



UNIVERSITI PUTRA MALAYSIA

***KNOWLEDGE TRANSFER INTERVENTION ON FLOOD RISK
REDUCTION USING FLOOD LEARNING EDUCATION KIT AMONG
SCHOOL CHILDREN IN THE KLANG VALLEY, MALAYSIA***

EZZA SABRINA BINTI AZMI

FPSK(m) 2021 24



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USING FLOOD LEARNING EDUCATION KIT AMONG SCHOOL CHILDREN
IN THE KLANG VALLEY, MALAYSIA**

By

EZZA SABRINA BINTI AZMI

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of Master of
Science**

November 2019

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in
fulfilment of the requirement for the Degree of Master of Science

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November 2019

Chair : Vivien How, PhD
Faculty : Medicine and Health Sciences

Introduction: Investing in disaster risk reduction (DRR) for resilience community has been taken seriously worldwide by urging all parties, including local authorities, institutions, community and individual to devote in disaster risk education to proactively reduce and prevent disaster risks via structural and non-structural measures. Integrating DRR in schools would be helpful to inculcate disaster awareness culture in the community starting from children. Therefore, a sustainable disaster risk education via interactive knowledge transfer has seen as an important step to initiate awareness among children at the school level. **Objective:** This study aims to implement a knowledge transfer intervention by engaging children's learning through an interactive learning education kit to enhance flood risk reduction knowledge transfer among school children. The effectiveness of this knowledge transfer was later compared with the traditional classroom-based teaching approach among school children. **Methodology:** A quasi-experimental study was designed to evaluate and compare the effectiveness of knowledge transfer on the flood disaster knowledge by using two teaching methods among school children which have been grouped into the experimental and control group. The experimental group was treated with the customized miniature of flood learning educational kit, and the control group was treated with a common teaching slide prepared using Microsoft PowerPoint. 352 children shall be recruited from eight selected primary schools in the Klang Valley area, which were calculated based on the sample size. By using a simple random sampling, a total of 337 school children were selected and recruited as the respondent from eight primary schools. The response rate obtained was 95.74%. The respondent for both groups was requested to complete a set of questionnaires twice (before and after the knowledge transfer intervention) to evaluate their baseline knowledge on flood risk reduction and their knowledge level following the intervention program. This questionnaire covered four parts of questions; Part 1: General knowledge on flood, Part 2: Flood warning and hazard, Part 3: Assembling flood

emergency kit and Part 4: Readiness and responses to flood. **Results:** 71.8% of the respondents are ten years old students and another 28.2% are nine years old students. Among all the respondents, 55.8% are female students while 44.2% are male students. The majority of the respondents are Malay (97.3%), followed by Indians (1.5%), Chinese (0%) and other races (4%). By using a paired sample t-test, the result shows positive outcomes on knowledge level after conducting the intervention by using flood learning education kit. For the experimental group; the mean score shows a significant difference for all parts in the questionnaire with a mean difference of total score -6.048 (95% CI -7.532, -4.564; $p < 0.001$). For the control group; the mean scores also show a significant difference for all parts in the questionnaire except for Part 4: Readiness and responses to flood with mean difference -0.168 (95% CI (-0.778, 0.443; $p = 0.588$) and total score -6.188 (95% CI -8.248, -4.127; $p < 0.001$). ANCOVA was used to identify the effectiveness of both teaching method (learning education kit and traditional teaching method) to enhance the flood risk reduction knowledge level among school children in Klang Valley. After considered the influence of flood experience and pre-evaluation as a covariate, there is no significant difference between both methods with total score $F(1,332) = 0.024$, $p = 0.877$. **Conclusions:** This study shows that an effective educational approach will help to increase the knowledge of the learner. It is safe to conclude that, this interactive disaster learning kit on the flood disaster, was responsible for the knowledge improvement among the school children as the respondents of this study.

Keywords: Knowledge Transfer, Children, Flood Risk Reduction, Learning Educational Kit, Disaster Education

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

INTERVENSI PEMINDAHAN PENGETAHUAN BAGI PENGURANGAN RISIKO BANJIR MENGGUNAKAN KIT PEMBELAJARAN PENDIDIKAN DALAM KALANGAN KANAK-KANAK SEKOLAH DI LEMBAH KLANG, MALAYSIA

Oleh

EZZA SABRINA BINTI AZMI

November 2019

Pengerusi : Vivien How, PhD
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Pengenalan: Melabur dalam pengurangan risiko bencana (DRR) untuk komuniti yang berdaya tahan telah diambil secara serius di seluruh dunia, dengan mendesak semua pihak, termasuk pihak berkuasa tempatan, institusi, komuniti dan individu untuk menumpukan pendidikan risiko bencana untuk mengurangkan dan mencegah risiko bencana secara proaktif melalui langkah-langkah struktur dan bukan struktur. Mengintegrasikan DRR di sekolah akan membantu memupuk budaya kesedaran bencana dalam masyarakat bermula daripada kanak-kanak. Oleh itu, pendidikan risiko bencana yang mampan melalui pemindahan pengetahuan interaktif telah dilihat sebagai penanda penting untuk perubahan apabila dimulakan dalam kalangan kanak-kanak di peringkat sekolah. **Objektif:** Kajian ini bertujuan untuk melaksanakan intervensi pemindahan pengetahuan dengan melibatkan pembelajaran kanak-kanak menerusi kit pendidikan pembelajaran interaktif untuk meningkatkan pemindahan pengetahuan pengurangan risiko banjir dalam kalangan kanak-kanak sekolah. Keberkesanan pemindahan pengetahuan ini kemudiannya dibandingkan dengan pendekatan pengajaran berasaskan kelas tradisional dalam kalangan kanak-kanak sekolah. **Metodologi:** Kajian kuasi eksperimental direka untuk menilai dan membandingkan keberkesanan pemindahan pengetahuan mengenai pengetahuan bencana banjir dengan menggunakan dua kaedah mengajar dalam kalangan kanak-kanak sekolah yang telah dibahagikan ke dalam kumpulan eksperimen dan kawalan. Kumpulan eksperimen diperkenalkan dengan kit miniatur yang telah disesuaikan untuk pendidikan pembelajaran banjir, dan kumpulan kawalan telah diperkenalkan dengan slaid pengajaran biasa yang disediakan menggunakan Microsoft PowerPoint. 352 orang kanak-kanak akan direkrut dari lapan sekolah rendah terpilih di kawasan Lembah Klang, yang dikira berdasarkan saiz sampel. Dengan menggunakan persampelan rawak mudah, sejumlah 337 orang kanak-kanak sekolah telah dipilih dan direkrut sebagai responden dari lapan sekolah rendah. Kadar tindak balas yang diperoleh adalah 95.74%. Responden untuk

kedua-dua kumpulan diminta untuk menyelesaikan satu set soal selidik sebanyak dua kali, sebelum dan selepas intervensi pemindahan pengetahuan untuk menilai tahap pengetahuan mereka mengenai pengurangan risiko banjir pada peringkat awal dan berikutan program intervensi. Soal selidik ini meliputi empat bahagian soalan; Bahagian 1: Pengetahuan umum tentang banjir, Bahagian 2: Amaran banjir dan bahayanya, Bahagian 3: Menyediakan kit kecemasan banjir dan Bahagian 4: Kesediaan dan tindak balas terhadap banjir. **Keputusan:** 71.8% daripada responden adalah pelajar berumur sepuluh tahun dan 28.2% lagi adalah pelajar berumur sembilan tahun. Antara responden, 55.8% ialah pelajar perempuan manakala 44.2% ialah pelajar lelaki. Majoriti responden ialah Melayu (97.3%), diikuti oleh kaum India (1.5%), Cina (0%) dan kaum lain (4%). Dengan menggunakan *Paired sample t-test*, keputusannya menunjukkan hasil positif pada tahap pengetahuan selepas melakukan intervensi dengan menggunakan kit pendidikan pembelajaran banjir. Untuk kumpulan eksperimen; skor min menunjukkan perbezaan yang ketara bagi semua bahagian dalam soal selidik dengan perbezaan min skor keseluruhan -6.048 (95% CI -7.532, -4.564; $p < 0.001$). Untuk kumpulan kawalan; skor min juga menunjukkan perbezaan yang ketara bagi semua bahagian dalam soal selidik kecuali Bahagian 4: Kesediaan dan tindak balas terhadap banjir dengan perbezaan min -0.168 (95% CI (-0.778, 0.443; $p = 0.588$) dan skor keseluruhan -6.188 (95 % CI -8.248, -4.127; $p < 0.001$). ANCOVA digunakan untuk mengenal pasti keberkesanan kaedah pengajaran (kit pendidikan pembelajaran dan kaedah pengajaran tradisional) untuk meningkatkan tahap pengetahuan dalam pengurangan risiko banjir dalam kalangan kanak-kanak sekolah di Lembah Klang. Pengaruh pengalaman banjir dan pra-penilaian sebagai kovariat, tidak menunjukkan perbezaan yang signifikan antara kedua-dua kaedah dengan jumlah skor $F(1,332) = 0.024$, $p = 0.877$. **Kesimpulan:** Kajian ini menunjukkan bahawa pendekatan pendidikan yang berkesan akan membantu meningkatkan pengetahuan pelajar. Oleh itu, disimpulkan bahawa kit pembelajaran bencana interaktif untuk bencana banjir ini bertanggungjawab terhadap peningkatan pengetahuan dalam kalangan kanak-kanak sekolah sebagai responden kajian ini.

