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Health Education Mobile Application for Children: A Case Study of Flood Victims

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Abstract

Flood is a regular occurrence during Malaysia's typhoon season. It causes damage and loss of life to many people. The government spends a lot of money to overcome the situation by upgrading infrastructures such as embankments and disaster parks. This paper presents a case study conducted with a community in a local village. They are one of the communities that were affected by the devastating flash flood in early 2022. The objectives of this study are to identify the problems faced by the community and to propose IT-related solutions to overcome the problem. This study adopts the Soft System Methodology approach. The interview and observations have been conducted with flood victims to understand their awareness and readiness toward flood disasters and health information. The interview, reveals that the main problem is the lack of knowledge about floodwater and health information on the children. They were not prepared to handle the flash flood that is claimed to be the worst flooding in more than 20 years. The mobile app via gaming is proposed to increase health education awareness during a flood. It is vital to develop game-based learning solutions that combine the characteristics of inspiring children with software that is fun and unlike traditional learning.

Keywords: Health Education, Flash Flood, Game-Based Learning, Soft System Methodology

Introduction

The Department of Statistics Malaysia (DOSM, 2020) reported that the number of poor households had increased in the year 2020 to a record of 639.8 thousand households as compared to 405.4 thousand households in 2019. It is said that the COVID-19 pandemic

caused a huge impact on household income while affecting the structure of household groups. As such, everyone needs to acknowledge the problem and the effect caused by them. The catastrophic situation which was a devastating flash flood that occurred from the end of the year 2021 to early 2022, gave a significant impact on many citizens living in Klang Valley (Zack, 2021). Due to this, many families are forced to the bottom of the income group due to the sudden loss of income source, along with the loss of family members. The children are one of those affected due to the unexpected situation. They are already behind due to inconsistent schooling during the pandemic.

This paper presents a study that has been conducted with one of the communities in Klang Valley that were the victim of the devastating flash flood. They are the community who lived in a local village located near the Subang International Airport in Selangor, Malaysia. The objectives of this study are to identify the problems face by the community and to propose IT-related solutions to overcome the problem. This study adopts the Soft Systems Methodology (SSM) approach. By using the method, the problem faced by the community is laid out and explained further while one IT-related solution that can facilitate in solving the problem is introduced. The interview and observation were conducted with the selected community to gather problem situations and elicited flood data. The practical result is suitable IT solutions for emergency preparedness that have a low environmental impact.

Methodology

Soft System Methodology (SSM) is introduced by Peter Checkland and his colleagues at Lancaster University in 1970 (Mehregan et al., 2012). It is a method of coping with all kinds of difficult, messy problems through action-oriented inquiry into problem situations, in which users learn from studying about situations and act to enhance them (Checkland & Poulter, 2006). Learning occurs as a result of a systematic process in which a situation is investigated using a set of directed action models (each built to summarise a worldview) as intellectual devices or tools to inform and structure discussion about the situation and how it can be improved as a system approach for analysis and problem solving in complex and jumbled conditions (Maqsood et al., 2009).

The SSM perspective is built on a complete complexity theory in which all systems are focused on the concept of human activity, i.e., a real perspective of a human being with an unstructured and complicated nature that can be deeply analyzed as an activity to produce output that can improve the problematic situation and conditions (Hardjosoekarto, 2012). He said that the conceptual model is more toward the relevant human activity system and not a representation of the real world. It is abstract of an activity system with a meaning that is important to real-world situations that are identified as challenging. There are similar studies on adapting SSM for community IT-based projects in Malaysia (Isa et al., 2020; Isa et al., 2020). This study adopted the SSM which the typical cycle consists of 7 (seven) steps:

- Problem situation considered problematic.
- Problem situation expressed.
- The root definition of the relevant purposeful activity system.
- Conceptual Models of the system are named in the root definition.
- Comparing the models with the real world.
- Changes are systematically desirable and culturally feasible.
- Action to improve the situation.

Results and Discussions

Step 1: Problem Situation

The observation and interview have been conducted with the community in the local village. From the interview, it was found that the main problem is the lack of knowledge in floodwater safety for the children affected by the flooding in the area.

Step 2: Rich Picture

The problem situation is portrayed using a rich picture that consists of actors, their relationship with each other, and problems owned by the actors as seen in **Fig. 1** below. This rich picture was created by considering the people involved in the creation of the problem and the problem that arises due to loopholes in addressing the issue.

