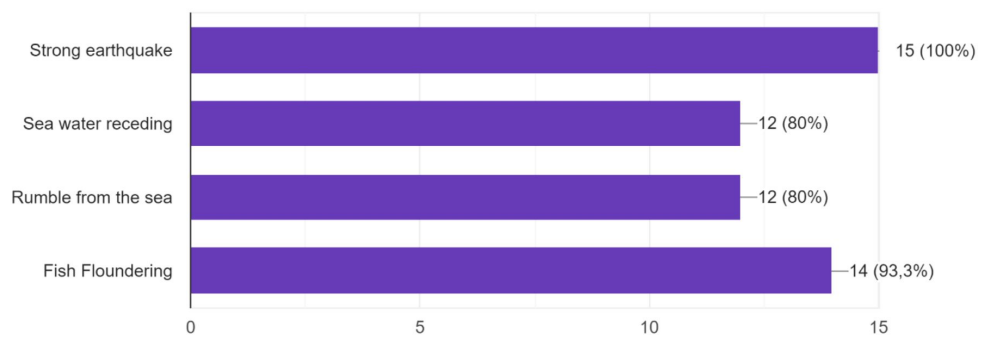


B. Result of Pretest and Post Test

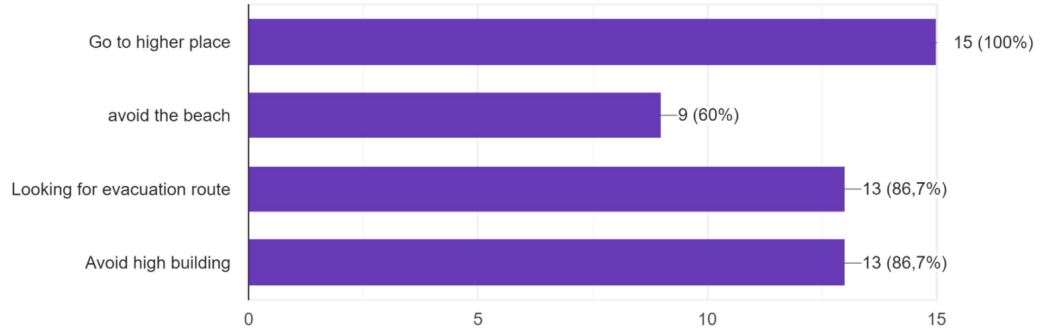
Which natural signs of tsunami below do you know?
15 responses



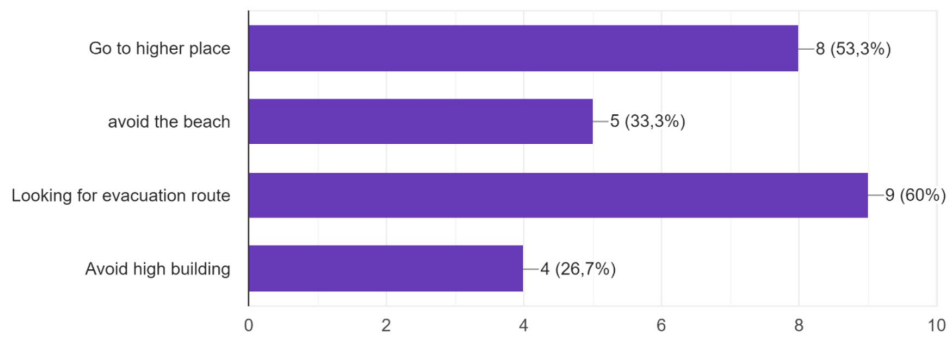
Which natural signs of tsunami below do you know?
15 responses



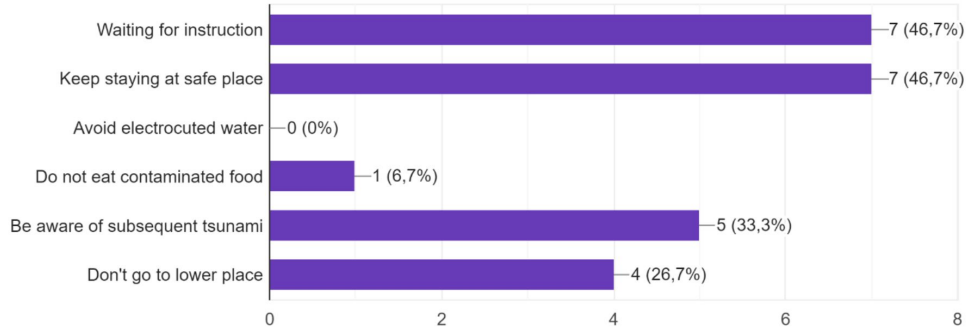
What should you do when tsunami outbreak?
15 responses



What should you do when tsunami outbreak?
15 responses



What should you do after tsunami recede?
15 responses



What should you do after tsunami recede?
15 responses