Kata kunci: Pemindahan Pengetahuan, Kanak-kanak, Pengurangan Risiko Banjir, Kit Pembelajaran Pendidikan, Pendidikan Bencana

ACKNOWLEDGEMENTS

First, I would like to say Alhamdulillah for all the strength and good health for me to finish this Master research study and during the Thesis writing.

I would like to give my deep gratitude to my supervisor, Dr. Vivien How for her supervision and constant support. Thanks for her patience, guidance and financial support during this Master research study and until it completed. Not forget to mention my co- supervisor, Associate Professor Dr Haliza Binti Abdul Rahman.

Then I would like to acknowledge everyone who involved in this study. Thank you for all the students and teachers who participated and give support during this study conducted. Not forgotten the Ministry of Education for their approval to conduct this study in selected primary schools.

Last but not least, I would like to give my special thanks to my family and my friends who give me moral support and their advice during this Master research study being done.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Declaration by graduate student

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Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
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LIST OF ABBREVIATIONS

ADPC	Asian Disaster Preparedness Centre
CBDRR	Community-Based Disaster Risk Reduction
CVR	Content Validity Ratio
DID	Department of Irrigation and Drainage
DRR	Disaster Risk Reduction
EC	European Commission
GAR	Global Assessment Report
HBM	Health Belief Model
IFRC	International Federation of Red Cross and Red Crescent Societies
IUCN	International Union for Conservation of Nature
MERCY	Medical Relief Society Malaysia
NADMA	National Disaster Management Agency
NASA	National Aeronautics and Space Administration
NGO	Non- Government Organization
NIDM	National Institute of Disaster Management
PLaNS	'Play, Learning and Narrative Skills' Project
PMO	Prime Minister's Office Malaysia
PTSD	Post-Traumatic Stress Disorder
RDRT	Regional Disaster Response Team
RDS	Rapid Deployment Squad
SMEs	Subject Matter Expert
SPSS	Statistical Package for Social Science

UN	United Nations
UNCRD	United Nations Centre for Regional Development
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy for Disaster Reduction
USGS	United State Geological Survey
WHO	World health Organization



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CHAPTER 1

INTRODUCTION

1.1 Study Background

The fact of natural disaster keep worsening year by year due to climate change has been widely acknowledged as the top global problem worldwide. Climate change occurred due to global temperature rising and eventually will continue through this century and beyond (NASA, 2018) and the effect of climate change has seen to bring significant changes as it causes short-term to long-term health and economic impacts on society. Worldwide, more than 40% of all-natural hazards and about half of all deaths are recorded as flood disasters (Persendt et al, 2015). Malaysia which is known to be located in a strategic geographical location where it is fortunate to be freed from natural disasters such as volcanic eruption, earthquake or typhoon has been experiencing flood disasters for the past decade which cause both catastrophic impacts to health and economic development in the country (Mohamed & Ahmadun, 2006).

Apart from climatic variability and seasonal monsoon that cause the regular flood occurrence (IFRC, 2014; Noorhashirin et al, 2016; Rahman, 2009), flood's risk in the country has been increased alarmingly due to changing physical characteristics of the hydrological system caused by human activities: continued development of already densely populated flood plains, encroachment on flood-prone areas, destruction of forests and hill slopes development (Chan, 1997; Elias et al, 2013). The rapid and increasing number of the urbanized areas and insufficient drainage has failed to support the amount of water flow, especially during heavy raining. Subsequently, causes unusual flood which later overflow and inundated lowland and urbanized area (Jani et al, 2015).

From the past 10 years, Malaysia has recorded massive disastrous flooding which involved eight (8) states causes billions of properties, infrastructures and lives loss (Noorhashirin et al, 2016). It is estimated that 29,800 sq. kilometers are flooded and affecting 4.82 million people in Malaysia with up to RM 915 million property losses annually (NIDM, 2014). Klang Valley is a region in Malaysia and located in the state of Selangor, centering on Kuala Lumpur and including joining cities and towns of Selangor, extended to Rawang, Semenyih, Klang and Port Klang (Gin, 2017). Klang Valley and Kuala Lumpur are rapidly developed and most densely populated in Malaysia and also located in the vicinity of the Klang river basin (JPBD, 2018). Due to deforestation and national development, Klang valley unable to cope with excessive runoff water, which then, resulting in instant flood occurrences (Suparta & Rahman, 2016). Thus, the Klang valley area often included as the flood-prone area (The Star, 2019). Malaysian is generally considered as vulnerable to natural hazards and the potential risks brought by disaster at all levels. Lacking preparedness and

awareness among local communities are among the crucial problem being highlighted over the year (Dorasamy, 2010). Moreover, the fact that in Malaysia, structural measures of flood mitigation is over-emphasized (Mohit et al, 2015) resulting in non-structural measures being under-developed can also cause in low level of preparedness. Hence why, this study is focused on the non- structural measures of the awareness campaign and the educational programs.

During a disaster, it is crucial to managing knowledge effectively to ensure decisions could be made under a constrained situation. Understanding how and to whom the knowledge is transferred is essential and is the key to successful implementation in the knowledge management system. Understanding the process of knowledge transfer has focused in various fields such as management, business, education, and healthcare, however, no works have been conducted to examine the knowledge transfer process in a disaster context (Hashim &Ahmad, 2013). Thus, various methods have been used to inculcate disaster education through knowledge transfer or educational intervention. Recent efforts to engage the community at an early age in discovering and recognizing various hazards experienced and modify from hazard awareness to more engagement-focused activity (Petal & Izadkhah, 2008).

1.2 Problem Statement

1.2.1 Flood in Malaysia

Malaysia is located on the Sunda tectonic plate (at the bottom end of Eurasian plate) and outside the "Pacific Rim of Fire" which then minimize the country from the direct risks of earthquakes and volcanic activities. Tropical cyclones are rarely happening as Malaysia is located on the north of the equator which is distant from the major typhoon pathways, resulting the turbulence of the cyclone to drift far enough from the location (Met Office, 2018; NIDM, 2015). Apart from the strategic geographical location, Malaysia is the tropical climatic country. This local climate of Malaysia allows flood, landslide or mudslide to occur due to the seasonal heavy rain. Climate change accompany by seasonal monsoon and man-made factors has worsen the flood situation in Malaysia and causes an increased impact to both human, environment and economic for the past decades.

Flood disaster risk could cause injuries, loss of life and property damages. According to Romali et al (2018), at the of 20th century there are about 100,000 deaths and 1.4 billion of people affected due to flood disaster worldwide, and in Malaysia flood affected 4.82 million people with average annual physical damage for about 915 million and affecting almost 29,800 km² area. During 2010 flood affected four states in Malaysia and claimed as the worst in 30 years. Throughout the flood disaster it claimed 4 deaths and at

least 37,000 people were affected (Relief Web, 2010). At global, in 2000 cyclone-induced floods Zimbabwe and Mozambique, have claimed 700 lives, affected 500,000 people and infrastructure damage cost USD 1 billion and floods in Muzarabani during the 2007 event, has caused disease outbreak such as cholera, diarrhoea, food insecurity, and malaria that affected more than 1000 families.

1.2.2 Flood Prone Area

There are total of 189 river basins throughout peninsular Malaysia (89 of river basins), Sabah (78 of river basins) and Sarawak (22 of river basins). Even though flood occurrences in Malaysia were divided into two categories which are flash flood and monsoon flood, flash flood were dominated the occurrences (Mohamad et al, 2012). According to the area of flood occurrence, urban areas are more significant to flash flood due to urbanization. Yet, the nature of flood has changed from monsoonal to flash flood due to the unruly land use in the rural area (Mohamad et al, 2012). The distinct differences between both flood categories are the time taken to subside to the normal level of the water flow, flash flood takes some hours to recover while monsoon flood can take up to months (Noorazuan, 2006).