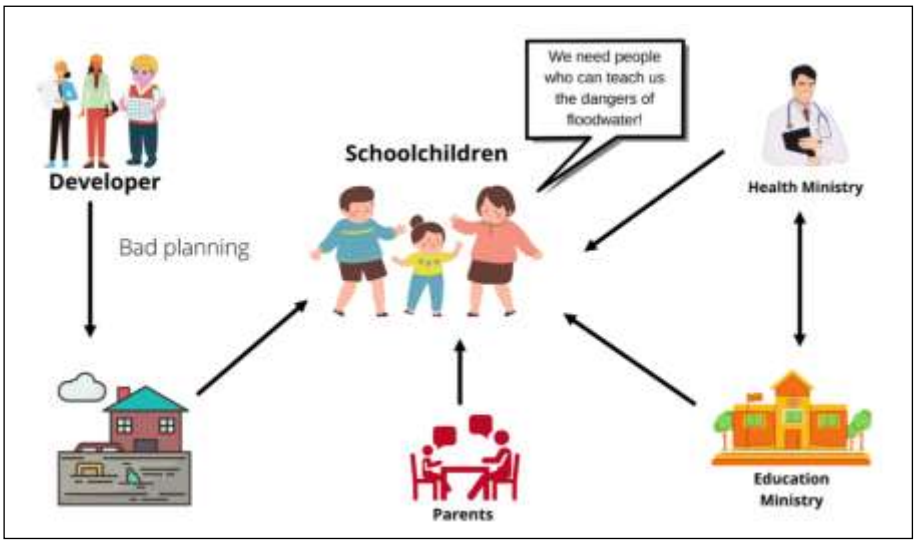

Fig 1. Rich picture poster of the problem situation

When developers choose to develop the area, they cause many changes to crucial water stream channels that can limit the channels' ability to direct floodwaters. Due to this, the community consisting of families with children was not prepared to handle the flash flood that is claimed to be the worst flooding in more than 20 years. In addition, rescue authorities were forced to choose areas that were even more severely affected while leaving other areas to fend for themselves. The interview revealed that the children were not exposed to the knowledge of floodwater such as lessons that were given for dental health in elementary school. Such lessons from hospitals or trained healthcare professionals became harder to conduct due to the ongoing pandemic.

In addition, parents who were occupied with other matters related to the flooding paid less attention to their children and let the children play with the flood water. The United States Department of Health and Human Services stated that standing flood waters is capable of spreading infectious diseases while containing chemical hazards, and will cause injuries such as drowning (Centers for Disease Control and Prevention, 2019). In addition, exposure to contaminated floodwater could cause wound infections, skin rash, gastrointestinal illness, tetanus, and although not common, leptospirosis.

By looking at the mapped rich poster problem, several ideas can be implemented specifically for the children in the community to teach them basic health information that can help them to be safer during the flood. One of the ideas is to introduce a mobile application

with an interactive gaming experience that will educate them on the reasons to avoid floodwater, the dangers of floodwater, and the diseases they carry.

Step 3: Root Definition (RD)

The Root Definition (RD) is described using the CATWOE checklist. The CATWOE checklist consists of six elements which are Customers, Actors, Transformation, World View, Owner, and Environmental. Fig. 2 illustrates the CATWOE analysis for this project.

