DESIGNING AND SUPPORTING TECHNOLOGY ASSISTED INCLUSIVE LEARNING FOR DISASTER PREPAREDNESS: A CASE STUDY OF BANGLADESH

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ABSTRACT

This research aimed to explore the ways in which a technological artefact can assist in creating an inclusive learning environment to provide localised disaster preparedness training for predominantly technologically disadvantaged rural people of Bangladesh, one of the most disaster-prone countries in the world. The research was complex and required a multidisciplinary approach. Content selection and interface design in the medium chosen for dissemination was a significant part of the research process, as was conducting the field research to understand how the content could be disseminated among the participants in the chosen locations to improve their disaster awareness.

'Rapid ethnography' and 'Participatory action research' were the key research strategies that were used in the fieldwork and interview and observation methods were used to collect the data. A design log, a content specification and two sources of feedback from expert and general user evaluators were used to collect data for the development cycle of the content and the interface.

The research findings established the local needs and they also demonstrated a set of ways in which localised content and a localised interface could be created; one that preserved local values and cultures and ensured that end users were not overly exposed to foreign content. Furthermore, they provided insights into how a meaningful 'disruptive learning' that reduced existing negativities that less literate people associate with learning could take place by removing physical and psycho-social barriers and facilitating user-friendly ways to engage with a (newer) technological artefact. The findings also assisted in determining how teaching functions interacted with both the technological artefact and technologically disadvantaged people within a social learning setting to deliver a training programme with minimal supervision. Finally, the findings provided insights into how faster and informed decision making could be achieved by improving

knowledge of available resources and fostering proactive rather than reactive action.

One of the major contributions of this research to the knowledge was the identification of the limitations of ‘Minimally Invasive Education' as a teaching pedagogy. The research identified its weak and under-acknowledged theoretical base, an ignoring of the importance of contextualised content, and a lack of clarification of the role of teaching functions. Another crucial finding was that majority of prior user interfaces designed for less literate and illiterate people have largely ignored local languages and presented the numerals in the standard ‘Arabic’ format with a common understanding that everyone knows the universal numerals. The empirical findings of the research establish this as an uncertain approach with a potential for confusion due to the universal numeral's similarity with local numerals which may not represent the same number. Finally, this novel initiative to provide disaster preparedness training contributes to an understanding of how by using a newer and unfamiliar technology artefact among people who are generally technologically disadvantaged, less literate, financially challenged and plagued with gender discrimination can learn essential lifesaving skills.

This research adds to the current practices of integration of ‘localised' content in a technology artefact to be used predominantly by technologically disadvantaged, less literate and illiterate people. The contributions of this research are significant for disaster risk management practitioners, especially those based in Bangladesh, with a possibility of replication within the neighbouring countries who share similar socio-cultural traits.

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Beyond main study phases, this research has now reached to more locations, and its potential has been recognised by Brac Manthan Digital Innovation Award (BMDIA) 2016, World Summit Awards (WSA) 2017, Risk award 2017 and World Summit on the Information Society (WSIS) Prize 2017. In all four of them an extension of my research work branded as 'Training In A Tab' has been a finalist. In BMDIA, this project was the runners up, it has won the WSA national award, was in the top 10 of the Risk Award, was a finalist in WSIS Prize 2017 and one of the field photos was the winner of the WSIS 2017 photography contest. I would like to thank the jurors who have placed their trust in the project and have seen it as a potential instrument of bringing a positive change in the way disaster awareness is considered in those disadvantaged localities. Also, I would like to appreciate the prominent NGO directors of Bangladesh who has shown a keen interest in its expansion. Being first of its kind tablet based disaster preparedness training programme for the mass, the ultimate aim of the extension of this project is to make disaster awareness and disaster preparedness a social priority.

1. CHAPTER 1: INTRODUCTION

1.1 PREAMBLE

Use of technology in an educational setting is not new. We see many technologies come and go, some change the way we lead our life and some sink without a trace (Cuban 1986). Those that sink without a trace give us an important clue that technology isn't the sole determinant, that there are underlying (social) factors that drive a technology to make a meaningful change to our life. Being trained as a computer engineer the researcher initially believed in the power of technology in changing the world. For a developer, an ideal dream is to develop an 'idiot proof' software. Moving from the applied technical field to a social field led the researcher to understand the complexities of human interactions with technological artefacts. The use of the term 'case study' in the title is intended to clarify the position of Bangladesh as the context and location and not to identify the methodology used in this research.

With the occurrence of natural disasters across the globe and especially in the Indian subcontinent region the researcher explored alternate provisions to better prepare the affected people. Bangladesh having faced catastrophic natural calamities frequently struggles to create sufficient awareness among residents, especially those who are living in poor areas. Resources allocated in those regions, both physical and technological, are scarce. This research positioned in Bangladesh, aimed to reach out to some of the needy communities of Bangladesh with a technological artefact to provide disaster preparedness training.

1.2 BACKGROUND OF THE RESEARCH

Education is a key area of modern society that has continuously attempted to use mainstream technologies to reduce issues of inequality, access and inclusion. Decades ago, radio reached out to communities that were far apart and there were several attempts to disseminate educational activities using the radio (Cuban, 1986). Similarly, television reached to almost all corners of many countries

regardless of their social status and there were also some successful attempts to deliver educational programmes through the television (Toyoma, 2015). In recent decades, we have seen the growth of the educational use of personal computers, the internet and mobile phones.

Now we are going through a phase where all these three components can be merged in one 'smartphone'. Without losing the functionalities of a smartphone we have another variant with a large screen which is labelled a 'tablet' device. These technologies have the potential to greatly impact on the way we see and experience education. There are arguments about whether these technologies fit well with communities that are relatively poor and already plagued with low literacy. Recent evidence suggests that despite literacy concerns, African and Asian communities have embraced the mobile phone and mobile networks have reached to rural places. People who are less literate, or might not have used such technologies in the past, have found ways in which they can make use of mobile phones. This is important, because through these mobile phones, they can connect with the 'modern' and 'technologically advanced' societies.

While connectivity matters, it is also important to explore, what the connectivity would bring. Using mobile phones farmers are accessing the mainstream market – eliminating the profit extracting middle man, healthcare applications have been built using the telephone network so contact could be made with experienced doctors by those seeking medical advice. Distance education has also been attempted using mobile devices (Maddox and Overa, 2009; Chhachhar and Omar, 2012; Brownlee, 2012). This research intends to further explore the potential of modern technological artefacts to 'reach out' within technologically deprived locations.

1.3 MOTIVATION OF THE RESEARCH

This research is situated in Bangladesh a country in South Asia, located at the apex of the Bay of Bengal which is bordered by India and Myanmar. With nearly 170

million inhabitants on a landmass of 147,570 square kilometres, Bangladesh is among the most densely populated countries in the world and currently ranks 8th with a population density of 1033 per square kilometre. Statistically, 79% of Bangladeshis live in rural areas with 50 million Bangladeshis living in the coastal area. From the economic standpoint, Bangladesh is part of the "Next 11" (N-11) economies (Spence, 2014) with an aim to achieve the 'Middle Income Status' by 2021 (Gimenez, Jolliffe & Sharif, 2014).

Floods, tropical cyclones, tornadoes, and tidal bores are some of the most frequent natural calamities that occur every year in Bangladesh. To make it worse, vast areas of the country are also affected by deforestation, soil degradation and erosion. The Bangladesh government released statistics, from 1980-2010, showing that there were 234 natural disaster events affecting 323,480,264 people; 191,836 were killed and economic damage was 1.7 Billion USD (UNESCO, 2011; Government of Bangladesh, 2014; PreventionWeb, 2014). In 2015, Maplecroft rated Bangladesh as the country most at risk due to extreme levels of poverty and a high dependency on agriculture, whilst its government has the lowest capacity of all countries to adapt to predicted changes in the climate (Verisk Maplecroft, 2014). In addition, Bangladesh has a high risk of drought and the highest risk of flooding. This was exemplified during October 2010, when 500,000 people were driven from their homes by flood waters created by storms.

It is expected that climate change related hazards will occur on a wide scale in Bangladesh. Flash floods will affect some 80% of the land area during the monsoon season (Salauddin and Ashikuzzaman, 2012). It is reported that, due to climate change, the surface average temperature has been rising in Bangladesh, for example abnormal temperatures were recorded in April, 2016 (Imam, 2016). It is projected that, floods will be more intense, will inundate more areas and occasionally will devastate people's livelihoods, the national economy and infrastructure. In 2015, Maplecroft's Climate-Change Vulnerability Index (CCVI) classified Dhaka (the capital of Bangladesh) as the most climate change affected 'Extreme Risk' cities among the top fifty (Verisk Maplecroft, 2015).

Cyclone and Tsunami also have higher impact followed by earthquake and drought. As a result of climate change, it is likely that future tropical cyclones will become stronger, with larger peak wind speeds and heavier rainfall associated with ongoing increases of tropical sea-surface temperatures (Pender, 2008). Cyclones are expected to become 10 to 20% more powerful if sea-surface temperatures rise by of 2 to 4°C in South Asia. Therefore, the number of devastating cyclones will increase (Salauddin and Ashikuzzaman, 2012). Cyclones are expected to have 3% to 12% faster wind speeds by the 2020s, rising to 4% to 20% faster by the 2050s (Tanner et al., 2007).

These issues can potentially eclipse the country's impressive track record on growth and development. In the past decade, the economy of Bangladesh has grown at nearly 6 percent per year, life expectancy, the level of literacy has increased, and poverty has dropped by a third. Since 1992, more than 15 million poor Bangladeshis have moved out of poverty (Government of Bangladesh, 2014). The annual occurrence of natural hazards under the impact of climate change will be a major challenge for Bangladesh and its predicted growth.

In the starting phase of this research work in 2012, Bangladesh was still recovering from the aftermath of Cyclone Sidr (2007) - one of the worst natural disasters in Bangladesh, resulting in up to 10,000 deaths and causing damage of $1.7 billion (2007 USD) (PreventionWeb, 2014). Bangladesh faces similar incidents almost annually. It is not just the cyclones, there are seasonal floods, droughts and earthquakes to be worried about in Bangladesh. Though there has been increased involvement of government, local and international NGOs to minimize the impact of the most common natural disasters, at a grassroots level people still remain in the dark in terms of taking informed decisions. Many locations are still poorly connected with towns and there is growing concern about the scarcity of cyclone shelters. Bangladesh has poor literacy rates and these are particularly low in the rural areas. To make things worse, the traditional education system gives very little hands on knowledge on how to better prepare for disasters. Bangladesh despite

being a country of rivers, every year during the monsoon season, many die (both in urban and rural areas) due to not knowing how to swim. There is a clear gap in the reality that people have to face and the knowledge they gain through the educational system.

The researcher being born and having lived in Bangladesh for 24 years was aware of these gaps but also having lived in the UK for around 10 years, came to know of many ways in which awareness building programmes can be accessed in the UK. The availability of clearly thought out disaster preparedness programmes for the general public are rare in Bangladesh. Those that are available can only be found in the capital city and in the district towns and rural areas they are non-existent. This is largely due to lack of resources and low literacy. The outsider perspective motivated the researcher to explore potential ways in which technology can be customised to overcome the barriers to training caused by resource limitations leading to the possibility of creating useful training to upskill people on disaster preparedness.

1.4 FORMULATING THE RESEARCH AIM

Considering the research background and the motivation, the scope of the research was further narrowed down and the research aim became:

> *"to investigate how technology assisted learning can be utilised to inclusively train disaster preparedness in a developing country – Bangladesh."*

1.5 CONCEPTUAL AND THEORETICAL FRAMEWORK OF THE RESEARCH

The research aim clearly indicated that the research would be dealing with multiple components (understanding technology integration in education, reviewing the state of disaster preparedness training in Bangladesh, conducting development and design of content and an accessible interface, being informed about learning theory

and pedagogic approaches that could make the training successful). Each aspect may initially appear to be isolated but each of the components informs the rest.

Moving from a commonly found technological deterministic consideration in using artefacts in technology deprived locations that technology itself can successfully initiate and facilitate learning in a social context, in this research the importance of the social elements such as culture, participation dynamics were further studied using variants of ethnographic and action research with a profound consideration of individual characteristics such as experience, interpretation of a problematic scenario, to find out how these can inform design and development of the content to be delivered, the use of a technology artefact in general and choices of teaching pedagogies.

Two of those components (learning theory and pedagogic approaches, and development of content and interface) required precise theoretical understanding. From the theoretical point of view, the researcher was inspired by both cognitive and constructivist learning theories. Pedagogies that inform adult learning with minimal supervision in a social setting were of particular interest. This was supported by an appreciation of the cognitive considerations that could arise in the proposed learning setting. A practical fit of those cognitive considerations within the constructivist interpretation was sought. The content and interface design was informed by identified cognitive considerations (Cognitive load being the most prominent).

All elements related to the conceptual framework are presented in the Chapter 2 of this thesis. The researcher has followed an interpretivist framework with the ontological understanding that multiple realities can exist and they are socially constructed through our lived experience and our interactions with others. From an epistemological point of view, reality is co-constructed between the researcher and the researched and this is shaped by individual experience. Further commentary on these issues is presented in Chapter 3.

From an applied point of view, following elements of the research were subject to methodological understanding:

a) The recursive development of the content and the interface
b) Use of the interface, the content and interactions by the participants among the chosen research locations
c) The way in which the local people constructed knowledge during the training

To understand the above, possible methodological stances were reviewed (detailed in the chapter 3). Three suitable ones were selected which are fully developed in the chapter 3 and are listed below:

a) Action research which was in the form of cyclic development of the interface and content.
b) (Rapid) Ethnographic research was used to study the participants in the chosen locations.
c) The way learning and teaching works were studied through exploring appropriate pedagogic approaches.

1.6 STRUCTURE OF THIS THESIS

The thesis is divided into eight chapters. The present chapter provides an overview of the background and motivation of this research. It has outlined the conceptual and theoretical frameworks which will be fully developed in the forthcoming chapters. A synopsis of the findings is also provided.

Chapter 2: Literature review

In this chapter, a review of the key literature is conducted. As this research had multiple elements, the literature was divided accordingly. Identification of the limitations of previous work and also limitations of current teaching practices were thoroughly reviewed. Potential “Knowledge gaps” are identified at the end of the chapter.

Chapter 3: Research Methodology

This chapter establishes the researcher's philosophical stance in this research with the rationale for its selection. A justification for the adoption of an interpretivist paradigm for this study is provided. This chapter details the methodological frameworks that informed the design of the research. Selection of both the (rapid) ethnography and action research as the research strategy is critically evaluated and the rationale for their selection is also elaborated. This chapter also provides information on the selected locations, sampling method and the way a sampling frame was developed to use in those locations. Data collection methods are clearly described and discussed for their suitability in this research. The way the researcher interprets the reliability and validity of this research is also presented. Finally, the ethical approval system is provided.

Chapter 4. Processing and Analysis of the Data

Since various data sets were collected in this research it necessitated a thorough understanding of the underlying systems used to process each data set and how those data sets were analysed. This chapter lays out separately each data source of the fieldwork, and the processes are sequentially explained. Software assistance in data analysis through the use of NVivo (for the textual data) and Pixa (for the images taken by the participants) are also presented with illustrations. The development of the coding frameworks to process field data for further thematic analysis is provided.

Chapter 5. Content Selection and Evaluative Interface Design

This chapter deals with the next major component of this research, the development of the content and interface. For the interface and content development an iterative and 'evaluative' cyclic process was followed and this is set out and illustrated in detail.

Chapter 6. Findings from the fieldwork

In this chapter, data extracts from the three fieldwork data sources are presented systematically using themes and sub-themes. Interpretation and analysis of the themes and subthemes in the light of the collected data was also presented. In the initial sections, the three fieldwork data sources – interviews, images and observation logs are separately processed. They are then combined and common themes from the separate data sources are synthesised and presented.

Chapter 7. Discussion

In this chapter, the findings of this research are connected to the existing literature and how the results of this research have contributed to original knowledge is elaborated.

Chapter 8. Conclusions and Recommendations

This chapter is dedicated to consolidating the findings regarding the research questions and research aim in general. Also, a reflective interpretation is presented to give an account of the way the research has taken shape throughout the duration of the doctoral study and also how the researcher has gained skills to conduct research on a larger scale.

2. CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

To inform the research, the literature review focused on four broad areas – integration of technology in education, relevant learning theories, the current state of disaster preparedness training in Bangladesh, and interface and content design. It was evident that this research would require exploring literature on how technology assisted education can be used in a developing country and to what extent the existing learning theories and pedagogies inform that process of technology assisted learning. Furthermore, literature was required to be reviewed to identify weaknesses in existing approaches to disaster preparedness training in Bangladesh and to understand why a new way of providing disaster preparedness training is required and how it can be implemented within the Bangladesh setting. As a tablet device based interface using Bangla is a novel undertaking, it was important to understand the design considerations and to review previous works. From this discussion of the literature in these four broad areas, the research has taken a critical stance to understand weaknesses in the existing work and to identify knowledge gaps. The final section of this chapter illustrates how this research can contribute to closing those knowledge gaps.

2.2 INTEGRATION OF TECHNOLOGY IN EDUCATION

Technology can play an important role in development, and most of the success of technology deployments depends on adequate planning, infrastructure availability and favourable policies. With the growth of technology, we have seen computing devices becoming household artefacts in the last few decades. These devices are becoming more and more affordable, which makes use of such a device a possibility in the developing world context. Donner (2008) noted that, mobile networks had grown enormously worldwide. The result is that there are places that are deprived of electricity but have mobile network coverage. These developments provide people who were excluded with new opportunities to close the 'class' gaps (Aker

and Mbiti, 2010; Brewer, Demmer, Du, and Ho, 2005; Chapman and Slaymaker, 2009).

2.2.1 A brief historical review of some of the key technological integrations in education that inform this research

> *Perhaps we are always destined to rediscover ideas from the past when seeking to make improvements on the present. Nevertheless, old though an idea may be, it frequently benefits from the revisions and refurbishment afforded by re-examination in the light of contemporary scientific and educational knowledge. (Levin & Allen, 1976, p. 241)*

Integration of technology in education is not a new phenomenon. The premise of technology-based instruction was imagined by Thorndike (1912) almost half a century before the feasibility of such a system became possible. He wrote:

> *If, by a miracle of mechanical ingenuity, a book could be so arranged that only to him who had done what was directed on page one would page two become visible, and so on, much that now requires personal instruction could be managed by print. (p. 165)*

Influenced by Thorndike, in the early 1920s Sidney Pressey, developed a machine to provide drill and practice items to students in his introductory courses (Pressey, 1927). In the late 1950s, Skinner (1958) further developed the teaching machine to provide automatic, immediate and regular reinforcement without the use of aversive control. The material presented could be adjusted as per the individual need which would make the students interested and attentive. In 1932, Thomas Edison was certain that motion films would make books obsolete, based on this assumption that we retain 2% of what we read from the books but 100% of what we can see over the film are absorbed (Toyama, 2015). The radio, another technological invention, was thought to be able to bridge the geographical gaps in quality teaching. Benjamin Darrow in 1937 commented on the power of radio that

it would ‘bring the world to the classroom’. During 1950-60s, television took the central stage, and it became the new sensation in modernising education (Toyama, 2015).

The last decade has seen some fascinating projects that tried to push the boundaries of technology enhanced learning in developing world contexts. Projects like Mitra’s ‘Hole in the Wall (HiWEL, 2015), Negroponte’s ‘One Laptop Per Child’ (One Laptop per Child, 2015a), ‘One tablet per child’ in Ethiopia (Talbot, 2012), and UNICEF’s solar-powered PCs in Uganda (UNICEF, 2011) are some of the path-breaking projects. Funded by a number of technology corporations such as AMD, Chi Mei, eBay, Google, Marvell Technology Group, News Corporation, Nortel, Red Hat, and Quanta, in 2005, the ‘One Laptop Per Child (OLPC)’ programme was inaugurated to eliminate the digital divide by providing low cost laptops to children in developing countries around the world. It was believed that these laptops would help the children engage in collaborative, joyful and self-empowered learning (One Laptop per Child, 2015b, Selwyn, 2013). In the later sections of this chapter, concern related to these projects will be further elaborated as this is important for the researcher to consider the limitations of the existing projects so that they can be eliminated or minimised in the proposed endeavour.

2.2.1.1 Case of the ‘Teaching Machines’

The idea behind Pressey’s teaching machine’s development was to make teachers free of the burden of routine drills and information delivery. He believed that while these tasks can be taken care of by the machine, teachers could be involved in inspirational and thought-stimulating activities, which were to him, the “real function of the teacher” (Pressey, 1926, p. 374). Holland & Skinner (1961) claimed that by using the teaching machine (developed by Skinner), the students learnt efficiently by producing the desired behaviour which was described as ‘learning by doing.’ In both cases, teachers’ abilities were preserved for tasks/lectures that required sophisticated delivery. Teachers who adopted the machine found it required carefully prepared software. As the machine proceeded in a linear

manner, it had a limited capability to provide for the wide range of learners with different needs. The presence of a teacher was not of such importance when the teaching machine preserved the teaching function. It is not clear within the teaching machine literature who provided the technical support or whether there was involvement of the teacher in the technicality of the programming of the content for the device. Benjamin (1988) reviewing the history of the teaching machine found that:

> *One school district spent $5,000 on machines and dis- covered there were no programs available for them. Some machines seemed little more than toys, offering almost no educational benefits. (p. 710)*

2.2.1.2 Case of the 'Television'

Overhauling the entire education system by using television programmes was once thought to be an answer to development. Countries like, Ivory Coast, Niger and American Samoa that were early enthusiast nations to adopt the idea, had abandoned the project shortly after implementation as they could not see any improvements in practice (Toyama, 2015). However, there was one project in Niger that had shown progress. Thomas and Kobayashi (1987) stated that in a distance learning programme, 510 children out of 800 graduated primary school without a single face-to-face lesson. This programme taught the kids to ask questions and find answers by themselves. The authors mentioned that this was possible because the themes of the television programmes were closely related to the children's need. The authors also commented that the failure of other programmes was most likely due to the contents of the programmes not being appropriately developed for the targeted pupils. This gives an indication that, even if the teachers were not physically present, they had to carefully consider the creation of the educational programme. Assessing the educational condition at the time they were writing, Thomas et al. (1987) advised that radio or television should not be central to instruction in the evolving educational system. They advised that, learners may be better served by a new set of instructional media that would place both radio and television in a supporting role.

2.2.1.3 Case of the 'Desktop Computers' (especially in the Hole in the Wall project)

Among various desktop computer based educational initiatives (Unwin, 2009; Alias, 2013), the Hole in the Wall (HiWEL) project remains an interesting one in the Indian subcontinent. It was initiated by Sugata Mitra with a simple idea of putting a computer on a wall, close to a slum in New Delhi, to see how the local children would make use of the computer. The underlying principle behind the HiWEL project was that if the children were given computers, they would self-teach themselves how to operate a computer and take their learning further, irrespective of their demographics, ethnic background and existing literacy (Mitra, 1998, 2000, 2005). This project of unsupervised learning using computers claimed to have demonstrated that children initially amused by the technology could eventually educate themselves on complex topics. In the HiWEL project, it was suggested that teachers could be completely replaced in children's learning, and this argument was supported by observing a group of slum kids accessing the wall fixed computers.

A lack of empirical evidence of HiWEL's success, other than those successes reported by Mitra and his colleagues (Toyama, 2015), and the unclear methodological underpinnings of the research, led Kirschner, Clark & Sweller (2006) and Arora (2010) to question the overall success of that project. Nevertheless, as this was a documented project and there was a dominant presence of a customised teaching pedagogy, this may be of greater importance in this research. The researcher will further elaborate on this in section 2.3.5.

2.2.1.4 Case of the 'Laptops' in developmental, educational settings

Negroponte in his OLPC project claimed that, "you actually can give a kid a laptop and walk away" (Negroponte, 2010; Swaminathan, 2010). Negroponte claimed that the kids in Peru OLPC programme had shown that, not only could they learn to read and write by themselves, they could also teach their parents to do the same too (Negroponte, 2010). Though, in the OLPC, project it wasn't always feasible to ensure that every child indeed had a laptop, in schools they were commonly

available for the majority of the children. The traditional teacher was supposed to make active use of the laptops in the class. An independent evaluation by Peru's government, the Inter-American Development Bank, and GRADE (a Peruvian NGO) found that the use of computers in the classroom would decrease after the initial period of amusement, and the difference of performance between children who received the computer and those who did not was marginal (IADB, 2010). They also concluded that the negligible difference may also represent that those children did not interact with the device for a prolonged period which was required for them. The OLPC project sets an example suggesting the need for pedagogical and technical support for teachers, as well as indicating that the planning of appropriate activities and digital resources for educational use cannot and should not be ignored (IADB, 2010). Another similar experimental study run by Fairlie and Robinson (2013) randomly picked 1000 students from grade 6 to grade 10 across the states in the US and let them use a laptop for two years. It was found despite using the laptops they did not do any better than a controlled group who had no access to a computer. The researcher agrees with Toyama (2015) who argues that unrestricted access to technology does not deliver any better learning than unrestricted access to books.

2.2.2 The social construction of technology or technological determinism?

One key element which is noticeable in the HiWEL & OLPC projects is their root in forms of 'Technological Determinism'. Leaving children alone with the technology was taken to be sufficient for achieving success in those projects. Exploring the idea of technological determinism and alternative philosophical stances is important to consider for any educational research that involves the use of technology.

Technological determinism is the notion that technology drives change in society, and the development of the technology is autonomous and not dependent on social conditions. While technology shapes the society, it is not reciprocally influenced by it (Mackay & Gillespie, 1992). Technological determinism on its own is unsatisfactory because looking at the actual development of technological artefacts

shows that technology does not have a predetermined path to follow. Its development is highly dependent on various social, political and economic factors (Bijker, Hughes and Pinch, 1987, 1989; Mackay & Gillespie, 1992; Bimber, 1994; Heilbroner, 2008).

'Interpretive flexibility' is a key component of Pinch & Bijker's (1987, p. 40) original conception of the 'Social Construction of Technology (SCOT). It is the idea that, technological artefacts are culturally constructed and interpreted. Thus, once a new technology is innovated and introduced, various social groups will associate meaning to it, which is not necessarily the same as that intended by the developer/introducer (Doherty, Coombs & Loan-Clarke, 2006). These interpretations are often unimagined by the developers. There are many such examples: the cassette recorder was made to play pre-recorded tapes, but they were heavily used for recording from records and the radio (Kimizuka, 2012). Video was introduced to make films and play them back at home, but it was predominantly used to 'time shift' television programming (Toyama, 2015). Thus, when we talk about technology interventions, it is important to consider the culture in which the technology was created and the culture where it was intended to be used.

Technological interventions in education have failed to achieve their targets when they failed to acknowledge the power of the social forces which shape those interventions either directly or indirectly. It would not be wrong to say that technological integration within a society is highly dependent upon its compatibility with the existing technology and the society within which it aims to operate (Selwyn, 2013). Before, embarking on a project with a newer technological artefact, it is thus, important to understand the challenges of such technological integration. This is largely because although the look and feel of the device might have changed over the years the issues of putting them into an educational setting remain almost identical. From radio to TV, then TV to computers, laptops and now mobiles and tablets, there has been a continuous flow of new technologies. While the existing ones were getting cheaper, the new ones took the centre stage. Rather than

focusing on eliminating flaws with the existing system, the world has jumped to integrate the next technology as a panacea for all the existing technological integration's shortfalls (Cuban, 1986; Toyoma, 2015). The history of repeated technological interventions suggests that we need to understand the role of technology in shaping education and whether technology can be the sole driver of change and make technology projects successful.

After years of operation the OLPC project had dramatically increased access to technology, and was found to have contributed to some cognitive development. Unfortunately, there was very little evidence that it helped improve numeracy or literacy skills, which were the project's intended aim (Cohen, 2006). Sandro Marcone, then an educational official of Peru commented:

> *The (Peru) ministry is not going to do another macro project of this type. It is not going to make multimillion-dollar purchases and distribute (computers) like candy. (Foster, 2012, para. 13)*

Selwyn (2013) investigated the reason for the failure and noted that, these devices were lab centric designs rather than user needs oriented, thus, they failed to fit in with the developing country's educational setting.

Another iteration in this initiative was introducing 'One Tablet per Child' or 'XO tablet' to children in Ethiopia. Negroponte sensationalised the success of 'One Tablet per Child' programme in Ethiopia by stating that, without any intervention of teachers just by accessing the tablets Ethiopian children learned to sing the 'ABC song' in two weeks and by the fifth week they had learned to 'hack' the android system and turn on the disabled camera feature (MIT Technology Review, 2012). What they had discovered was how to 'hack' (turn-on) the camera function which was disabled by default. This short-sighted 'success' overlooked the needs of that country, the locality. To put things in perspective, after years of the project's presence, Ethiopia had a literacy rate of 49%, which compared to their neighbour Kenya's 87.4%, was very low (AFRICAW, 2015; CIA, 2015). Children in Ethiopia might learn an 'ABC song' or enable a previously disabled functionality in the device, but

we can certainly argue whether learning to sing a foreign song or learning to enable the camera operation is what those children needed to improve their lives. These projects and variants of them are continuing in various developing countries. The core purpose of these technology interventions varied significantly, but they were criticised by academic commentators for their failure to understand various contextual issues of such intervention (Selwyn, 2013). It is to be understood that, with identical technology deployed in different places we can get different outcomes because the social factors that work with technology are complex. Enriquez (2009) argues that, technological integration has a wider context other than a deterministic interpretation, the researcher considers that, any technological intervention should connect to the culture of the people where it is going to be put into practice.

2.2.3 Differences a localised adoption of technological artefact can bring

> *Localisation is the adaptation of a product or service to meet the needs of a particular language, culture or desired population's "look-and-feel" (Rouse, 2015, para. 1).*

A successfully localised service or product is one that appears to have been developed within the local culture. In addition to native language translation, details such as graphics, local colour sensitivities, gender roles and geographic references must all be considered (Rouse, 2015).

There were a handful small to medium scale projects that did not use the commonly found 'push' strategy of technology integration rather these projects intended to localise implimentation of technologies. Educative projects run by 'Worldreader' to bring digital books to remote African countries have seen significant growth since its inauguration in 2010 (Stone, 2012). As of May 2015, they have delivered 9,363 numbers of e-readers and 1,383,682 books to 133 schools and libraries in Africa (Worldreader, 2015). Worldreader's library contains the most e-books written and published in Africa (63% of the total pre loaded e-books) and

world-class books donated by partnering publishers (37%) which are culturally-relevant and curated for the local needs (Worldreader, 2016). Beneficiaries of these projects are even paying small sums for Worldreader's service (Scott, 2012, Zell, 2013). This suggests that, if there is a profound identification of need to spend for learning, regardless of their economic background, potentially people are willing to contribute financially.

The review of previous uses of technological artefacts in educational settings indicates that deployment must carefully consider the learner's needs (Selwyn, 2013), the suitability of the artefact (Toyama, 2015), and potentially altered teaching functions (Jones, 2015). In addition to these, participants should be able to interpret the content clearly, relate to it and realise its importance. For this understanding, the local needs are required to prevail over just introducing the device with the ambition that it will be self-sufficient in delivering the training. The researcher believes that knowing how 'local need' can be connected with the applied technology to bridge the current void can help ensure a sustainable, successful technological integration.

2.2.4 Technology-based initiatives in Bangladesh and their limitations informing this research

In recent years, use of mobile phones became very popular in Bangladesh, there are 130.843 million active mobile subscribers (BTRC, 2015b). Mobile user penetration is 67% percent and country coverage is 98% (Grameenphone, 2015). The growth rate over the last 5 years is almost 20 times higher than the previous record, and a majority of internet subscribers in Bangladesh use mobile internet (BTRC, 2015a). Islam and Hasan (2009) found that, in Bangladesh, there are several medium-scale projects (Pallitathya Kendra, Sustainable Development Networking Programme, Amader Gram Learning Centre, Rural ICT Centre, Youth Community Multimedia Centre, Rural Information Research Centre, etc.) and a few large-scale projects (Community Information Centre of Grameenphone and Gonokendra) that involve

the use of technology to improve the generic hygiene and income of the local people.