Approximately 33.298 square miles or 10.1% area of Malaysia are flood prone area and surrounded by 5.67 million people who living in the area (Noorhashirin, 2016; Zain et al, 2018). Selangor is among the 77 identified flood prone area in the country that often encounter with flood due to ineffective drainage system and retention ponds. Besides, the flood risks increase when there are seven river basins in Selangor including Sungai Bernam, as Sungai Tengi, and Sungai Buloh, Sungai Klang, Sungai Langat and Sungai Sepang / Sepang kecil. Each of the river basins have own natural geography structure. As for the Klang river basin, it was located in the central part of the west coast Malaysia. Most of the Klang River basin is the region's which rapidly developed and most densely populated in Malaysia where the Klang Valley and Kuala Lumpur is located (JPBD, 2018). This has somehow increased the impact of flood risks to communities, especially those living near to the river basin.

Focusing on more specific on the study location, Klang Valley area was included in the list of flood-prone areas in Selangor and part of Kuala Lumpur (DID, 2015; The Star, 2018). There were many flood cases were reported happen in Klang Valley area. Among others, there was report from Utusan Online (2012) which claimed about 5, 000 students affected in 8 schools in Klang (Utusan Online, 2012). Deputy state director of education said that all the 8 schools ordered to be closed due to the increased level of flood water in the schools. The flash floods hit Klang was the second in three days. The flood victims around the area said that in 2015 almost eleven times the water increased into the residential area. The situation has caused discomfort among the people because they have to move to a safer area and clean up their homes (Sinar Online, 2015).

1.2.3 Children as the vulnerable group

Disasters will happen regardless of the place as everyone has the similar chance to be affected by it. The ability to protect one own self is important to avoid disaster hazards, and to minimize the severity of the risks of disaster-strikes. Therefore, women, elderly, children and ill/ disabled people are among the vulnerable group encounter disaster hazards and are potentially affected, both physical and mentally due to flood disasters (WHO, 2002). Children have seen as the assets and leaders in future generation of the world, but unfortunately millions of children often affected by hazard risks of disasters and world crisis. There are about estimated 535 million of children lives in the countries that shackled with emergencies condition without protection, good education and medical access. The impacts from those conflicts and natural disasters forced them to flee from their home and putting them at the risks and danger thus threaten their live and future (UNICEF, 2016).

As of today, schools as a public space for our children are still serving as the vulnerable public place when hit by flood. The impact of this flood would hit beyond imaginable especially when the disaster happens during the school hours. Children, who are vulnerable in nature, would be in danger when encounter with flood situation without parents, and, without sufficient knowledge and preparation in response towards the flood disaster. In addition to this, floods caused loss of learning hours, loss of qualified personnel, outbreak of waterborne diseases, high absenteeism and low syllabus coverage leading to children's poor academic performance (Mudavanhu et al, 2015; Ahern et al, 2005). In view of this, it is crucial to first prioritize the problem of insufficient disaster risk knowledge and behavior development among children when it comes to disaster risk reduction at the early age. It required a proactive approach to build a resilient community by transferring knowledge and inculcate right attitude and behaviors in response to the flood disaster.

1.3 Study Justification

1.3.1 The Implementation of Disaster Risk Reduction Education

Disaster risk is widely acknowledged as the consequence of the interaction between a hazard and the characteristic to vulnerable people and places. Besides that, disaster risk is expressed as the 'likelihood of loss of life, injuries or the destruction and damage caused by a disaster in certain time period' (UNDRR, 2015). Flood disaster occurrences could cause injuries, loss of life and property damages. Literally in this study, did not focusing on just one particularly risk to reduce. However, what this study wants to emphasize is actually wanted the target population (school children) to aware that there is possibility of having safety and health effect if they are really exposed to flood risk.

Most of recent efforts in Malaysia to integrate disaster risk reduction education were done mostly by implementing various awareness and preparedness programs normally involving larger community at once. The example of an effort which were involving young children are one of the programs by MERCY Malaysia called “School Preparedness Program” aimed to enhance disaster awareness among school children focused on the hazards and risks posed by natural disaster and by engaging them with simple hands- on activities (MERCY, 2019). These provide a clear view on the efforts as well as the importance to inculcate disaster awareness and preparedness among community to minimize hazards and risks encounter, by implementing disaster risk reduction education among community especially young children effectively. Thus, instead of providing or requiring a group of trainers for a larger scale of community program, by integrating educational intervention by using the Flood Learning Educational Kit in school, it could be providing the same input and the school teachers as the educator, as well as the focus also can be increased particularly to the group of school children.

Globally, UNISDR together with UNICEF has produced a board game, called ‘Riskland’, to highlight the interactive approach to foster disaster education in the community by using various methods and materials. Riskland is an educational board game for disaster prevention learning for a better understanding of some actions can reduce disaster impact, also can increase vulnerability (UNISDR, 2004). A study in Caribbean countries have conducted knowledge transfer intervention using game technique and have developed an educational game called ‘The Disaster Awareness Game (DAG)’ to evaluate the hazard awareness level to determine and prioritize intervention for disaster education (Clerveaux, 2009).

Malaysia government have organized awareness program to assist to raise the level of preparedness, aid response and the recovery activities (Jani et al., 2015). It is undeniable efforts that there are studies conducted on implementing community intervention program, such as a study on the implementing pilot program on disaster education among local community have been done to focus the community’s safety and resiliency issues and how disaster education through intervention program benefit community preparedness (Nifa et al., 2017). However, the effort has been so far, thus, it is hoped that the development of the kit will contribute to the awareness and preparedness raising effort which more effective and in a focused manner.

1.3.2 Different Learning Pedagogy as an Initiative

School has the responsibility to deliver education as they are an education institution. It is an effective platform in transferring information, knowledge and skills to the surrounding communities. However, traditional classroom- based education may no longer suitable to be implemented for community- based learning due to packed syllabus and schedule. Since problem-based learning has recently become a promising alternative to the traditional classroom

teaching (Djordjevic et al, 2015), an efficient and effective skill on knowledge transfer to the community, different modes of educational approaches are needed in order to deliver the information effectively.

In fact, a random survey done among tertiary school students suggested that, they would like to learn more on the necessary preparedness knowledge and response skills in school as where they spend most of their time. Therefore, it is advisable that school has a tangible role in building community resilience (How et al, 2015). Based on the Community- based Disaster Risk Reduction (CBDRR) approaches as proposed by the Sendai Framework (2015- 2030), this study is to implement two core principles which are, (i) sustainable learning, (ii) participatory approach.

Building the awareness through teaching is by far the best approach on flood preparedness and response to the school-community is realized as the strategy to communicate the risk and hazard with the school children. School as the nurturing and supportive environment could help children cope with adverse situations and contributes to building their resilience. In view of this, the initiative of using interactive learning educational kit in school in this study is seen as an alternative to delivery disaster education among school children. Therefore, this study suggests that it is possible to initiate disaster education by developing the flood learning educational kit that encourage interactive problem-based learning with imaginary simulations of different case scenarios to facilitate knowledge transfer.

This educational toolkit (flood learning educational kit) act as a medium, and the design could provide a multi-sensory learning environment that may improve learners' ability to retain information. Apart from that, teaching and learning process by using interactive slides PowerPoint also implemented in this study with a purpose to compare the effectiveness with the uses of learning educational kit prototype as learning pedagogy. By utilizing two different learning pedagogies as an initiative to identify an effective way to deliver disaster risk reduction education effectively, this study assumes that active engagement and interactive classroom setting are deem more effective in knowledge transfer as compared to traditional classroom-based education.

1.3.3 School children as respondents

The theory of Erik Erikson (1963) was a famous psychosocial development theory that used in many psychosocial studies. According to this theory, children at the aged of 5 to 12 years are at the excellent stage of absorbing information through some skills such as reading, seeing, listening and feeling. Besides, the intellectual developments of children at the age of 6 to 9 years old are most likely to readily engage their bodies and the minds to learn new things through experience. In other words, learning new information with the assist of learning model will allows children to observe and reflect, forming concepts,

testing new situations and gaining experience more effectively. Therefore, school children are considered as the target group who should be inculcated the flood preparedness and response knowledge with the aid of the flood learning educational kit.

1.3.4 School as platform to convey information

School has long been considered as one of the safest learning buildings for our young generation. Nevertheless, the safest learning space has changed ever since schools were affected by flash flood due to its nonstrategic location along the river basin and in the location with poor drainage system. The incident of school affected by flood has reported frequently these years. For instance, eight schools were ordered to be closed and affect 5, 000 students due to the increased level of flood water in the schools in Klang (Utusan Online, 2012) and heavy floods happened in east coast of Peninsular Malaysia during monsoon season back in year 2017 has forced the closure of 27 schools. Many of these schools were flooded by flood waters, and some roads linking to the schools had been cut off. Schools were challenged to operate normally during and after a flood.