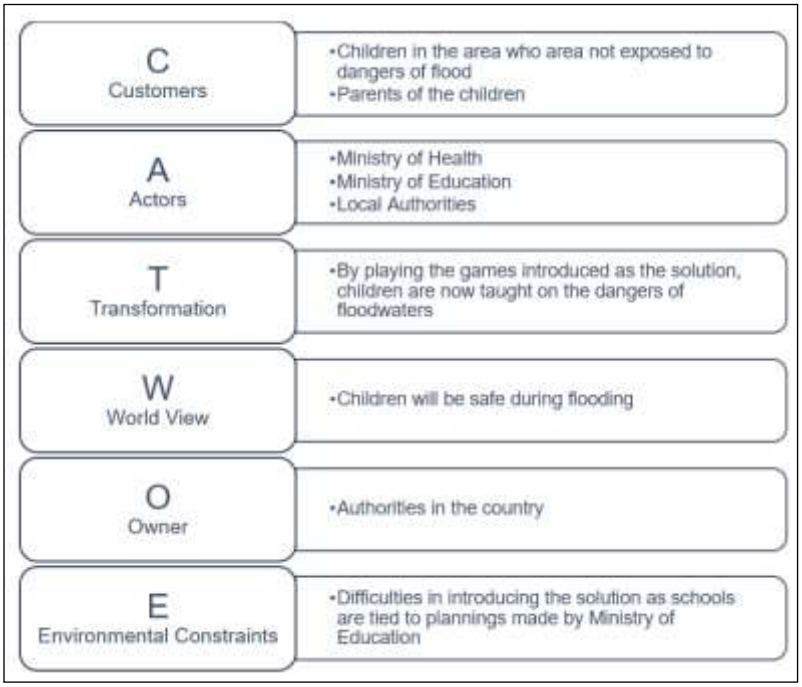

Fig 2. CATWOE Analysis

Step 4: Conceptual Model

The Conceptual Model that visualizes the process of activities is created based on the Root Definition stage and the CATWOE checklist as shown in **Fig. 3**. The first step is to identify the problem where suitable solutions can be suggested. Then, the identification of items to be introduced to the customers are then done where the suitability is determined to see whether the solution can be introduced. Simultaneously, the efficiency of the solution is also determined so that the solution can be improved to benefit the Customers.

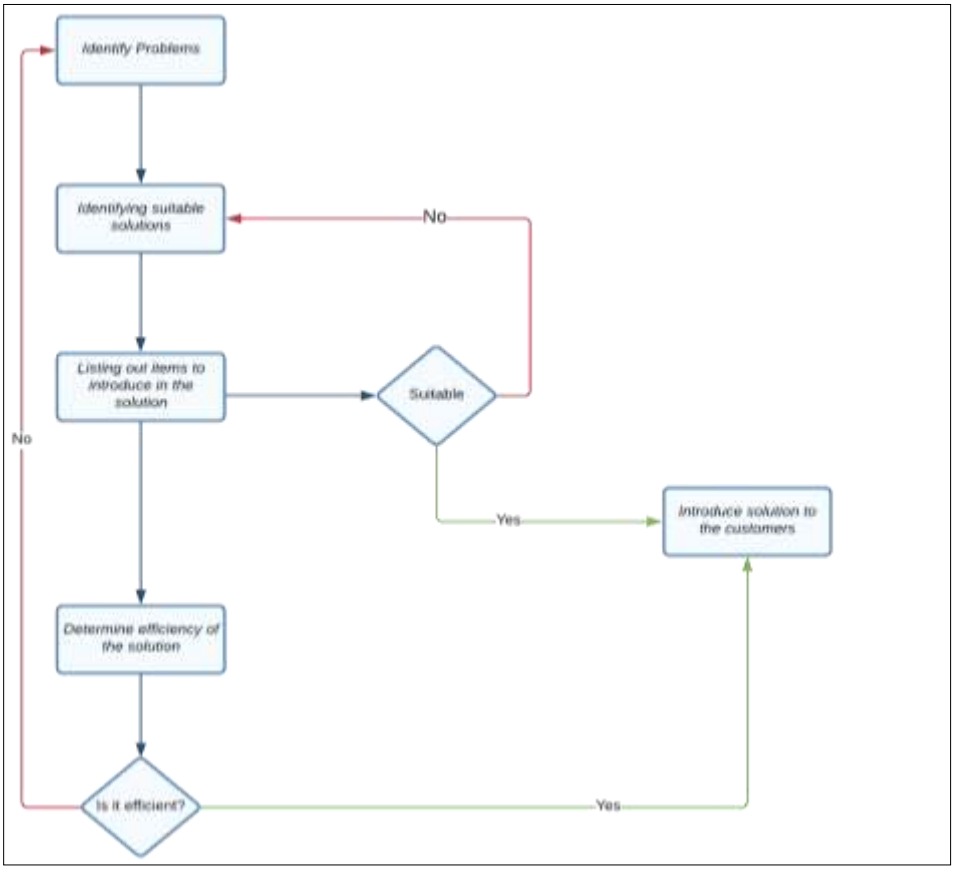

Fig 3. Conceptual Model

Step 5: Compare Model with the Real Model

In this step, the Conceptual Model is compared with the Real-World situation. The comparison between the Conceptual Model and the Real World is summarised in **Table 1**.