Poor fishermen in some rural parts of Bangladesh, have started to use mobile phones to create their own buyer network that allows them to get more value for their stocks (Maddox and Overa, 2009; Chhachhar and Omar, 2012). Using mobile applications, attempts are also made to reach out with medical services to people in places where medical services are not available or, in the worst-case, non-existent (Brownlee, 2012; Nessa, Ullah and Kwak, 2008). With the aim of sustainability and accessibility, Boat school launched in 2002 to provide primary education and training in sustainable agriculture to approximately 20 million people living in villages accessible only by boat. A traditional mode of delivery is followed supported by library, internet connected computers and multimedia projectors on which customised videos are shown to the participants. This project powered by solar energy has reached up to 90,000 families and annually provides training to 15,000 people (Corcoran, 2012; Deriquito & Domingo, 2012). Dimagi and BRAC have initiated basic healthcare related short interactive audio courses that can be taken on standard mobile phones. The participant calls a designated number to access the course and by using the mobile keypad, they can answer questions (Deriquito & Domingo, 2012).

The projects mentioned above are mostly service oriented. Educational projects that involve ICT, take access as the major challenge. However, there are other underlying issues such as motivating people with low literacy to access education, inclusion of a heterogeneous population and the design of aspects of learning that also require attention. Islam et al. (2009) reviewed current NGO led projects and commented that many of the training programmes were administered in closed boundaries that often-made rural people feel awkward. In addition to this, the lack of reliable communication infrastructure, unreliable electricity supply, lack of specialised contents, restricted access of women, lack of technological & literacy skills, and being unaware about technological advancements often made these initiatives fall short of expectations (Islam, 2010, Rahman 2005).

2.2.5 Considerations for a tablet-based training in Bangladesh

The desktop and laptop based projects that were reviewed were demanding and involved high maintenance costs (Foster, 2012). The researcher also believes as projects like HiWEL had a fixed setting in a brick and mortar structure and they were often physically uncomfortable for certain groups of users (e.g. being too tall or too short for the installation). It might be worthwhile to attempt to reduce these barriers and search for alternative learning solutions to give further room for innovative teaching approaches. For this, it is important to consider alternatives that provide greater portability and flexibility.

Tablet devices can fit in this context as they have most of the features that can be found on a traditional computer but offer greater portability. Tablets, being portable, allow the training not to be bound to one location, allow more innovative activities to be designed to keep the participants interested and overall it may make the learning process different to the traditional offerings. Specialised content can be created and the long battery life of the tablet device will mean the training will not be so dependent upon electricity connection. Being compact in size and available in a robust hardware design, fewer maintenance issues are anticipated. All these factors make the use of a tablet device as a portable learning station, a viable option for the chosen location.

Several tablet based projects across the world were reviewed to understand the tablet's suitability in an educational setting. Outcomes of, One Tablet per Child-Thailand (Viriyapong & Harfield, 2013), iRead Pilot-Ghana (Moody, 2010), All Child Reading- Ghana (OLE-Ghana, 2015), eLimu's tablet project–Kenya (Wahito, 2012), while at the primary stage, were encouraging. Despite the critical reception of OTPC project, the projects listed above are an indication that regardless of location, and economic standing newer technology can be deployed for the betterment of underprivileged or less privileged members of society.

This proposed research will use the tablet device because it can take advantage of quick adaptability (seamless touchscreen function), greater connectivity (cellular network, WiFi), flexibility of the power source (good battery life, ability to use solar chargers), fewer maintenance issues, useful features supporting education (multimedia, GPS sensor, camera, voice recorder). The use of a tablet device based disaster preparedness training in Bangladesh can also potentially be synchronized later with the Open Street Map Bangladesh project (Ridwan, Ferdous, & Ahmed, 2011; Latif, Islam, Khan, & Ahmed, 2011) and enable crowdsourcing initiatives when they are ready to be deployed to assist in disaster events. Since the beginning of this research to the time of writing, no other initiative has investigated the educational use of tablet devices using native Bangla language in Bangladesh. This research intends to contribute to this knowledge gap.

Knowledge Gap 1 (KG1): ***Tablet devices can potentially overcome limitations of PC/laptops and can provide a better learning experience to the technology deprived people of Bangladesh.***

Knowledge Gap 2 (KG2): ***To what extent tablet devices can be adopted by the rural people needs to be better understood as this is the first of its kind initiative to include people from a diverse, challenging background to take up a disaster preparedness training.***

2.3 A REVIEW OF THE RELEVANT LEARNING THEORIES AND PEDAGOGIES

This research deals with the active use of a technological artefact in the learning environment with reduced physical presence of a teacher. The review of the literature dealing with learning theories and pedagogies is thus narrowed down only to this research context allowing a better understanding of the learning and teaching process that can be positioned within disaster preparedness training. Two aspects of learning become significant within the process: 1) how learning takes place with minimal supervision where teaching functions are possibly reformed and, 2) how social interactions contribute to learning and the retention of

knowledge leading to better decision making and greater awareness. These aspects will be explored in this section.

Pedagogy is the art and science of teaching and is "how" the teaching and learning occur. It is concerned with the underlying values and principles that influence our approaches to learning, teaching and assessment (The Higher Education Academy, 2014). No single or universal approach suits all learners thus to be an efficient and effective teacher it is necessary to use a range of teaching strategies. The expectation is that by using different strategies in different combinations with heterogeneous learners the learning process will be enhanced (Conole, Dyke, Oliver & Seale, 2004). Effective pedagogy recognises differences between learners, supports cognitive engagement, connects learners to the wider world and creates a supportive learning environment (Knowles, 1973; Merriam, 2001).

Before considering the dynamics of teaching, it is important to consider how people learn. Cognitive, emotional, and environmental influences, as well as prior experience, all play a part in how understanding, or a world view, is acquired or changed and knowledge and skills are retained (Illeris, 2004). Learning theories are an organised set of principles explaining how individuals construct, retain and recall knowledge. An individual's personal, social, cultural, economic and political experiences shape his/her knowledge, beliefs, attitudes, behaviours, language, identity and even thinking, and this applies to both learners and teachers. Understanding how individuals learn helps teachers to identify how their teaching practices impact on the learning of learners from diverse backgrounds (Caffarella & Merriam, 2000; Weimer, 2013; The Higher Education Academy, 2014). Learning theories help to explain the connection between the conditions of the new learning environment and an individual's previous educational experience and their cultural and social background for facilitating or hindering learning.

Jones (2015) noted that, a commonly practised way of contextualising learning theories with new technology is to frame the discussion as proceeding from behaviourism to cognitivism and then on to constructivism. A brief review of these

classical theories is provided in the next few sections with the rationale of the relevance of applicable classical learning theories and their modern variants in this research.

Thorndike (1920), Pavlov (1927), Watson (1959) and Skinner (1974) are the main developers of the behaviourist theories. Behaviourist theorists assume a learner is essentially passive, responding to environmental stimuli. They believe the learner starts off as a clean slate (i.e. black box) and all behaviour can be explained without considering internal mental states or consciousness. Positive or negative reinforcements are key to changing behaviours in a learner. Positive reinforcement indicates the application of a stimulus and negative reinforcement indicates the withholding of a stimulus. Learning to a behaviourist is a change in behaviour in the learner. Early behaviourist research work was often done on animals (e.g. Pavlov's dogs, cats used by Thorndike) and later generalised to humans.

The cognitivist revolution replaced behaviourism in the 1960s as the dominant paradigm. The cognitivist theorists essentially argued that the "black box" of the mind should be opened because it was necessary for understanding how people learn. Schema based interpretation of the internal process of comprehension and an information processing model of memory are briefly discussed here.

The concept of schema (the term "schema" was introduced by Piaget in 1923) is used by cognitive psychologists to understand the comprehension process. Within the 'Schema theory', knowledge is organised into units and within those units information is stored (Rumelhart, 1980). Piaget believed knowledge was constructed on cognitive structures. He proposed that cognitive structures are developed by accommodating[1] and assimilating[2] information. Piaget thought that

[1] Accommodation is creating new schema that will fit better with the new environment or adjusting old schema.

[2] Assimilation is when people use a current schema to understand the world around them.

schemata are applied to everyday life and therefore people accommodate and assimilate information naturally (Rumelhart, 1980).

Mental processes such as thinking, memory, knowing, and problem-solving are also viewed from an information processing model drawing on parallels to how a computer functions. One such information processing model was proposed by Atkinson–Shiffrin (1968). They proposed that memory consisted of three stores: a sensory register, short-term memory and long-term memory. Information passes from store to store linearly. Information is detected by the sense organs and enters the sensory memory. If attended to, this information enters the short-term memory. Information from the short-term memory is transferred to the long-term memory only if that information is repeated. If repetition does not occur, then information is forgotten and lost from short-term memory through the processes of displacement or decay. Concepts from the information processing model have potential implications for this research which are further elaborated in section 2.3.2.

Constructivists define, learning as an active contextualised process of constructing knowledge rather than acquiring it (Ertmer & Newby, 1993). The learner is not a blank slate, but s/he brings past experiences and cultural factors to a situation. Constructivists believe that knowledge is constructed based on the learner's personal experiences and interpretation of the (social) environment. Piaget (1957) concluded from his systematic study of cognitive development of children that cognitive development is eventually a result of biological maturation and a transformation through social exposure. Dahl (1996) suggested that Piaget belonged to the constructivist perspective that saw learning as construction. Vygotsky offered an alternative to Piaget's stages of cognitive development. Influenced by Marx, Vygotsky believed the socio-cultural environment is critical for cognitive development (Bruner, 1997). Vygotsky explained cognition and learning as interactions between the individual and a situation, and knowledge as situated, a product of the activity, context and culture in which it was formed and utilised (Vygotsky, 1930-34/1978). Vygotsky agreed with the Piagetian claim that learners

respond not only to external stimuli but to their interpretation of those stimuli. However, Vygotsky saw such development as a continuous process and rejected the assumption made by Piaget that it was possible to separate learning from its social context. Vygotsky argued that all cognitive functions originate in a society, and must, therefore, be explained as products of social interactions and that learning is a complex social process by which learners were integrated into a knowledge community. Vygotsky also emphasized the importance of cultural tools in cognition. Woolfolk (2013) explained that cultural tools can be any technological tool or any symbolic tool which aids in communication. Language, the media, television, computers, and books are only a handful of all the cultural tools available for problem solving or learning (Woolfolk, 2013). Piaget advocated less teacher intervention in discovery learning, Vygotsky contrasted with Piaget by promoting guided discovery where the teacher would be a very active support by providing ‘scaffolding’ and by determining a ‘Zone of proximal development’ in the student's knowledge construction. Both of these elements are important for this research and are further elaborated in section 2.3.4 and 2.3.5.

In the late 90s there were several theories that dealt with considerations of participation within a social context which Vygotsky focused. Hutchins (1995) also saw social collaboration as a part of cognitive development, which was interconnected with the learner. 'Situated learning theory' and 'Community of practice' drew on the constructivist learning theories to recognise learning through active participation within a community regardless of its setting (the community can be family, can be with friends, can be unknown people but with a common interest) (Lave & Wenger, 1991, Lave, 2009, Wenger, 1998). Informed by these theories the researcher developed an understanding of how learners within a community could construct knowledge by engaging in meaningful actions such as activities, discussions and reflections that ultimately lead to valuable knowledge creation within that community. In this research, adult learners would be placed within a social setting and technology is expected to enhance the learning process by reducing the physical presence of the teacher (this reduction of presence is planned to be compensated for by thoughtful use of the artefact) as in remote

locations it is often difficult to find a skilled teacher. Informed by these classical learning theories the researcher had to make further specific considerations in regards to how adults learn effectively by using their previous understanding and knowledge in the social learning setting. These considerations included use of experiences, cognitive load and minimal guidance of the teacher. The theoretical basis of the above-mentioned attributes is further detailed below:

2.3.1 Considerations for the adult learners in the technology enhanced learning environment

As this research is concerned with adult learning, the researcher reviewed some of the theories and approaches that are specific to adult learning. Knowles (1973, p. 43) contrasted andragogy (originally coined by Kapp in 1833) as "the art and science of helping adults learn" with pedagogy defined as the art and science of helping children learn. Knowles conceptualised an adult learner as autonomous, free, and growth-oriented. Around the same time when Knowles introduced and popularised his 'andragogy' approach, self-directed learning strategies also emerged that differentiated adult learners from children (Merriam, 2001). Acknowledging the vagueness of the term 'andragogy', Rachal (1983) suggested using the terms 'self-directed' and 'teacher-directed' instead. Within such learning strategies the goal of learning, the process of learning (as a transformation) and the adult learner became important (Merriam, 2001). This research has a significant connection with adult learning and self-directed learning with minimum guidance.

Past experiences are a key to self-directed adult learning, which were academically acknowledged by theorists such as Dewey (1938) and Kolb (1984). They claimed that learning through experience is possible as this can be used to make connections with the past and the future. This type of learning leading to change in knowledge was defined as 'Transformative learning' by Mezirow (1997) which itself is widely related with self-directed learning and it also has importance for this research. Transformative learning is the process that transforms:

> *'the structures of assumptions through which we understand our experiences. They selectively shape and delimit expectations, perceptions, cognition, and feelings' (Mezirow, 1997, p. 5).*

According to this view 'actions and behaviours will be changed based on the changed perspective' (Cranton, 1994, p. 730). Cranton (2002) explained the catalysts that cause transformation are activating events that reveal an inconsistency between what was always assumed true by a person to be contrary to what has just been experienced, heard or read. These events can be a single event or a series of events that occur over a much longer period (Mezirow, 1997; Kegan, 2008).

It is understandable that the process of transformation is complex and highly subjective. While a transformation is building up over a prolonged period it is likely to have a transitional phase. The researcher takes into consideration the concepts of 'Transitional learning' to explain this phase.

> *Transitional learning emerges when individuals are faced with unpredictable changes in the dynamics between their life course and the transforming context, and when they are confronted with the need to (learn to) anticipate, handle and reorganise these changing conditions. (Wildemeersch & Stroobants, 2009, p.222)*

These unpredictable situations trigger a continuous process of constructing meaning making choices, taking up responsibilities and dealing with the changes in the personal and societal context.

2.3.2 The role of human cognition in minimally guided teaching approaches

Dasen (1994) found in his research conducted in remote parts of the central Australian desert that cognitive development is not purely dependent on maturation but on cultural factors too. This important aspect was not recognised in the Piagetian classification of the universal stages of cognitive development and

biological maturation. This also suggested that human cognition as traditionally seen is not just confined to an individual. Hutchins (1995) pioneered the argument that cognition is rather distributed across individuals, objects, artefacts and various tools found in the environment. Distributed cognition (Hutchins, 1995) indicates that through a technological artefact such as a tablet device, it is possible to design learning where the physical presence of a traditional teacher can be reduced as it has supportive functionalities (multimedia) to store and retrieve critical information related to learning. For instance, a recorded training session can be played through the device but with a number of tasks to be completed by the learner. Here the device plays an active role in storing and disseminating information required for the learner to construct knowledge. As in this research, physical presence of the teacher is expected to be reduced by carefully developing an interface that would guide the participants, there was an underlying assumption that the artefact will have a vital role in the knowledge construction process.

The nature of adult learning involves problem solving to some extent. Learning can take place in problem-solving situations where the learner is presented with a problem and s/he needs to solve that by drawing upon his/her own experience and prior knowledge (Bruner, 1961). Roblyer & Doering (2000) found such 'discovery learning' is successful only when learners have prerequisite knowledge and experience. Construction of knowledge through inquiry rather than direct instructions was brought in the discussion by Dewey (1938) and later by Papert (1980) and Schimidt (1983). In Papert's variant of discovery learning, technology was used as a tool that allowed the development of environments or educational programs in which the learner through interacting with those environmental elements would have constructed their own knowledge. These theoretical premises informed the researcher to better use participants experience in the training.

The belief in 'Problem Based Learning' (PBL) that activities, experiences and knowledge come together to construct new knowledge do not explicitly or implicitly refer to actual cognitive connections, which assist in creating new memories. Kirschner et al. (2006, p.76) argued that any instructional model that does not refer

"…to the characteristics of working memory, long-term memory, or the intricate relations between them" is not likely to be effective. Kirschner et al. (2006) used human cognitive architecture proposed by Atkinson and Shiffrin (1968) which divides memory structures as sensory memory–working memory–long term memory. Working memory is the cognitive structure in which conscious processing occurs. As per the theorists and their followers, we are only conscious of the information currently being processed in working memory and are more or less oblivious to the far larger amount of information stored in the long-term memory. Acknowledging, the limitations of Atkinson and Shiffrin's model, which is that this model is too simplistic and provides a linear representation of the complicated human memory, the researcher nevertheless accepts that as the human brain has a finite space and there must be a finite limit to the processes that the brain can handle in a specific given time to create new memories. Also, the researcher agrees that this limit of the finite space hasn't been successfully quantified and at present, we can only make guesses.

Cognitive Load Theory (Sweller, 1988) which builds upon Atkinson and Shiffrin's model, focused on the working memory and its limitations. 'Cognitive load' relates to the amount of information that working memory can hold at one time. Sweller argued that, considering the limited capacity of the working memory, instructional methods should avoid overloading it with additional activities that don't directly contribute to learning. Considering this, we can still argue that, exposing participants to unknown device and content with minimal or no supervision for undecided hours can lead to cognitive overload (Tuovinen and Sweller, 1999) which may have an adverse effect on learning (Kirschner et. al., 2006). Kirschner et. al. (2006) and a range of US literature (Kerka, 2005) concluded that unsupervised learning is best adopted where participants have prior knowledge or experience of the topics studied. Following the concerns with 'cognitive load' the researcher further considered possibilities of using 'scaffolding' and 'zone of proximal development' concepts to reduce such adversities.

Novice learners who have to search for solutions to posed problems will have a heavy load on their working memory. Yet, that working memory load does not contribute to the accumulation of knowledge in long-term memory because while working memory is being used to search for problem solutions, it is not available and cannot be used to learn. The aim of all instruction is to alter long-term memory. If nothing has changed in the long-term memory then nothing has been learned (Kirschner et al., 2006). Inferring from the above circumstances and critiques, it can be said that minimally guided teaching techniques need to be developed in a way that recognises the complexity of knowledge creation. Merely thinking that making the device (where the problems or inquiries can be found) accessible to learners is going to lead to knowledge creation is a far fetched idea (Kirschner et al., 2006; Hmelo-Silver et al., 2007). What is important is to understand how the problem settings can be structured so that there is a less (cognitive) burden for the learners.

2.3.3 Teaching functions and responsibility for the technical guidance in minimally guided teaching approaches

As reviewed in the earlier sections of Chapter 2 section 2.2, many of the technology assisted alternate forms of education are claimed to be (almost) free of the teacher's presence. Claiming people who had never seen such an artefact before were perfectly able to learn to use the device and then do something meaningful with it, without the physical presence and active guidance of a teacher. Where the physical presence of a teacher is limited, how the teaching functions get displaced is worth exploring and clarifying. Jones (2015) highlighted the need for such exploration and stated:

> *Teaching is not always conducted by a teacher … … … which although it might once have been embodied in a single person, is now often dispersed and located in a number of persons and/or material or technological artefacts. (p. 69)*

In the reviewed projects, little or no importance was given to acknowledge those dispersed functions (such as - content selection, content creation, intervention

planning, conducting interventions, monitoring learner progress and tracking completion).

Technical support is also an important aspect of technological interventions. Surprisingly, in the majority of the reviewed projects, trainers and learners were implicitly required to have some basic troubleshooting skills to overcome technical problems while using the new device. Hardware issues were a common problem in the HiWEL project where on multiple occasions, the learners complained of having a faulty keyboard & mouse (Mitra, 2006). Similarly, lack of support, 'buggy' software and hardware issues were among the many other complications faced by the teachers and students who were regularly using the OLPC laptop. Teachers untrained to provide the technical support would box up the failing equipment and put it back in the corner (Vota, 2011; Foster, 2012). The fact that the commands required to fix common issues were in English, proved to be another barrier (Derndorfer, 2010). Sandro Marcone, then an educational official of Peru agreed:

> *In essence, what we did was deliver the computers without preparing the teachers. (Bajak, 2012)*

In its first five years of operation in Peru, with an expenditure of USD 200 million, more than 800,000 low-cost OLPC laptops were delivered to children across the country. OLPC critics believe, the project's aim seemed to be hard to achieve, unless the troubleshooting[3] concerns illustrated above were addressed. This prolonged issue indicates that for any minimally guided teaching approach where a technological artefact is used, it is important to anticipate how the technical troubleshooting would be taken care of. If teacher(s) and assisting personnel are presumed to be active in the technical, troubleshooting aspect, then they should be adequately trained and made capable of resolving probable technical issues with the software or device.

[3] trace and correct faults in a mechanical or electronic system.

2.3.4 Understanding interventions in a minimally guided learning environment

Intervention points can be directly linked with learning milestones in a minimally guided learning setting. Interventions are also a way to reduce 'cognitive' load as the learners can get a quicker access to many unresolved components of the training. Vygotsky (1930-34/1978, p86) developed his idea of 'Zone of proximal development' (ZPD) which clearly sets out when and why the more learned person can assist in the learning process of others with less ability to achieve above their current state of understanding. This is defined as,

> *The distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable others. (Vygotsky, 1930-34/1978, p. 86)*

This fits well within any teaching strategy that involves the minimal presence of the teacher. As the teacher (or more capable other, a peer, for example) can play a vital role during the intervention to take participants' understanding to the next level. 'Scaffolding' can be the way to achieve this 'potential development'. Daniels (2001) defined 'scaffolding' as:

> *the distance between problem- solving abilities exhibited by a learner working alone and that learner's problem- solving abilities when assisted by or collaborating with more-experienced people. (p. 59)*

Paas, Renkl & Sweller (2003) acknowledged that by effectively using scaffolding there is possibility to reduce cognitive load. Scaffolding can also be distributed across the programme and when the learners are using artefacts, restricting available options to an optimal level so that the task is more accessible and manageable (Hmelo-Silver, Duncan & Chinn, 2007).

It is worth acknowledging that, when the teacher's presence is minimal the nature of scaffolding can be rather complex as there can be numerous situations where the right course of action may not be well understood by any of the group members leading to confusion about who is right and who is wrong. Mitra's (2006) argument that the children of the HiWEL project were both learner and teacher at the same time underestimated the complexity of the nature of those children's involvement in scaffolding. As this research also has plans for direct interventions, issues such as those outlined above will require careful consideration.

2.3.5 Developing the concept of 'Zone of proximal development' for adults

While for children, ZPD infers mental development (Chaiklin, 2003), for adults this may differ, as adults already possess developed cognitive structures (Kirschner et al. 2006). The concept of ZPD for adults can potentially be developed further to explain knowledge creation processes in adults which can be transformative (Mezirow, 1990) or transitional, depending on the depth of the interventions. Learners who have previously experienced disaster events (see 2.3.1) already possess interesting characteristics as learners: a) they have seen a life-changing event, that might have challenged the way they perceive their world which is transitional and b) if they are facing such events recurrently and from past experiences learnt new ways to face the pre-disaster and post-disaster occurrences these become transformative for them. It is worth noting that as mentioned earlier knowledge creation is also a complex cognitive process. Not all experience leads to knowledge. Some experiences never enter consciousness and communication but remain emotional and subconscious. What is transformational to one may be transitional to another or even meaningless to someone else.

Concerning when the interventions should take place, there is no clear guideline within the minimally supervised learning projects (especially in MIE, discussed in detail in section 2.3.6). Furthermore, within the work of Vygotsky, there are no clear concise recommendations of methods or techniques for the intervention at ZPD (Chaiklin, 2003; Daniels, 2001). This research will attempt to fill the gap of the

intervention strategy by using the concept of 'Zone of Proximal Development' to initiate intervention at times when the learner is faced with complex tasks requiring precise understanding. It is expected that in general such interventions will assist in reducing cognitive loads.

2.3.6 Reviewing 'Minimally invasive education' pedagogic approach informing this research

Minimal presence of the teacher in a learning setting can take many shapes and this has been termed in many ways by the theorists and practitioners. During the literature review, the researcher found, concepts of unsupervised learning have been in existence long before the HiWEL project (discussed in section 2.2.1.3). As long ago as 1797, Bell a superintendent of a school (then labelled as an Asylum) in Madras, India was struggling to teach the students and devised a system where older students were put in charge of teaching the other students which to the amusement of Bell, later become hugely successful (Bell, 1823; Levin & Allen, 1976). Lancaster in 1803 improved on Bell's system and asserted that using this system up to 1000 other students could be taught by one student (Lancaster, 1821). The requirement for that achievement was accurate mechanical delivery. A report prepared by Klaus (1973) also emphasised the appropriateness of using peer tutoring in underdeveloped countries which corresponds to the idea of using ZPD and Vygotsky's suggested knowledge construction process.

In the HiWEL project a 'Minimally Invasive Education' (MIE) pedagogic approach was used that advocated that children could learn with the bare minimum of supervision, and teachers could be replaced by computers (Mitra, 2000; 2006). The HiWEL project was situated in a comparable socio-cultural setting to Bangladesh in India. Thus, the MIE approach used in HiWEL project was expected to greatly inform this research.

Children's learning has been predominantly the choice of MIE with only a few exceptions as found in Dangwal & Sharma (2013). 'Children learning' and 'adult

learning' dispositions have been taken to be interchangeable within the literature on MIE. Mitra (2000) claimed to have developed MIE's theoretical premise based on Piagetian cognitive theory, situated learning and constructivism, and this claim was later uncritically and exactly repeated by subsequent researchers (Dangwal, Jha, Chatterjee & Mitra, 2002; Inamdar, 2004; Dangwal & Kapur, 2008; Dangwal & Thounaojam, 2011). Interestingly, how these theories may fit together within MIE has never been explained, nor was it explored in the literature. The literature review indicated that various other theories of unsupervised learning have been in existence since at least the 1960s: Personal construct theory (Kelly, 1963); Self-Organised Learning (Thomas & Harri-Augstein, 1985); Discovery Learning (Bruner, 1961); Inquiry Learning (Papert, 1980); Problem-based learning (Schmidt, 1983). Rooted in psychology, Kelly's 'Personal construct theory' (1953), advocated a non-invasive technique of psychotherapy 'the repertory grid interview' which allowed patients to uncover their 'constructs' (the way they interpret the world). Here the therapist would take the role of a facilitator to assist the patient to understand the world. Based on the theoretical underpinning of Kelly, Thomas & Harri-Augstein (1985) put forward their 'Self Organised Learning' theory that presented scenarios with simpler conversation techniques to get the best result in Kelly's grid interviews. An extensive literature review of MIE confirmed that these closely related existing theories were not acknowledged by either Mitra or other academics (such as Dangwal & Kapur, 2008 and Inamdar, 2004) who have prominently discussed MIE.

The MIE technique involved periodic interventions but its theoretical underpinnings did not make it clear when they should take place. Mitra once mentioned that a 'constructivist' teacher can conduct the interventions within a short timeframe (Mitra, 2000). In subsequent publications, he expressed the view that, the role of the teacher was almost non-existent in most of the kiosks (Mitra, 2005). Also, there were cases where the burden of progress tracking, intervention and troubleshooting was passed on to the 'caretaker' (Mitra 2000, 2006). It must be clarified here that the use of the term and the roles that a 'caretaker' bears in India is not close to the role and responsibilities of a 'facilitator' in a learning setting. In a

place where computing devices are rare, how just anyone, perhaps the caretaker (as Mitra suggested), can make sense of the progress of the learning is not clarified and yet to date this hasn't been questioned. Thus, the initial expectation that Mitra's theory and practice might have a significant contribution to the understanding of teaching and learning for this research did not materialise.

Knowledge Gap 3 (KG3): ***Minimally invasive education (MIE) is an interesting pedagogy, which currently stands on a weak theoretical base. Content design, interventions and overall teaching functions within MIE are not well explored thus are less explained.***

Knowledge Gap 4 (KG4): ***Social participation is recognised within MIE, but how individual knowledge is created within a social context or the social construction process of learning has not been thoroughly academically investigated yet.***

2.4 DISASTER PREPAREDNESS EDUCATION IN BANGLADESH CONTEXT

In this section, the focus will be brought to the Bangladesh context. Building on the risk profile of Bangladesh from Section 1.3 of Chapter 1, a review of the current state of disaster-related education in Bangladesh will be provided to rationalise the need for a customised disaster preparedness training.

The UN International Strategy for Disaster Risk Reduction (UNISDR) defines a disaster as,

> *A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. (UNISDR, 2009, p.9)*

Disaster preparedness refers to measures taken to prepare for and reduce the effects of disasters. That is, to predict and, where possible, prevent disasters, mitigate their impact on vulnerable populations, and respond to and effectively

cope with their consequences ("Preparing - IFRC", n.d.). Disaster preparedness activities embedded with risk reduction measures can prevent disaster situations and result in saving maximum lives and livelihoods during any disaster situation, enabling the affected population to get back to normalcy within a short time period ("Preparing - IFRC", n.d.)

2.4.1 Current status of disaster preparedness education in Bangladesh

Disaster preparedness approaches in Bangladesh commonly take a top down approach which commonly causes lack of community participation which, on occasions, results in failures in meeting vital humanitarian needs and an unnecessary increase in requirement for external resources (Sabur, 2012).

Given the disaster risk profile of Bangladesh, unfortunately, the curriculum of primary and secondary education in Bangladesh rarely provides lasting constructive knowledge on how to face disasters when they take place (Islam, 2010; Khan, 2008). A critical review of the contents that are currently in use to teach disaster-related issues in primary and secondary schools across the academic disciplines (science, commerce and arts) in Bangladesh suggests normal people are 'unaware' of disaster preparedness, which leads to loss of life and other enduring consequences (Bashiullah 2008; Rabbi, 2008).

With an aim to minimise this gap, NGOs in Bangladesh have designed their own training sessions in a study circle format to overcome limitations of the public education system (Khan, 2008). However, Rahman (2005) found that, NGO initiatives often fail to achieve desired outcomes as the arranged training often lacks interactivity and clarity, which results in poor understanding and insufficient skill adoption among the trainees leading to delayed decision-making during disasters (Yap, Heeks & Ospina, 2011, p.7; Palttala, Boano, Lund & Vos, 2012). Also, an independent review by UNESCO revealed that there is no established organisation to review NGO created contents, and there are no means of quality assurance of the content delivery (Grönlund, Lim & Larsson, 2010). To be effective,

local communities must be supported in analysing their hazardous conditions, vulnerabilities and capacities as they see them themselves (Sabur, 2012). Considering the shortfalls of the existing systems, alternate ways of providing disaster preparedness training is thus, worth exploring further.

To prepare a community to face emergencies some of the key attributes the community should have are knowledge, awareness and access to necessary resources which take the time to build and require a lot of reinforcements (Khan, 2008). Disaster preparedness training if is limited to only a handful NGO selected local volunteers of a community, it will have risk of a time gap between impact of an event and a response from the local volunteers as they might also be directly affected themselves. Perhaps, it is important to raise overall awareness among the disaster stricken people rather than the handful selected ones. This approach can be a key to build disaster-resilient communities.

2.4.2 Current state of inclusive education in Bangladesh

Apart from the natural calamities, Bangladesh is also plagued with low literacy. In rural areas of Bangladesh, literacy rates are quite poor (50.6%) in comparison to the urban areas (65.6%). Such literacy assessment also has questionable validity as in the national literacy assessment survey, 17.4% with no formal education were found to be literate also 31% respondents who completed secondary school had forgotten their literacy skills and became illiterate (Bangladesh Bureau of Statistics, 2013). Thus, the complexity of creating an educational programme for this population brings practical challenges.

In simple terms, 'inclusive education' can be expressed as a way of reducing barriers to participating in learning in any educational setting. These barriers can be extrinsic or intrinsic in nature. The roots of inclusive education can be traced back to 1960, when in 'Convention against Discrimination in Education' it was recognised that alongside universal respect for human rights, equality of educational opportunity is also important to consider (UNESCO, 1960, Article 1). Dakar

Framework for Action, adopted by the World Education Forum in 2000, extended the focus of education for all children to young and adults in general (UNESCO, 2000). It was also recognised that gender-based discrimination remains one of the most intractable constraints to achieve education for all (UNESCO, 2000, section 40). Inclusive education has been termed by international organisations, countries, academics, NGOs from various points of views and there is no single terminology that suffices as a comprehensive universal definition. Within the definitions of 'Inclusivity' in existence, there are always boundaries that represent the magnitude of exclusions in that definition of inclusion or inclusivity. This makes the implementation strategies of the inclusive education challenging for many countries or communities.