Schools need to be well secured and protected since it plays a vital role in every community (Birkland, 1997; Shaw & Kobayashi, 2001). In fact, the concept of school safety shall not be limited to prevent the collapse of school buildings in disasters, but to also ensure the safety of teachers and students, but rather extends to disaster risk reduction (UNCRD, 2009). The theme 'Disaster reduction, begins at school' has been emphasized by the UN International Strategy on Disaster Reduction (UNISDR) since year 200 in line with the Priority 3 of the Hyogo Framework for Action 2005–2015, which states that 'Use knowledge, innovation and education to build a culture of safety and resilience at all levels' and because schools are the best venues for building durable collective values and therefore suitable for building a culture of prevention and disaster resilience (UNISDR, 2006). Regardless of all the important highlighted above, program/project implemented Disaster Risk Reduction (DRR) in Malaysia are mostly conducted by NGOs or academia which is yet to fully integrate into school curriculum syllabus (Johnson et al, 2014; Ronan, 2014). This un-sustainable learning has increased the vulnerability among the school children which could lead to disastrous effect on flood disaster (Mutch, 2014).

1.4 Conceptual Framework

Figure 1.1 below shows the conceptual framework of this study, explaining and summarize the relation between the knowledge transfer intervention by using flood learning educational kit and the knowledge level enhancement. The existing of flood disaster occurrence must take into account as a primary problem to be studied and focused on the flood management. Flood

management can be classified into two measures, which are non- structural and structural measures. However, current study only focusing on the non-structural measures of the awareness campaign and the educational programs. Among all the common non- structural measure implemented by the local authority, it is aimed to minimize the flood threat against the local community through the awareness campaign and education program. According to this, the study is focusing on the vulnerable group towards flood risks, which are children. This group of children specifically taken from schools that located in the flood prone area in Klang Valley, Selangor. They were divided into two different groups, which are experimental group and control group. Both groups were introduced with two different types of teaching methods respectively (Experimental group: flood learning education kit; Control group: normal teaching slide) after completing the pre-test by using a set of questionnaires to evaluate their basic knowledge level related to flood risk reduction. A set of same questionnaires from previous pre-evaluation were given for both groups after a month completing the knowledge transfer intervention process (post-evaluation) intended to evaluate their knowledge level after the knowledge transfer.

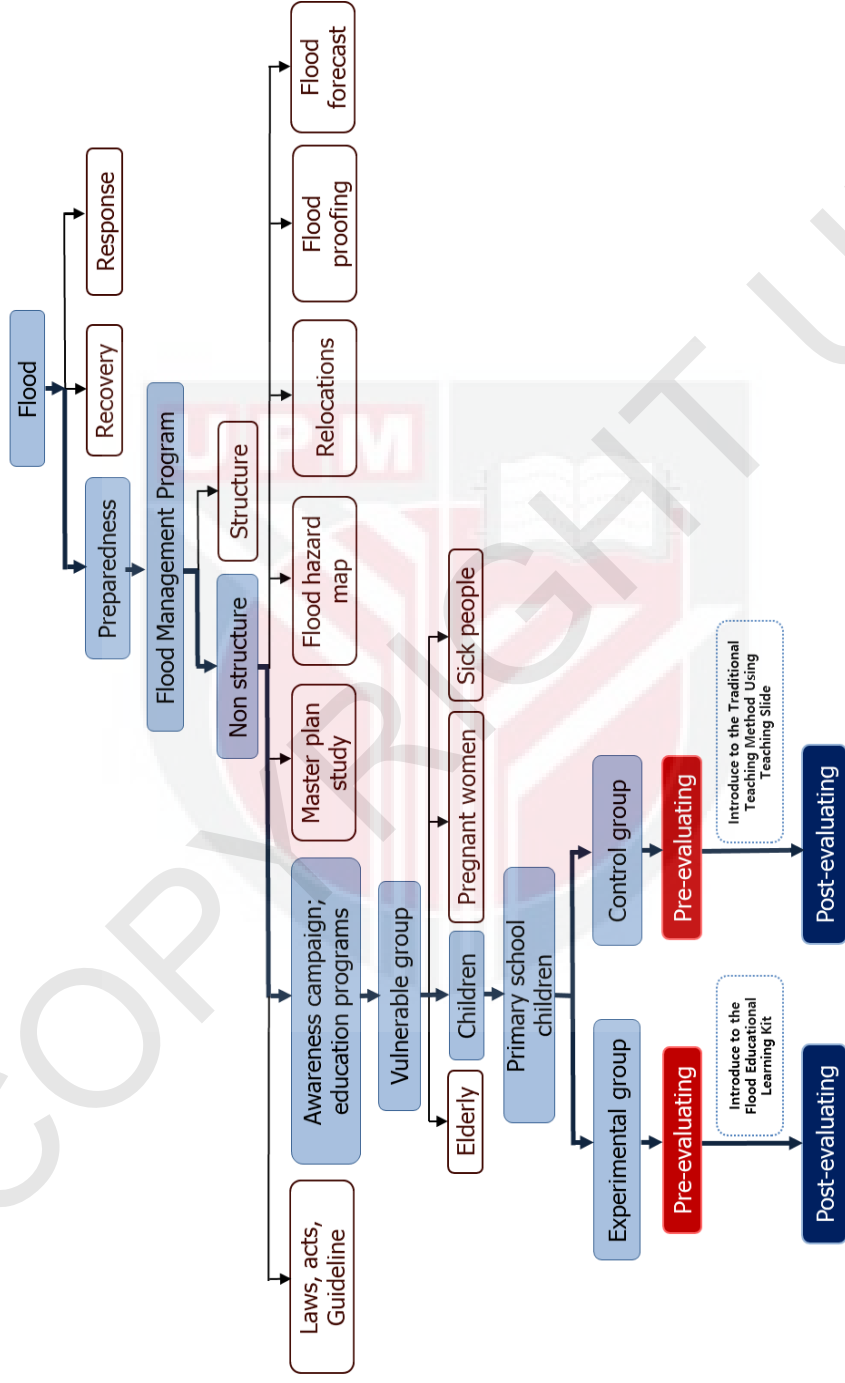


Figure 1.1: The Conceptual Framework

1.5 Theoretical Framework

Figure 1.2 below is the theoretical framework use for this study which based on "Health Belief Model" as recommended by Glanz et al (1997) and adapting the model below from Akhtari- zavare et al (2016) study. According to the literature, HBM is commonly used and recommended in health education and health promotion program (Glanz et al, 1997). HBM assist to explain and predict related behaviour after health promotion program. This study implemented HBM to examine the effectiveness of flood risk reduction education intervention program among school children. Generally, the study aims to implement two different learning methods which used to increase flood risk reduction knowledge and eventually increasing their awareness and preparedness towards flood disaster occurrences. By using this "Health Belief Model" as theoretical framework, it helps to explain how the theory to predict the behaviour and attitudes changes after being introduced to the learning methods to increase their flood risk reduction knowledge level.

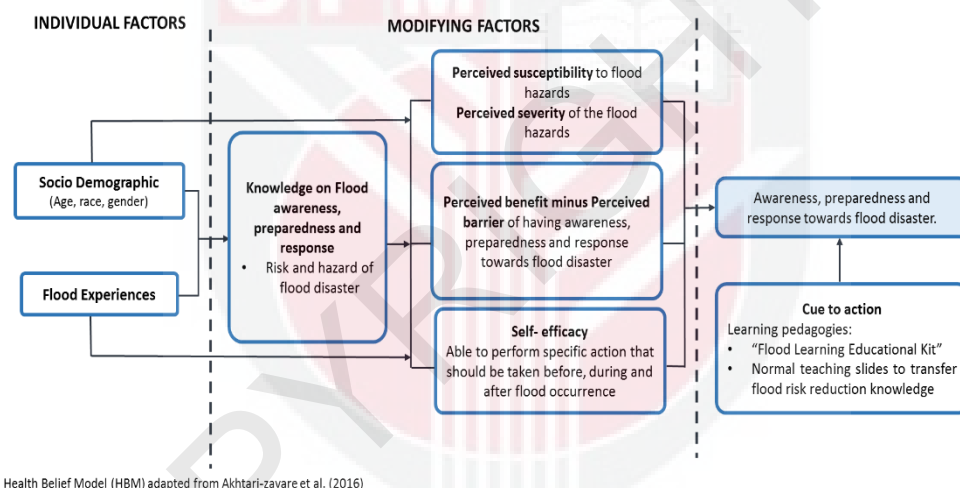


Figure 1.2: The theoretical framework based on Health Belief Model

From the Figure 1.2, the socio demographic and flood experience were considered as personal perception that affecting the internal factors of an individual which non modifiable. Both factors were believed can influence the awareness and preparedness of a person and indirectly affecting the outcome of the intervention program positively or negatively (health behaviour). Age, race and gender are the characteristics that were considered in socio demographic information. Table 1.2 below explained the related variables in the Health Belief Model that fit the application in this study to change the habitual behaviour of the school children from low awareness and preparedness on flood disaster to become more knowledgeable on flood risk reduction.