Table 1

Comparison between Conceptual Model and the Real World

Conceptual Model	**Description**	**Real World**	**Output**
Identify problems	Finding actual problems faced by the actors	Interviewing the stakeholders affected by the flooding	Lack of exposure to knowledge during flooding among young children
Identifying suitable solutions	Proposing an IT-related solution i.e., the mobile game application	Development of the application	Interactive education on flood-related dangers
Verifying the efficiency of the solution	The solution is fully capable of educating young children about the dangers of flood	Solution implementation may be hard due to costs	The children are also dealing with urban poverty, thus, implementing the solution is difficult as they need sufficient devices to operate the solution with

Step 6: Define Possible Changes

This is where action proposals for upgrades, tweaks, and changes in real-world circumstances are developed. This shift can be determined by suggestions that are in line with research interests and problem-solving interests in research, or it can be determined through recommendations that are acceptable and culturally feasible.

Mobile learning is presently the most beneficial as a supplement to ICT, web learning, and other traditional learning methods, and it can significantly enhance the user's learning experience. Mobile learning could be a major element in attracting dissatisfied people to learning in the future, where more traditional techniques have failed. Since mobile devices are becoming more affordable to acquire and share, recommending a mobile app as a solution may be realistic in the long run.

A few techniques have been developed to ensure that children are interested in using this mobile app solution. The first is to give children a variety of learning approaches based on their circumstances and environments. The second goal is to aid the teaching-learning process by creating a mobile e-learning application that can run on both Google Android and Apple iOS platforms. Furthermore, the app should have modules for notes, flashcards, and quizzes, allowing children to learn basic course topics utilizing mobile devices both online and offline. More crucially, the solution focuses on the interaction of learning content with the human-machine interface, as well as several levels of design strategies and methods for mobile learning apps.

Step 7: Recommend Action

The implementation measure to improve, refine, or change the problem situation comes in the seventh step. The formulation of action step proposals made in the previous stage serves as the foundation for this step of action. As a result, a Flood Informative Game app is developed and the user targeted the children. After installing the apps on their phone, the user will be prompted to Welcome Page. On this page, the user needs to choose the characteristic of either a boy or girl to proceed to the next step. The navigation was done via soft touch on the screen phone. Next, the user enters the World Map. This page served as a guideline for the user to check where their character's current location. It is very important to always check the map since the size of the map itself is huge. Currently, only a few stages were unlocked at the beginning as a fun factor for the user. Once completion of the quiz at certain stages, more locations will be unlocked, and the user will experience more tasks and quizzes.

At Stage 1, the user will be respawning inside the character's main home as the owner. Users can move the character using a move button. The user uses Button A for Pick and Button B for Cancel. At this stage, the user will be noticeable there was heavy rain and a possible flood alert. The quiz at this stage will be mainly focused on the emergency item to be packed by the user before moving out to a more secure place since the house will be flooded soon.

In Stage 2, the user will be headed to the community center for shelter on this stage. Some information tips and quizzes will pop up along the journey of the user to the Community Centre. The user should try to avoid flood or else the character will be dead and respawn back to the main character's home. User is encouraged to always check the world map to check the location of the community center.

Stage 3: After the user successfully arrived at the community center, the character will begin the conversation with the Doctor to check on their health and any physical injuries during the journey to the center. This stage also will have a quiz on the disease that can infect

the user. Users must be able to answer the quiz correctly, if not their life may reduce. Besides the quiz, some information and basic health book can be found during this stage to allow users to study information before taking the quiz.

Stage 4: Then the user will be able to go through the final stage which is the sleeping area in the community center. In this area, the user will be able to interact with another character who shares their health condition after taking the journey to embrace the flood. Users must be able to carefully avoid physical touch from another character to reduce the risk of disease spreading. Users must also do some tasks such as cooking clean water and washing their hands regularly as a health precaution.

The Information Page shows an example of the interface on health information and tips provided for the user to read and increase their knowledge regarding health information and precaution during the flood. The information may be included on one page only or more. Users just need to click the arrow on right to read more or the left arrow to come back to the previous page. After finishing the reading, the user will be provided with extra life which will be useful during taking the quiz.

The application is also designed with the Quiz Page. This page was an example of a quiz page where the user need to choose either one of the answer selections. Users will be able to choose the answer by clicking on the screen of their phone. For any wrong answer, user life will be reduced until no more life can be spent and the user will be respawning back to the home character. A sample of Quiz questions will be packed with a lot of questions designed to increase user knowledge regarding health information during the flood and equipped readiness to face an unexpected disaster such as a flood.