A comprehensive study conducted by UNICEF (2003) to assess the state of inclusive education in Bangladesh noted that the concept of inclusive education hasn't gained much attention and there is a lot of vagueness in understanding among the policy makers and the practitioners. Lack of skilled trainers who can promote inclusivity alongside a deficiency of an adequate formal support system jeopardises the achievement of the educational programmes.

From UNESCO's observation of good practices, it was found that all the inclusive practice's initiations have been a result of concerted community awareness and financial support from external agencies (UNICEF, 2003). It is a positive thing that there are communities that are concerned and aware of the needs of inclusive learning. However, as this is linked to children or to be specific children with special needs, it overlooks diversified learning characteristics of adult learners. Wider aspects of inclusive education thus remain unexplored in the Bangladeshi education system.

2.4.2.1 Importance of localised content in inclusive design of learning

The researcher argues (any) content becomes localised when it is culturally adapted, uses local dialect, and media which reflects local people and their lifestyle.

Localised contents can open a path to connect with local knowledge that people have gathered through their experiences. Firoz (2010) has found that although the importance of local knowledge is accepted there is still a wide scope of negotiation between local knowledge and institutional arrangements. Government agencies and NGOs are often reluctant to consult with the locals before making a training program; thus again, a 'one size fits all' style of westernised training program takes place that undervalues locals' knowledge and results in leaving them uninterested in the programme and vulnerable (Tarek, 2016; Selwyn 2012). Unthoughtful design of content for the target population not only undermines local needs but also raises questions about such interventions for educational purposes. If the quality of the content is not given importance, then the whole idea of enhancing education by embedding technology becomes unconvincing. In such a scenario, inclusive learning cannot be expected, as this has deeper roots in both design and development stages of the content and activities.

2.4.2.2 Why content must cater for female and less able members of the society

In Bangladesh, even though there is a continuous rise of the nuclear family, the majority of the families in the rural area are joint families. In such families the knowledge of the head of the family is paramount in decision making. All the major decisions are taken by this person who is generally a male. Women who are primarily responsible for domestic duties such as childcare and care for the elderly or disabled, often do not have the liberty to go to training programmes that will not make them any money[4]. Furthermore, women have limited access to vital resources be it economic resources, education, social networks, skills building activities, personal mobility, freedom from violence and control over decision-making, which are essential to disaster preparedness.

[4] Since the late 90s there have been numerous NGO programmes which only targeted and were accessible to women where they get money for attending training and also micro loans to start their own business.

Women are closer to the household chores so during an emergency they can play a very active role. The failure to recognise this reality means that women's visibility in society remains low, and attention to their training needs is woefully inadequate (Ikeda, 2009). Non-traditional skills training for women not only will equip them with the critical skills and bring them into the public domain, but it also will help in transforming the perceptions of the community towards women. Likewise, non-traditional skills training for men and boys, i.e., managing household chores, childcare, first aid, caring for the sick, etc., would help them to understand the crucial importance of these skills before or after a disaster (Pincha, 2011).

Security during emergency: Especially in the safety shelters

Women's security during emergency situations has been a concern of academics, and this issue has been raised many times in literature on disasters in Bangladesh. Hossain, Dodge & Abed (1992) noted women were not safe even when they were in the shelter. There exists a great deal of hesitancy among women who don't want to bring those unpleasant personal experiences into discussions. Women in general, and particularly young women, also frequently face different types of physical and mental harassment. Stories of harassments even include involvement of the law enforcement officers. Matin & Taher (2001) found it a cause of real concern because it reinforces the idea held by many men in that society that women should not leave their homes.

Making them aware of the common issues in the safety shelters

Shelters are often of limited holding capacity, and this is common across the country thus most shelter residents, and especially children and the elderly, suffer some inconvenience (Ikeda, 1995). Paul & Rahman (2006) found that most children, particularly infants, are vulnerable to injury due to stormy and rough weather. The elderly also suffer in shelters due to lack of sufficient space and food as well as general neglect. The absence of adequate medical facilities leads to severe

problems among pregnant women. The disabled are also vulnerable to abuse in shelters. Lastly, all shelter residents suffer from a severe lack of water supply and sanitation facilities. Paul & Rahman (2006) also claimed that,

> *During severe cyclones, most people are so busy saving their own lives that they do not treat the weaker members of their family, such as the elderly and the disabled, with due care and respect. In fact, it is common for disabled family members to be left behind as the family retires to a shelter during a cyclone. (p. 208)*

This claim requires further probing as culturally Bangladeshi people have love and respect for the elderly and negativity towards a disabled person is quite dependent upon the type of disability s/he possesses.

An inclusive disaster preparedness training, apart from the literacy related participation consideration, should consider the needs of both genders and should encourage both genders to participate spontaneously. As of now, there have been no such ICT-based training projects in Bangladesh, aiming at inclusive design and delivery of any specific curricula within the researched communities. This research project intends to create, deliver and evaluate an inclusive disaster-training programme for the mentioned communities.

Knowledge Gap 5 (KG5): ***ICT projects need to consider cultural context, gender participation, literacy rate and people's needs in terms of interface design and disposition. Inclusivity within the wider aspect of the computing device based training is not addressed adequately.***

Knowledge Gap 6 (KG6): ***Training designed for rural population needs to reflect learners' experiential knowledge and various cognitive limitations. Outcome of such customised approach in the selected context is not well explored yet.***

Knowledge Gap 7 (KG7): ***Inclusive education concept is not well understood in the Bangladeshi education sector, especially in the training programmes. It is important to explore the notion of inclusivity in terms of adult learning.***

2.5 USER INTERFACE AND CONTENT DESIGN IN THE CHOSEN CONTEXT

Selwyn (2013) suggests that successful technological adoption in education depends on the way it embraces the culture and context of the location. From the literature review, it was found that, there are gap in understanding local needs in ICT oriented projects in Bangladesh.

Studies using laptops and mobile phones have reported that the greatest challenge faced in designing any application for developing region was the receivers – that is for people who have little or no education (Medhi, Sagar & Toyama, 2006; Medhi, Prasad & Toyama, 2007; Thies, 2015). As English is predominantly used as the default language in most of the devices, even this poses a challenge to the literate section of the population who are competent (at least verbally) in their native language, Bangla.

2.5.1 A classic case of misunderstanding Inclusive learning: Case of a Government sponsored all-inclusive disaster management programme in Bangladesh

In 2015, Bangladesh Ministry of Disaster Management and Relief launched Moodle based comprehensive disaster management courses which were aimed at anyone (Learn Disaster Management Online, 2015). Even though they were aimed for anyone there were various aspects of the content selection and User Interface (UI)[5] design that indicated otherwise. In terms of access, it was not located to any group of users, but to access the Moodle based training, the prospective participant must have an email to register. This created a barrier as there are a limited number of people in Bangladesh who are connected to the Internet and have an email address. The courses were developed in both English and Bangla. The content was extensive and took a textbook approach of teaching theories and models of disaster

[5] A user interface (UI) is a set of commands or menus through which a user communicates with a program.

management. These highly complex and sophisticated elements of content could easily demotivate a prospective learner. For a less literate learner, even though access to the training is provided, the complexity of the programme may deter the participant. Having an English based portal with an optional Bangla language version does not reflect the country where a large percentage of the total population is yet to be proficient in their mother tongue, let alone a foreign language.

2.5.2 Considerations for the tablet based interface informed by literature

The tablet interface can use the touch functionality and ability to use graphics and audio/video clips (Huenerfauth, 2002) to make learning more pleasurable for those people who would otherwise find it hard to decode large text blocks from a printed format. It is known that less literate people have some underdeveloped cognitive skills (Medhi, Lakshmanan, Toyama & Cutrell, 2013) which means that they find it troublesome to abstract received information (Friscira & Knoche, 2012; Santa & Baker, 1975). This creates a problem for interface design for disaster preparedness because if video and pictures are considered to be alternative to a textual representation, then the users have to be able to comprehend the information and understand the practicability of that information. Some research has identified that less literate users are comfortable with numbered representation (Friscira & Knoche, 2012; Medhi & Cutrell, 2012).

Audio narration was also found to be useful for certain scenarios (Medhi, Prasad & Toyama, 2007) though in some cases a speech based user interface was prone to more errors (Ahmed, Jackson & Zaber, 2013). These findings suggest an interface used in the tablet device should adopt a mixed approach having on demand audio (also suggested by (Knoche & Huang, 2012)) and also a numerical representation of the text blocks. There is a growing literature that suggests having 'Same Language Subtitle (SLS)' increases acceptability of the content and in many cases, improves literacy (Kothari, Takeda, Joshi & Pandey, 2002; Findlater, Balakrishnan & Toyama,

2009; Knoche & Huang, 2012). In segments where the content includes an audio or video clip, then it will be appropriate to include an SLS with the clip.

As the content is intended to be delivered to a wide range of users, including literate to less literate people, to ensure the content is simple, yet effective, so that the users do not feel awkward, the interface design should ensure that the intended meanings of the pictures, navigator buttons, symbols, icons and language are culturally suitable for the participants. Such a design should allow them to understand the intended meaning (Ford and Gelderblom, 2003). Cuendet, Medhi, Bali & Cutrell (2013) identified that less literate people have an underdeveloped cognitive structure that impacts their ability to navigate through a hierarchical UI irrespective of textual representation or pictorial representation. Thus, commonly used menu based hierarchical navigation would not only make a new device adoption process complex but also make the learning process complicated (Jones & Marsden, 2006; Ahmed et.al. 2013).

2.5.3 Revisiting cognitive considerations for an interface design

One of the main barriers to creating a training programme for less literate users in a language other than English is representation of the information. Medhi (Medhi et al., 2007; Medhi et.al., 2006), in a range of experiments, tried to create a text-free job search User Interface for illiterate users with pictures, icons as a visual cue and a voice narrator as the replacement of the text blocks. Having the voice and pictures side by side in the UI meant that issues like cognitive load became important. As Medhi et.al. (2006) confirmed, despite the participant's subject knowledge, they faced barriers beyond literacy, including a lack of comprehension of how the information was relevant to them. This statement can be a confirmation that Medhi's experiment participants were unable to follow the visual cues, and the intended simplicity of the text-free UI was not so simple in reality.

As discussed in section 3 of this chapter, the concept of cognitive overload and its relation to instruction design is important to consider so that the content and

interface are well-developed and the sessions and interventions are well paced. For illustration as suggested by Atkinson & Shiffrin (1968), when users are presented with the content, it will be initially stored in their working memory or the short-term memory – which deals with audio and video data. The capacity of the working memory is limited and gets replaced if succeeding new information needs processing. If the presented data creates a stimulus beyond the receiver's working memory capacity, there are high possibilities that it will overload the working memory, resulting in erasing the existing stimuli that are in the process of being processed leading to inadequate knowledge construction (Kirschner et al., 2006; Sweller, 1988). On the contrary, when items in the working memory are iterated, it will create a stronger association with the long-term memory (Atkinson & Shiffrin, 1968). Any successful content and instructional design should alter the long-term memory to some extent. Design that does not influence the long-term memory or increase the information retrieval efficiency in the long-term memory is not going to make any significant impact (Kirschner et al., 2006). Considering many of the participants might have experienced disaster events, it is important to align the content in a way that would associate with their past experiences and will build upon those, so that, more connections are created with the long-term memory.

Knowledge Gap 8 (KG8): ***Designing a tablet device based interface in a secondary language is challenging. In Bangladesh context, as this is the first attempt, various socio-cultural aspects will need to be considered.***

2.6 CHAPTER SUMMARY

In this chapter, relevant literature was reviewed to understand the role of society and technology in shaping education for disaster preparedness. By drawing on the limitations of the previous projects and studies, knowledge gaps were identified that this research intends to complement. While the need for a new technological artefact based intervention was justified, it was also needed to understand what learning theories were used within those projects and, the learning theories that were relevant for this research. In the concluding section, how the interface can be

developed for the targeted people was critically reviewed. Considering the knowledge gaps that were identified from the literature review, and the research aim as identified in chapter 1, following research questions are posed:

RQ1: How can technology be used in rural areas to teach disaster preparedness using a tablet device?

RQ2: How content can be designed for the tablet device to teach a mixed group of learners?

RQ3: Can people with minimal supervision and minimal computer knowledge adopt learning using a tablet device?

RQ4: Can decision-making be improved leading to greater awareness among the community by using a tablet device based learning?

RQ5: Can bottom-up disaster training raise overall awareness for disaster management?

3. CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

All researchers have different ways of interpreting their surroundings which leads to varied ways of conducting research. Though different paths can be taken to study an area of interest, the chosen path should follow certain standards and principles. These standards guide the researcher to conduct the research in a meaningful way.

In this chapter, the researcher has critically evaluated research paradigms, approaches and methods to understand their suitability for the planned research. Due to the novel nature of this research, the researcher gave a detailed account of the philosophical and methodological positioning of this research including the methods followed so that the wider audience can follow the stages that were used during the research.

In the beginning of the chapter a justification of the selected research paradigm and rationales for the selection of the research methodology and research strategies – 'Rapid ethnography' and 'Participatory action research' is provided. Following this section, the research methods incorporated in this study are further elaborated and explained. In the next section, the research design for all three stages of the research are explained with the sample selection process including the fieldwork planning. All the data sources that were used in the data analysis come after the research design section. Finally, reliability, validity and the ethical considerations are discussed in the later sections of this chapter.

3.2 RESEARCH PARADIGM FOLLOWED IN THIS RESEARCH

> *A paradigm is thus a comprehensive belief system, world view, or framework that guides research and practice in a field. (Willis, Jost & Nilakanta, 2007, p. 8)*

The set of beliefs, rules and standards that guide the researcher's actions in a research engagement can be interpreted as their paradigm. From the philosophical point of view, Guba (1990) has outlined the opinion that a paradigm will consist of: a) a view towards the nature of reality, whether it is internal or external to the knower, which is ontology; b) a related view of what knowledge is and how it can be acquired, which is epistemology; and c) a systematic approach to creating that knowledge, which is methodology. Saunders, Lewis and Thornhill (2009), Creswell (2009), and Neuman (2014) all emphasised the need for having a defined research paradigm for research as it has a wider influence on the way the researcher undertakes social research from its start point to its conclusion. In accordance with this view two major research paradigms – Positivism and Interpretivism were considered for the theoretical assumptions and fundamental beliefs underpinning this research.

Positivism, in general, refers to the philosophical position that deals with empirical data and scientific methods. Positivists believe that, the world consists of measurable regularities (Wahyuni, 2012). A researcher can observe the real world and gather knowledge about the world. A researcher following the positivist philosophy is expected to be more concerned with general rules (Mack, 2010). From an ontological point of view, the world is treated as external, and it is assumed that there is a single objective reality for any research scenario irrespective of the researcher's perspective or belief (Keat, 1981).

On the contrary, interpretivist philosophy is rooted in the belief that reality is not objective but is constructed by the society, and the perception of people (Berger and Luckman, 1967; Carlsson, 2001). It is believed that construction of reality is an ongoing process that varies according to people's experiences in real life, assumptions, and the contexts in which they interact socially. As human perceptions and experiences are subjective, this may change the form of social reality (Lincoln and Guba 1985; Hennink, Hutter and Bailey 2011; Creswell, 2013).

In accordance with the research aim and objectives, the researcher needed to create and present a customised disaster preparedness training content using a tablet device to facilitate learning to the technologically disadvantaged population to improve existing knowledge and awareness of the chosen participants. Four key elements of the research that were subject to methodological understanding are:

a) The development and use of content
b) The development and use of the interface and interactions
c) Use of the content, the interface and interactions by the participants among the chosen research areas.
d) The knowledge construction process and its interpretation within the chosen context.

Cohen, Manion & Morrison (2013) clearly stated that positivist science could provide the clearest possible ideal knowledge. However, Kuhn (1970) had previously emphasised the social character of natural science research. Verstehen (In English "to understand") is used with the sense of the "interpretive or participatory" examination of social phenomena in the context of German philosophy and social sciences (Platt, 1985). Verstehen refers to understanding the meaning of action from the actor's point of view (Weber, 1962). It also implies that unlike objects in the natural world human actors are not simply the product of the pulls and pushes of external forces. Individuals are seen to create the world by organising their own understanding of it and giving it meaning. To do research on actors without considering the meanings they attribute to their actions or environment is to treat them as objects.

Insisting on the belief that there is a harmony between scientific understandings fails to take into consideration three important differences between natural and social science as identified by Marsh and Furlong (2010). Firstly, social structures exist depending on the activities that shape those social structures. Secondly, social structures are dependent on human views because humans reflect upon the societies they belong in and change with time (Weber, 1962), which is not a case for the natural world. Thirdly, social structures are often shaped by the people who are

within it; thus, social structures are prone to change depending on human factors, including time and location (Houghton, 2011). The failure to embed these differences between the social world and the natural world makes positivism a less appropriate approach for a study that involves a deeper understanding of the social phenomena. Within positivist research, outcomes that fail to fit into the currently held theories may be either dismissed as anomalies or ignored. The strength of interpretivist philosophy is the possibility that the anomaly leads to an overthrow or revision of the existing theory. In Kuhn's framework, a 'scientific revolution' would mean a change in the paradigm of normal science (Kuhn 1971).

It was anticipated that differences in understanding might be central to the research because the way people make sense of technology in the chosen location may be different to the way it is perceived in the developed world. Relying on objective reality wouldn't help to discover the appropriate meaning of various complex social elements such as culture, behaviour, assumptions, feelings, and meaning making of the people of the chosen locations of Bangladesh.

Nuryatno (2003) argued that some theoretical frameworks such as post-positivism, constructivism, symbolic interactionism and social constructivism can be put under an 'Interpretivist' umbrella because they share a common agenda of understanding and interpreting human phenomenon. Among these many variants, this research work has a substantial connection with constructivism which is concerned with the way humans construct their understandings of the world. Constructive investigation expands to the understanding of broader concepts – such as cultural issues, a key aspect of the people's life.

The researcher took into consideration the views of Nuryatno (2003), Guba & Lincoln (1994), and Mackenzie & Knipe (2006) that there is no single superior paradigm and that each philosophical school of thought has its own purpose in providing distinct knowledge. However, the researcher believes that the interpretivist philosophy would provide this researcher with a higher possibility of discovering reality in terms of the participants' perspective. Answers to the

research questions that were posed are beyond just a yes/no answer and the answers can probably found in exploring the bigger picture, which can only be done by studying the people, the location and the context in which they live. Because of this, interpretivism is the best philosophical direction for this research, as this does not demand an independent scientific reality but wants to unveil the hidden knowledge that is perceived within the society by people who face those issues. An interpretivist researcher can have some prior knowledge of the research context but accepts that it may not be sufficient to deduce a fixed research design. However, attempts can be made to create a working research design which will be subject to modification at each research phases, due to the unpredictable nature of the research setting. This allows the researcher to be open to new knowledge throughout the duration of the study and some of that new emergent knowledge can be developed further by the researcher to understand the researched setting better. This happens because interpretivists believe that no one can gain complete prior knowledge of social reality which is bounded in several contexts. In this research, the choice of an interpretivist paradigm was suitable as the researcher was eventually engaged with the research sites in three distinct phases and in each phase, the research design evolved to accommodate insights received from the previous phase.

3.3 RESEARCH METHODOLOGY FOR THIS RESEARCH

Creswell (2014; 2009) stated the most common way of categorising research methodologies: Quantitative, Qualitative and Mixed Methods. As the researcher had selected an interpretivist research paradigm for the study, it would be practical to have a research methodology that fits within the interpretivist philosophy. Ontologically, quantitative approaches have an objective view of reality and, epistemologically, the justification for the validity of results is made by empirical confirmation. A quantitative approach, that deals with data that is measured and enumerated, generally follows natural scientific methods because it predominantly tries to generalise from collected data to test a theory or hypothesis. Other than being numerical in character a quantitative approach also assumes that human

behaviour and cognition can be predicted and explained. This is fundamentally opposite to the selected interpretivist philosophical view and contradictory to the researcher's belief that human cognition is subjective.

A qualitative approach, on the other hand, deals mainly with non-numerical data (such as words, pictures & videos, etc.) (Bricki & Green, 2007). Qualitative researchers commonly believe that human behaviour is dynamic and changes with respect to time and space. Thus, qualitative researchers rarely take an interest in generalising the research outcomes beyond the studied participants. The studied group or people within qualitative research are perceived to construct their own reality from their subjective perspectives, and these socially constructed realities influence how they see and react to the world. Qualitative research is more suitable for research scenarios where very little is known about the issue or the phenomenon, and one wants to explore it further or wants to learn more about it.

Before a final decision could be made, a mixed methods approach was considered which focuses on both subjective and objective realities and involves a mix and match of both quantitative and qualitative methods within a single paradigm. Mixed methods researchers believe both quantitative and qualitative research methodologies applied on their own are limiting and they can lead to a partial result. By combining research methodologies with different strengths and weaknesses in a research study, the researcher can make it less likely that s/he will miss something important or make a mistake.

Each phase of this research required a careful understanding of the targeted community's characteristics which also reflected in the development cycle of the interface and the content. This adaptive feature of the research suggested using a qualitative methodology to understand the studied population better. Furthermore, to have sufficient data to generalise, would require a signification number of test cases and samples which were not expected in the early stages of this research and were beyond the scope of this research. Even though there were a significant number of data collected at the final phase of this research the nature of this

research was more subjective than objective. The use of quantitative data in qualitative research studies and reports has been controversial, and there is some resistance to acceptance. However, Maxwell (2010) explained how simple counts of things to make statements such as “some,” “usually,” and “most” more precise has been supported by prominent qualitative researchers such as Becker (1990) and Hammersley (1992). Given the core undertaking of understanding subjective thoughts, the resource implications and the number of participants considered for this research both quantitative and mixed methods research would not have been suitable for having an interpretivist stance. Considering these factors, a qualitative approach was selected as the research methodology to gather data representing the participants’ views on the given context.

3.4 RESEARCH STRATEGIES

In this research, the key focus was to improve disaster preparedness skills of the studied people by conducting several iterations of the customised training programme in the selected locations. This primary focus drove the selection of the research strategies. The interpretivist philosophy underpinning it and the choice of having a qualitative research approach guided the researcher to select strategies that suit to the research needs. Ethnography could enable the researcher to study the participants and their way of interpreting disaster awareness before, during and after the training. Action research, on the other hand, would give a way to improve the content and interface over time. To what extent they would suit the research aim is further justified in the following subsections.

3.4.1 Use of ethnographic research strategy

Ethnography could be used to unfold the characteristics of the people, and action research could focus on utilising insights received from one stage of research to those following (Gill and Johnson, 2002). It is also important to mention that these strategies have several variants which can be used in specific situations. Also, as a

selection of the research strategy guides the researcher in planning the research methods it is important to understand the research strategies.

Ethnography is an established approach to doing a systematic study of people and culture. The word *ethnography* is derived from the Greek words' *ethnos* (“tribe” or “people”) and *graphos* (“something that is written”). So, literally, the word ethnography means “writing about people". The primary purpose of conducting an ethnographic research is to find out rich and holistic insights into the patterns and unique complex attributes of the studied group, including the nature of the location they inhabit and interactions that take place among the group members (Ellen, 1984). LeCompte and Schensul (2010) stated that ethnography is a research method useful in the discovery of knowledge that is embedded within a culture or community.

The culture here refers to the set of attitudes, knowledge, beliefs and values that influence a particular group of people. In this context, embedded can be the recognition that the individual identity is shaped by the experiences and communications that s/he shares within that community. It is thus a key requirement for the researchers to have an understanding and relationship with the participants in the research so that the participants’ beliefs translate in the data collection phases. Hammersley & Atkinson (2007) outlined five key features of ethnographic research, and these are:

a. The research should not have experimental setup or highly structured interview rather it should be conducted in a natural setting.
b. Main data source remains observation and relatively informal conversations alongside supplementary sources.
c. Data collection process is also unstructured for most instances because the categories and themes are developed at a later stage during data analysis phase.
d. The focus of the research is in-depth study of a small number of cases in a single setting or within a group of people.

e. Analysis of data involves interpreting meanings of the participants' actions within the research setting.

Blommaert & Jie (2010) showed that the ontology and epistemology of ethnography leads the researcher to engage with the studied community actively. As discussed earlier, social reality is constructed through the meaning-making interactions of the social members which is structured in multiple layers of contexts. Considering this, an ethnographic strategy will require the researcher to join a learning process to become a 'knowing member of the community'.

The fieldwork aimed to look into the participants' disaster awareness and how they conceptualised disaster preparedness. The researcher had gone beyond participants' simple expression of safety to understand whether the participants' perceived preparedness in the same ways that the textbooks depict. In cases where a difference was suspected, to what extent it is different and what are the reasons for this difference were further probed. The researcher was required to understand the level of awareness, gender dynamics, possible gender discrimination, the ability to engaging in collaborative discussions and participants' ability to use the device. These factors undoubtedly made ethnography the first choice as within this strategy the required tools (such as observation, field notes, interviews) to interpret the above-mentioned elements were situated. Selection of the ethnographic research strategy fitted well from the ontological, epistemological and methodological point of view.

However, several constraints pertained to this research work including periodic gaps in the fieldwork and evolution of the research in each stage meant a conventional ethnographic study involving months of fieldwork was not viable. Considering the limitations, the researcher has followed a fast track, rapid way of using ethnographically informed methods to conduct the research. The use of a rapid method is not new. There are several other scholarly works being conducted using this ethnographic variant. A detailed literature review pointed out that this format is labelled differently by various scholars depending on their way of

deployment and the context. Some of those fast track ethnographic variants are called: 'Rapid ethnography' (Millen, 2000); 'Short-term ethnography' (Pink & Morgan, 2013); 'Quick and dirty ethnography' (Randall, Harper & Rouncefield, 2007); and 'Focused ethnography' (Knoblauch, 2005). These variants have one common element that is intensity in data collection. A shorter duration of field work is compensated for by multiple data sources, and it is very common to use audio and video data so that these can be processed later.

3.4.2 Emic and Etic role of the ethnographic researcher

One major concern in this research was to gather sufficient insight within a short timeframe that researchers normally gather from a long-term participant observation. In long-term observation, the researcher becomes aware of the way participants behaves or takes part in certain activities. With the length of observation shortened it is a challenge to understand a communities' characteristics. Pink & Morgan (2013) noted, in short term field work, this long-term understanding is not 'lost' but is developed through various engagements of the participants. Pink & Morgan (2013) have generated innovative research techniques that would make the short-term ethnography meaningful. One positive aspect was the researcher being part of that culture could easily communicate with the participants when required as this would minimise the time requisite to build the introductory bonding with the participants. The success of any ethnographic research is largely dependent upon the extent to which the researcher manages to immerse themselves among the studied population and their socio-cultural setting. This brings up the emic (insider) and etic (outsider) perspectives of an ethnographic study of a population which is a commonly used differentiator of the researcher's role in the field (Pike, 1952; Markee, 2013). Morris, Leung, Ames & Lickel (1999) explained, along with differing constructs, emic and etic researchers tend to have differing assumptions about culture. Emic researchers tend to assume that culture is best understood as an interconnected whole or system, whereas etic researchers are more likely to isolate components of culture and state hypotheses about their distinct antecedents and consequences (Morris et al., 1999).

As a Bangladeshi citizen conducting a research in Bangladesh, the researcher can be considered as an insider. However, that can be only in a very broad perspective. The researcher was born and grew up in the capital city, Dhaka and spent his life in the city. Only on a handful of occasions, were the rural locations of Bangladesh briefly visited. The researcher's parents were from villages in the South West part of Bangladesh, and eventually, the researcher has been to both villages as a part of the research work. Being a city dweller, the researcher had the usual disconnect with rural life and as he was brought up in a liberal family, his ideologies at times would not be representative of the traditional values that the majority of the Bangladeshis have. These include interpretations of the role of religion, family dynamics and societal connections. These distinctions almost make the researcher an outsider, or to be exact, an informed outsider who is well versed in the language the people of Bangladesh speak and aware of their tradition and cultures. The researcher has also lived more than nine years in the UK and considers himself as a naturalised person in western culture. This gives him further ability to take a critical stance on the differences between both the cultures. Having a well-established social background in Bangladesh helped the researcher to get access to the selected research locations. Out of the six research locations, two were quite well known because of the ancestral connections. Having a network of people who have a strong presence in various places in Bangladesh helped the researcher to gain access even in the rural locations, especially the one without any electricity.

3.4.3 Use of an action research strategy

Action Research investigates a phenomenon through intervention in a challenging situation (Meyer, 1993). Action research is used in various disciplines in different forms, but the one that is closely connected with educational research is John Dewey (1938)'s belief that knowledge and actions should not be separated. Dewey believed that by applying scientific and problem-solving methods, educators would model the scholarly skills and socially responsible ideas to educate people (Lodico, Spaulding & Voegtle, 2010).

Zuber-Skerritt, (1996) proposes these principles of action research:

1. Uses a cyclic or spiral process, which alternates between action and critical reflection and in the later cycles, continuously refining methods, data and interpretation in the light of the understanding developed in the earlier cycles.
2. It is thus an emergent process that takes shape as understanding increases; it is an iterative process that converges towards a better understanding of what happens.

Interpretivist research conducted over a period in connected discrete segments can take the form of action research where the initial research data feeds into the later research enquiries, and the same process repeats with new insights from each stage of the research. Action research cycles consist of planning, acting, observing and reflecting phases. In an action research cycle, researchers continually examine their own assumptions and biases because they are contextually active participants in the setting that they study. The underlying assumption of this strategy which has traces in Lewin's (1948) work is that effective social change can be brought about when people of that society are aware of the necessity of the change and take an active role in that change process. It is also understood that collaboration of any kind with the target population can give the people and the researcher the time and support required to make fundamental changes in their normal practices (Simmons, 1995). Within the two aims of the action research, the first being improving the existing (challenging) system and the second being researching the phenomenon of interest, the researcher could situate his previously selected and justified ethnographic strategy without conflicting any of the strategies.

A specific form of action research, participatory action research (PAR) matched with the iterative process of this study. Participatory action research claims that this strategy involves 'researching with' people rather than 'researching on' people (Kindon, Pain & Kesby, 2007). In participatory action research, the "objects of research" or the community, in general, is in the centre of the research and become

part of their own theory of practice (Whyte, 1991). Within PAR, Community Based PAR (CBPAR) and Ethnographic Action Research (Tacchi, 2015) have a similar research strategy. However, there were several disconnects within both approaches to this research. CBPAR greatly involves the community and participants, but it takes a partnership approach where these community members become part of each stage of the research. For this study, this was not possible as a considerable proportion of the research was conducted from overseas and the participants though having taken an active part in each cycle, had limited scope for involvement in all the stages of the research.

Another variation, 'Ethnographic Action Research' incorporates the ethnographic style of data collection and participatory action research cycles but one of the two major building blocks of this strategy is a technologically deterministic view for the communities. This research strategy takes it for granted that technology is the key to development and a 'results-based management' approach drives the cycles (Lennie and Tacchi, 2014; Tacchi, Slater & Hearn, 2003). EAR does not fit with the philosophical and practical views of the researcher, as it perceives technology as the central driving force fundamentally undermining the idea of social shaping of technology which is one of the foundations of this research and it is inconsistent with the interpretivist and constructivist approach that informed this research

Stringer (2007), Brydon-Miller, Greenwood & Maguire (2003) and Williams & Brydon-Miller (2004) emphasised that in PAR, the researcher who acts as an external figure to the problems can provide the people with the necessary support and resources to have things done in a way which is suitable to their culture and lifestyles. Following this strategy would eliminate criticisms of the reviewed projects that postulated technology on its own can solve the problems. Such research approaches also fail to understand or value the life experiences of the people on whom the research is conducted.