Table 1.1: Describe the application of the study on Health Belief Model

Variables	Explanations	Applications
Perceived Susceptibility	A person's point of view for the chances to get into the situation.	Describe a basic description on flood hazards and risks, and the conditions that reflect to the flood situation.
Perceived Severity	A person's point of view on how serious the situation and the impact to them.	Explain about the impact of flood disaster towards them and their family.
Perceived Benefits	A person's belief in the effectiveness of the recommended method to reduce the risks of the impact.	Clarify the benefits for them to have flood disaster awareness with basic descriptions of the 'do' and 'don't' during flood situation. Teaching them the best way to react to flood situation.
Perceived Barriers	A person's point of view of the obstacles to engage with the recommended method.	Transferring the flood risk reduction knowledge with interactive ways of teaching and learning process and giving the participants an incentive items after finishing the session.
Cue to Actions	Strategies that necessary to engage with the method and motivate the positive actions.	Using two different learning methods to transfer flood risk reduction knowledge at once promoting awareness and preparedness of flood disaster.
Self- efficacy	Confidence in a person competence to take the action.	Provide information and guidance regarding flood risk reduction.

1.6 Definitions

1.6.1 Conceptual Definitions

Flood

According to Haliza (2007) stated that generally flood is the unwanted amount of water, which give similar meaning on the existence of excessive amount of water that can lead to flooding occurrence. Flood can be defined as temporary covering of land by water as a result of surface waters escaping from their normal confines or as a result of heavy precipitation (Kron, 2005).

Flood risk

Flood risk is defined as 'the probability of a flood event to occur (hazard) and the potential of flooding impacts to the community and assets (vulnerability) (Romali et al, 2018).

Flood prone area

The flood prone area is defined as the area adjoining to the water course that tend to cover with flood water when the elevation of the water is at twice the maximum depth at bank full level (Rosgen, 2002).

Flood management

Flood management defined by the Department of Irrigation and Drainage of Ministry of Natural Resource and Environment Malaysia (2016) as an approach focus on the implementation of major flood mitigation project to converge with continuous and rapid urban development, also to provide immediate flood relief works.

The mitigation measures are divided into structural and non-structural. Structural measures are all the measures are including the projects that have been done by the local authority to increase the flood relief and reduce the flood damage. While non- structural measures more focus on programs such as awareness campaign and education programs.

Children

Definitions for children may vary. According to the Oxford English Dictionary (2016), school children were defined as a child who still attending school. Twigg (2015) defines them according to the classes of age. Those that age below 15 years, mostly 7 to 15 years old were considered as 'children'. The age above 15 which mostly up to 25 years old were consider as young people. Knowledge transfer.

According to University of Cambridge (2019), knowledge transfer is a term used to comprise a wide range of beneficial alliances between universities, business, and the public. Besides that, knowledge transfer is used alternately in many literatures in various field of study. Schwartz & Te'eni (2011) defines knowledge transfer as a process of knowledge being shared and moved from the source of the knowledge to the recipients of the knowledge.

Awareness and preparedness

"Awareness, by Oxford dictionary's (2019) simple definition is a knowledge or perception of a situation or fact, and a concern about and well-informed interest in a particular situation or development". "Preparedness, by Oxford dictionary's (2019) defines as a state of readiness".

1.6.2 Operational Definitions

Flood

According to this study, flood is defined as the disaster situation caused by natural disasters nor caused by excessive development or urbanization that led to the poor drainage systems in certain areas thus causing floods that can threaten the life of the community in the area.

Flood hazard

Hazard is any sources that will potentially damage, harm or give adverse effects on individual under certain condition. According to this study, in the terms of flooding, the flood hazard is divided into biological and safety hazard which resulting from the flood. The hazard will cause harm or will affect the flood victim on their health condition, safety or damage their properties.

Some sources of biological hazard may include bacteria, viruses, insects, or animal's carcasses can cause a variety of health effects such as skin irritation, allergies and infections. Besides that, the safety hazard might be happened when a person entering the flood area. The hazard may include the submerged debris such as nails, broken glass, or sharp metal. The safety hazard can cause serious body injuries to the flood victim.

Children

According to the World Health Organization (2016) stated that children, pregnant women, elderly people, malnourished people, and sick people or immune-compromised, are often classify as vulnerable when a disaster happen. These groups of people are considered as vulnerable since they seriously need help from person that healthier and stronger than them.

Vulnerability is the degree to which a population, individual or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters (WHO, 2016). In term of this study, children were chosen as the respondent. The school children at the age of 9 to 10 years old are believed to not have any awareness on emergencies preparedness during disasters. Thus, the children with the age of 9 to 10 years old who school in Klang Valley area in Selangor state, was selected.

Knowledge transfer

Knowledge transfer is the method used in this study. Knowledge transfer is effective to be used in the early years of children life, since the early years of children are the basis for their future. Educations play a critical role in preventing emergencies. According to Unicef & Pigozzi (1999) Basic education involving a combination of essential competencies, knowledge, skills, and attitudes that functions as the basis of any individual's lifelong learning. To make the process of learning more effective and not as a short- term response, school children are the best target population for the interaction of learning since they still in the state of exploring things as the way of learning. The education activities will be contributed to preparing the school children for their lifelong learning if emergency happen in or out of the school.

Awareness and preparedness

A literature from Jani et al (2015) stated that Malaysian community are still lacking in awareness and preparedness during the flood as they are lack in knowledge regarding factors and impacts cause by flood. In order to increase the level of awareness at once improve the preparedness among community, various flood awareness programs can be performed. Thus, this study is an

effort to help community to improve their awareness and preparedness towards flood occurrences starting from school children level. They will be prepared for any disaster such as flood event that unpredictable and become more resilience.

1.7 Objectives

1.7.1 General Objective

To evaluate the effectiveness of the flood learning educational kit on flood risk reduction knowledge transfer.

1.7.2 Specifics Objectives

- i. To develop the flood learning educational kit for primary school children.
- ii. To examine and compare the flood risk reduction knowledge levels between the experimental and control group before the knowledge transfer intervention.
- iii. To examine and compare the flood risk reduction knowledge levels before and after one month interval of the knowledge transfer intervention among the experimental and control group.
- iv. To compare the flood risk reduction knowledge levels after one month interval of knowledge transfer intervention between the experimental group and control group.
- v. To compare the effectiveness of transferring flood risk reduction knowledge by using a prototype of flood learning educational kit and traditional teaching method among study population.

1.8 Hypothesis

- i. The knowledge levels among the experimental group who have used prototype of flood learning educational kit will be increase significantly among the school children after one month from the knowledge transfer intervention.
- ii. The knowledge levels among the experimental group who have used prototype of flood learning education kit to transfer the flood risk reduction will be significantly higher than the control group that used traditional teaching method.
- iii. Using a prototype of flood learning education kit is more effective to increase flood risk reduction knowledge level among school children, as compare to the traditional teaching method.

REFERENCES

- ABC News. (2012). Thousands flee flooding in Malaysia. Retrieved December 15, 2019, from <https://www.abc.net.au/news/2012-12-26/an-thousands-flee-malaysia-floods/4444110>
- Acharya, S., Bhatta, D. N., & Assannangkornchai, S. (2018). Post-traumatic stress disorder symptoms among children of Kathmandu 1 year after the 2015 earthquake in Nepal. *Disaster Medicine and Public Health Preparedness*, 12(4), 486-492.
- Ahern, M., Kovats, R. S., Wilkinson, P., Few, R. & Matthies, F. (2005). Global health impacts of floods: Epidemiologic evidence. *Epidemiologic Reviews*, 27(May 2017), 27 (1), 36–46. <https://doi.org/10.1093/epirev/mxi004>
- Aini, M. S., Fakhru'l-Razi, A., & Daud, M. (2001). Evolution of emergency management in Malaysia. *Journal of Contingencies and Crisis Management*, 9(1), 46-53.
- Anderson, M. (1994). Focus on Gender (now Gender and Development). *Oxfam Publications*, Vol. 2, No. 1, pp. 4. Retrieved from https://www.gdnonline.org/sourcebook/chapt/doc_view.php?id=1&doc_id=238
- Asarnow, J. R., Scott, C. V., & Mintz, J. (2002). A combined cognitive-behavioral family education intervention for depression in children: A treatment development study. *Cognitive Therapy and Research*, 26(2), 221-229.
- Ateş, Ö. & Eryilmaz, A. (2011). Effectiveness of hands-on and minds-on activities on students' achievement and attitudes towards physics. *In Asia-Pacific Forum on Science Learning & Teaching*, 12 (1), 1.
- Bern, C., Snizek, J., Mathbor, G. M., Siddiqi, M. S., Ronsmans, C., Chowdhury, A. M. & Noji, E. (1993). Risk factors for mortality in the Bangladesh cyclone of 1991. *Bulletin of the World Health Organization*, 71(1), 73.
- Bothe, D. A., Olness, K. N. & Reyes, C. (2018). Overview of Children and Disasters. *Journal of Developmental & Behavioral Pediatrics*, 39(8), 652–662. doi: 10.1097/DBP.0000000000000600.
- Boud, D., Cohen, R., & Walker, D. (1993). Using experience for learning. McGraw-Hill Education (UK).