Finally, after all, the stage and quiz successfully answered with the correct answer, the user will be in conversation with Doctor as the final stage on the ending page. The conversation will be ended by wishing the user to have an increase in knowledge of health information after playing the game and wish to take care of when a real disaster occurs.

Fig. 4 shows the new, improved rich picture poster after Soft Systems Methodology is applied. Parents can now provide resources such as mobile phones to educate their children on flood-related dangers. While these children are affected by poverty, parents may find solutions such as applying for affordable packages at telecommunication companies. Other ways also include the Ministry of Health may liaise with the Ministry of Education to provide a curriculum on disaster education. Also, the Community may help in providing education to the children while they are out and about.

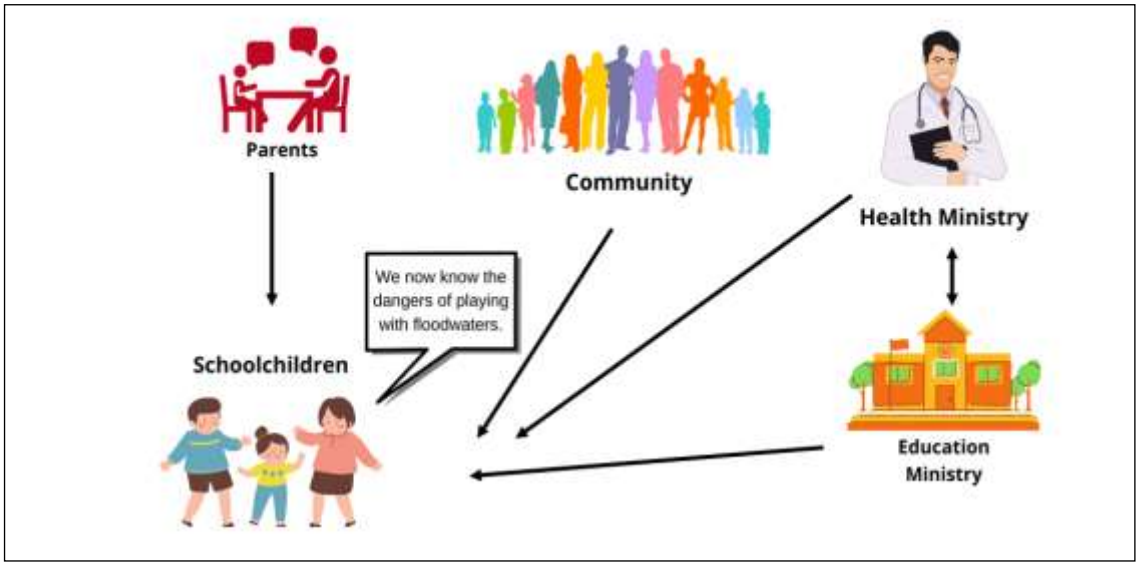

Fig 4. Improved rich picture

Conclusion

This study adopted an action research study where a comprehensive study has been conducted with the flood victim. The interview and observation of the victim's behavior have been video recorded with permission. From the problem identified, the flood informative game is proposed as a useful educational tool for flood-related health issues whose targeted user is children. The Soft System Methodology (SSM) is used to elaborate deeply on the context of mobile application development to reflect the major findings of the study. The mobile application is designed by employing four techniques. The techniques are to entertain children's interest to play the game; give children a variety of learning approaches based on their circumstances and environments, to aid the teaching-learning process by creating a mobile e-learning application that can run on both Google Android and Apple iOS platforms, the app should have modules for notes, flashcards, and quizzes, allowing children to learn basic course topics utilizing mobile devices both online and offline, the solution focuses on the interaction of learning content with the human-machine interface, as well as several levels of design strategies and methods for mobile learning apps. The flood informative game often increased pupils' enthusiasm to learn. In comparison to traditional lectures, where motivation is difficult to sustain, students preferred to learn through an interactive game. The use of game-based learning to promote health education during a flood is a convincing design that works. It has been shown to significantly increase students' motivation to learn more about floods and health concerns. As a result, it is vital to develop game-based learning solutions that combine the characteristics of inspiring students with software that is fun and unlike traditional learning. This concept served as the impetus for the flood game's proposed remedy.

Acknowledgement

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