All three practical elements of this study: fieldwork, content design & interface design have gone through several iterations over a three-year period. In this

research, iterations in general and the post-iteration revision process had direct input from the community where the study took place. Thus, the action research strategy used in this research resembled some characteristics of PAR. PAR had potential to enable active participation of the community members who with their enhanced skills can then lead to better-informed decision making and was also appropriate to lead the researcher to understand various problems within the research settings and work on those issues within the iterative cycles. However, the 'collaborative' role of participants was limited as there were no 'repeat' studies conducted within the same community. Where a research location was close to a past research location, previous participants were invited to take part in the recruitment stage. The ex-participants had browsed through the modified interface and content and given their thoughts, but that engagement was optional.

3.4.4 Understanding the researcher's role from the action research perspective

Expectations from an action researcher are to take an active role alongside the collaborators and stakeholders in the community or groups in the collaborative process (Berg, 2004). The action research part of the research advocated that the participant works with the researcher closely. Participants often became key role players in the development cycles. The way participant feedback was used in the research was that feedback given in one phase was used in the next iteration. The researcher has allowed the participants to be themselves and express their own thoughts and ideas. The role of the researcher was to record the suggestions and give the participants a feeling of ownership in the process. Other than the field trips, during the cyclic development process of the interface and content, the characteristics of the action research were more observable as there was repeated feedback received from the evaluators. Throughout the evaluative development, the researcher collaborated with the evaluators and the supervisory team to ensure that suggested changes were appropriately judged and taken into consideration in the main study. These factors are more elaborately presented in Chapter 5.

3.5 RESEARCH METHODS FOR THE STUDY

Crotty defined research 'methods' as *"the techniques or procedures used to gather or analyse data related to some research question or hypothesis"* (Crotty, 1998, p. 3). Philosophical and methodological underpinnings of the research make certain methods more suitable and useful as they match with the underlying principles of the chosen philosophical stance and methodology. The researcher has selected to address the research problem from an interpretivist philosophical stance using qualitative methodology. Rapid ethnography and a participatory action research strategy would allow the research to frame the research methods required to collect data for this research. To understand how the participants would interact with the device and the content presented in the interface it would require observational records and to understand whether the learning was useful, interviews would be suitable. Additionally, to get insights about the interface and the content design it would be useful if there was a systematic way of ensuring the changes were tracked and evaluated at various points. Research methods for this study are broken into two subsections, methods for the iterative fieldwork and evaluation of the content and interface design.

3.5.1 Methods for iterative fieldwork

In the fieldwork, due to the interpretivist philosophical standpoint, appropriate research methods were selected to collect qualitative data from the field in natural settings. The methods that were used during the fieldwork included interviews (individual and photo elicitation based group interviews), and participant observation recorded in field notes. During the pilot stage, interview and observation were taken as the main sources of qualitative data. A photo elicitation technique was added in the later phases of this research, where the participants were asked to take photos for a given scenario. These methods are presented below in detail with the rationale for their usage.

3.5.1.1 Interviews

Interview is one of the most common qualitative data collection techniques (Guba and Lincoln, 1994). Lodico et al. (2010, page 123) reinforced that an interview is essentially a 'conversation with a purpose'. Interviews can be conducted one to one where the participant is encouraged to express his/her feelings. The goal of the individual interview is to determine the participant's feelings, interpretations, or reactions to a set of events which he/she has gone through. In a group interview setting, shared beliefs and actions are explored often by posing a hypothetical problem or a situation and by understanding how each of them would address that problem or situation (Creswell, 2013).

Interview structures can be of three types; structured, semi-structured and unstructured (Kvale, 1996). Each of the types is distinctive in its own way. In a structured interview, the focus is towards getting information from several pre-selected questions. The researcher is bounded within those questions and has no scope of going beyond the setup even if it may seem necessary. In the semi-structured interview, the researcher develops an interview protocol which includes a set of topics to be discussed, but the researcher has the flexibility to change the order of the questions, to skip a few questions and to paraphrase the questions. Also, if novel issues emerge then the researcher may ask additional questions to probe into those new emergent issues. An unstructured interview is more like a conversation and offers greater flexibility. The researchers can just have a few themes noted on which the questions will be based and often begins with a standard prompt or question but then proceeds by engaging with the participant's responses. Generally, in qualitative research some room for flexibility is required. Thus semi structured and unstructured interviews are commonly used by the qualitative researchers.

Semi-structured interview methods were most suitable for this research because it would allow the researcher to probe into the teaching, learning and retention aspects. Semi-structured interviews fit well within the chosen research methods

and strategy because data gathered from the interview would enable the researcher to understand how the participants made sense of previous disaster encounters and how they prepared themselves to minimise the risks. Also, these interviews were useful to shed light on current practices in the community to stay informed and be safe. During the interviews, the researcher avoided asking leading questions and focused on open-ended questions so that the participants felt comfortable answering them. Mason (2002) took a critical stance on this method as the quality of the interviews often rely on the participant's capability to interact, understand the questions, conceptualise, retrieve their memory, summarise the memory and finally make it clearly understandable to the researcher. In each stage of the research, a separate interview protocol and participant information sheet were produced. This changed over the time as required by the research and the location of the research. Probing questions also improvised as the research progressed from pilot to the main stages. This scope for improvisation was particularly useful for the nature of the interpretivist research.

In the main study, a photo elicitation based group interview was initiated to better understand the participant's spatial understanding of potential hazards during a disaster. Photo elicitation is a technique of inserting photos as a prompt to elicit further information into interviews. Photo elicitation was first introduced and documented by John Collier in 1957 who was researching mental health in Canadian communities (Parker, 2009, Van Auken et al. 2007). Collier (1957, p. 859) stated,

> *No matter how familiar the object or situation may be, a photograph is a restatement of reality; it presents life around us in new, objective, and arresting dimensions, and can stimulate the informant to discuss the world about him as if observing it for the first time.*

Collier used photo elicitation technique to understand objective reality. However, Barthes (1981) has acknowledged the polysemic feature of images, which is that images can suggest multiple meanings, and one picture can be interpreted in many alternate ways (Bignante, 2010). Images taken by the participants can alternatively

be treated as a coded message that can potentially be unlocked by the participants. Their understandings and interpretations of the picture are linked to the way they think, imagine and use the memory of their past experiences. This contradicts Collier's objectivist view of this technique and perhaps extends the use of this tool within an interpretivist paradigm as it enables a way to understand what participants think of a given scenario at a given point of time. Harper (2002) explained from a psychological perspective that, parts of the human brain that processes visual information are older than the parts that process verbal information. Visual information may trigger deeper feelings that perhaps may not arise within verbal communication.

Use of this method was perceived to be very useful in breaking the wall between the researcher and the participants' understanding. The method of using participants as photographers has been used in previous research elaborated in Carlsson's (2001) work. Such research was conducted when studying the culture of the Navajo Indians (Collier & Collier, 1990) and in a study of a Dutch neighbourhood (Harper, 1994). Another study in which participants (school children between the ages of 6 and 14) acted as photographers was about the lives of families in a coal mining area in southern Kentucky (Ewald, 1985).

Anthropologist, Pink (2001) has also suggested the use of visual methods paired with ethnography as a qualitative research method. However, no similar work was undertaken with the people of the South Asian countries, especially in the Indian subcontinent. This research method which has great potential to empower people to express themselves in an alternate way was anticipated to be useful in this research context. Normally there are two types of photo elicitation. In the first type, participants are given a set of pictures pre-selected by the researcher to evaluate certain scenarios. In the second type, the participants are asked to select pictures of their choice (either the images are taken by the participants or given by the researcher). In this research, the participants have initially captured images and then selected images for the photo elicitation interview.

The photo elicitation interview was conducted in a group setting. The researcher had randomly created the groups. One to one semi-structured questions based on the images were asked to each participant in the presence of the other group members who could listen to him/her but did not participate in the conversation. By creating groups in this activity, the researcher could complete the interview sessions in a reasonable timeframe. Charmaz's (2006) concern that in a group interview, participants may be inclined towards implicit social conversation rules and focus more on what should be said was minimised as the participants were made aware that there are no right and wrong answers and everyone is right from his or her own point of view. This stance reaffirmed the mutual respect for participant's thoughts and ideas. Through this participant-driven approach the participants could represent their own thoughts and bring many issues that would otherwise be left untouched. This participatory approach to data collection fitted well within the participatory action research strategy.

Photo taking activities evolved throughout the study. In the pilot study, this method was not incorporated. In the first iteration of the main study, two photo elicitation activities were planned. Firstly, to understand whether the participants were aware of their surrounding spatial elements that can cause incidents in a disaster event. Secondly to understand what things they would pick for an emergency kit. There were some issues with the second activity which are elaborated further in the Chapter 6 (section 6.2.1.4, para 4). In the final phase of the main study only the first photo taking activity was retained and the second activity was merged in the photo elicitation interview.

During the first phase of the main study, the participant captured photos were printed off and given to the relevant participant to select the best ones for the context (up to 5). In the final iteration, pictures were not printed off as this was replaced by going through the photos on the tablet device. When a participant was given the tablet for photo taking purpose, the last picture number was noted and after the picture taking was over the last number of the photo was noted to trace pictures taken by the participants.

3.5.1.2 Participant observation

Denscombe (2007) discussed two types of observation commonly found within the social sciences – Systematic observation and Participant observation. Systematic observation intends to produce quantitative data for statistical analysis. Systematic observation tries to capture 'what' happens but it cannot quite document 'why' that happens as contextual information is often lost within the structures. In contrast, participant observation is qualitative in nature and less structured. It is normally associated with exploratory research questions where the researcher sought reasons behind a phenomenon or tries to understand why certain observable behaviour occurs (DeWalt & DeWalt, 2011). Data generated from participant observation provides the researcher with a dimension to capture nonverbal expressions of the participants, determine how participants interact with each other and how various activities are completed by the participants (Schmuck, 1997). For this research, it was fundamental to understand to what extent the participants were using the tablet device, the content presented through the interface, and the activities designed for minimal guidance. Participant observation also fits well within the chosen research philosophy and approaches as this would allow for an understanding of the subjective reality within the chosen context.

Type of engagement of the researcher: An observational researcher can adopt various stances in observing the participants. One possible way of engagement is fully engaging with the participants. The other way is enacting a distance spectator role. In this research, in the planned intervention points the researcher actively participated with the participants, and in the rest of the period, the observation was recorded as a spectator. Observation can also be interpreted as explicit and implicit which is, to what extent the participants are aware that they are observed or are aware of the actual reasons behind the observation (Kawulich, 2005). It is argued that when the participants are aware they are observed, they become cautious and pretend to do things in a way that their might perceive as the best way of doing the task which may please the researcher. To avoid this possibility, a researcher can hide the actual reasons for observation, but this may be an unethical

practice. In this research, the observation was explicit, but the participants were not explicitly aware of the factors being observed. As a part of the training, the participants were required to demonstrate certain tasks such as basic first aid. Participants formed groups to perform those tasks. The observation was used to see how the participants were progressing with the tasks. Other tasks involved them taking pictures of 'elements that they feel can be hazardous during a disaster event' and nominating 'things they would put in an emergency bag'. In the photo taking activity, how they managed to use the tablet device to take pictures was also observed to understand how comfortable they were using the device and accuracy of the task completion so that there were no gaps in the collected data.

As stated by Lodico et al., (2010) most of the observational records made by qualitative researcher come in the form of field notes which can take form of being descriptive – recording what certain participants are doing or how they are interacting, and reflective- which records the observer's feeling and understanding of the observed event. Throughout the fieldwork of the research, notes were taken in the form of descriptive notes, and later these notes were word processed and merged with the observation log. Observation notes were an important source of data to understand the participant engagement in the entire process.

3.5.2 Methods for evaluative content & interface design:

Unlike the fieldwork, content and interface design was mostly conducted away from the field, which warranted the use of different methods to collect qualitative data. In chapter 5 this is discussed in greater detail. A brief account of the methods is given here.

The methods that were used in the design of content and interface were evaluation feedback from general user & expert user evaluators, participant feedback, supervisory team's feedback and analysis of the design logs that illustrated the changes made to the content and interface over the period of three years. There

were two documenting methods used to track this design cycle: a) Training programme specification and b) Design log.

Training content was continuously evaluated considering the need of the people of the chosen locations. Training programme specifications would normally change after completion of one phase. This would also trigger potential changes in the digital content presented through the interface.

Interface design was a cyclic process which allowed the researcher to improve the design over the period of the research. The interface design has gone through two formal customised evaluations. Evaluators were divided into general and expert groups. Engagement of the evaluators was voluntary. Data from the evaluators were based on their response to a series of open-ended questions.

'General user evaluators' had to go through eleven open-ended questions to record their input (further elaborated in 5.5.2.2) and 'Expert user evaluators' gave feedback on three key elements using 17 open-ended questions. Those key elements were:

SET A: Quality, comprehensiveness and appropriateness of the content

SET B: Learning and teaching perspective

SET C: Interface, usability and miscellaneous factors (memory recall)

(further elaborated in 5.5.2.3)

Analysis of the feedback and their direct input for further improvement were reflected by making changes to the interface. The supervisory team overviewed the progress and commented on the suitability of advised changes. All the evaluators were made aware of the research purpose, research locations and participant demographics. During each iteration, participants were asked a number of open-ended questions on how they found the device, the content and the way they interacted. Their responses were important feedback which was taken into consideration.

3.6 RESEARCH DESIGN

"*The function of a research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible." (De Vaus, 2001)*

The previous sections of this chapter provide justification for the selected interpretivist research philosophy (section 3.2), qualitative research methodology (section 3.3), the use of 'Rapid ethnography' and 'Participatory action research' as strategies (section 3.4), and the specific research methods (section 3.5) for fieldwork (interview and observation), and for the content and interface design (expert and general user evaluation). In this section, the focus is shifted towards the three phases of implementation. All three phases are separately documented. Documentation of each phase includes an overview of the locations, the sample size and the sampling technique. Data analysis techniques are separately presented in Chapter 4.

Social research needs a design to understand how data collection can be conducted to generate sufficient data to answer the research questions in a convincing way. As illustrated in the introduction of this chapter, research questions of this study are abstract questions aiming to find out how technology can be used in technologically disadvantaged locations to provide disaster preparedness training and whether it will be able to raise overall awareness, a descriptive research design was required to answer these research questions.

The study of a specific phenomenon can be done in its own right, or it can be a base to provide further information on another similar phenomenon. For example – in this case, the researcher might have wanted to focus on tablet-based learning and its various aspects. The focus would be on learning. Alternatively, the researcher can study aspects of this learning strategy within the context of Bangladesh, to understand how it works for the community and to inform ways in which followed strategy or similar strategies can be applied in similar context and similar countries.

This implies a ‘case study’ approach. Methods used within a case study research, often resembles that of an ethnographic research (Creswell, 2014). The central differentiator is that, the ethnography is inward looking (deals with the tacit attributes of the participants) and the case study is outward looking (provides deeper understanding of the nature of a phenomenon) (Best & Kahn, 2006) The research premise was more like a case study in itself as there were no previous instances of using a tablet device based disaster preparedness training in Bangladesh. Research findings also indicated ways in which similar research problem can be dealt with (which is detailed in the Chapter 6 and 7) which had elements of the ‘case study’ approach.

The research work completed in three stages – ‘Pilot study’, ‘Main study -phase 1’ and ‘Main study -phase 2’. These multiple stages in the research spanned over three years gave the researcher adequate time to plan for the research design and go through changes to accommodate the emerging themes and unforeseen circumstances.

At the beginning of the research, three locations were proposed for the study: a) Baintala Village – Rampal, prone to drought and cyclone, b) Sorui - Bagerhat District, prone to flood and cyclone and c) Dhaka City (Capital of Bangladesh), prone to flood and earthquake. One of the major challenges in administering the research was, there were no (even on a small scale) tablet-based training programmes administered in Bangladesh, and there was a lack of literature on possible ways to arrange the research. Thus, the researcher was aware of the continual changes that this research might require. As the research progressed new locations were eventually added as it gave a better understanding of the premises of the research and assisted in sufficient data accumulation. In 2013, the ‘Pilot study’ was conducted in Sorui, Bagerhat. In 2014, the ‘Main study -phase 1’ was conducted in Fultola, Bagerhat and Baintala village, Rampal. In 2015, the ‘Main study -phase 2’ was conducted in Karapara & Afrah village, Bagerhat; Nagori Village, Kaligonj, Dhaka Division and Bhairab Sodor, Bhairab.

3.6.1 Pilot study

This was conducted in 2013 in a small area of Sorui which is near to the Bagerhat town centre and is a quite technologically advanced location in terms of connectivity. Duration of the training was five days. This location has been prone to annual flood and frequent cyclones. During the pilot study, the researcher had created an interface with content on disaster preparedness (especially for flood and cyclone). It was anticipated that internet connection could be an issue. Use of video clips was thus, reduced and only the most important clips were used. Contents were designed using Articulate Storyline (Articulate, 2016a) and Articulate Studio (Articulate, 2016b) which was later uploaded to the Articulate Online platform (Articulate, 2013) to be accessed by Articulate player in an iOS system. Other alternates to Articulate such as iSpring Suite and Adobe Captivate were tried and tested. However, none other gave a complete solution to using Bangla language effectively error free. The required Articulate player was available for iPads only and resulted in using Apple branded tablets. Apple iPad tablet 3G, 2nd generation was used to access the online contents using Grameen telecom provider's internet package which was chosen due to its wide network coverage. Citicell Zoom network package was reserved as a backup.

3.6.1.1 Sampling technique and sample size

Probability sampling is inappropriate for qualitative research (Wilmot, 2005). In probability sampling members of the research, population are chosen at random and have a known probability of the selection. In the case of equal probability, the proportions are accurately drawn, and in the case of unequal probability, collected data are reweighted to calculate a true proportion. The aim of such probability sampling, in general, is to produce a statistically representative sample, suitable for hypothesis testing which goes with quantitative research strategy. Qualitative research commonly uses non-probability sampling as it does not aim to produce a statistically representative sample or draw the statistical inference. Indeed, a phenomenon needs only to appear once in the sample to get included in the

findings (Wilmot, 2005). Purposive sampling is one technique often employed in qualitative investigation. With a purposive non-random sample, the number of people interviewed is less important than the criteria used to select them. The characteristics of individuals are used as the basis of selection, most often chosen to reflect the diversity and breadth of the sample population.

During the pilot stage, the plan was to take a heterogeneous sample that would represent most the combinations of gender, age, literacy and technological literacy. These characteristics were grouped by the following:

Gender: Male and Female
Age: 18+ to 25, 25+ to 35, 35+
Technological Literacy: Elementary, Moderate, Advanced**.**
Literacy: Illiterate, Semi-literate or less literate and Literate.

Literacy as defined by the Bangladesh Bureau of Statistics (BBS) (2013, p. 3), is:

> *… the ability to read, understand, interpret, communicate and compute in verbal and written forms in varying contexts. It involves a continuum of learning that enables individuals to develop their potentials and knowledge base and to participate fully in community affairs and wider social and development context.*

In this research, a literate person was defined as the following:

> *a literate person would be able to communicate within the community and beyond using native language profoundly in various modes such as reading, writing and verbal.*

A Semi-literate person was someone who lacked fluency in reading and writing. Only verbal proficiency was not treated as semi-literacy. An illiterate person was the one who was unable to comprehend the written form of the native language (Bangla). Generally, people in this category could express themselves verbally with ease. It is worth noting that, borderline literacy is very complex to judge in

Bangladesh. People who attained literacy at a lower level are prone to forget this skill at a later date because of less use of it in daily life. Being unaware of losing the skills, they may still label them as literates but in reality, they are not.

In 2013, when the pilot study was planned, there was no official categorisation and definition of technological literacy in Bangladesh. Thus, for the pilot study, elementary technological literacy was categorised by the participant who could use some form of technology including radio and television, moderate technological literacy meant they could use a feature phone, and advanced users were those who were using basic smartphones. As this research was aimed towards adults, exclusion criteria were that the prospective participant must be of 18 years old to participate and not with any disability.

Table 1: Sample for the pilot study

Male, 18 to 25, moderate technologically literate, literate x1	Female. 35+, elementary technologically literate, less literate x1
Male, 35+, elementary technologically literate, literate x1	

3.6.1.2 Access and recruitment

Access to the participants is often a challenge for research conducted overseas. The researcher had a highly-trusted informant who was a resident of the locality and had a good network within the area. This had a two-fold benefit. Firstly, the participant recruitment was easier as the participants could be easily contacted and secondly, the participants would trust and be more prepared to participate as they were referred to the researcher by someone they respected and trusted. The local informant also informed the local government officials that such research work was to be conducted. They verbally approved and gave consent.

Prospective participants were initially identified from the publicly available voter list published by the local authority which is available both electronically and in a paper

format. That list had all the necessary information that the researcher initially needed such as name, date of birth and current address. The local informant was used to initially contact the prospective participants. Selected participants were approached three days before as planned and confirmation was received personally by the researcher in their dwelling place. Confirmed participants were given a 'participant information sheet' which gave all participants necessary information regarding the research and what they could expect in these five days. **Appendix A** outlines the research plan of the Pilot Study.

3.6.2 Main Study- Phase 1

In 2014, 'Main Study- Phase 1' was conducted in Fultola, Bagerhat and Baintala village, Rampal. While Fultola was moderately technologically advanced, Baintala was quite deprived with many houses still without electricity. Using the insight from the pilot study, relevant changes were made to the content and the interaction strategies were revamped considering the theoretical stance the researcher had regarding learning that can place using the tablet device as a medium. Changes in interaction strategies also led to further data collection which would strengthen the research.

It was suggested by the participants in the pilot stage that, the training days could be shortened as there were small sessions over five days in the pilot study. In the 'Main Study- Phase 1', the days were reduced to four days, but it was noted that it could have been completed in lesser days, given that there was assistance to conduct the interviews. Content creation and dissemination platform remained the same and to include more participants, two Apple iPad tablet 3G, 2nd and 3rd generation were used. For the first aid demonstration, the researcher engaged 2 qualified nurses who volunteered to demonstrate bandaging and CPR to the participants.

3.6.2.1 Sampling technique and sample size

Sampling technique remained the same. However, sampling frame and the sample size were different. The sample size was six from each location.

Gender: Male and Female

Age: 18+ to 35 and 35+

Technological Literacy: Elementary, Mature.

Literacy: Illiterate, Semi-literate or less literate and Literate. [Definition same as Section 3.6.1.1]

There were only two divisions in the age compared to three in the pilot because with two boundaries the desired group of people could be included. Technology literacy was perceived to be mixed among the groups. People who use feature mobile phone were treated as mature and others as entry level technology literate. This sample in total (as presented in Table 3) had a gender balance and within this sample mixed age groupings could be formed to facilitate intriguing social interactions which were needed for the study. Access to the participants was made through local informants, and the recruitment process was same as the pilot study. Research schedule of Main Study- Phase 1 is presented in the Appendix O.

Table 2: Sample for MSP-1

			Location 1: Baintala (Total 6)		Location 2: Fultola (Total 6)	
Age	**Technology Literacy**	**Literacy**	**Male**	**Female**	**Male**	**Female**
18+-35	Elementary	Literate				
		Semi-literate				1
		Illiterate				
	Mature	Literate	1	2		
		Semi-literate			1	
		Illiterate				
35+	Elementary	Literate			2	
		Semi-literate	1	1		1
		Illiterate		1	1	

	Mature	Literate				
		Semi-literate				
		Illiterate				

3.6.3 Main Study- Phase 2

In the 'Main study - phase 2', the choice of locations and participants were such as to give an overall understanding of different localities of Bangladesh. In this phase, various changes were undertaken to reflect feedback received from the previous phase. The content design was updated for the chosen locations. Having a wider range of population being studied was perceived to add better clarity in understanding the research context. MSP-2 was conducted in Bhairab Sodor, Kishoreganj, Dhaka Division; Nagori Village, Kaligonj, Dhaka Division and; Afrah village, Bagerhat, Khulna Division and Karapara Village, Bagerhat Sadar, Khulna Division.

Bhairab is situated beside the rivers of Meghna and Brahmaputra. Most the population is Muslim (95.18%), average literacy of this location is 22.1%, and the main occupation of the residents is agriculture (31.37%) (Kishorgonj, 2016). Nagori Village is situated beside the river Shitalakshya. Most the population is Christian, average literacy of this location is 49% (Nagariup.gazipur.gov.bd, 2016). Afrah village is situated in Jatrapur union, Bagerhat, established on the banks of the river Bhairab. Majority Muslim population with 65% of the population of Jatharapur union is termed as literate (Jatharapur Union, 2016). No precise data was available for Afrah village in terms of literacy. Karapara Village is situated in Karapara Union, Bagerhat. Muslim population with 65% of the population of Karapara union is termed as literate (Karapara Union, 2016).

In 2015, Articulate developed their software for both iOS and Android platform. This enabled the researcher to use the content even in cheaper non-branded tablets. Alongside two previously used iPads, another Android tablet was used in

locations where the participant number was higher. The duration of the programme varied to reflect the resource availability and availability of the participants. Informants and research assistants were used to speed up the data collection process.

3.6.3.1 Sampling technique and sample size

In this phase of the study, given the insight from the phase 1, purposive sampling was used to get representatives from all possible scenarios, especially those that could not be accommodated in the previous iterations. Different locations with varied characteristics of the population were chosen on purpose to see if that made any difference to the type of training conducted.

Gender: Male and Female

Age: 18+ to 35 and 35+

Technological Literacy: Elementary, Mature. [Definition same as Section 3.6.2.1]

Literacy: Illiterate, Semi-literate or less literate and Literate. [Definition same as Section 3.6.1.1]

Table 3: Sampling plan for the Main Study Phase 2

Age	**Technology Literacy**	**Literacy**	**Location: Bhairab** (Total 11)		**Location: Nagori** (Total 11)		**Location: Afrah** (Total 48)		**Location: Karapara** (Total 26)	
			Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
18+ to 35	E	L					1	2		2
		SL					2	2	1	4
		I		1				9		
	M	L	2	2	2		2	1	3	5
		SL	2				2		1	1
		I								
35+	E	L			4	1	1	1		1

		SL		1		2	3	2	1	1
		I		1			6	12	1	3
	M	L	1			1	2	1	1	
		SL	1		1					1
		I								

Legends:
Elementary = E
Mature = M
Literate = L
Semi-literate = SL
Illiterate = I

3.6.3.2 Access to participants, use of the research assistants

As before the researcher used personal and professional contacts to identify possible locations for this phase. Priority was given to locations that are prone to flood and cyclone including high land and lowlands. Also, different categories of localities were chosen such as majority Muslim or majority Christian locality; this was done to see if religious belief had any significant role in shaping preparedness or belief in preparedness. Also, taking the research in different locations would eliminate the possible bias of a particular locality's beliefs regarding disaster preparedness.

Alongside the informants, research assistants were used to speed up the data collection process. Research assistants were briefed in terms of the research premise, and they were taken through possible interview questions and 2 mock interviews were taken to prepare them for the field engagement. This saved additional training hours. The research assistants were prompt in taking notes during the interview and were adequately resourced to record interviews as required.

3.6.3.3 Fieldwork planning

This phase required the researcher to demonstrate further project management capabilities as there were four locations and research assistants were used in the data collection process. Rather than dividing the training in 'days', it was broken

into several sessions. Upon confirmation of the research assistants and informants, sessions were scheduled (but not hard time bound) to ensure the sessions are adequately managed.

Table 4: Research Schedule Main Study Phase 2

Session	Research Activity	Participant Activity
1	**Briefing [Intervention 1]** *Introductory session, information on common disasters in the locality and importance of disaster preparedness.* ***Intervention details:*** *1. Guidance on using the device – Navigation through the interface.* *2. Using camera feature to take the point and shot pictures.*	Understand what is required of them during the study, brainstorm on how they can improve their current preparedness. Review their preparedness strategies and understand why the early warning is important. ***Main Activities:*** *Group Discussion, Brainstorming, Drag and Drop quiz.*
2	No Intervention.	*Understand why an emergency plan is required to ensure better safety.* ***Main Activities:*** *1. Creating an emergency plan.* *2. Taking pictures of perceived hazardous elements that may affect them in a disaster event.* *3. List things that they will put in an emergency kit*
	Conduct interview of the participants.	Attend the interview session.
3	**Demonstration: Emergency First aid. [Intervention 2]** ***Intervention details:*** *1. Demonstrate how to stop*	Learn how to do first aid in emergency scenarios. ***Main Activities:*** *1. Learn and demonstrate how to*

	bleeding from an wound. Bandaging techniques. *2. Demonstrate CPR.*	*stop bleeding from an wound and bandaging techniques.* *2. Explain the stages of CPR.*
4	No Intervention	Understand basic elements to be put in an emergency kit. ***Main Activities:*** *Creating an emergency kit*
	Conduct interview of the participants.	Attend the interview session.

In Bhairab, a total of 11 participants took part in the training. 2 groups were made with 6 in one and 5 in the other. A total of 3 tablets and 2 research assistants were used. It took total 2 days to conduct the training and other associated activities at this location. In Nagori, a total of 11 participants participated in the training. 2 groups were made with 6 in one and 5 in the other. A total of 3 tablets and 2 research assistants were used. It took total 2 days to conduct the training and other associated activities at this location. In Afrah, a total of 48 participants participated throughout. 8 groups were made with 6 participants in each. A total of 3 tablets and 2 research assistants were used. Total training took 6 days to complete. Parallel sessions were conducted to accommodate the participants and maximise resource allocation. In Karapara, a total of 26 participants took part throughout the training. Four groups were made with 6 in two and 7 in other two groups. A total of 3 tablets and 2 research assistants were used. It took total 3 days to conduct the training and other associated activities at this location. In 'Appendix K' the generic activity planner of the MSP-2 stage is presented with a through the breakdown of the estimated time calculation of the 'Karapara' location.

3.7 DATA SOURCES

Data sources have been enhanced over the course of the research. During the pilot stage, the data collection intention was to collect primarily qualitative data and limited quantitative data. In the pilot stage, qualitative data came from interviews

and observation logs. Quantitative data came from two surveys. The first one was in the form of a diagnostic test and the second one was an exit survey[6]. Other data sources were quiz, activity results and tracking of the time spent on contents through the interface.

In the 'Main study- phase 1', these data sources were further refined and reconsidered given the philosophical stance and choice of the research strategies. Graded tasks were replaced by exploratory tasks (engagements were observed) and limited quantitative data came from initial checks while joining the programme. A diagnostic test was not deemed necessary as almost all did not have any prior disaster preparedness training and the exit survey was replaced by adding additional questions to the interview. The data sources were the same for the 'Main study- phase 2'. In the MSP-1 and MSP-2 stage Qualitative data came from two strands – one through fieldwork and another through the content and interface development.

3.7.1 Cyclic fieldwork data sources:

Cyclic fieldwork data sources as illustrated below are further detailed in the following sections:

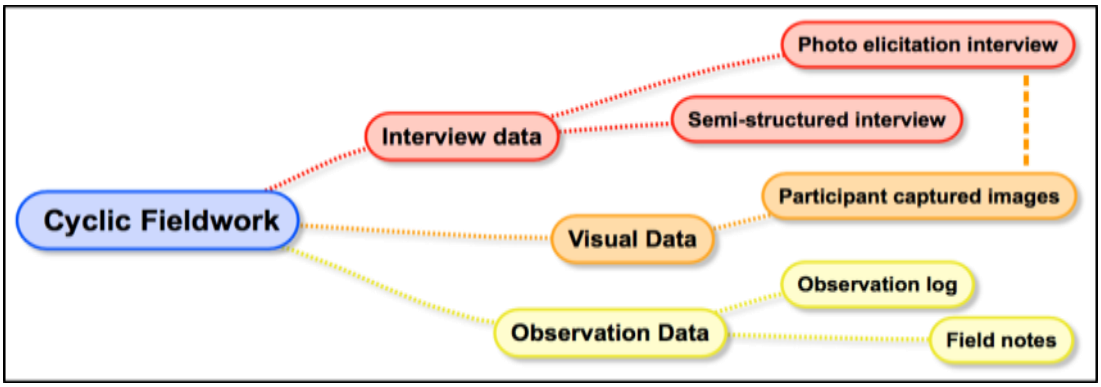

Figure 1: Cyclic fieldwork data sources

[6] Exit Survey for this research were carried out to have a better understanding of participant's involvement and awareness building as a result of the training.