- Britto, P. R. (2016). The Lego Foundation; the Lego Group, the Lego Foundation and UNICEF Launch Campaign to Celebrate and Inspire Play and Learning. Retrieved May 4, 2017 from <https://www.lego.com/en-us/aboutus/news-room/2016/september/partners-in-play-campaign>
- Brown, S. W., & King, F. B. (2000). Constructivist pedagogy and how we learn: educational psychology meets international studies. *International Studies Perspectives*, 1(3), 245-254.
- Cambridge Dictionary. (2019). Prototype Definition. Retrieved December 18, 2019, from <https://dictionary.cambridge.org/dictionary/english/prototype>
- Chan, N. W. (1995). A Contextual Analysis of Flood Hazard Management in Peninsular Malaysia, Ph.D. Middlesex University (UK).
- Chan, N. W. (1997). Increasing flood risk in Malaysia: causes and solutions. *Disaster Prevention and Management: An International Journal*, 6 (2), 72-86, <https://doi.org/10.1108/09653569710164035>
- Chan, N. W. (2015). Impacts of disasters and disaster risk management in Malaysia: The case of floods. In *Resilience and Recovery in Asian Disasters* (pp. 239-265). Springer, Tokyo.
- Chan, N. W., & Parker, D. J. (1996). Response to dynamic flood hazard factors in peninsular Malaysia. *Geographical Journal*, 162 (3), 313-325.
- Clerveaux, V., & Spence, B. (2009). The communication of disaster information and knowledge to children using game technique: the disaster awareness game (DAG). *International journal of environmental research*, 3(2), 209-222.
- De Lorenzo, R. A., & Abbott, C. A. (2004). Effectiveness of an adult learning, self-directed model compared with traditional lecture-based teaching methods in out-of-hospital training. *Academic Emergency Medicine*, 11(1), 33-37.
- Department of Irrigation and Drainage (DID). (2017). Flood Management - Programme and Activities. Retrieved December 15, 2019, from <https://www.water.gov.my/index.php/pages/view/419?mid=244>
- Dilley M., Chen R.S., Deichmann U., Lerner-Lam A.L., Arnold M., Agwe J., Buys P., Kjevstad O., Lyon B., & Yetman, G. (2005). Natural Disaster Hotspots: A Global Risk Analysis. The World Bank and Columbia University, Washington, DC, USA.
- Dorasamy, M., Raman, M., Muthaiyah, S., & Kaliannan, M. (2010). Disaster preparedness in Malaysia: An exploratory study. In *Proceedings of 4th WSEAS Marketing and Management Conference*.

- Douglas, I., & Gupta, A. (Ed.) (2005). *The Urban Geomorphology of Kuala Lumpur*. In *The Physical Geography of South-East Asia* Oxford: Oxford University Press.
- Ebner, M., & Holzinger, A. (2007). Successful implementation of user-centered game-based learning in higher education: An example from civil engineering. *Computers and Education*, 49(3), 873–890. <https://doi.org/10.1016/j.compedu.2005.11.026>
- Elias, Z., Hamin, Z., & Othman, M.B. (2013). Sustainable management of flood risks in Malaysia: Some lessons from the legislation in England and Wales. *Procedia-Social and Behavioral Sciences*, 105(1), 491–497.
- Emily, Y. Y. C., Crystal, Y. Z., Poyi, L., & Kevin, S.L. (2016). *Training Manual on Health and Disaster Preparedness in Rural China*. China: CCOUC & Wu Zhi Qiao Charitable.
- Flanagan, B. E., Gregory, E. W., Hallisey, E. J., Heitgerd, J. L., & Lewis, B. (2011). A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management*, 8(1), 1–22. <https://doi.org/10.2202/1547-7355.1792>
- FloodList. (2013). Malaysia Floods Update. Retrieved August 12, 2019, from <https://floodlist.com/asia/malaysia-floods-update>
- FloodList. (2016). Malaysia – Floods in 4 States Leave 2 Dead and Thousands Displaced – 30cm of Rain in 4 Days in Kuching. Retrieved August 12, 2019, from <https://floodlist.com/asia/malaysia-floods-johor-melaka-sarawak>
- Fluid Surveys Team. (2014). What is the difference between a response rate and a completion rate? Retrieved August 12, 2019, from <http://fluidsurveys.com/university/difference-response-rate-completion-rate/>
- Gibben, S. (2018). National Geographic: How Hurricane Michael's storm surge and wind impacted Florida Retrieved August 12, 2019, from <https://www.nationalgeographic.com/environment/article/news-hurricane-michael-florida-explained>
- Gin, O. K. (2017). *Historical dictionary of Malaysia*. Rowman & Littlefield.
- Global Assessment Report on Disaster Risk Reduction. (2015). Data: Malaysia Disaster Frequency. Retrieved July 20, 2018, from <https://www.preventionweb.net/english/hyogo/gar/2015/en/home/>
- Hackathorn, J., Solomon, E. D., Blankmeyer, K. L., Tennial, R. E., & Garczynski, A. M. (2011). Learning by Doing: An Empirical Study of Active Teaching Techniques. *The Journal of Effective Teaching*, 11(2), 40–54.

- Haines, A., Kovats, R. S., Campbell-Lendrum, D., & Corvalan, C. (2006). Climate change and human health: Impacts, vulnerability and public health. *Public Health*, 120(7), 585–596. <https://doi.org/10.1016/j.puhe.2006.01.002>
- Hale, E. D., & Treharne, G. J. (2010). Applying psychological interventions in rheumatic disease. In *Rheumatology* (pp. 151-162). Churchill Livingstone.
- Hansen, R. E. (2000). The Role of Experience in Learning: Giving Meaning and Authenticity to the Learning Process in Schools. *Journal of Technology Education*, 11(2), 23-32.
- Hashim, K. F., & Ahmad, M. (2013). A Theoretical Knowledge Transfer Model in Disaster Management: A Case Study of Managing Floods in Malaysia. ISICO 2013, 2013.
- How, V et al. (2016). A manual Guide to Building a Resilience Community: Community- based Participatory Approach. Sri Kembangan: Lot 2 Resources.
- How, V., Peter, P. J., Martinus, K. B., Dzahir, N. B. M., Ali, A. I. B., Dzahiruddin, N. D. A. B. A., & Aripin, M. F. B. Z. (2015). A Case Study of Campus-Based Initiatives to Disaster Awareness Program: The Road to Resilience. *Open Access Library Journal*, 2(10), 1–7. <https://doi.org/10.4236/oalib.1101987>
- Hua, A. K. (2014). Monsoon flood disaster in kota baru, kelantan case study: a comprehensive review. *Int. J. Sci. Eng. Res*, 3, 79-81.
- Hutchinson, A., & Estabrooks, C. A. (2010). Knowledge Translation in Health Care: Moving from Evidence to Practice- Section 4.3 Educational theories. Retrieved from <https://cihr-irsc.gc.ca/e/41950.html>
- International Federation of Red Cross and Red Crescent Societies (IFRC). (2014). Information bulletin- Malaysia: Seasonal Floods 2014. Retrieved from <https://reliefweb.int/sites/reliefweb.int/files/resources/IBMYfl281214.pdf>
- Izadkhah, Y. O., & Hosseini, M. (2005). Towards resilient communities in developing countries through education of children for disaster preparedness. *International journal of emergency management*, 2(3), 138-148.
- Jabatan Perancangan Bandar dan Desa Negeri Selangor (JPBD). (2018). Laporan Tinjauan Kajian Rancangan Struktur Negeri Selangor 2035. B11: Saliran. Retrieved December 19, 2019, from <https://www.jpbdselangor.gov.my/en/download/report/rancangan-struktur-negeri-rsn-1/rancangan-struktur-negeri-selangor-2035.html>