The image above depicts the cyclic fieldwork data sources which distinguish the visual data source from the rest, even though the visual data sources were also part of the photo elicitation interview. Due to the rich nature of this source in providing crucial insights about the researched locations, it was essential to manually tag the pictures (this was roughly equivalent to coding and it is discussed further in section 4.4.3.2). This process was separate from the photo-elicitation interview data as it was processed at a later stage and was independent of the interview data. The dotted lines illustrate that the same images were used in both the photo elicitation interviews and the manual tagging process.

3.7.1.1 Interview data

During the pilot study, two one to one interviews were conducted during the intervention points on Day 2 and Day 5. The gap between the interviews was intentional as within these gaps participants would have completed the training, and the researcher would be able to have a better understanding of their learning. Initial interviews captured the participant's understanding of disaster preparedness, past experiences and how they learn from their experiences and what support they get from various governmental and NGOs. Also, there were probes regarding the use of the tablet device and the training programme to see how they were progressing. The questions were not leading and were based on themes. Semi-structured interviews were suitable to use with the chosen research framework as this allowed the researcher to capture rich data on individuals' experiences and attitudes within the chosen context.

Interviews were conducted at two different points in the 'Main study- phase 1'. The first was a one to one semi-structured interview which was more like the pilot study (see Appendix G for a complete semi- structured interview transcript). Informed by the pilot phase, the researcher was vigilant in shortening participant's answers that were beyond the scope of this research. The total length of the interviews were around 15 minutes (with several exceptions where the duration was around 25-30 minutes). Interview questions were directly related to the research questions (see

Appendix N). Interviews were audio recorded and noted simultaneously so that even if one fails, the other will be able to retain data. This precaution was particularly useful as because one of the locations- Baintala had no electricity. The second round of interviews was taken in a group setting after the participants had completed the photo taking activity. A photo elicitation technique was used during the interview (see Appendix H for a complete photo elicitation interview transcript). As this was the first time the technique was tried by the researcher, all the participant captured images were printed off. To do this, the research had to go back to the town to access the photo printer. These images were systematically and clearly marked with the participant identifiers (detailed in section 4.4.1.2).

In the next iteration, two research assistants were used in conducting the interviews to speed up the process of the data collection as many participants were unable to fully commit to four days training. The assistants were closely aware of the research locations, and the researcher participated in several mock interview sessions to train the assistants to ask appropriate questions. All the themes and key questions were given to the assistants. Ethical considerations were explained thoroughly to avoid any conflict. Transcription, translation and validation process of the interview data used in this research is presented in the Chapter 4 [section 4.4.1.1].

3.7.1.2 Visual Data

Visual data were not initially (in the pilot stage) planned and it was more of an experimental addition in the Main Study Phase 1. The rationale behind inclusion of this process was to take the training further beyond the interface and the device by better utilising the device. Eventually it assisted in discovering the participants' special understanding of potential hazards during a disaster (further elaborated in the Findings Chapter).

Visual data complemented the rapid ethnographic format of the research. Pink (2001)'s claim that, narratives paired with visual media can assist a researcher in

documenting 'self-representations' of the participants was found to be confirming in this research as eventually, this data source emerged as a major parallel contributor to the research during MSP-1 data analysis stage. As a part of the group interview, participants were asked to take pictures of surrounding elements closer to their house that might cause them harm or can lead to tragic outcomes in a disaster event. Images were captured by the participants who were guided by the researcher to use the camera function on the tablet device. In a majority of cases, there were no issues, and no reshoot was required. There were cases where the participants have zoomed beyond the optical zoom capability[7]. This has resulted in images with grain effects. Also, there were cases where the subject area was too far. The quality of the images also varied with the use of different tablet devices which had different megapixels. However, the rationale behind taking the picture was more valued rather than the quality of the picture.

3.7.1.3 Observation Data

The third data source of the fieldwork that was integral to the research was the observation logs which also included the field notes. An observation log was maintained throughout the training. The observation log was structured (see Appendix I). Apart from the observation log several notes were made to record incidents and interesting finds which preliminary would not fit within the observation log. Initially, the notes were taken primarily in Bangla, and during the data processing stage, they were translated back into English. This process of conducting the observation was performed solely by the researcher. Observation logs were also solely translated by the researcher. During this translation phase, self-reflection was useful in understanding the themes.

[7] Digital zoom is higher than the optical zoom which is a standard feature of a stock camera in major tablet devices.

3.7.2 Evaluative content and interface development data sources

Evaluative content and interface development data sources as illustrated below are further detailed in the following sections:

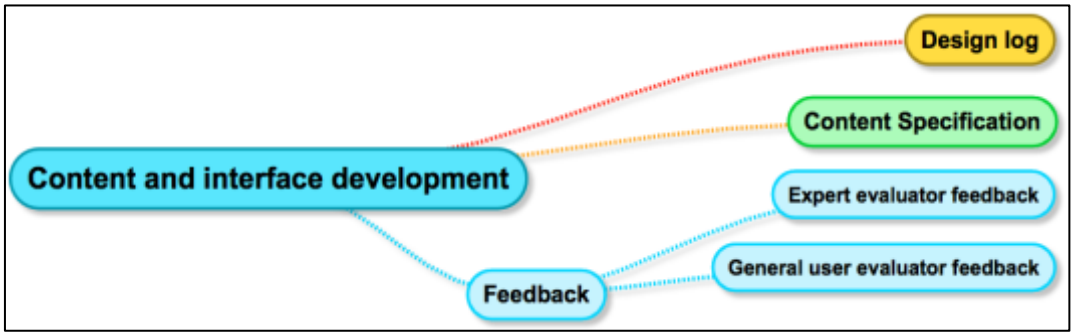

Figure 2: Content and interface development data sources

3.7.2.1 Design log

Design log in this research was a written account of how the content and interface design was shaped over a period of time by going through a range of changes suggested by general users & expert user evaluators, participants and the supervisory team. Design logs that illustrated the changes made to the content and interface over the period of three years. The design log traced the changes made to the interface with the reasoning given for the changes (see Appendix F).

3.7.2.2 Training programme specification

Training programme specification outlined the day wise learning outcomes, what learner's evidence demonstrated, whether there was a planned intervention. Content to be delivered were clearly signposted and was updated after each phase of the training. This is further discussed in Chapter 5, section 5.3.

3.7.2.3 Feedback

As explained in section 3.5.2, feedback data came from two groups of external evaluators. General users used an online service to record their responses to eleven

open-ended questions and expert user evaluators recorded their feedback on three key elements using 17 open-ended questions. These are further elaborated in section Chapter 5, section 5.5 of this thesis.

3.8 RELIABILITY AND VALIDITY OF THE RESEARCH

Eisner (1991) states, a good qualitative study can help us

> *understand a situation that would otherwise be enigmatic or confusing. (p. 58)*

Reliability is a concept that is commonly used in quantitative research, but it is also often used in all type of research works. Lincoln & Guba (1985: p. 290), in relation to the reliability of a qualitative research, posed the question:

> *How can an inquirer persuade his or her audiences that the research findings of an inquiry are worth paying attention to?*

According to Stenbacka (2001, p. 552),

> *… the concept of reliability is even misleading in qualitative research. If a qualitative study is discussed with reliability as a criterion, the consequence is rather that the study is no good.*

Patton (2015) argued that validity and reliability are the two factors that should be taken into consideration during the research design, analysis of results and in judging the quality of the research.

Considering the differences in the way those terms are perceived within quantitative research, concepts of validity have been reported as quality, rigour and trustworthiness (Lincoln & Guba, 1985, Stenbacka, 2001). Mishler (1986), replacing the idea of discovering truth through reliability measures by the idea of trustworthiness and establishing confidence in the findings (Golafshani, 2003).

In qualitative research, Lincoln and Guba (1985) used “dependability”, which closely corresponds to the notion of “reliability” in quantitative research (Golafshani, 2003). Also, the concept of dependability was endorsed with the concept of consistency or reliability in qualitative research by Clonts (1992) and Seale (1999). The researcher agrees with Lincoln & Guba (1985) that, in qualitative paradigms, the terms ‘Credibility’, ‘Neutrality’ or ‘Confirmability’, ‘Consistency’ or ‘Dependability’ and ‘Applicability’ or ‘Transferability’ are essential criteria for quality.

3.8.1 Credibility

Internal validity is reflected by credibility in qualitative research (Bryman, 2008). As Golafshani (2003) states the two best techniques to do that are through member validation (Bloor, 2001) and triangulation (Denzin, 2009). This research was conducted over a period of three years, and the data transcription and analysis did not take place alongside the data collection thus it was not feasible to do respondent validation. As an alternative, the research supervisors gave feedback on the analysis and provided feedback on the researcher’s approach and improved the credibility of the results. The researcher has also submitted various sections of this research work to peer-reviewed conferences and presented before audiences with relevant expertise and knowledge. Their questions and reflections after the talks were regarded as colleague/peer validation for the findings. Also in this research, there were a number of independent data sources and varied methods of data collection. This contributed in gaining an informed understanding of the chosen context from various standpoints and increased the researcher’s level of knowledge of the researched population. Cumulatively these systems are expected to contribute to the credibility of this research.

3.8.2 Transferability

Shenton (2004) stated transferability is concerned with the extent to which the findings of one study can be applied to other situations. Lincoln and Guba, (1985),

argued transferability is parallel to external validity. 'Thick descriptions' in qualitative research can improve the transferability of the research to other contexts and settings. Golafshani (2003) argues that more detailed description of the cases and contexts can help to generalise the results for similar contexts. Shenton (2004) note that, even when different investigations offer not entirely consistent results that does not necessarily imply that one or more of the investigations are untrustworthy or not transferable. It can be the reflection of multiple realities, and in such cases, an appreciation should be gained of the reasons behind the variation. Due to the nature of this research and its philosophical standpoint, it is not the intention of the researcher to look for generalisation of the findings so that the results can be transferred. However, within the research, there are certain aspects of the findings (such as the pedagogic approach of this research– more details can be found in Chapter 7 and Chapter 8) that can be transferred to similar contexts.

3.8.3 Dependability

Dependability mirrors reliability in qualitative research. Shenton (2004) explained how detailed reporting of a study could enable a future researcher to repeat the work. Also, a detailed research design can enable the reader to assess the overall research process. Shenton (2004) guided the qualitative researcher to include sections with:

a) the research design and its implementation, describing what was planned and executed on a strategic level;
b) the operational detail of data gathering, addressing the details of what was done in the field;
c) reflective appraisal of the project, evaluating the effectiveness of the process of inquiry undertaken.

All the stages of this research were explicitly detailed in the research design section. How the data was collected and processed was also elaborated in other sections.

The research protocols were reviewed by the ethics committee and data analysis was conducted under close supervision.

3.8.4 Confirmability

The concept of confirmability is the qualitative investigator's comparable concern to objectivity (Shenton, 2004; Guba & Lincoln, 1994). The research work done by the researcher must reflect the thoughts, ideas and experiences of the participants rather than the researcher's own. The researcher has given a detailed account of his positionality in terms of the perspectives of being an emic (insider) and etic (outsider) ethnographer in section 3.4.2 (page 76).

As the researcher had interviewed participants, there was a high risk of the position of the researcher having an effect. Asking leading questions could have directed the participants towards giving a plausible answer that they might have thought would be appreciated by the researcher. The effect of positionality was avoided by having semi-structured interviews with open-ended questions. This allowed the participants to give their own opinion. The personal views of the researcher were expressed in the analysis section.

3.9 Ethical considerations and LJMU Research Ethics Committee approval

Every single research work has an underlying ethical responsibility to the participants, and the way research tools are used over a period. As a concept, research ethics refers to a complex set of values, standards and institutional schemes that help constitute and regulate scientific activity. Ultimately, research ethics is a codification of ethics of science in practice. In other words, it is based on general ethics of science, just as general ethics is based on common sense morality (De nasjonale forskningsetiske komiteer, 2016).

Ethical responsibilities inherent in research are partly associated with standards related to the research process, including relationships between researchers, and partly with respect for the individuals and institutions being studied, including responsibility for the use and dissemination of the research (De nasjonale forskningsetiske komiteer, 2016).

BERA code of ethics (BERA, 2014) recognised research related to education is varied and complex, and the continued pursuit of improved knowledge and understanding of all aspects of education is vital for our democracy and social well-being. For educational researchers, BERA (2014) outlined eight key elements for being ethical to the participants which are: 1) Voluntary informed consent, 2) Openness and discloser, 3) Right to withdraw, 4) Ensuring best interest of children, vulnerable young people and vulnerable adults, 5) Informed use of incentives, 6) Detriment arising from participation in research, 7) Privacy, and 8) Disclosure. BERA has also outlined two key elements for being ethical to the community of educational researchers which are: 1) Avoiding misconduct and 2) Authorship (significant contribution in work) (BERA, 2014).

Liverpool John Moores University (LJMU) outlined the necessity of research ethics as:

> *Research ethics ensures the safety, dignity and rights of research participants whilst providing assurance that research is being conducted within an ethical framework as outlined in LJMU Code of Practice for Research.* (Kelly, 2016)

It is a requirement for any research student to seek ethical approval from LJMU Research Ethics Committee (LJMU REC) if his/her research work involves engagement of human participants in the research activities which can be in the form of completing surveys, being observed, participate in focus groups or give interviews.

LJMU Code of Practice for Research has been adapted from the UK Research Integrity Office Code of Practice for Research, and it outlines important aspects of ethical considerations. Section 2 and Section 3 of the code gave the researcher a set of research principles and standards for researchers. In addition to this guideline, there were two important legal requirements that the researcher needed to follow which are Data Protection Act, 1998 and Mental Capacity Act 2005. While the data protection act was followed to safeguard participant information and handling of the research data, the mental capacity act was followed to recruit appropriate participants for the research. Because Bangladesh was the research location, the researcher was also required to adhere to the legal requirements of Bangladesh to ensure there was no conflict of interest between the ways this research is conducted.

3.9.1 Approval from the Ethics committee

As a mandatory requirement, ethical approval was sought from LJMU REC before conducting the data collection (see Appendix L). Ethical approval for the pilot study was sought on 10th April 2013, which was deferred by REC because the exclusion criteria for people with a learning disability were needed to be further clarified, and more information was required for the location and timing of the participation. Necessary clarifications were added and with the support of further documents, ethical approval was granted by REC on 03rd June 2013.

After the successful completion of the pilot research, the researcher had more knowledge of the researched locations and people regarding the chosen context. Thus, to improve the process major modifications were required in the data collection process, which were:

1) Participants were asked to take photographs of non-living objects.
2) Independent evaluators of the interface will be invited to evaluate the interface of the software using a predetermined template.
3) Modified sample size and inclusion criteria to reflect the research design.

For the participant shot pictures, the researcher suggested that the participants would be guided to take pictures of non-living objects and if they accidentally take a picture of surrounding people that section would be blurred.

A major amendment to the ethical approval was sought on 9th January 2014, and the REC agreed with the researcher's ethical considerations on the 17th January 2014, and full consent was given to conduct the subsequent iterations of the research. Further to this, the researcher was vigilant on the other ethical issues that were required to be taken care of to safeguard research participants throughout this research project. These were a) voluntary participation and informed consent, b) risk of participation, c) benefit of participation, d) confidentiality and privacy. These issues are elaborated below. These are further elaborated in Appendix P.

3.10 CHAPTER SUMMARY

In this chapter, an overall review of the research philosophies was conducted. The complex nature of the research premises was explained and how an interpretivist philosophical stance could help the researcher to understand the studied participants and locations were presented with justification. How the researcher eventually chose a qualitative research methodology and opted for a rapid ethnography and cyclic research informed by participatory action research was detailed. Roles of the researcher within both selected research strategies were presented in detail. Each phase of the research including a profile of the locations, sampling size and research plan are thoroughly evidenced. In the concluding sections, reliability and validity issues are addressed. Ethical considerations were evaluated as per the university guidelines and how the researcher adhered to the university's ethical codes were discussed. In the following chapter a detailed account of the data analysis will be provided where the researcher will explain how data collected from these selected research methods were systematically processed to reach to the research findings.

4. CHAPTER 4: PROCESSING AND ANALYSIS OF THE FIELDWORK DATA

4.1 INTRODUCTION

In the previous chapter, the researcher has set out the research methodology and methods to be used to collect data for the research proceedings. In this chapter, how the collected data from the fieldwork was processed and analysed will be presented in greater details. The data processed and analysed for the content and interface design will be separately presented later in chapter 5. This chapter layout separates each data source of the fieldwork, and the processes are sequentially explained.

4.2 THE RESEARCHER'S ROLE REVISITED

In Chapter 3, the research approach was outlined as a mixture of (rapid) ethnography and (participatory) action research. Through the action research cyclic lens, the magnitude of the studied problem is better explored in depth. In doing this, the ethnographic researcher's role was vital. After all, the overall success of an ethnographic study is dependent upon how much the researcher can immerse himself in the culture being studied such that he can blend his etic (outsider) perspective with the emic (insider) perspective of the society being studied.

Being a Bangladeshi citizen and knowing the basic socio-cultural traits helped the researcher to connect with the participants easily. Also by having an outsider perspective, the researcher could identify the disconnects between what is usually expected and what the locals would do instead. Anokwa et al. (2009) raised a potential concern for researchers with an etic perspective researching a less advanced population as one of his co-authors experienced the following:

> *My collaborator finally took me aside and explained that because I was a woman, and especially because I was a "white" woman, regardless of whether they were actually listening to me, understanding what I was saying, or anything, they would always tell*

me exactly what they thought I wanted to hear (which was generally "yes"). (p. 106)

The researcher acknowledged such possibility but also understood that the questions that will be asked of them should require more than a 'yes/no' answer. Also, such participation bias was largely eliminated as the participants were clearly told, there is no right or wrong way of engagement in this training, and they should participate heartily.

4.3 DATA SOURCES REVISITED

As discussed and introduced in Chapter 3, qualitative data came from two strands – one through fieldwork and another through the content and interface development. In the fieldwork, qualitative data came through interviews (two rounds) and observation logs (also notes related to the first aid demonstration and picture taking activity were merged in the logs). In the content and interface development, data came through expert user's evaluation and general user's evaluation and the design log which tracked all the changes with commentary (further documented in Chapter 5).

Within the two rounds of interviews, one was a photo elicitation based interview where participant own taken images were actively used. Due to the polysemic feature of the images, it emerged as a parallel contributing data source. From six locations, in total 105 individual interview transcripts and 23 photo elicitation based group interview transcripts were generated. Images were found to be a rich in portraying a critical understanding of disaster preparedness and wider aspects of it; this also called for a detailed analysis to assist in revealing the studied population's understanding of disaster awareness which is important in making them better prepared. Images taken by participants from six locations which were in total 384, were considered for further analysis. In total 24 observation logs were produced which included notes related to the first aid demonstration and the picture taking activity of the participants.

4.4 DATA ANALYSIS

In the data analysis stage of qualitative research, the researcher aimed to understand the bigger picture using the collected raw qualitative data. Creswell (2014) asserted that, qualitative data analysis involves processes such as coding, categorising and making sense of the essential meanings of the phenomenon. When a researcher processes the rich descriptive data, common themes begin to emerge. This stage involves total immersion. There are two common ways in which this can be done. First, the 'deductive approach' where a researcher starts with a theoretical base and from that generalised level move towards more specific level by using the collected data from a research work (Denzin, 2009). This 'top-down' approach is associated with the scientific investigation. Opposite to this process is called the 'inductive approach' where a researcher begins by collecting data that is relevant to his or her topic of interest. Once a substantial amount of data has been collected, the researcher would take a step back to have a greater understanding of the data by looking at it holistically (Zhang & Wildemuth, 2009). At this stage, patterns are identified from the data, and a theoretical premise is developed that could explain those patterns. This 'bottom-up' approach starts off with very specific observation and moves towards a theoretical generalisation. The philosophical stance of the researcher was interpretivist which made the inductive approach more suitable for this research as this would allow him to understand, from an ethnographic perspective, how the studied population interprets the chosen context within their socio-cultural environment and how it impacts on the decision-making process.

The data analysis process of the data collected from the field trip had the following stages:

Stage 1: Data preparation and processing

Stage 2: Identifying the coding frameworks

Stage 3: Reduce data using the coding frameworks

Stage 4: Use the frameworks for thematic analysis

4.4.1 Stage 1: Data preparation and processing

The amount of data collection had gradually increased over the duration of the research. The three key data sources required separate management and analysis. While interview and observation logs were of a similar kind (textual), the images taken by the participants were of the different type (visual). These together informed the research outcome.

4.4.1.1 Interview data

Interview data was collected from all six research locations. The researcher was the sole interviewer in the Pilot and MSP-1 stage. In the MSP-2 stage, because of increased participants' additional assistants were required to conduct the interview timely. The assistants were taken through mock interviews so that they understand the context and type of probes that need to be used.

4.4.1.1.1 Duration of the interviews

In the pilot and MSP-1 stage, interviews were conducted by the researcher without any external assistance. Interviews at this stage were around 30 min long which varied with the participants. Some participants would take longer as a few needed to pause in between the interview process. The pace at which Bangla was spoken by the participants was relatively faster than an English conversation. Thus, more questions could have posed by the researcher within the allocated timeframe. The duration of the interviews was further optimised throughout the cyclic process as with each iteration, the researcher, and his assistants (who took part in the final stage of the research) became experts in reducing unnecessary conversations that went beyond the scope of the research. This was done by not encouraging out of scope conversations and prompting the participant with a more contextual question.

4.4.1.1.2 Capturing the Interview data

The interviews were recorded and the professional grade audio recorder was useful as that could cancel background noise quite effectively. However, the audio recording was not always done with the professional recorder; this is because there were times when the interview schedules had overlapped. Alternate recorders included USB audio recorder and the tablet device. In these alternate devices, the audio quality at times was not great because of echo and background noise. Given that, in the post-processing stage, those could be reduced through computer software (Audacity software: http://www.audacityteam.org/ was used in such cases).

In addition to audio recording, a traditional method of using pen and paper was also used to record responses. This was useful as because there were places where there was a scarcity of electricity and use of battery could be uncertain as the battery charge could have finished in the middle of the interview which would cause a disturbance. Use of both methods was also useful as it later provided better clarity and confidence in the quality of the transcription.

4.4.1.1.3 Transcribing interviews

In the post-interview processing stage, there were two elements, the captured audio (in Bangla) and notes (in Bangla) in papers. Because of a large number of interviews, it was not the best way to use the audio clips only as that would make the analysis process complex. Similarly having the notes in Bangla and audio clips in Bangla would make it difficult to process further in NVivo. Also, if the clips were transcribed in Bangla first and then translated into English, the researcher would have an enormous amount of Bangla transcripts to work with which would be an additional complexity. Thus, it was decided to transcribe the interviews in English directly from the audio. This wasn't an impossible task as the researcher could initially do the translation and also there existed many affordable bilingual service providers who professionally translate Bangla to English. Transcription was not

done at one go. It was done slowly, part by part. This process though was simple but it was time-consuming as the researcher, and his overseas transcription assistant in Bangladesh had to listen to the recorded materials in Bangla and transcribe back in English.

4.4.1.1.4 Ensuring accuracy of the translation

Transcription is a change of medium where the verbal expressions made by the participant are transferred into written form. Both mediums are distinctive in nature, and this can create issues of losing elements such as the intonation, the pace and speed at which answers were given, the pauses and the emotional outbursts, the sudden hesitation and so on. These unique features of spoken language can reveal important clues to the ethnographic researcher and losing these is an obvious danger in the transcription. Another potential risk was the de-contextualization of the content. When translations are made, bits of information are taken at once and transferred in words. Translation of a longer narrative of an event or a long answer meant there was a risk of losing out on the primary focus of the larger conversation in general. It was of greater importance to the researcher to be aware of these pitfalls during the transcription stage.

In the pilot stage, there were three participants, and six interviews were conducted by the researcher without external assistance with transcription. In the MSP-1 stage, the interview data was also transcribed by the researcher. The complexity of the research was increased in the MSP-2 stage where the participant numbers increased significantly. Three external professional translators were engaged alongside the researcher to complete the transcription process.

In total four translators (including the researcher) were utilised to get the interviews transcribed. The initial plan was to check 10% of the translated copies to find out whether the translators were accurately transcribing. Especial consideration was to ensure the core findings are not lost in the verbatim translation process. This could be identified through the choice of words by the

participants and the tone and emotions attached to their spoken language. As Bangla is a rich language, there are many synonyms for common words and at times the choice of the translators' words had impacted on the overall meaning of the sentences. This issue was identified once the transcripts were put through the NVivo software. Upon identification of this issue, each of the transcripts was closely checked at least once to make corrective changes to ensure the right mode and tone of the participants were preserved. This was a time taking activity as various checks (transcription and audio matching, keyword search in the text) were required to be put in place to ensure the English translations are representative of the Bangla counterpart.

4.4.1.1.5 Processing of interview data for NVivo

To work with NVivo; first, the researcher had to create a *Project* to hold the project data. In the NVivo project, the researcher could create and explore documents and nodes, for this the data required to be appropriately formatted. In the interview transcripts, first few lines were reserved for participant's information; subsequent sections were divided by 'Heading 1' and 'Heading 2' formatting. The former being used for the interviewer and the later for the interviewee's response. This formatting allowed NVivo to automatically process and store the interview information. In NVivo, both document and node browsers have an *Attribute* feature, which helped the researcher to refer the characteristics of the data such as age, gender, literacy status, technological literacy, etc.

Transcripts of interview data and observation logs (explained in section 4.3 of this chapter) were saved as individual documents in NVivo. Audio clips were *Hyperlinked* to the associated interview transcript this allowed the researcher to capture conceptual links which were observed during the analysis. With a click on the hyperlink, the researcher could easily reach to the source for further reading or listening.

NVivo was prone to failure. The researcher initially had processed all the audio and the transcriptions, but the file got corrupted because of the large file size. The researcher had to start from scratch to repopulate the whole structure of data organisation. There were quite a few scenarios where the programme would crash and lead to loss of data. The researcher later became cautious and saved the project file every five minutes while working in NVivo. Data collected from 'Main study- phase 1' and 'Main study- phase 2' were processed together using the same formatting method, and newer versions of NVivo, NVivo 10 (2014 version) and NVivo 11 (2015 version) was used to organise the interview transcriptions.

4.4.1.2 Visual data: participant captured images

The visual data was collected at the later stage of the training. This was important as through the visual imagery an understanding of the participant's way of illustrating disaster awareness could be captured. Use of visual data produced by the participants, in the research was challenging; partly because visual data were not initially (in the pilot stage) planned and it was more of an experimental addition in the Main Study Phase 1. The rationale behind inclusion of this process was to take the training further beyond the interface and the device by better utilising the device. Eventually it assisted in discovering the participants' special understanding of potential hazards during a disaster (further elaborated in the Findings Chapter).

In a few cases, participants captured human beings, and it wasn't quite clear whether a prior permission was taken from the subject. In such cases, only those images were used where the participant had ensured a prior permission was taken. In cases where there was doubt, the face was blurred. Before giving tablets to the participants, the image number of the last image on the device was noted, and upon retrieval of the device from one participant again the last number of the image was noted alongside the participant identifier (i.e. P1, P2, etc.). This ensured the images were rightly processed at a later stage. Images were later renamed with the Location, Participant name and the image number.

4.4.1.2.1 Processing of the visual data using Pixa

Originally it was planned to use NVivo for the visual data processing. However, after processing all the images through NVivo, there were several issues as NVivo programme crashed at times during the data processing stage cause loss of organised data. For safety concerns, an alternative option was sought.

Pixa (http://www.pixa-app.com/) was found to be dependable as it had its own backup system and images could be organised as per their common attributes (date of shot, time of the shot, major colours found in the images, etc.). This enabled the researcher to organise the data as per the locations. Images could be tagged and grouped as per a chosen code or category (both interpretation of the photographed content and outer context of the content) which was required for the data analysis stage. All the images had location and participant information tagged with them which made it easy to identify the contextual information of the images.

4.4.1.3 Observation data

Observation logs were completed for each location for each training day by the researcher. Field notes were also merged with the processed observation logs. Field notes at times were scribed in Bangla which was later translated into English. In the observation logs, date, time and critical incidents were logged. In the draft documents, participant names were used but when the logs were finalised all the names were removed with just the participant code P1, P2, etc. Each location had separate observation logs. This process is further elaborated in the next chapter. Observation logs had information of the location, time, and identification of the group of people who were observed. Observation logs were also processed in NVivo for data analysis purposes. The processing system was identical to interview data processing for NVivo hence it is not elaborated here.

4.4.2 Stage 2: Identification of the coding frameworks

There were two coding frameworks used in this stage. Interview and observation logs were textual, and identical framework worked for both. Visual data, on the contrary, was of a different kind and required a different framework to work with which could enable better data extraction, processing and interpretation.

4.4.2.1 Coding framework for the textual data:

Once the interview transcriptions and observation logs were processed in NVivo, it enabled the researcher to look for common words. NVivo assisted to have all the data in one location in an organised format. Navigation through the NVivo system was much quicker.

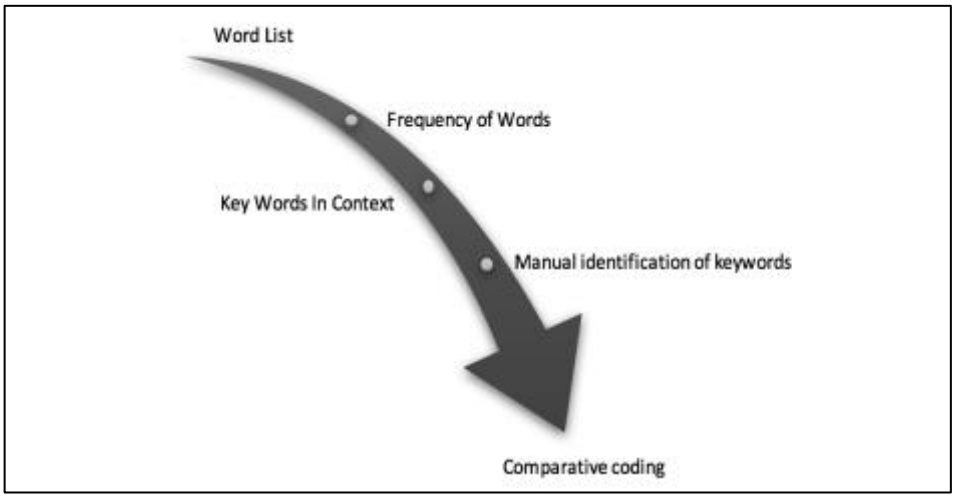

Figure 3: The flowchart of processing data from interview transcriptions and observation logs

Initially, it was useful to have a generic idea of the words that frequently appeared in the interviews or the observation logs. These both data sets were separately processed as the number of transcripts was significantly higher than the number of observation logs; however, the importance of the observation logs was no less than that of the interview transcripts.

4.4.2.2 Coding framework for the visual data:

Though Stage 1a was quite identical to the interview and observation log processing framework, what made it different was the researcher's own coding of the images and comparison of codes generated in Stage 1a and Stage 1b (see Figure 4, page 126).

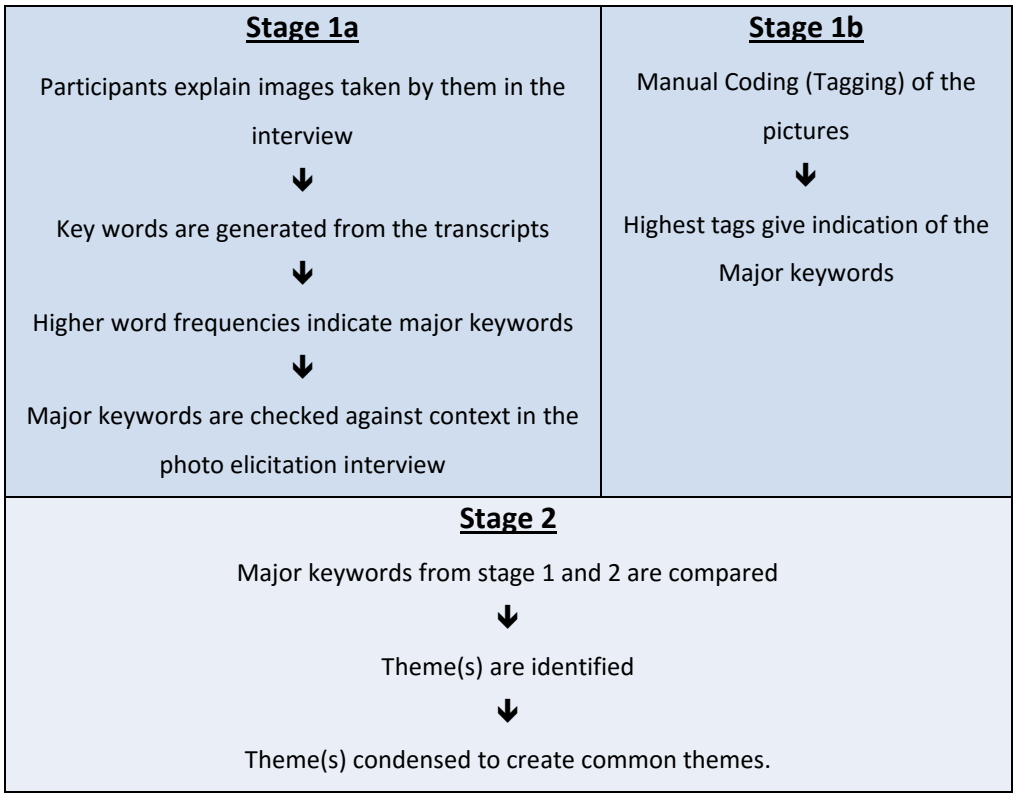

Figure 4: Coding Framework for the visual data.