- Jani, J., Nasir, S. M., & Zawawi, N. M. (2015). Community Awareness and Preparedness towards Flood in Kuantan, Pahang. In *ISFRAM 2014* (pp. 41-50). Springer, Singapore.
- Jempson, M. (2003). Johnstone River flood Study Final Report, vol. 1 of 2. Retrieved May 5, 2018, from <https://www.cassowarycoast.qld.gov.au/downloads/file/1740/johnstone-river-flood-study-vol-1-of-2-final>
- John, P. B., Russell, S., & Russell, P. S. S. (2007). The prevalence of posttraumatic stress disorder among children and adolescents affected by tsunami disaster in Tamil Nadu. *Disaster management & response*, 5(1), 3-7.
- Kelly, J. (2012). The Peak Performance Center: Learning Theories. Retrieved from May 5, 2018, <https://thepeakperformancecenter.com/educational-learning/learning/theories/>
- Kishore, K. (2003). "Disasters in Asia and the Pacific: an overview", February, available at: <http://www.fao.org/3/AC120E/AC120e21.htm>
- Ko, J., & Sammons, P. (2013). *Effective Teaching: A Review of Research and Evidence*. CFBT Education Trust. 60 Queens Road, Reading, RG1 4BS, England.
- Kron, W. (2005). Flood Risk = Hazard • Values • Vulnerability. *Water International*, 30(1), 58–68. <https://doi.org/10.1080/02508060508691837>
- Lavrakas, P. J. (2008). *Encyclopedia of survey research methods*. Thousand Oaks, CA: Sage Publications, Inc. doi: 10.4135/9781412963947
- Lawshe, C. (1975). A Quantitative Approach to Content Validity 1. *Personnel Psychology*, (1), 563–575. <https://doi.org/10.1111/j.1744-6570.1975.tb01393.x>
- Loo, Y. Y., Billa, L., & Singh, A. (2015). Effect of climate change on seasonal monsoon in Asia and its impact on the variability of monsoon rainfall in Southeast Asia. *Geoscience Frontiers*, 6(6), 817–823. <https://doi.org/10.1016/j.gsf.2014.02.009>
- Low, K. S., & Leigh, C. H. (1972). An Appraisal of the Flood Situation in West Malaysia. In *Proc. Symposium on Biological Resources and National Development, Kuala Lumpur, Malaysia* (pp. 5-7).
- McLeod, S. (2015). Simply Psychology: Cognitive Psychology. Retrieved March 27, 2017, from <https://www.simplypsychology.org/cognitive.html>

- Met Office. (2018). Location of tropical cyclones. Retrieved September 6, 2019 from <https://www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather/hurricanes/location>
- Meyers, C., & Jones, T. B. (1993). *Promoting Active Learning. Strategies for the College Classroom*. Jossey-Bass Inc., Publishers, 350 Sansome Street, San Francisco, CA 94104.
- Michael, J. (2006). Where's the evidence that active learning works? *Advances in physiology education*, 30(4), 159-167.
- Mohamad, S., Hashim, N. M., Aiyub, K., & Toriman, M. E. (2012). Flash flood and community's response at Sg. Lembing, Pahang. *Advances in Natural and Applied Sciences*, 6(1), 19-26.
- Mohamed Shaluf, I., & Ahmadun, F. L. R. (2006). Disaster types in Malaysia: an overview. *Disaster Prevention and Management: An International Journal*, 15(2), 286-298.
- Mohit, M. A., & Sellu, G. M. (2017). Development of Non-structural Flood Mitigation Policies and Measures for Pekan town, Malaysia. *Asian Journal of Behavioral Studies*, 2(6), 9-20.
- Morrow, B. H. (1999). Identifying and Mapping Community Vulnerability. *Disasters*, 23(1), 1–18. <https://doi.org/10.1111/1467-7717.00102>
- Mudavanhu, C., Manyena, S. B., Collins, A. E., Bongo, P., Mavhura, E., & Manatsa, D. (2015). Taking Children's Voices in Disaster Risk Reduction a Step Forward. *International Journal of Disaster Risk Science*, 6(3), 267–281. <https://doi.org/10.1007/s13753-015-0060-7>
- NASA. (2018). Global Climate Change: Effects. Retrieved from <https://climate.nasa.gov/effects/>
- New Straits Times. (2015). News: Flood: Situation in Sabah worsens. Retrieved from <https://www.nst.com.my/news/2015/09/flood-situation-sabah-worsen>
- New Straits Times. (2017). News: Floods cause havoc in Penang, Kedah and Perak. Retrieved January 7, 2018, from <https://www.nst.com.my/news/nation/2017/11/299330/floods-cause-havoc-penang-kedah-and-perak>
- NIDM. (2014). Country Profile: Malaysia. Retrieved from https://nidm.gov.in/easindia2014/err/pdf/country_profile/Malaysia.pdf
- Nifa, F. A. A., Abbas, S. R., Lin, C. K., & Othman, S. N. (2017). Developing a disaster education program for community safety and resilience: The preliminary phase. In *AIP Conference Proceedings* (Vol. 1891, No. 1, p. 020005). AIP Publishing.

- Nifa, F. A. A., Lin, C. K., Rani, W. N. M. W. M., & Wei, O. J. (2018). A study on awareness of disaster risk reduction (DRR) among university students: The case of PETRONAS residential hall students. In *AIP Conference Proceedings* (Vol. 2016, No. 1, p. 020005). AIP Publishing.
- Noorazuan, M.H. (2006). *Urban hydrological changes in the Sankey Brook catchment*. Manchester, University of Manchester. Unpublished PhD thesis.
- Noorhashirin, H., & Juni, M. H. (2016). Assessing Malaysian Disaster Preparedness for Flood. *International Journal of Public Health and Clinical Sciences*, 3(2), 1-15.
- Office of Disaster Preparedness and Management. Government of the Republic of Trinidad and Tobago. (2013). Hazards: Flooding. Retrieved from <http://www.odpm.gov.tt/node/16>
- Othman, G. (2001). Sekolah berkesan dan program pembaikan sekolah di Malaysia. Past issues of educator's digest, 1(2), 2001.
- Oxford English Dictionary. (2019). English oxford Living Dictionary: Definition of Vulnerability. Retrieved from <https://www.lexico.com/en/definition/vulnerability>
- Pakhrozi Mohamad. (2019). Banjir Kilat. Retrieved December 18, 2019, from <https://shopee.com.my/BANJIR-KILAT-i.55439173.1970782860>
- Persendt, F. C., Gomez, C., & Zawar-Reza, P. (2015). Identifying hydro-meteorological events from precipitation extremes indices and other sources over northern Namibia, Cuvelai Basin. *Jambá: Journal of Disaster Risk Studies*, 7(1).
- Petal, M., & Izadkhah, Y. O. (2008). Concept note: formal and informal education for disaster risk reduction. In *Proceedings of the International Conference on School Safety*, Islamabad, Pakistan (Vol. 1416).
- Pfeffer, J., & Sutton, R. I. (1999). Knowing "What" To Do Is Not Enough: TURNING KNOWLEDGE INTO ACTION. *California Management Review*, Vol. 42(1), 83-108.
- Piyasil, V., Ketumarn, P., Sitdhiraksa, N., Pithayaratsathien, N., Pariwatcharakul, P., Lerthattasilp, T., & Wanlieng, T. (2011). Tsunami Disaster in Thailand: A 5-Year Follow-Up. *J Med Assoc Thai*, 94, 3.
- Prime Minister's Office of Malaysia. (2019). Vision 2020: Malaysia as a Fully Developed Country. Retrieved from <https://www.pmo.gov.my/vision-2020/malaysia-as-a-fully-developed-country/>

- Prince, M. (2004). Does Active Learning Work? A Review of the Research. Bucknell University.
- Rahman, H. A. (2009). Global Climate Change and Its Effects on Human Habitat and Environment in Malaysia. *Malaysian Journal of Environmental Management*, 10(2), 17–32.
- Rahman, H. A. and Suppian, R. (2018). Bencana Alam dan Jangkitan Penyakit. *Bencana Alam Sekitar*. Serdang, Selangor: Penerbit Universiti Putra Malaysia.
- Relief web. (2007). Updates: Floods Malaysia, December 2006 and January 2007. Retrieved July 14, 2019, from <https://reliefweb.int/map/malaysia/floods-malaysia-december-2006-and-january-2007>
- Relief web. (2010). Disasters: Malaysia: Floods - Aug 2010. Retrieved July 14, 2019, from <https://reliefweb.int/disaster/fl-2010-000161-mys>
- Relief web. (2011). Disasters: Malaysia: Floods - Jan 2011. Retrieved July 14, 2019, from <https://reliefweb.int/disaster/fl-2011-000021-mys>
- Relief Web. (2014). Updates: Malaysia: Seasonal Floods 2014 - Information Bulletin. Retrieved July 14, 2019, from <https://reliefweb.int/report/malaysia/malaysia-seasonal-floods-2014-information-bulletin-n-1>
- Relief Web. (2017). Disasters: Malaysia: Floods - Dec 2016. Retrieved July 14, 2019, from <https://reliefweb.int/disaster/fl-2017-000002-mys>
- Relief Web. (2017). Updates: Malaysia: Seasonal Flooding - Information Bulletin. Retrieved July 14, 2019, from <https://reliefweb.int/report/malaysia/malaysia-seasonal-flooding-information-bulletin-n-2>
- Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of micro worlds, simulations, and games. *Educational technology research and development*, 44(2), 43-58.
- Rigolet, A. (2015). The Effects of Major Natural Disasters on Developing and Underdeveloped Countries: A look At the Savings Rate. *MaRBL*, 2.
- Rofi, A., Doocy, S., & Robinson, C. (2006). Tsunami mortality and displacement in Aceh province, Indonesia. *Disasters*, 30(3), 340-350.
- Romali, N. S., Yusop, Z., Sulaiman, M., & Ismail, Z. (2018). Flood risk assessment: A review of flood damage estimation model for Malaysia. *Jurnal Teknologi*, 80(3).

- Russoniello, C. V., Skalko, T. K., O'Brien, K., McGhee, S. A., Bingham-Alexander, D., & Beatley, J. (2002). Childhood posttraumatic stress disorder and efforts to cope after Hurricane Floyd. *Behavioral medicine*, 28(2), 61-71.
- Schwartz, D., & Te'eni, D. (2011). Transnational Knowledge Transfer. In *Encyclopedia of Knowledge Management*, Second Edition. Retrieved from <https://www.igi-global.com/dictionary/transnational-knowledge-transfer/16477>
- Shaw, R., & Kobayashi, M. (2001). Role of Schools in Creating Earthquake-Safer Environment. *Disaster Management and Educational Facilities*, 1-7. <https://doi.org/10.1787/9789264028340-en>
- Sommerville, I. (2011). *Software engineering* 9th Edition. ISBN-10137035152.
- Stuart, G. W., Tondora, J., & Hoge, M. A. (2004). Evidence-based teaching practice: Implications for behavioral health. *Administration and Policy in Mental Health and Mental Health Services Research*. Retrieved from <https://link.springer.com/content/pdf/10.1023%2FB%3AAPH.0000042743.11286.bc.pdf>
- Suparta, W., & Rahman, R. (2016). Spatial interpolation of GPS PWV and meteorological variables over the west coast of Peninsular Malaysia during 2013 Klang Valley Flash Flood. *Atmospheric research*, 168, 205-219.
- Tang, W., Zhao, J., Lu, Y., Yan, T., Wang, L., Zhang, J., & Xu, J. (2017). Mental health problems among children and adolescents experiencing two major earthquakes in remote mountainous regions: a longitudinal study. *Comprehensive psychiatry*, 72, 66-73.
- The Star Online. (2015). News: Sarawak hit by severe floods. Retrieved July 14, 2019, from <https://www.thestar.com.my/news/nation/2015/01/19/sarawak-hit-by-severe-floods-1023-flee-to-relief-centres-as-state-issues-orange-alert/>
- The Star Online. (2016). Selangor tackling flash floods in 37 'hotspots'. Retrieved July 14, 2019, from <http://www.thestar.com.my/news/nation/2016/05/12/selangor-tackling-flash-floods-in-37-hotspots/>
- The Star. (2017). Flood warning for Selangor. Retrieved September 1, 2019, from <https://www.thestar.com.my/metro/metro-news/2017/12/02/flood-warning-for-selangor-high-tide-and-continuous-rain-expected-at-states-coastal-areas-on-dec-4-a/>

- The Star. (2018). These are the flood hotspots in the Klang Valley. Retrieved December 22, 2019, from <https://www.thestar.com.my/news/2019/12/02/these-are-the-flood-hotspots-in-the-klang-valley>
- The Straits Times. (2017). Asia: Seven dead in worst floods to hit Penang. Retrieved September 1, 2019, from <https://www.straitstimes.com/asia/se-asia/seven-dead-in-worst-floods-to-hit-penang>
- The Straits Times. (2018). Asia. Seven dead in worst floods to hit Penang. Retrieved September 1, 2019, <https://www.straitstimes.com/asia/se-asia/seven-dead-in-worst-floods-to-hit-penang>
- Tuladhar, G., Yatabe, R., Dahal, R. K., & Bhandary, N. P. (2013). Knowledge of disaster risk reduction among school students in Nepal. *Geomatics, Natural Hazards and Risk*, 5(3), 190–207. <https://doi.org/10.1080/19475705.2013.809556>
- Twigg, J. (2015). *Disaster risk reduction*. London: Overseas Development Institute, Humanitarian Policy Group.
- UN Office for Disaster Risk Reduction (UNDRR) - PreventionWeb. (2017). Terminology: Structural and Non-structural Measures. Retrieved April 20, 2018, from <https://www.preventionweb.net/terminology/view/505>
- UN Office for Disaster Risk Reduction (UNDRR) - unisdr. (2004). 2004 World Disaster Reduction Campaign. Retrieved December 22, 2019, from <https://www.unisdr.org/2004/campaign/pa-camp04-riskland-eng.htm>
- UN Office for Disaster Risk Reduction (UNDRR) - unisdr. (2015). Disaster risk. Retrieved December 22, 2019, from <https://www.preventionweb.net/risk/disaster-risk>
- UN Office for Disaster Risk Reduction (UNDRR) - unisdr. (2019). Who We Are: What is Disaster Risk Reduction? Retrieved April 20, 2018, from <https://www.unisdr.org/who-we-are/what-is-drr>
- UN Office for Disaster Risk Reduction (UNDRR) - unisdr. (2019). What We Do: We Coordinate; Sendai Framework for Disaster Risk Reduction. Retrieved April 20, 2018, from <https://www.unisdr.org/we/coordinate/sendai-framework>
- UN Office for Disaster Risk Reduction (UNDRR) - unisdr. (2019). What We Do: We Coordinate; Hyogo Framework for Action (HFA). Retrieved April 20, 2018, from <https://www.unisdr.org/we/coordinate/hfa>
- United Nation. (2000). World Disaster Reduction Campaign: “Disaster Prevention, Education and Youth”. Retrieved April 20, 2018, from <https://www.unisdr.org/2000/campaign/pa-camp00-kit-eng.htm>

- United Nation. (2006). World Disaster Reduction Campaign: "Disaster Risk Reduction Begins at School". Retrieved April 20, 2018, from <https://www.unisdr.org/2007/campaign/iddr/2006-iddr.htm>
- United Nation. (2011). World Disaster Reduction Campaign: "Making Children and Young People Partners for Disaster Risk Reduction". Retrieved April 20, 2018, from <https://www.unisdr.org/2011/iddr/>
- UNSECAP. (2010). Asia- Pacific Disaster Report: Protecting Development Gains. Retrieved April 20, 2018, from <http://www.ndma.gov.pk/Publications/The%20Asia%20Pacific%20disaster%20report%20Protecting%20development%20gains.pdf>
- UNSECAP. (2017). Asia- Pacific Disaster Report: Disaster Resilience for Sustainable Development. Retrieved April 20, 2018, from https://www.unescap.org/sites/default/files/publications/0_Disaster%20Report%202017%20High%20res.pdf
- Ward, L. (2016). Early year education. Children should learn mainly through play until age of eight. <https://www.theguardian.com/education/2016/mar/15/children-learn-play-age-eight-lego>
- Whitebread, D., & Basilio, M. (2015). Towards a playful pedagogy in Literacy-The Play, Learning and Narrative Skills (PLaNS) Project: Africa Play Conference. Retrieved from <http://playconference.africa/wp-content/uploads/2018/07/Towards-a-playful-pedagogy-in-Literacy-the-PLaNS-project.pdf>
- Whitebread, D., Basilio, M., Kuvalja, M., & Verma, M. (2012). The importance of play. Brussels: Toy Industries of Europe. Retrieved from <https://www.csap.cam.ac.uk/media/uploads/files/1/david-whitebread---importance-of-play-report.pdf>
- Williams, R., Alexander, D. A., Bolsover, D. & Bakke, F. K. (2008). Children, resilience and disasters: recent evidence that should influence a model of psychosocial care. *Current Opinion in Psychiatry*, 21(4), 338–344. doi: 10.1097/YCO.0b013e328305b6e4.
- World Health Organization (WHO). (2002). Vulnerable groups. Retrieved April 20, 2018, from http://www.who.int/environmental_health_emergencies/vulnerable_groups/en/
- World Health Organization (WHO). (2019). Humanitarian Health Action; Definition: Disaster. Retrieved December 22, 2019, from <https://www.who.int/hac/about/definitions/en/>

Zaalberg, R., & Midden, C. (2010, June). Enhancing human responses to climate change risks through simulated flooding experiences. In International Conference on Persuasive Technology (pp. 205-210). Springer, Berlin, Heidelberg.