4.4.3 Stage 3: reduce data using the 'Coding' frameworks

> *Coding is the process of disassembling and reassembling the data. Data are disassembled when they have broken apart into lines, paragraphs or sections. These fragments are then rearranged, through coding. (Ezzy, 2002)*

Informed by Creswell (2014), Saldaña (2015) and Cohen et al. (2013) the researcher had gone through all the text-based data (interview transcripts, field notes,

observation logs) in a systematic way to identify keywords, ideas, phrases or concepts that represented the researched locations.

4.4.3.1 Coding of textual data including photo elicitation interview using NVivo

To assist in this systematic coding, two types of coding techniques were used for the textual data collected in this research:

a) Word Lists and Key Words in Context (KWIC)
b) Comparative coding

These are explained in greater details in the sections below.

a) Word Lists and Key Words in Context (KWIC)

Following Ryan & Bernard's (2003) suggested 'Word Lists and Key Words in Context (KWIC)' technique to quickly process the collected data, NVivo's 'Autocode' was used to generate a list of frequently used words. Interestingly, there were many synonyms to common words and choice of the translator's words had a bigger impact when the transcripts were deconstructed by NVivo's 'Auto code' in generating a frequency of words.

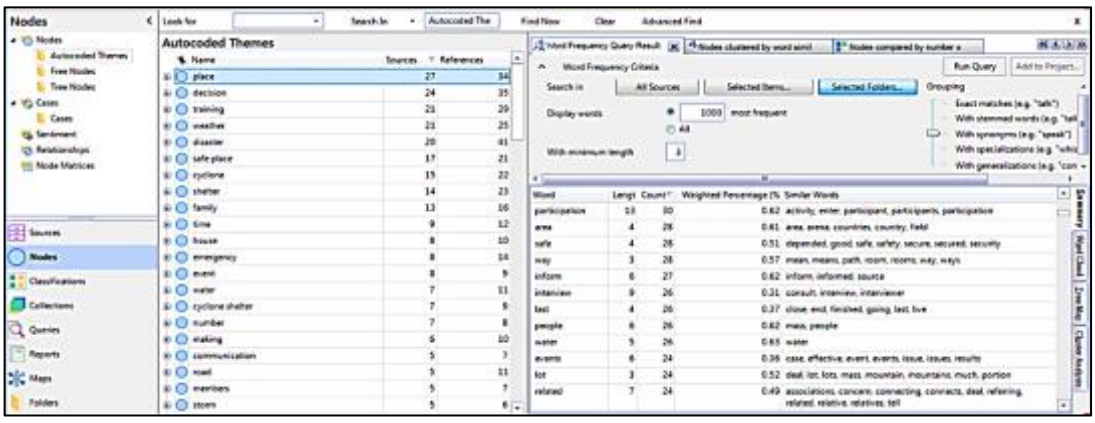

Figure 5: A screenshot of the NVivo Word Frequency and word similarity check of the collected data from a research location

After processing the interview transcripts through NVivo, it generated 100s of words in the word list, many of which were almost synonymous, further processing

was required to find out the most common ones. After grouping the similar words, the next step was to identify the words in their context. Words with higher frequency were most likely to be the keywords. However, the researcher was concerned that, deconstructed words could be less representative of the original context. To reduce such chances, the researcher used the KWIC technique. The researcher first identified codes with most entries and then systematically searched the text to find all instances of each keyword or phrase. On each matched occasion the context in which the word was used was noted. An ethnographic emic (insider) perspective was useful in classifications such as this.

Furthermore, it was found that some of the codes made more sense if they were considered alongside the researcher's observation. Similarly, some of the less frequent words were identified as emergent codes. In the subsequent iteration, this process was repeated. Printed codes, Microsoft Word and NVivo were used to process and record the codes. In tabular format, they were categorised with the research questions (presented in section 4.4.3.2 and Appendix J).

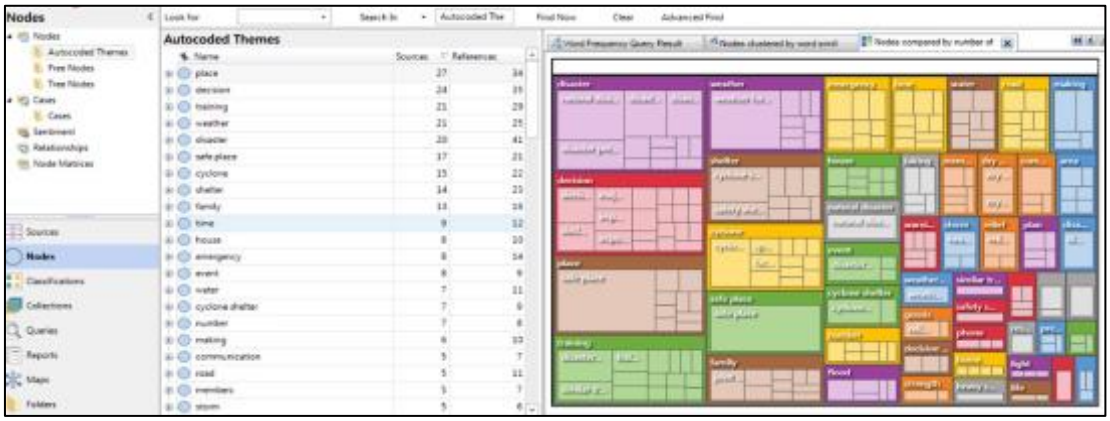

Figure 6: A screenshot of the NVivo Autocode processed data of a research location

This coding process was followed in this research using both NVivo and manual coding. The codes were saved within the NVivo database as nodes. Nodes that were created in NVivo were similar to physical sticky notes that the researcher places on the document to indicate that a particular topic belongs to a certain theme. Unlike physical sticky notes, the nodes in NVivo were easily organised and could be

searched through the NVivo interface. This allowed the researcher to easily navigate through the codes and as required change or modify the nodes.

Figure 7: A screenshot of the NVivo processed 'Decision' node compared by number of coding references

As the research traversed in various locations with a considerable contrast in socio-cultural characteristics, common threads were looked for and later identified that connected the way people of the chosen locations either demonstrated similarity or dissimilarity in the ways they understood and interpreted disaster preparedness and acquired disaster preparedness skills from the training.

b) Comparative coding

This research was conducted in three phases, and data was collected from fieldwork on all three occasions. The researcher was cautious as Preissle, Lecompte & Goetz (1981) noted that choice of analytical techniques is crucial when there are multiple research sites. As the context remained same, codes generated from one phase could be compared to another data set collected in another phase. Cohen et al. (2013) outlined the process of this 'constant comparison' which was followed to compare the codes across the phases with an intention to achieve consistent representative codes leading to themes generation.

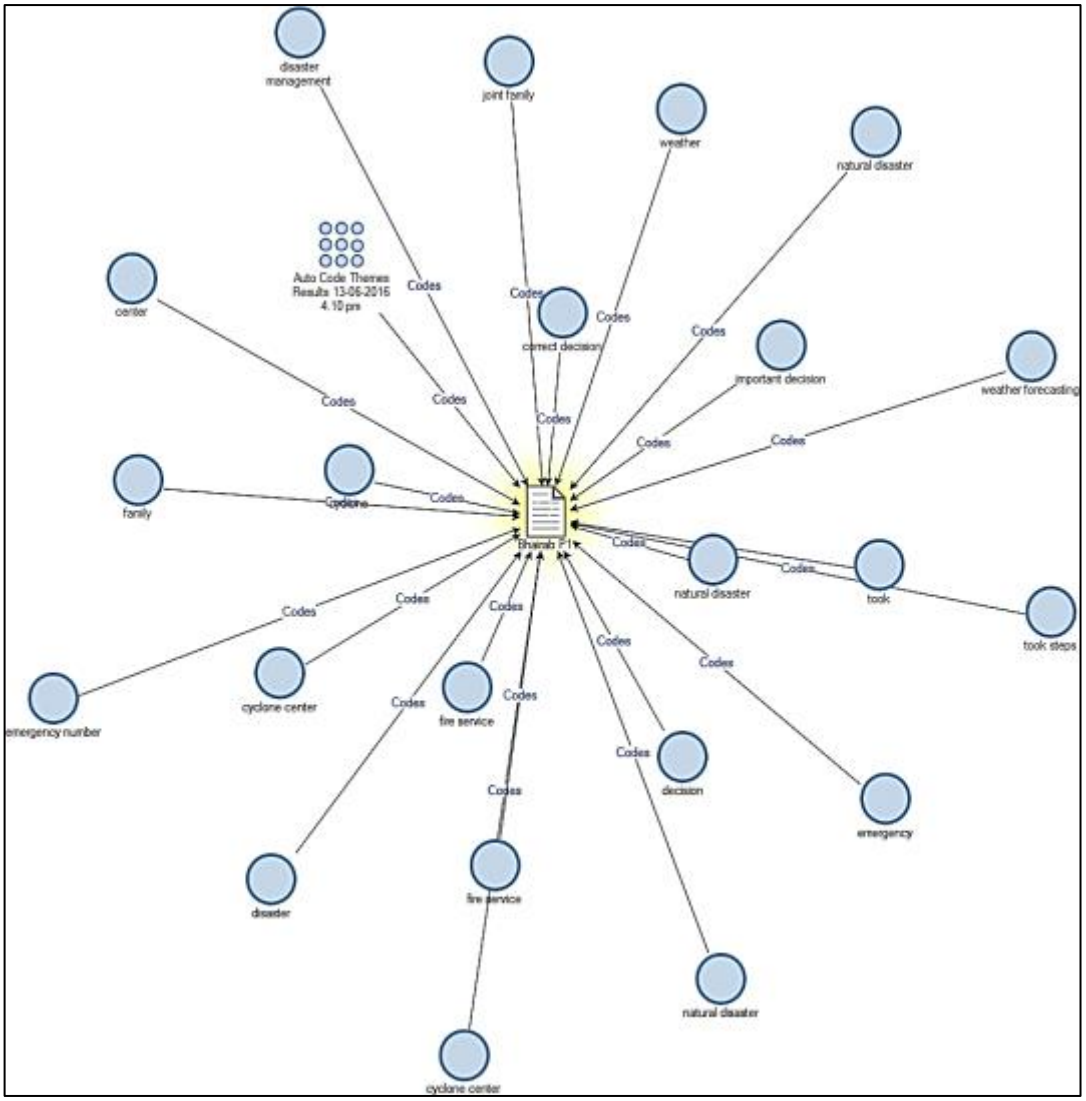

Figure 8: Nodes generated from a participant's interview transcript

The researcher used open, axial and selective coding as suggested by Böhm (2004) to assist in developing themes and conduct the thematic analysis. Table 5 of page 135-136 lists how those codes contributed in answering the research questions.

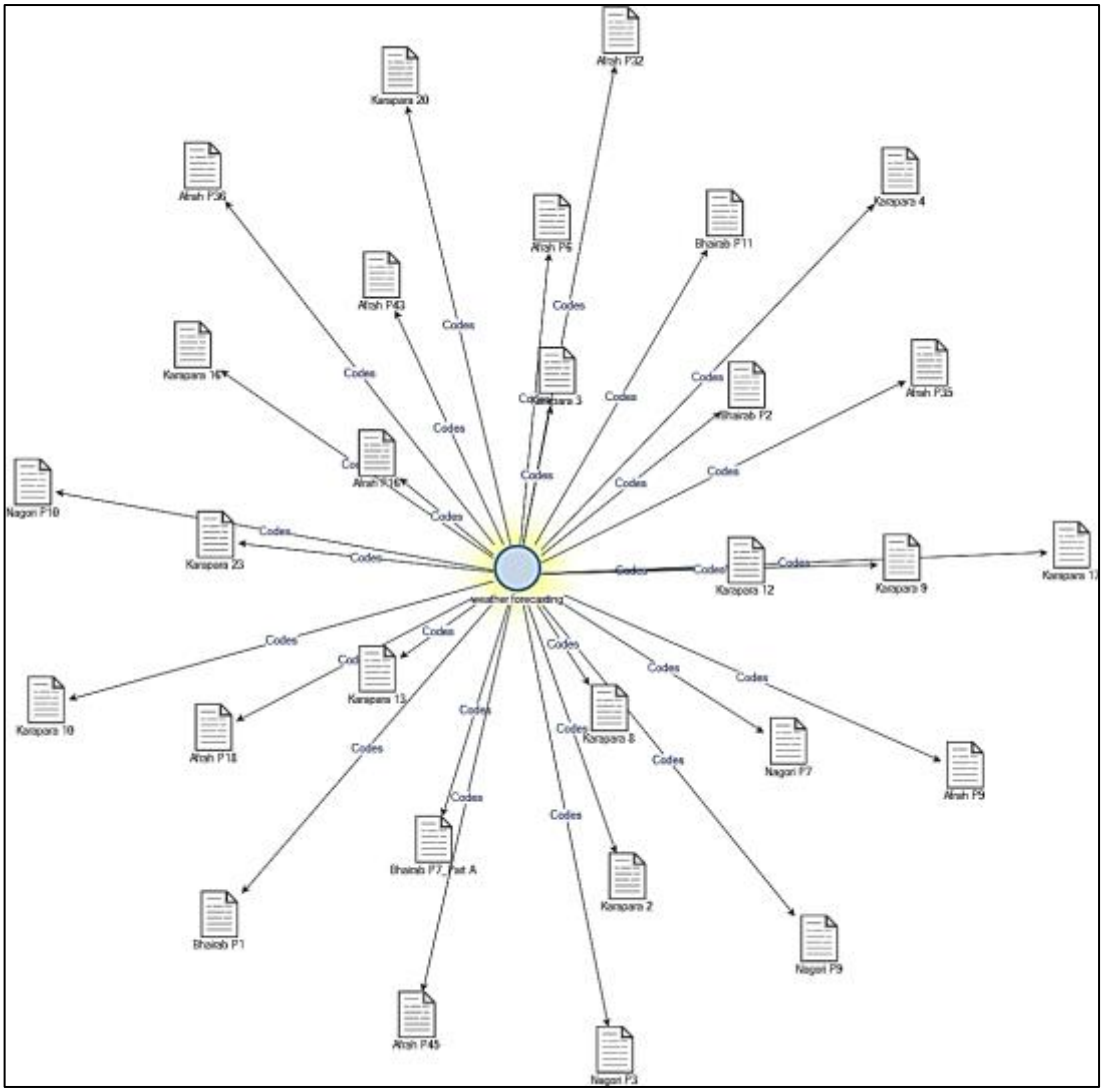

Figure 9: Connections found for comparison across the interview transcripts using a single node 'Weather Forecasting'.

In the main study phases, codes from the past phase(s) were compared with the existing codes to understand connections between them and also if there was dissimilarity they were added as separate codes. The comparative cycle of matching old codes with new data was repeated several times before it reached saturation.

4.4.3.2 Coding of visual data using Pixa

The photo elicitation interview was processed using NVivo which gave an indication of the major keywords. However, as the visual data was richer in conveying a message beyond the verbal words, there was a prominent need to have a secondary lens to see it through the eyes of the ethnographic researcher.

Hatten, Forin & Adams (2013) argued that, in a photo elicitation interview, analysis occurs during the actual interview as participants and researchers engage in discussion of the photos. Hatten et al. (2013, p. 5) explained

> *What might seem clear to the researcher (e.g., a photo of a boy standing on a sidewalk) can be much more nuanced for the participant (e.g., the boy is their best friend who moved away, with the photo representing the participant's loneliness).*

Informed by this, to add an additional lens, a secondary manual tagging (coding) technique independent of the participant's justification of the images was used for the visual data collected in this research. Pixa allowed all images to be manually tagged and later on images with similar tags could be grouped for further probing.

Most common 33 tags are presented in the following page.

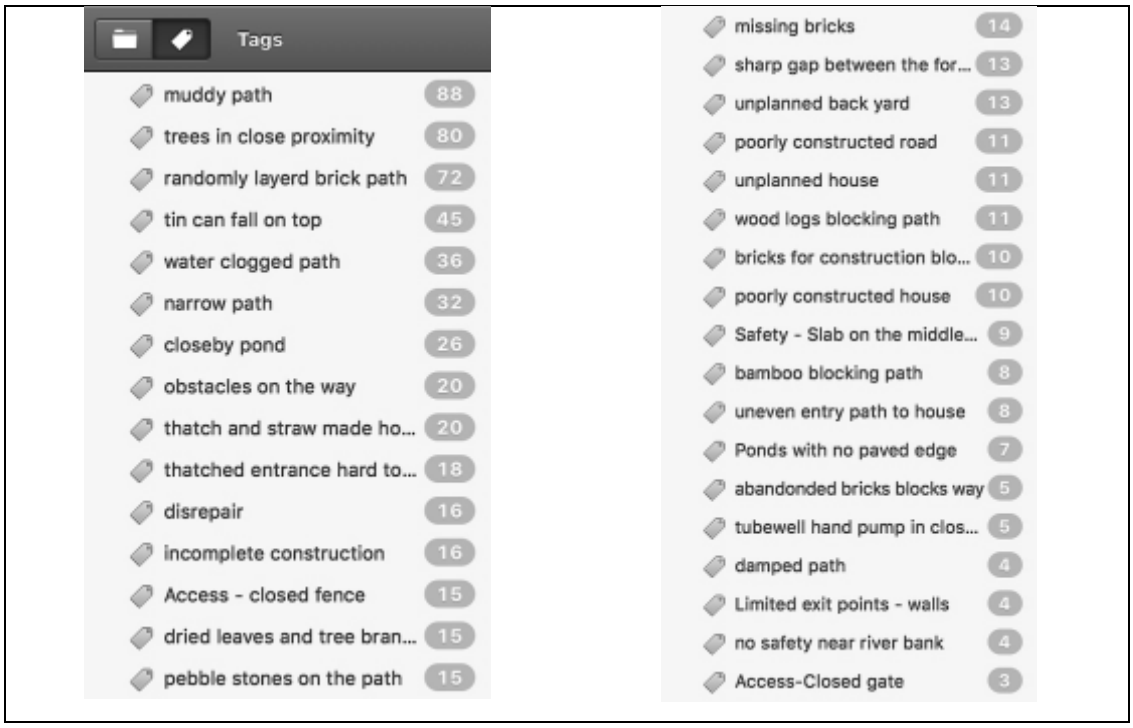

Figure 10: Most Common Manual Tags in Pixa

Higher counts here indicate that this issue is present in the majority of the research locations. Some keywords though were different in nature but depicted similar issue. For instance, 'closed fence' tag is closely related to 'limited exit points – walls', though one might have been found in a village area and other in closer to town area, they depict one issue of faster exit towards safety. These tags and codes thus were further consolidated alongside the textual codes.

4.4.3.3 Finalised codes from the data sources:

Before the researcher presents the codes, it is important to acknowledge that, these codes and generating sources are intertwined across the research questions. Not all the codes for each research question are disconnected and the categorisation attempted here was just a way of navigating through the collected data and reduce it. Some codes found in one research question might have contributed more towards another research question at the later stage of the data analysis.

Table 5: The codes that informed RQ1- 'How can technology be used in rural areas to teach disaster preparedness using a tablet device?'

Data Source	**Open coding**	**Axial Coding**	**Selective Coding/ Themes**
Interview & Literature Review	Learning to use computer is difficult	Physical awkwardness	Reducing awkwardness to enable participation
Interview/ Observation	No or less use of foreign language in the tablet device	Mental awkwardness	
Interview & Literature Review	Learning computer involves learning to use keyboard, mouse and the interface		
Observation	Mental pressure of		

	encountering a new device		
Observation	Worrying if anything goes wrong when using the device		Reducing worries with what-if
Observation	Using tablet device is easy and intuitive	User friendliness	Reducing psychological barriers to participation
Observation	Assistance from facilitators	Teaching function	Supportive supervision
Observation	Guidance provided during interventions		
Interview & Observation	Peer support in interpreting scenarios and contexts	Role of peer support	Peer support than peer pressure
Interview & Observation	Peer support in encouraging participation through discussions and tasks		
Observation	Having respect for all participants		The role of respect in participation
Observation	Ensuring the device is available and accessible	Inclusion	Access to the device

Rest of the codes for other research questions are placed in Appendix J.

4.4.4 Stage 4: use the frameworks for thematic analysis

The ethnographic data that was collected in different phases took an action research shape. The methodological underpinning clearly guided the researcher to avoid generalisation of the data to generate theories but focus to generating rich themes from the codes. The researcher opted for the 'Thematic analysis' which Braun & Clarke (2006) argue is an analytic method on its own right. As a flexible research tool, thematic analysis can provide a complex account of data.

Ryan & Bernard (2003) had put importance on discovering themes as the basis for any research analysis dealing with social aspects. Themes were generated from the data through an inductive process and the researcher's prior understanding of the research context assisted in this process. From an ethnographic perspective, some of the themes were anticipated by the researcher however there were also themes that were culturally rooted, symbolic or unique. The majority of the themes were generated by using an inductive process from the collected empirical data. The researcher also found as argued by Dey (1993) that all the themes cannot be anticipated before analysing the data. Once all the themes were worked out, the final analysis stage began that would encompass the findings from the data sources to construct a coherent story of the data by using the themes.

Informed by the literature and following the coding process below themes and sub-themes were generated:

a) Findings from the interviews

Theme 1: Concepts of disaster awareness and disaster preparedness.

Sub-themes:

1. Current inadequate state of education and training on disaster preparedness
2. Subjective perception of disaster – what is a disaster to them?
3. Subjective perception of safety - what is safety to them? Is the shelter safe?

4. Moving out/Moving in- how easy is to leave everything behind?
5. Awareness that doesn't lead to action

Theme 2: Socio-Cultural traits are shaping awareness and decision-making process.

Sub-themes:

1. Gender dynamics in regards to education, awareness and safety
2. The role of family members in decision making– who does what and why?
3. Religious beliefs – do they have a role to play?
4. Proactive than reactive- wait for something to happen
5. Literacy and voice- is there any indication of how the literate members behave and make decisions. Do the illiterate or less literate have less voice?

b) Findings from the participant captured images

Theme: Geographical Characteristics of Disaster Preparedness

Subthemes:

1. Location of the house
2. The build of the house.
3. Communication channels
4. Unplanned surroundings
5. Where is safety ensured (Location)

c) Findings from the observation logs

Theme 1: Socio-cultural aspects of participation

1. Participation dynamics
2. The role of respect in participation

Theme 2: Reducing physical barriers

1. Access to the device

Theme 3: Removing psychological barriers

1. Reduce time to learn to use the device
2. Reducing awkwardness
3. Illusive literacy
4. Reducing worries with what-if
5. Peer support than peer pressure
6. Supportive supervision

Above themes inform and frame the answers to the research questions which is further detailed in the final chapter of this thesis.

4.5 CHAPTER SUMMARY

In this chapter, stages in the data analysis were thoroughly discussed. Following the four-stage data analysis, themes relevant to the research questions were generated. From using NVivo to manual coding techniques were elaborated in this chapter. Codes generated from the data are also presented in the tabular form. In the following two chapters, major findings from the research will be presented using data extracts from the major data sources of this research.

5. CHAPTER 5: EVALUATIVE CONTENT SELECTION AND INTERFACE DESIGN

5.1 INTRODUCTION

This chapter is dedicated to the evaluative content selection and interface design aspect of the research work. In the previous chapter, the researcher has given a detailed account of the data analysis of the data collected from the cyclic field works. Purposefully the data sources related to the content selection and interface design was not presented in the previous chapter as these data sources were not primarily field work oriented but were a continuous process that went on in the background and were mostly conducted offsite. User interface (UI) design is more common in the human-computer interaction (HCI) discipline where the focus is on improving the way users communicate with computers. UI design eventually became an integral part of this research, as without having a usable interface the whole tablet-based training programme would fall apart or make no sense to the participants. Similarly, the content design had to be consistent with the socio-cultural values of the research approach as well as having a depth so that elements learnt through this research would be useful to the participants.

In this chapter, findings from the data sources concerning the content and interface design of the research work will also be presented. The findings will be directly informing Research Question (RQ) two which is:

RQ2: How content can be designed for the tablet device to teach a mixed group of learners?

5.2 CONTENT SELECTION FOR THE INTERFACE

It was noted in section 2.4.2 of the literature review chapter that literacy rate in the rural areas of Bangladesh is poor and section 2.4.1 indicated that the current education system in Bangladesh does not sufficiently prepare people to be aware of the disasters and to be prepared to face them. These considerations had larger

roles to play to ensure the constructed content is not overly complicated, complex and worst of all, meaningless to a common person.

The researcher acknowledged the conscious use of English especially in operating mobile phones by the less literate people (Ahmed et al., 2015; Medhi et al., 2011). However, informed by the growing concerns raised by Selwyn (2013) and Toyoma (2015), the researcher was critical in considering such common but isolated trial and error use of English as the primary or even as a secondary language in the interface as the impact of such use is seldom thought through and the associated ethical and cognitive impact are not actively considered by the content and interface designers.

Bangladesh has been combatting gender inequality in the last decade through several government sponsored campaigns, and various initiatives which were also taken by the private and not for profit sectors to improve the current imbalance. Despite these initiatives achieving a near equal status remains a distant prospect (Khan, 2008). The society still largely dictates the roles and responsibilities of a male and a female member of the family. Sometimes it is explicitly spoken, sometimes it is symbolically expressed. Inclusivity of content is important to provide an equal focus to both men and women. The researcher was required to be careful to not send any sort of demeaning message to any gender group.

It was also expected that there would be a good number of participants who might not have any formal education. Though not formally educated they were expected to have a wealth of experiential knowledge, and within the design process, the researcher explored ways to enable them to use their experiences. While illiteracy is an obvious issue, the barrier created by the lack of awareness of disaster preparedness is also complicated to break through. If the content was complex, then the participants wouldn't pay much attention. If it was too simple, they might not feel the need to have this specific training. Thus, in the design process, several evaluative stages were planned and implemented (detailed later in this chapter) to ensure those identified limitations were not repeated in this research.

In the Bangladesh education system, the success of learning is measured by the recall of information, mostly in an examination setting. Disaster preparedness skills are 'skills for life', and this requires certain actions and not just information recall. For the training to raise awareness, it must be able to reach out to the participants and make them understand the topic comprehensively. For example, there is a clear difference between knowing one should have an emergency plan and actually constructing an emergency plan which is shared with family members. One way of achieving this was to blindly follow the traditional curriculum of disaster preparedness[8] designed for field specialists which would make the course overly complicated. However a 'backwards' approach to design (Clayton, 2011; Wiggins and McTighe, 2008, 2011) was considered which would first acknowledge what skills participants should attain that can make them safer and then place topics related to attainment of these identified key skills at the centre of the curriculum with the teaching methods and assessment tools designed to support knowledge constructive process.

5.3 CYCLIC DEVELOPMENT OF THE CONTENT

During the pilot stage a wide range of contents was reviewed which included – a) disaster preparedness related content available in the national curriculum, b) national and international NGO developed contents and c) various international agency developed contents on disaster preparedness. During the pilot study content selection stage, a range of topics was chosen from the above which had a local need. Feedback received from this stage was fed into the next cycle of the content design. The content was created for five key areas: understanding disaster, ensuring safety in disasters, understanding health and safety issues, understand roles of family members, recognise the role of technology and community in disaster preparedness. The programme specification of the pilot stage was the following:

[8] There exist higher level courses on disaster preparedness for government officials.

Table 6: Training programme specification for the pilot study

Day	Learning Outcomes (LO)	Learner's Evidence Shows
1	LO1: Understanding disaster	1.1 Elementary knowledge of disaster. Defining disaster.
		1.2 Knowledge of risk profile of Bangladesh.
		1.3 Knowledge of reoccurring disasters in Bangladesh.
2	LO2: Ensuring safety in disasters	2.1 Awareness of pre-Disaster safety measures.
		2.2 Understanding of signs of selected disasters for the locality.
		2.3 Ensuring safety when plans go wrong.
3	LO3: Understanding health and safety issues	3.1 Knowledge of Health and safety issues to be considered.
		3.2 Safety for vulnerable people in the family.
		3.3 Formulation of a safety plan for family (where to meet, where to take shelter).
4	LO4: Understand roles of family members	4.1 Understanding importance of collective effort.
		4.2 Understanding role of different family members in a disaster situation.
		4.3 Importance of awareness for disaster events in the family.
5	LO5: Recognise the role of technology and community in disaster preparedness	5.1 Understand the role of present technologies in ensuring safety.
		5.2 Knowledge of a range of assistances from different organisations in disaster preparedness.

As identified in the literature review enabling learning based on past experiences would be important to make an informed judgement on content selection. While an array of topics was presented in the pilot study feedback was taken to see how it was seen by the participants. Participants were happy with the content selection but wanted to watch more video clips, which would put the contexts in perspectives. Those who had experienced disasters in the past could easily link their experiences with the topics. They also identified that topics like 'knowledge of recurring disasters', 'importance of the collective effort' were less interesting. The participants wanted more first hand activities.

The 'Role of technologies' topic was found to be too broad and 'Assistance given by various organisations' led to discussions in which participants were diverted to talk about other issues such as the 'quality' of the relief goods and other concerns including mismanagement of the relief goods which was not a focus of this research. Informed by the pilot study, changes were made in the second iteration to get the participant's to be more engaged in various activities related to disaster awareness. The programme specification of the MSP-1 stage was the following:

Table 7: Training Programme Specification for the Main Study Phase 1

Training Day	**Learning Outcomes (LO) The learner will:**	**Assessment Criteria The learner can:**
1	LO1: Know Importance of disaster awareness and be able to produce a family emergency plan.	1.1 Identify how they can be better aware and ready for disaster events.
		1.2 Review and assess cyclone preparedness strategies.
		1.3 Review and assess flood preparedness strategies.
2		1.4 Develop an overarching family emergency plan which clearly distributes tasks to each family member and includes thoughts on ensuring safety for vulnerable people in the family.
3	LO2: Be able to demonstrate basic first aid skills.	2.1 Demonstrate how to stop bleeding.
		2.2 Demonstrate how to conduct resuscitation.
4	LO3: Be able to create an emergency kit	3.1 Understand and assess elements that should go in an emergency kit.
		3.2 Create an emergency kit.

In this phase, the focus was more towards bringing the participants experiential knowledge forward and then to build from that, so that it became more connected to their needs. Topics such as cyclone, and flood preparedness strategies, allowed the participants to discuss and find out how they could improve their current habits. Creating an emergency plan for the family allowed them to bring all the required information in one place. To further strengthen their understanding a basic first aid training was included which showed them several ways to stop cuts and bleed in different parts of the body. Considering that there were numerous cases of death during floods due to not knowing how to swim each year, CPR activity was included. Interestingly participants were reluctant to participate in this activity. So, in the MSP-2 contents were again revised to reflect the findings from the fieldwork. Demonstration of CPR was replaced with several animated clips of the stages of giving a CPR. Other than that, the roles of various family members in disaster awareness were explained separately. The programme specification of the MSP-2 stage was the following:

Table 8: Training Programme Specification for the Main Study Phase 2

Training Day	Session	Learning Outcomes (LO) The learner will:	Assessment Criteria The learner can:
1	1	LO1: Understand the importance of disaster awareness	1.1 Understand why we should be proactive than reactive to disasters
			1.2 Explore the notion of safety. What is being safe during a disaster event?
			1.3 Review and assess cyclone preparedness strategies.
			1.4 Review and assess flood preparedness strategies.
	2	LO2: Be able **to** produce a family emergency plan.	2.1 Understand the role of individuals within the family in disaster preparedness & how to coordinate with others during an event.
			2.2 Develop an overarching family emergency plan which clearly distributes tasks to each family member and includes thoughts on ensuring safety for vulnerable people in the family.
2	1	LO3: Be able to demonstrate basic first aid skills.	3.1 Understand the need for knowing First Aid.
			3.2 Demonstrate how to stop bleeding.
			3.3 Understand how to give CPR.
	2	LO4: Be able to create an emergency kit	4.1 Assess things to include in an emergency kit.
			4.2 Create an emergency kit.

5.4 INTERFACE DESIGN FOR THE CONTENT

Dennis, Wixom & Roth (2012) defined interface design as the process of defining how the system will interact with external entities. In this research, the interface was defined as an interaction layer between the system and the external entities. The system refers to the tablet device and external entity and user refers to the participants and the various evaluators. Within the design, various ways in which the user gives inputs to the system via the interface and how the system responds to the inputs to give an understandable output to the interface was considered.

Dennis et al. (2012) stated there are three fundamental parts of a user interface which are: navigation mechanism, input mechanism and an output mechanism. The navigation mechanism is through which the users makes their way around the content presented using the interface (buttons, menu bars, interactive menus, etc.) The input mechanism is through which the system captures information (layers,

forms, etc.) and the output mechanism is the final part where the system will feedback to the users. Even though there are conceptual differences these parts are all are intertwined to some extent. Cortes (1997, Section 1) argued that in a world where the users are growingly non-experts, 'a good programme' is one that 'not only works but is easy to learn' and 'a great program' is one that 'works and is so user-friendly it does not even need to be learned!'.

What Cortes outlined at 1997 remains 20 years later quite the same. When the target group includes semi or less literate and even illiterate participants, the interface indeed needed to be so fluid that there would be very little new to be learned about making the interface work. We have seen some intuitive and innovative interface designs from Medhi et al. (2006) which were discussed in detail in section 2.5 of Chapter 2. The aim of Medhi's various takes on interface design for semi-literate or illiterate user groups in India gave insights into various design aspects of the interface. The following sections are devoted to the interface design side of this research.

5.4.1 Planning the platform

It was understood in the early stages of the research that tablet devices would be used for the dissemination of the content. Thus, it was important to consider the best possible selection that would fit the interface development requirement. At the start of the research, in 2012, three major tablet devices were available iOS based, Android-based and QNX (Blackberry Tablet OS). As QNX had very limited support for developers and had a small number of applications, it was not fit for purpose. Android and iOS based systems both had supportive ecosystem and plentiful applications to work with; many of which were useful to create learning materials or training courses.

The training programme required the table to have multimedia capabilities (such as- the ability to play videos at high resolution) and support for other languages. In

native applications, although Bangla could be used they would still have some form of English language attached to them in the form of menu or navigation buttons. Also, what was more of a major issue was that not all the Bangla Alphabets were supported by the major iOS and Android application design platforms for non-coders (www.appsgeyser.com, www.appypie.com, www.appyet.com, ibuildapp.com and www.mobincube.com), coding from scratch was not tried as that would have taken significant time to get the interface created. Another alternative could have been the creation of a web-based application. Even though the chosen devices would most likely have internet connection options but as internet connectivity is not widespread in Bangladesh and also the speed of internet connection is only decent in the main cities it was not a suitable choice for the targeted locations.

As creating a native iOS or android application was not feasible, the focus was shifted to using a 3rd party software to create customised content. After initial checks three probable options were found:

1. iSpring from http://www.ispringsolutions.com/
2. Adobe Captivate from http://www.adobe.com/uk/products/captivate.html and,
3. Articulate Storyline from https://www.articulate.com/

Of the above three, 'Articulate Storyline' provided an easily understandable and customisable interface. 'Articulate Storyline' also came with a free native iOS application 'Articulate player' which could download storyline content to the device for offline navigation. Also, using 'Articulate Storyline' content could be customised to be used in Android based tablets. There were negligible issues with using Bangla to design the content. Hence, 'Articulate Storyline' was selected to create the content. Though in 2012, the platform did not have an application for Android powered tablets, in 2015 the software developers released 'Articulate player' for the Android platform which enabled the researcher to use the same content on an Android powered tablet.

5.4.2 Principles for the User Interface (UI) design

As identified in the literature review chapter, one of the major benefits of using a tablet is that it is a multimedia device. Content can be created by using a mixture of written texts, audio and video clips. Since the internet speed was slow for multimedia streaming, having high-quality video clips would eventually end up wasting training time as it would take a long time to buffer the video or even the audio clip. A population with a low literacy rate also meant ideally the slides should not be predominantly written text. In addition to these considerations, it was essential that the entire content and its representation was simple and easily understandable.

Dennis et al. (2012) analysed various dilemmas of user interface (UI) design and listed six key principles of the design that would make the interface look interesting yet simple to use and also reduce unnecessary interactions of users with the UI. These six principles are appropriate for this research too. These principles are:

1. Layout
2. Content awareness
3. Aesthetics
4. User experience
5. Consistency
6. Minimise user effort

These are elaborated below:

5.4.2.1 (Interface) Layout

Layout refers to the screen area which is organised in certain ways consistently throughout the user interface. The screen or the active window can be partitioned into smaller sections to provide users with navigational options, to display content and to provide active feedback on the user action. Consistency in screen layout is necessary to make the UI visually appealing to the prospective users.

The screen size of the main tablet devices is either 7'' or 10''. To maximise the screen space, a 'Landscape' mode was preferred for the layout. The screen was divided into three segments. The top segment would state the currently studied topic. Middle segment held a large part of the screen and was used to display key information, multimedia content, discussions and activities. A typical screen layout of the interface is presented below:

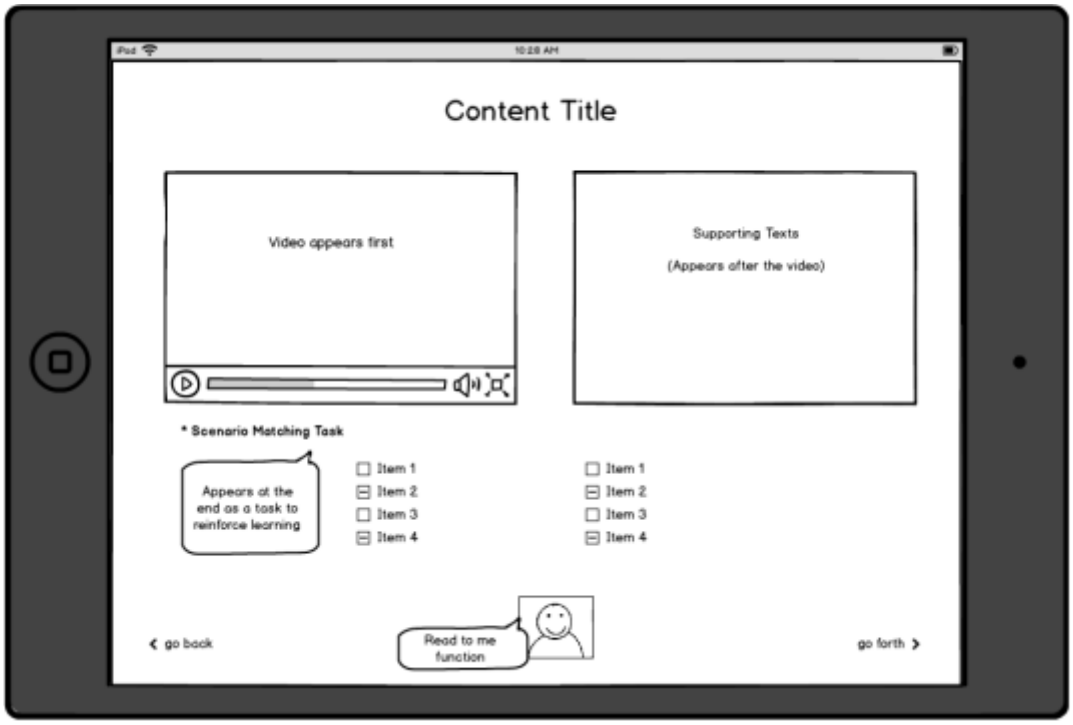

Figure 11*: Sample Application Screen Layout. (Mock was created with Balsamiq Mockups Software)*

Screen areas and the segments were always rectangular in shape; this was done as using odd shapes could have distracted participants. Margins of the edges were maintained in each of the slides. Each individual area was given adequate space, so that information of one block did not run into another block, even if the screen is rotated from 'Landscape' to 'Portrait' mode. To give the participants a natural reading experience and to ensure they are not made to move from one area to other without any clarity, the metaphor of how the participants would read or navigate through a paper-based book or reading material was taken into consideration. In Bangladesh, people read from top to bottom and from left to right. Navigational directions are flipping the right page takes the reader to the next page, and flipping the left page takes to the previous page. In the mock design

stage, the same strategy was implemented for laying out the UI elements. Navigation buttons were placed at the bottom, the right one to direct to next segment and left one to take to the previous segment. In the centre of the screen, there was placed a 'Read to me' function which would read out the contents of the screen in an audio format. This was particularly useful for participants with no or limited literacy. The consistency of shape, size and colours of the buttons, texts and text boxes were maintained throughout the interface.

5.4.2.2 Content awareness

Content awareness can be interpreted as the ability of an interface to be able to make the user aware of the information presented on the screen with a reasonable (minimum) effort from the user. Content awareness should be reflected throughout the interface. Keeping the user informed will ensure that they are not made bored, made hesitant of trying to use the interface, or made feel guilty by performing a wrong action within the interface. This has enormous importance as the target population was already identified as groups that lack technological awareness, are generally less literate, and are not always given the opportunity to take an active role in their day to day activities. As they were not very aware of tablet devices, it is not uncommon for them to have reservations about using the device as they might think it will be hard to learn to use. Content awareness can make them feel comfortable with the device.

The research wanted to create the interface in a way that would sufficiently cater for a mixed group of learners. Irrespective of age, gender, literacy skills and technological literacy the participants should be able to participate actively and use the interface. There were two particular considerations to demonstrate content awareness:

Linear or Nonlinear Navigation: Medhi & Cutrell (2012) and Medhi, Lakshmanan, Toyama & Cutrell (2013) repeatedly found that less literate users have

underdeveloped linguistic, cognitive structures, which makes hierarchical UI navigation difficult for them. The researcher had an option to represent contents in a non-linear way which would allow (previously trained or already trained) users to navigate quickly through the interface and get to the training contents which they wanted to reinforce or learn afresh. During the pilot test and in the subsequent phases the researcher could hardly find anyone who had any disaster related training of any kind. A few were first aid trained. Thus, having a non-linear approach for this research would have disadvantaged a majority, if not all the learners. A linear approach to content navigation was implemented throughout. There was no menu system. Once commenced, the training would sequentially take the participants forward. If they wanted to go back again, a sequential approach was also required to be taken. Alternatively, a navigational menu could have used, but it could have taken away the simplistic design which was not ideal for the target population. However, for the facilitator or trainer, this ability could have been easily added, but the lack of this was not felt at any stage of the research.

Age Appropriate Navigation: Darejeh & Singh (2013) concluded from their different age group participants that there exists a strong relationship between age and interface preferences. However, Demiris et al. (2004) argued there is no evidence that older people resist new technologies. It rather depends on the interface design, which plays the key role in people's willingness to use it. In a study with elderly people, Dickinson, Newell, Smith & Hill (2005) found that elder novice users prefer a simplified user interface with clear navigation paths and the presence of assistance within the device. Thus, the design was required to be done in a way which would not be overwhelming to any group of participants.

5.4.2.3 Aesthetics

Aesthetics refers to one of the key aspects of an interface. A good welcoming interface will generally be pleasing to the eye. Alongside being functional, interfaces need to be inviting to use. It was concluded from the literature review that, content should be presented in a way which would lead to a lower cognitive burden for the

participants. One way of doing this was having a minimalistic approach to content presentation. While a normal computer or laptop screen tends to have higher screen sizes with a tablet device the screen size is quite compact. A range of content representations, especially the key projects such as HiWEL (Mitra, 2000) and One Laptop Per Child (2013) that were mentioned in the literature review, were evaluated to find the best possible way to develop the aesthetic values of the interface. Key issues with the existing representations were: densely presented content, too much information was put into a single screen which would easily distract the learners. Dennis et al. (2012) have argued that novice or new users of an interface prefer low-density screens with less than 50% of the screen being occupied by information. Though more experienced users may prefer a higher percentage of the screen to be occupied, this was beyond the scope of this research to test expert only user groups in isolation.

The size of texts and use of eye-pleasing fonts are also an important part of the design. Use of too many fonts and different sizes can baffle the user and thus, a large font size was kept for titles and smaller font size for normal texts within the interface. 'Kalpurush' and 'Amar Bangla' font was mainly used in the interface which was easy to read. Use of multiple colours and patterns could add to cognitive load as colours with high density can attract the user towards that, but if it is not used carefully, then the whole purpose of grabbing attention was prone to failure.

As about 10% of men are colour blind, use of improper colour can make them unable to read accurately. In general, black text on a white background is the most readable, with blue on red the least readable. With the aim to provide pleasant reading experience, high contrast colours (White & Black) were used predominantly in the interface. Olson (2010) has conclusively found a colour affects not only emotion but also both conscious and unconscious cognition. In the western context, red provokes intense emotion (e.g., anger) and blue provokes lowered emotions (e.g., drowsiness). In Bangladesh, 'Green' colour (all variations) corresponds to green trees, paddy fields, etc., 'Yellow' corresponds to the sunshine, 'Black' corresponds to sadness, death and 'Red' corresponds to inspiration,

determination and also anger. These colour linkages were maintained in the design process.

There was a 'Read to me' function and to make it very explicit to remember and recall the researcher used the colours of Bangladesh flag to design the navigation button. Medhi et al. (2006) had previously used a picture of the main researcher (Medhi) in a similar context as the help function navigation button. The researcher believed, going for something more memorable to all the participants could achieve the same level of consistency, and in the fieldwork, all the participants could identify the button without seeking any external assistance.

5.4.2.4 Consistency & minimising user effort

To make any user interface easy to use it is vital to have consistency in the design so that the users can predict actions. In a consistent design, when users interact with one part of the system they know how to interact with the rest. Consistency occurs at various levels of the design process. Consistency can refer to giving users a system which is consistent with perhaps what they do in real life. For example, if they were reading a book in Bangla they would turn the right-hand side page to go to the next page and left-hand side page to go back. If the navigational menus on the interface were put in an alternate direction it would have raised the possibility of confusion, frustration and probable refusal to use the interface.

To make the navigation process simple, only four primary controls were used. Two dedicated buttons for going back and forward through the screens. One dedicated button to use the 'Read to me' function and another button to submit tasks (Drag-drop & matching) to the system. Multimedia content - video and pictures had their own controls to play, pause or zoom. 'Same Language Subtitle (SLS) was used where video clips had audio. As per Dennis et al. (2012), interfaces should be designed to minimise the amount of effort needed to accomplish tasks. Tasks designed within

the interface were a simple drag and drop or matching in a format which was intuitive and would be simple to understand on the first demonstration.

5.4.2.5 User experience

User experience refers to designing the user interface with the users' level of computer experience in mind. As the chosen locations are technologically less advanced with only a handful people having access to current technologies, it was relatively easy to understand the interface was required to be designed from scratch to make it more usable by even the least technologically connected person. Novice users usually are most concerned with ease of learning—how quickly and easily they can learn to use the system. To be able to make the system user-friendly, commonly used functions were kept within easy reach of the user.

The touchscreen functionality of the tablet device gave the fluidity to operate the interface with a touch of the finger. The content representation had to take advantage of the touchscreen functions and make it easy for the participants to get comfortable with the device. Dennis et al. (2012, p. 321) stated:

> *Novices, for example, often prefer menus that show all available system functions, because these promote ease of learning. Experts, on the other hand, sometimes prefer fewer menus that are organized around the most commonly used functions.*

However, for a tablet device, having a clutter-free screen with few menu options deemed a priority for the targeted users. Additionally, cultural (especially various linguistic and traditional values were relevant to this study) and high-low level details, including graphics, needed to be appropriate for the chosen location to facilitate a smoother user experience (Russo and Boor, 1993). A range of interfaces used in the key projects mentioned in the literature review was examined to understand what sort of user experience should be designed. It was quite surprising that English was commonly used in those interfaces which was not even a second language of the participants (further details of this are provided in section 7.4.6).

Thus, over the three iterations (detailed in section 5.5) all the elements of the interface were designed respecting and recognising local needs and values which resulted in smoother user experience.

5.4.3 Designing the user interactions with the interface

There were two important interaction strategies that were integral to the dissemination of the content, 1) interaction within the interface and 2) interaction beyond the interface. Interaction within the device was crucial as this would be the first point of connection for the participants who would use the device in a group. Since the participants had never used the device before the interaction within the device needed to be simplistic. Thus, there were less navigational options. The video could be played and paused with a single touch. To avoid unintended erroneous page-flips finger swipe was disabled for most of the content viewing but for tasks like 'drag-drop' they could use touch function to drag items on the screen. Graphics were also set in a way that the participants could zoom any graphics if they wanted to see it in a higher resolution. This was particularly useful where different stages of disaster preparedness were presented. When the interface presented the participants with a task or content, they were required to discuss among themselves in smaller groups and the activity presented in the device's interface would induce activity outside the interface. For example: In one activity in which they were required to watch a video on cyclone preparedness and after that they would do a drag and drop activity. When the interface presented them with the activity, they would engage in discussions, and then they selected their answer and input that in the interface. Afterwards, the interface would give them feedback on their responses. Activities that participants were engaged with beyond the interface were: various formats of scenario-based group discussions, photo taking activity, demonstration of first aid skills and the creation of an emergency kit. The social setting of the interaction beyond the interface was intended to allow the participants to feel less awkward because they were not just interacting with the device but also with fellow participants.

5.5 EVALUATIVE CYCLIC INTERFACE DESIGN

Shneiderman (1998) suggested that interface design is a five-step iterative process. Where the stages are: Use scenario development, Interface structure design, Interface standards design, Interface design prototyping, Interface evaluation. Shneiderman acknowledged that UI designers often move back and forth between steps rather than proceed sequentially from step 1 to step 5. In this research, understanding the scenarios, building up the interface structure, designing a prototype was important, but what was more important was a robust evaluation process so that the constructed interface was definitively suitable for all the targeted populations in the chosen locations. The evaluative part was given priority because in the literature review it was found that the key projects informing this research were critiqued for their relative ignorance towards the needs of the target population (Vota, 2011; Bajak, 2012; Foster, 2012; Selwyn, 2013; Toyama, 2015).

The evaluative interface design of this research was more like a spiral loop which can be simplified by presenting it in a diagrammatic form as the letter 'S' (see Figure 3). Each step of the design process was evaluative. A cumulative documenting process, 'Design Log' (see Appendix F) was in place to capture information related to the modifications.

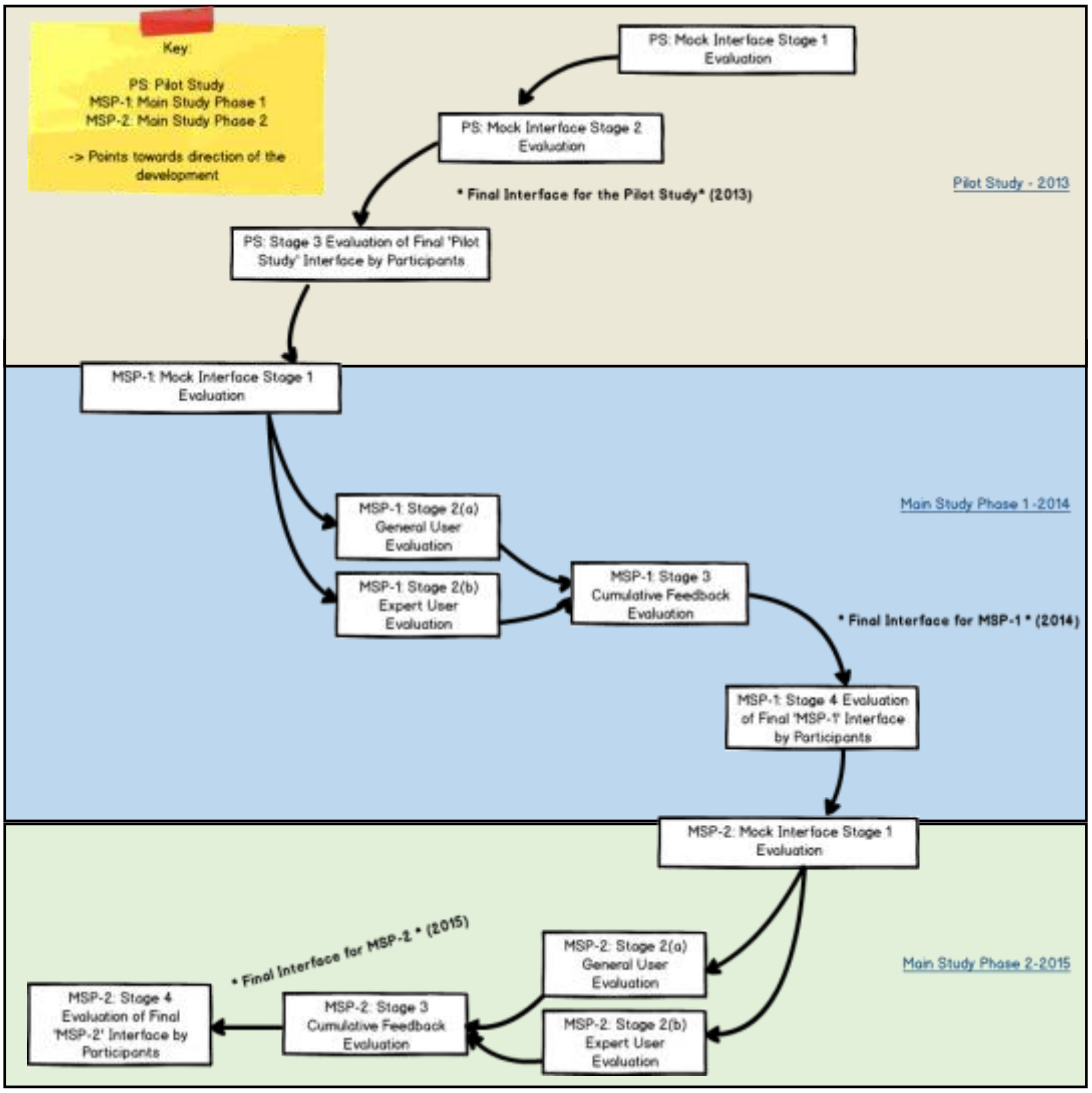

Figure 12: Interface evaluation stages

5.5.1 Pilot study -2013

In the pilot study stage, most the design decisions were made by evaluating interfaces available in the Bangla language to ensure the customised interface was fit for purpose. Interfaces made in other parts of the world were also checked for inspiration. There were two pre-deployment evaluative development stages and one post-deployment evaluative stage in the pilot study. They are presented below:

5.5.1.1 Mock interface Stage 1 evaluation

The researcher designed the initial mock interface based on previous similar study interfaces and by taking inspiration from other tablet-based educational applications user interfaces that were deemed suitable for this research. Initial designs were overseen by the supervisory research team. The initial evaluation was mostly related to 'know-hows' of the various elements of the interface (navigational menus, buttons and activities), rechecking and validating content representation using the software.

5.5.1.2 Mock interface Stage 2 evaluation

After the content was ported to the interface a final recheck was done on all the suggestions gained throughout the evaluative process since Stage 1. In this stage, further checks were made to ensure contents were arranged accordingly and were best suited for the target population. Feedback was also taken informally from general users (Bangladeshi) to see whether the content made sense to them. At the end, all the functionalities were rechecked, and the interface was signed off as the final version for the pilot study.

5.5.1.3 Stage 3 evaluation of final 'Pilot Study' interface by the participants

The participants of the pilot study were questioned about the interface and how they liked to interact with the device in general. Within the interviews, participants were asked to suggest if they would like the contents or the interface to be modified. The majority of the participants were happy with the content with one wanting to have more contents (video clips) and make alternative options rather than connecting to the internet as not all places had an internet connection.

5.5.2 Main Study Phase 1 -2014 and Main Study Phase 2 -2015

After the pilot study, had been completed, the subsequent phases had additional evaluation components added to ensure better integration of content development and design needs. There were three pre-deployment evaluative development stages and one post-deployment evaluative stage in these two phases. They are presented below:

5.5.2.1 Mock interface Stage 1 evaluation

The participants experience with the interface and the content was used to tweak the existing interface. In the main study phase 1, there were a few additional video clips, and larger clips were stored in the device. Internet connectivity wasn't a requirement as the content was stored for offline viewing. Also, alternate navigational options were taken into consideration, but the supervisory team felt it was too complicated thus only slight modifications were made to make it more user-friendly. In the next phase, further changes were made in the UI to remove the use of copyright logo from the introductory slide as this was diverting participants' attention. The supervisory team had overseen the development at this stage.

5.5.2.2 Stage 2(a): General user evaluation

In this stage, for both MSP-1 and MSP-2 phases, two different set of general users were selected who belonged to one of the research locations or had professional knowledge about the area and the participants. All this group of evaluators were native Bangla speakers. Eleven open-ended questions were asked to this group of users which would cover content, graphical representation, activity representation, fair participation and memory recall. Evaluators used www.surveymoz.com platform to complete their evaluation (see Appendix D for the questions poised to them and Appendix E for a completed evaluation feedback sheet). General users provided key insight on understanding the suitability of the topics for the chosen

locations. Also, from the responses on memory recall, the researcher could be confident that all the key elements are understood by the general user.

General evaluators gave constructive feedback on improving the way content was presented in the interface. For example:

> *I am pretty much satisfied. Contents are good and educative, but it could have been a little more interactive… few Images should have been a little bigger. there are 3-5 images have shown in few pages, I would recommend that show larger 2 images in every slide. (MSP-1, General Evaluator 1, In response to Question 2, see Appendix D)*

In response to a question related to content navigation one of the evaluators commented:

> *Yes, navigation process is simple and easy to use, so that anyone can use and understand; the course of actions is clear, clearly mentioned that how to go to the next step and also if anyone wants to go to the previous page that also can do… Anyone who have no idea about any mobile/tablet app, that person also can use this app … (MSP-1, General Evaluator 1, In response to Question 3, see Appendix D)*

While the evaluators found the interface to be easy to navigate, there were questions which probed whether they thought the content was engaging and could facilitate learning. One of the responses was:

> *The presentation and organisation of the contents make it easy to grab. Those who have lacking on the knowledge presented in the slides will definitely be assisted. There are a lot to learn from the instructions. Taking advantage of pictures, sound and videos make it engaging. (MSP-1, General Evaluator 2, In response to Question 6, see Appendix D)*

General user evaluators were also vigilant in identifying errors in content representation. A number of issues were flagged and indeed they did require changes.

> *There is a mistake in **Day 3 slide 2** – There is a space missing between two words. Check item number 2. **Day 3 slide 4** – The picture of this slide is wrong. This slide should contain a picture depicting the properly placed position of hands.*
>
> ***Day 4 slide 1** – There is a missing closing parenthesis in this slide. Other than that, the language is easy enough. The instructions are simple. The instructions came with pictures – this will be very handy to understand the concept. Having videos in some slides is useful too. Also, it's good to have the "Pore Shonao"(Read to me) feature for those who are illiterate. (MSP-1, General Evaluator 2)*

And also,

> *… there is a page where participants need to drag and drop the cloth on bleeding hand, that drag and drop part was not needed. It could have been a normal informative picture with content like other pages or after dragging / dropping and finding the correct match it could have popped up the right answer, in this way participants would have memorised easily... (MSP-1, General Evaluator 1, In response to Question 6, see Appendix D)*

As it can be read, evaluators have been careful in giving their feedback. Errors were identified by them and suggestions were given on how the content representation could be improved. Suggestions like this were then re-evaluated to see whether it was possible from the development end and whether the change is appropriate for the chosen community and location. Because of the later, one of the evaluator's recommendation to improve colour patterns and adding transition effects were discarded as having simple colours contrasts such as black and white would appeal to general people, and transition effect has very little to do with facilitating learning.

5.5.2.3 Stage 2(b): Expert user evaluation

Three expert evaluators were invited to evaluate the interface. The expert evaluators were those who had already created several interfaces for the people of Bangladesh. Also, they were aware of the importance of the native-ness of the interface design. The experts gave feedback on three key elements:

SET A: Quality, comprehensiveness and appropriateness of the content
SET B: Learning and teaching perspective
SET C: Interface, usability and miscellaneous factors (memory recall)

The experts answered 17 open-ended questions (see Appendix B for the questions poised to them and Appendix C for a completed evaluation feedback sheet) to give their feedback on the above three elements. With their expertise in native interface design, they suggested many improvements for the future iteration. Expert evaluators successfully pointed out where there was an abundance of information on one screen, where the data representation was too simple and several technical glitches that were easily fixable.

In MSP-1 phase two evaluators completed their evaluation, and in the MSP-2 phase, one evaluator of the two-invited managed to complete his evaluation within the given timeframe. Expert evaluators feedback was interesting because they would often take a contrasting stance for a specific criterion. For instance, in SET A, Question 4, when they were asked to comment on whether the content made use of participant's previous knowledge and assisted developing practical and logical thinking, the expert evaluators had split opinions.

> *No. Through group discussions, participants are asked to come up with what they think are some of the important things to do in order to prepare for a disaster they have had previous experience of. Thus, there is an element of using participant's previous knowledge. However, right after that participants are just simply presented with*

some to-do list to help them prepare for a disaster. The material is not presented in a way that links what people know previously from experience and with what they are told to do and thus does not assist in developing practical and logical thinking. One way to do so would be to ask the participants the problems they faced or saw/heard someone else facing, and what they think about how that problem could have been avoided and then compare their suggestions with the actual proposed solutions/steps. (MSP-1, Expert Evaluator 1)

However, the second evaluator was more focused on the appropriateness of the content given that it will be delivered to people with less expertise.

Since the training emphasises the learning of basic survival techniques, people could use their basic level of understanding with this material. (MSP-1, Expert Evaluator 2)

The suggestion of the expert evaluator 1, to have a comparative check could have undermined the local way of solving the problem. In many cases, the stages can only be suggested, and there can be legitimate exceptions. In the interface, there was provision for group discussions on how the participants could be better prepared followed by a localised suggested stage. Though the evaluator found it to be too simple it was well received by the participants. Development of practical and logical thinking aspect was captured by the expert evaluator of MSP-2 as:

Yes, there is a group discussion segment. In that part, participants can share their previous knowledge and experience with each other and can develop practical and logical thinking. (MSP-2, Expert Evaluator 1)

Though the interface was modified, the activity mentioned here was the same in both phases. The contrast of the expectation of the evaluators in terms of whether simplicity works or complex content is needed indicates there is a potential gap of understanding of the importance of local needs in the design stage. The participants, who had never had any sort of disaster preparedness training could have been flooded with content, but this would miss out the main intention of the

researcher to increase awareness. Knowing the basic elements was expected to form the basis for their quest to learn in more depth. Discussions at times in the field study would go deep, and they would come up with ideas or solutions that would support them in the future. The activities posed through the interface clearly had a connection to learning facilitation.

In Set B, Question 8 a similar split feedback was received. In this question they were asked whether they thought the training programme would provide a complete learning experience and enable acquisition of topic specific competency (e.g. First Aid, Emergency Plan, Emergency Kit, etc.).

The response from expert evaluator 1, MSP-1 was,

> *No. The information contained in the content is simply too minimal to suggest participants will acquire any level of competency in First Aid or Emergency Plans.*

However, the second expert evaluator of MSP-1 had a different opinion,

> *As a matter of fact, first aid and the emergency plan have been well demonstrated in this content, as per my opinion...The total learning process has been designed well step by step that can give a complete experience of learning on a topic.*

First expert evaluator of MSP-2 acknowledged the completeness of the content but was unsure whether this would provide complete learning. His feedback was the following:

> *I am not sure about "complete learning" but, yes, this training program covers all the required topics which are compulsory or everyone should know…if participants go through the contents, complete this training, memorise and follow as guided here then definitely they will be benefited.*

The evaluators though were aware of the interventions during the first aid training, but the first evaluator of MSP-1 clearly was not happy with the minimalist approach whereas the subsequent evaluators were happy with the step by step procedures which were explained in simple stages. As this activity was supported by direct intervention, the completeness of this part would be constructed from both contents presented within the interface and activities conducted beyond the interface.

In SET C, Question 14, evaluators were asked to provide feedback on the cultural aspects (pictures, image backgrounds, clips) of the interface design. Responses received on this were quite supportive.

> *Yes, cultural aspects including the use of red/green colour seem to be appropriate. However, as noted earlier the picture used to represent a family could use a more traditional tone. The use of the colour red/green similar to the way Bangladeshi flag is to represent the 'Read to me' section seems to be a nice thing. The white background and dark coloured text seem to be a good combination as it made the contents easy and clear to read. The contents are not too cluttered and are spaced appropriately that make it easy on the eye to get the information without much distraction. (MSP-1, Expert Evaluator 1)*

And,

> *The pictures, background images are in few cases - generic. They could have been more specific to the locality. Mostly, it feels ok with the context. (MSP-1, Expert Evaluator 2)*

Indeed, the flagged pictures by the evaluators required further local tone, and they were replaced at the next stage of the development.

Similarly, there were other improvement suggestions too. Such as:

1. *The exercise for emergency kit preparation seemed to be not working.*

2. *The second exercise to select the right element to use for stopping blood seemed to accept all answers, and no direct feedback was given as to whether the participant selected correctly or incorrectly.*
3. *The third exercise to put emergency items in the emergency kit was non-responsive.*
4. *The button to speak the text seemed to be not working, but this was briefed ahead.*
5. *The submit button for exercise one should also accept incorrect matches and show what the participant got wrong in the exercise besides the correct answer. The submit only accepts correct and completed exercise which is not intuitive.*
6. *I do recommend a back button to navigate to the previous slide.*

(MSP-1, Expert Evaluator 1, In response to SET- C, Question: 15.See Appendix B)

These were important elements of feedback, and some of the issues were device and software specific. This was identified by testing the same content in different devices. It was found that most recent versions of the software would resolve the majority of the non-responsive issues. However, the content layering was changed so that it became less dependent on the version of the software.

To identify the appropriateness of the content probing questions were used. There were two separate questions in SET-C, which asked the evaluators which element of the content they thought was most useful (Question 17) and which element they thought was least useful (Question 18). Responses received from the evaluators were intriguing. Such as: in response to SET- C, Question: 17, expert evaluator 1 of MSP-1 responded,

The information that we should send disabled, elderly, children and pregnant women to safe shelters before any possible natural disasters ahead of time in the list of steps to take in preparing for such natural disasters…The identification of all such vulnerable people and taking action ahead of time to secure the safety of such people seems to be a very important and crucial reminder in the context of disaster preparedness training.

The second expert evaluator of MSP-1, however, preferred the emergency kit and commented that,

An emergency bag is the most important thing to have during that time. It contains an essential element in need at the time of a natural disaster.

For the first expert evaluator, instructing participants to keep 'some' money as emergency cash was least useful information and the reason was illustrated by him in the following way:

The instruction to keep 'Enough money'; in the emergency kit. I personally find this to be the least useful information in the content.

It is the least useful in my opinion because most people already know how to handle their money well anyway. Whether to keep it in the emergency bag, or in one's wallet is a matter that should be left entirely up to the good judgement of people who own it.

I would not necessarily replace it, but it occurred to me as the least useful when compared to other very useful information in the content. (MSP-1, Expert Evaluator 1, In response to SET- C, Question: 18)

While it can be argued that people can keep money with them in multiple ways and not necessarily money is the only asset as at such times of need other valuables such as gold ornaments (this is a very common commodity in Bangladesh regardless of urban or rural location) can be used in transactions. However, the main reason

for the inclusion of money was to give a prompt to the participants that they should have some money with them if possible when they are leaving for a safety shelter.

The next evaluator felt the bandaging process was least useful and he would prefer appropriate medical attention.

> *I would refer to the process of healing (bandaging) a wound as least important. We'll get to have an emergency medical kit and usually get plenty of medical attention. They would do it with more professional competency than other people. I would personally suggest meeting an emergency medical team as soon as possible right after the disaster if any medical attention is required. (MSP-1, Expert Evaluator 2, In response to SET- C, Question: 18)*

Considering in the remote locations seeking medical help during an emergency can take substantial time, knowing the basics of first aid can fundamentally help the participants in taking informed decisions in ensuring exposed wounds are covered appropriately so that the bleeding can stop, prevent wound infection and protect it from the outer environment.

The evaluation during the MSP-1 stages was more detailed, and in the next phase, minor changes were made with some additional content which reflected in less critical feedback from the evaluator of MSP-2. Overall at the end of the cyclic evaluation process in both the phases the researcher made use of the critical feedback in making sure the interface and content were fit for purpose for the targeted community.

5.5.2.4 Stage 3: Cumulative feedback evaluation

It was at this stage when a final recheck was done on all the suggestions gained throughout the previous stages. Even though modifications were made in each stage however, not all the suggestions were suitable either to go with the interface or the intended research demographics. In this stage, each of the smallest

modifications was rechecked to ensure it worked holistically. Suggestions that were not accepted earlier were given a secondary thought for inclusion.

These evaluation stages in the interface development ensured that the interface design was robust, reliable and efficient for the target population. At the end of stage 5 in both MSP-1 and MSP-2, the interface was completed and was ready to be used in the device.

5.5.2.5 Stage 4: Evaluation of Final 'MSP-1'/ 'MSP-2' Interface by Participants

During the field data collection specific questions related to the interface were asked. This feedback was also used in the next iteration's development stage. Feedback from the fieldwork and observations enabled the researcher to provide further emphasis on aspects of contents that the participants wanted to elaborate on. Such improvements were made on topics such as creating an emergency kit, elaboration on the understanding role of family members in disaster preparedness and explaining how to conduct 'Cardiopulmonary resuscitation' (CPR).

5.6 CHAPTER SUMMARY

This chapter has summarised, presented and analysed the data sources that was used in the development of the content and the interface. The evaluative design of the interface was elaborated in details so that the cyclic process involved in the development could be better understood. Data sources in combination were interpreted to explain how content was designed for the tablet device to teach a mixed group of learners, which informed the research question two. Contribution to knowledge is not covered in this chapter as this is covered in details in Chapter 7. In the following chapter findings from the fieldworks will be presented with data extracts from each source.

6. CHAPTER 6: FINDINGS FROM THE FIELDWORK

6.1 INTRODUCTION

In Chapter 5, the researcher has presented and analysed findings of the research related to the content selection and the interface creation. In this chapter, the focus will be given to the fieldwork. Data that was collected over the three-year period, how it has contributed to the research and to what extent it has informed the current knowledge will be explored.

This chapter will present research data and analysis to satisfy the remaining research questions, which are:

RQ1: How can technology be used in rural areas to teach disaster preparedness using a tablet device?
RQ3: Can people with minimal supervision and minimal computer knowledge adopt learning using a tablet device?
RQ4: Can decision-making be improved leading to greater awareness among the community by using a tablet device based learning?
RQ5: Can bottom-up disaster training raise overall awareness for disaster management?

6.2 FINDINGS FROM THE INTERVIEWS

Throughout the cyclic process of the research six locations of Bangladesh was covered. As discussed in chapter 3, inhabitants of these six locations had some common traits as well as some distinctive characteristics mostly due to differences in their geographic location, literacy and technological advancement of that location. Interview data was collected from two streams. Apart from the pilot study, there was one interview which was one to one with the participant and then a photo elicitation based group interview. Through the data analysis, two major themes were identified across the locations.

Theme 1: Concepts of disaster awareness and disaster preparedness.

Sub-themes:

1. Current inadequate state of education and training on disaster preparedness
2. Perception of disaster – what is a disaster to them?
3. Perception of safety - what is safety to them? Is the shelter safe?
4. Moving out/Moving in- how easy is to leave everything behind?
5. Awareness that doesn't lead to action

Theme 2: Socio-Cultural traits shaping awareness and decision-making process.

Sub-themes:

1. Gender dynamics in regards to education, awareness and safety
2. The role of family members in decision making– who does what and why?
3. Religious Beliefs – do they have a role to play?
4. Reactive than proactive - wait for something to happen
5. Literacy and voice- is there any indication of how the literate members behave and make decisions. Do the illiterate or less literate have less voice?

In the following sections, both themes with the subthemes are discussed from an analytical point of view.

6.2.1 Theme 1: Concepts of disaster awareness and disaster preparedness.

"Disaster is not new to us; disaster preparedness training is!" [P3, Pilot study- Bagerhat Sadar]

The essence of a disaster preparedness training is to first establish the starting point with a clear understanding of what the target community is already aware of and where there exists a gap of understanding. In the interview process, participants have brought forward their idea in relation to what is a disaster event and how

much they are aware of its impact. Also, during the interview process, they have clarified their understanding of disaster preparedness. There are five subthemes in this category that are presented below:

6.2.1.1 Current inadequate state of education and training on disaster preparedness

One of the most important revelations from the interviews was the current inadequate state of the disaster preparedness in the national curriculum and NGO-led training. First of all, it was found that NGO led training is not targeted to everyone. They normally select local volunteers from each location, and then they get some form of training (the latter could not be verified in the field). Participants across the locations mentioned they were not aware of the person who was representing their location. This is a classical top-down approach limitation. Because the training is coming from the top, it lacks connectivity with the root level. It is not uncommon that there is some sort of delay in reaching the directly affected people. Many of the participants have shown their distrust in organisations that are operating in their areas as they felt these organisations only came after the cyclone and handed over relief goods to locations that are reachable by a vehicle. They rarely visit the locations that are not easily reachable. It appeared from the interviews that in relation to disasters the activities of NGOs are more inclined toward post-disaster events. Even then, there is a lack of follow-up activities which could build upon the occurrences and guide the affected to be better prepared in the future.

A large number of participants were semi-literates who lacked fluency in reading and writing. There were also a good number of illiterate participants. What was striking was that many of the self-claimed literate participants were found to lack fluency and they were not in reality above the semi-literate level. Similarly, many semi-literate participants had forgotten how to read due to not practising reading in real life. The person who at one point of his/her life was given a certificate to prove

he/she is literate may not be effective in the present time. So before starting any training programme with participants of similar demographics, caution is required in identifying the real literate or semi-literate person. A screening test may be of help.

For those who were literate and semi-literate, probes were used to find out to what extent disaster preparedness training was covered in the national curricula and to what extent they had learnt the basics of first aid and emergency preparedness first hand. Those who have at least attended primary school commented on what they had learnt in regards to disaster preparedness.

I- Did you ever attend any disaster preparedness training?

ND- *No, I haven't.*

I- Did you read about disaster preparedness in the school text books?

ND- *(Thinks). Yes, I did.*

I- Can you tell me about it briefly?

ND- *I can't recall. I forgot what was taught.*

[Bhairab, P8, Male, 21 years, Literate]

One of the senior participants of Nagori was asked about the way he has seen the education system evolve over the years. He also commented on the practicality of the disaster preparedness.

I- Did you ever had training on disaster preparedness before?

RDR- *I did not. I had training on first aid in my college.*

I- As you are one of the senior participants here, can you please tell to what extent someone can gain disaster awareness from current textbooks?

RDR- *That's a good question. The quality of our education system has been declined. My father used to tell me that their education system was reformed during the British Raj. They learnt many things which would help them to get a better life. I have seen years of East Pakistan. I was grown up and educated during that time. We learnt about our rivers, our agricultural lands and those were in English. What I found in the Bangladesh era is the textbooks were continuously changed every year, and there was very little focus on reality. I don't remember seeing any activity in the textbook that would ask students to learn swimming or climbing trees. Bangladesh is a country of rivers. How can you not learn swimming and call yourself educated Bangladeshi!*

I- But, was there any helpful content in the textbooks?

RDR- *No, I don't think so. You can read all about cyclones and floods, but unless you see one for yourself your learning is incomplete. I saw clips of cyclone today. That is more educating than reading about it in the textbooks.*

[Nagori, P9, Male, 74 years, Literate]

This participant has shed light to the practicality of a disaster awareness programme. Though he started off with a very vague description of the education systems that he has witnessed over the years in two different eras, he has identified one key issue which is connecting the textbook-based education with real life. It is not uncommon for many Bangladeshis to lose life in a flood just because they don't know how to swim. These deaths could have been easily avoided if the education system reflected and connected with the quintessential needs of the people. After visiting all the research locations, it was evident that the current state of disaster preparedness education does require a significant overhaul.

6.2.1.2 Subjective perception of disaster – what is a disaster for them?

As mentioned in section 2.4, the UN International Strategy for Disaster Risk Reduction defines a disaster as,

> *A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. (UNISDR, 2009, p.9)*

The interviews allowed judgment to be made about whether and to what extent the communities represented in the fieldwork held the same view about the nature of disasters. The way they perceived disasters are illustrated in the following sections with extracts of interviews.

In Nagori, the majority of the people were well informed and literate. To them, the whole premise of the disaster was something that they can't deal with locally even with the support of other neighbours. While materialistic and human losses were something that made them more concerned. In terms of economic loss, they were quite optimistic that they would be able to recover their losses. Being situated in the highland of Bangladesh, compared to any other regions in the country they have better natural resistance from the most common calamities. Despite being in the high land, there have been some instances of the flood, which were in the extreme cases.

An excerpt from an interview transcript from Nagori is presented below:

> ***I- Can you briefly explain your understanding of the natural disaster?***
>
> ***SS-*** *We have so many things to be concerned about like flood, river erosion and more. God has created this world. He has created a mountain, trees and rivers. Human is destroying the nature. Natural*

landmarks are demolished where it should not be. We are cutting the trees and filling up the rivers. The natural flow of things is hugely hampered. Because of the river embankment, when there is a heavy rainfall, the additional water gets clogged and floods surrounding places. I think these embankments are saving one location and flooding another. When you create embankment in the lowland and it gets water over its capacity, then it will have a devastating impact on overflowing to other places creating floods. If the water was flowing at 10km per hour, due to the embankment hindrance, will get more momentum and flow at 30km per hour and on its way, it will go over the trees and households everything. If there was any proper way to move the water, the situation could be better.

I- Did you face any natural disaster here?

SS- *I said earlier the place where I born there is less scope for a disaster. I have never witnessed one here. As a part of my job, I had to go to different places. I have been to Barisal and Khulna. A few years ago Khulna and surrounding Sundarban area were hit by a Cyclone. I feel the natural resources of Sundarban has not been given the security as needed, so no wonder nature is taking its revenge. I think more disasters will occur there in the future. I know the local people are consuming resources in terms of trees, animals from the forest too frequently. Trees are needed to reduce the impact of the cyclone.*

I- Coming back to the experience, what was your experience?

SS- *Oh! Yes, some trees were uprooted which damaged the road, and because of the heavy rainfall there was about 10-15-inch water on the road. Even though the house where I was staying was not flooded but the surroundings were flooded. People were stuck in their homes. We had to live on whatever we had in our stocks and consume that. In the meanwhile, there were 8-9 hours of load shedding because the*

transmitter busted. It took considerable time for the local authority to fix that. I am sure people who are hand to mouth had to starve for one or two days. It is just so hard to reach to the remote locations.

[Nagori, P1, Male, 60 years, Literate]

This participant gives a quite informed account of a natural disaster. He has clearly gone to a greater extent in explaining what he thinks of the disasters and causes behind this. Through this account, it is quite clear that even for a literate person the term 'disaster' is not exactly like the way we define it. They face it even before they know whether it can be coped with using the local or even the national resources. Like this participant, many would be stuck in their own house. The interrupted regularity of life, not being able to connect with the outside is what translates into a disaster for many. This participant had shown understanding of the effect of the river embankment, deforestation which are also contributing factor to a prolonged impact. This understanding is not so common among the general public, and this was established through other interviews that are presented later. Apparently, power cut off for a prolonged time, or food shortage is likely to trigger their consciousness that something is considerably wrong.

This was reconfirmed in another interview in Bhairab. An excerpt from that interview is presented below:

I- What is a disaster event to you?

HKS- *Something that affects our normal life. Like, if we get stuck at home because of the flood and then our daily lives gets affected because we can't find transport, even the bazaar is closed so we can't buy any food items. As the transport link is affected, ultimately we are cut off from the rest of the Bangladesh. This is a disaster for me.*

[Bhairab, P11, Male, 19 years, Semi-literate]

Three common elements are stated here. Interruption of daily life, unavailability of the communication channels and a shortage of food supply. The fear of isolation is

what constitutes a disaster to some. To some, it is seeing his or her world torn apart by the wrath of nature. One such account came through a participant of Karapara:

I: Have you faced any disasters in the past?

K- *Yes, I faced the Sidr in 2007. It was a horrifying experience. I could not do anything. My house was torn apart by the storm. Me and my family were helpless at that time. You can understand how little you can do when you face such devastation. I could sense everything I made in my life was getting destroyed piece by piece. I was thinking of the future of my family and praying to Allah to save us. We feared for our lives. Thoughts of that night still wake me up at night.*

[Karapara, P6, Male, 49 years, Literate]

Family plays a big role in the communities of Bangladesh. It hasn't been long since the rise of nuclear families. Still, there is the strong existence of joint families. In many cases, though there are nuclear families they live close by so that they can support each other in need, which is not necessarily financial. Mental and social support is also a key element in establishing a respectable social identity. The notion of disaster is thus, to them, more associated with the fear of separation from the family members. One such account was found in Afrah. Excerpt of that interview is presented below:

I- Did you face a natural disaster in the past?

SB- *I have faced once.*

I- Can you try to tell me what happened during that time?

SB- *We had to pass our day in great misery. There was a school which was the safety shelter, but we could not go there as it is far away. Already heavy rainfall started, and people around us was rushing to get back to their home. Luckily, all of our family members were in the house. One of our big trees falls on top of the roof causing damage to the already fragile structure. I feared the roof would collapse and we will get exposed to the heavy rainfall. I had my infant with me so I*

was scared to death. I would never put her life at risk. For safety, my husband suggested we should move down to the corner side of our house. It was hard for us and a really trying moment. Eventually, rain drops started to come through the damaged part of the roof, and we felt this is getting dangerous. Ignoring the heavy rain, we made our way to the nearest mosque. This was a 15 min walk which seemed very difficult to reach as the wind was blowing against us. We were there for one night with our infant. When we came back home, our house was severely damaged, and all our stored dry food stocks were wasted. We had lost everything and was left with only a small sum of money which wasn't enough to rebuilt what we had lost in a matter of few hours.

[Afrah, P11, Female, 24 years, Illiterate]

Another interesting fragment was found from a participant of Afrah. He started off by placing the incident where he could have lost his life in the liberation war in the 1971 as the top most disastrous event he faced. Despite having a prompt of 'natural' disaster he labelled that as a disaster. Once probed with a lead, he immediately could relate to it. He has his thoughts surrounding life or death scenario.

I- Can you recall any natural disaster?

AR- *Yes, in 1971.*

I- What happened that time?

AR- *That time during the liberation war, I was arrested in the marketplace by the Pakistani Military, and an hour later the commander let me go.*

I- OK. You know that's not a natural disaster. War is a different type of disaster. We call it a man-made disaster. We are here to talk about the natural disaster. Did you face any such?

AR- *Disaster is a disaster isn't it? I don't see the reason of putting a different name to it. To me that was the biggest disaster. I thought of telling you the biggest one of my life, as that truly to me was life threatening. Yes, I faced a number of cyclones in the past. But I am still alive, in 1971, I could have died.*

I- So, what is a disaster to you?

AR- *When I can die. When no one will be there to help me. It can be a cyclone or a flood. If I am with my family and my neighbours, I am safe.*

[Afrah, P40, Male, 54 years, Illiterate]

As it can be read, he was even reluctant to divide a line between man-made and natural disasters. To him, disaster was a line between being alive and dead. Safety was also not just about his own safety. It was more a collective term, in his thoughts. If safety is interpreted from this viewpoint, ensuring safety appears to be associated with some degree of a feeling of togetherness. Togetherness might give one the mental strength to pass through the tough, trying and testing times of a disaster which the participant had associated with being safe.

Another participant explained how her life was devastated by a flood. Her husband died in a flood and she was completely at a loss. She was unaware of what to do in such a scenario that her husband faced. A part of that interview is presented below:

I- When he died?

RB- *He died during the flood.*

I- What was the reason?

RB- *He was poisoned by snake. Because of the flood, we were already isolated from the main town. I didn't know what to do. I cried a lot, I wish I could save him. There were no doctors around; no one reached to us. It felt like we were left to die. Eventually, people*

reached us after 2 days. That was too late; it was a disaster already. My life was torn apart (cries).

I- Do you know where the nearest cyclone shelter is?

***RB-** I am not sure of any such place. It must be far, I can't leave the town, I am too poor.*

[Bhairab, P9, Female, 47 years, Illiterate]

So, from her point of view, disaster was that life-changing event that she would have to live with for the rest of her life. It is quite evident from these opinions that, there is a sharp contrast between the definition of disaster to the locality who are exposed to such events and to those who deal with a disaster situation from local and national policy making level. To a common person, he or she is not concerned to what extent the issues can be resolved within the available local or national resources, but it is about losing his or her everything, getting separated from his or her family and potentially living an isolated period of food scarcity. These situations need to be included in any disaster training so that the people can easily connect with the content of the training.

6.2.1.3 Subjective perception of safety - what is safety to them? Is the shelter safe?

A disaster event and safety concerns are closely related. Through the interview, participants explained their notion of safety and which place they associate with that. It is a natural trait of a human being to feel worried and helpless when something happens that goes beyond their control. Building a safe place to live in is something everyone cherishes. However, not everyone manages to save enough money to invest in a safe house. There are also worst case scenarios where a previously invested in house was completely destroyed by a cyclone. Housing structures made on the outskirts of the city and in rural locations at times lack careful consideration and informed judgements by the planner. It is very common for the fishermen to build a house closer to the river embankment. The layout of

the house of many low class or middle-class people overlooks the safety requirements which expose their lifelong investment to the risk of damage. It is common in Bangladesh that a large number of people get displaced in the event of a prolonged flood or an immediate hit by a cyclone. The government has created multipurpose cyclone or safety shelters with an aim to reduce life losses during such ill-fated occurrences. There are concerns that there are not enough safety shelters, and they lack maintenance at times. Given this context, several prompts were used to find out participant's understanding and outlook towards safety shelters and safety in general.

Quite surprisingly, a good number of the participants did not even know their nearest safety shelter. Connected to this was also an interesting finding. Women who were illiterate and semiliterate generally had less interest in knowing outside affairs, and they were more inclined towards following their husband's or parent's decisions. They were not generally interested as they won't be making a call to leave for the safety shelter. Some of them guessed that it would be the nearest school or the closest mosque. For them, their house is the safest place they can be in. This also has other contributing issues which came up during the interview. One such instance was captured through the interview in Karapara, a key section of that interview is quoted below:

> ***I: What you did afterwards the storm ended?***
>
> ***MB-*** *We regretted as we did not move to a safer location. As our house was destroyed we made our way to the safe shelter. It was a long walk. We couldn't save much stuff. And as everything already collapsed there was no time to look for anything in the ruin. We thought of coming back later to check. When we reached the shelter, it was the very late night. There were many unknown people as well who did not belong to our village. That was so uncomfortable and worrying.*
>
> ***I: Why you were worried?***

MB- *Well it's hard to judge which stranger is good and which one is bad. My elder daughter was about 16, and the other one was maybe 13 at that time. You don't want strangers around them at this age. It's not just the kids; there were others a bit more grown-ups were mixing closely. We don't allow our daughters to talk with unknown men. They are never allowed. Think, if they see others of their age are talking and laughing with those strangers, how I will manage my ones. I saw our local Imam was also dissatisfied to see such proximity. This is a big problem.*

I: How that place was managed?

MB- *It was a haphazard place. Everyone was running about, trying to take the best possible place. You can hear people shouting and kids crying. There was a scarcity of food as not everyone managed to bring food. We are poor. We cook using fire woods. I couldn't bring any as they were all wasted in the storm. I had nothing with me. Some other people around us were generous enough to share some of their food with us. Well eventually, the situation was under control, but that wasn't until the second day.*

[Karapara, P11, Female, 36 years, Semi-literate]

This participant expressed her concerns in regards to going in a place full of strangers. It was a common trait found in the interviews that those who are living far from the town, in the less developed area to have higher concerns for finding a safer arrangement. Safety is not only tied with the cyclone or flood shelter, and it is not just confined to the building of the premises. The safer arrangement is also a bigger concern which plays a determinant role in the decision of choosing a safer location. That feeling of insecurity in cyclone or flood shelters is generic among villagers and especially among the female and elderly members who would rather prefer to stay closer to their own neighbourhood. For the family heads and elderly members, it is of absolute importance to arrange an appropriate and secure temporary shelter as they are accountable to their family, relatives and neighbours

if anything goes wrong because of their decision. This was one of the main reasons why a majority of the female participants were very reluctant to make a move to those safe shelters.

There were also cases where there was no safety shelter and even for those who understood the importance of a safety shelter it was judged by them as not safe to try to cross miles to reach to a safety shelter. This leads to their conception of finding a more secure place close to their house, workplace or nearer to where they are during a cyclone.

I- Do you know the nearest cyclone shelter?

AH- *We don't have one. The closest one is in Tumulia, in the next village.*

I- So what will happen in an emergency?

AH- *We will try to come back to our house as soon as possible or try to take shelter in someone else's place. We can't risk going to the shelter which is miles away. That won't be safe.*

[Nagori, P8, Male, 45 years, Semi-literate]

This judgement of the house as the safest place was also seen in other locations. In Karapara, one participant who has a family member with mobility issues explained why she would rather stay at home than to hear other's suggestions to move to the safety shelter. In disaster preparedness training, we might just tell our participants that you should move the cyclone or flood shelter as this is the best possible action. In reality, this may not be the best course of action. The following excerpt can illustrate the scenario further:

I- Do you know which one is your local cyclone shelter?

L- *In 2007, when we faced the cyclone, we were suggested to move to a two storied school which is about 35-40 min walk.*

I- Is there any other close by cyclone shelter?

L- *No, that is the closest.*

I- Did you go there when it was suggested?

L- *No way. I have my mother-in-law who can't move. She is bedridden since 2000. It was impossible to move her as we were unable to find a van to hire as it was already heavily raining and the roads were empty. Also, even if we moved, who would take care of her? We didn't even know how crowded the place was. This could have been a really bad idea. We stayed home and prayed to Allah to save us. Our house wasn't that strong, but I had faith in Allah that he will save us that time.*

[Karapara, P14, Female, 39 years, Semi-literate]

Any disaster preparedness training will lack focus if scenarios such as the above-mentioned ones are not explored. As in theory it is much easier to tell a group of people to choose the safety shelter unanimously; however, this won't probably be the best-case scenario for many of those people who will find it difficult to make it to the safety shelter.

6.2.1.4 Moving out/ moving in- how easy is to leave everything behind?

A lot of discussions were around the topic of safety, finding a safe place and the safety shelter. In the previous subtheme, a contradictory position of a number of participants was identified where the notion of safety or safe became an overtly complicated topic, and it was in contradiction to the theoretical approach of suggesting the cyclone/flood shelter is the safest place. Let's assume it is perfectly possible for one such person to move to the shelter. Now, what happens in that scenario? Whom and what he/she is going to take with him/her? How informed is that judgement?

So, the first element to this question, whom and what is a series of complicated choice for them. 'What' part of this question is explained in the later part of this section. Families that consist of a pregnant lady, elderly people with mobility issues, disabled family member and dependent children face enormous trouble in coordinating such a move. There were some instances where the participant said he/she wouldn't leave the weakest member of the family and rather he/she will stay at home. Children especially infants are at high risk, a number of participants said as they were forced to move during heavy rain, even though they tried to cover their infants but many caught cold and were sick for weeks. But these cases are highly contextual, and no two cases are the same, as some people will have to go through rough communication channels and some will have to cross miles to reach a safe shelter. In the interviews strong family bond were found as none of the interviewees thought for a single moment that they would leave their family member behind irrespective of whatever challenge they posed.

To the participants leaving everything behind was not the most sought after choice. None of the participants mentioned that they are absolutely ready to leave when there is such an alarming situation. The majority would wait until the last minute and some completely dismissed such a possibility. Participants who came from a rather poor economic background had lesser things to cling on to. Those who are farmers have their own set of tools that they are attached to. Similarly, cattle, hens and chickens are also an inseparable part of their life for those who have them. Cows or cattle are not just a source of money, but they are everything that those people have. To a large extent, their life is dependent upon the well-being of their domestic animals. No wonder a large number of people eventually take their domestic animal to the safety shelters.

An emergency kit was one of the elements that were introduced in training. In the MSP-1 stage, the plan was that the participants would take pictures of the elements that they would carry with them or would most likely put in their emergency kit. However, the participants were self-conscious about showing aged, dirty and not so modern things to the researcher.

Figure 13: Participant selected items for the emergency Kit- Baintala P3 (left) and P4(right) MSP-1

This was quite a bit of a problem as eventually, they mentioned the sole reason for the selection of the majority of their items were 'it looked new', 'it had the original package' and 'it was costly'- so it shows they are more affluent than the other participants. Having this issue in hand in the next stage the approach was changed, and instead of taking a picture, participants were asked direct questions to find out what they would take with them. With this revised approach in the later stages of the research a more accurate account of their understanding could be obtained.

Following excerpts were randomly selected by the researcher:

Afrah

P6: I will take my ornaments, medicine, food, a bottle of water and a torch light.

P11: I would pick and take 'gamcha' (towel), sari (dress), dress for other members, my glasses and some money.

P18: I would pick torch, mobile phone, (personal) clothes (i.e. dresses, shirts etc.), jewellery, Quran.

P23: I picked some food, my cattle, clothes of my family and mobile

P31: I would pick medicine, radio, torch, something to eat, my chicken.

P34: I will take my goat, some food, my jewellery.

P47: I will take my medicines, water, mobile, charger, torch light.

Karapara

P7: I would take money, clothes of the family members and valuables if we had to move out.

P10: Dry food, water, clothes, phone and torch

P12: I would pick torch, medicine, radio, some food and my cattle.

P20: I would pick clean water, dry food, clothes, some money and praying mat.

P26: I would pick valuables, tasbih (prayer beads), janamaz (prayer mat) , torch and some food.

Nagori

P3: I would take my mobile phone, charger, water, some dry food.

P10: I would pick clothes, jewellery, some food.

P7: I would take mobile phone, some dry food, bottle of water, and some clothes.

P4: I would take water, some money, clothes, mobile phone, medicines

Bhairab

P1: I will pick my mobile phone in which I have all the numbers of my family members. Then also some dry food, clothes, and some money.

P6: I would take my ID, my wallet, phone with charger and some clothes.

P8: I would pick money, radio, Quran, tasbih (prayer beads), medicines and all the valuables.

P10: I would pick radio, dry food, medicine and money.

This data entry point was at the near end of the training. Across the locations, the items to be picked by the participants were quite similar. It was quite clear that leaving everything behind was never the first choice of all the participants. While items such as mobile, torch, radio, Quran (Holy book), janamaz (prayer mat), tajbih (prayer beads) were clearly identified, items such as money, clothes, medicine, water, jewellery, cattle and other domestic animals were less quantified. This can generate further confusion in an actual event where they have to pick these items. Clothes – what combination of clothes, how many for each family member, medicine – is it all the medicines available at home or just the regular ones, livestock – will they take the whole herd?, water and food - how much is sufficient for all the family members? These are not well understood, and there is a need to

give them an indication of what will be the ideal quantity of those items. People even with literacy issues have managed to remember the steps in creating oral saline where they have to mix a specific amount of sugar, salt and water. So, introducing some quantity measurements should not be difficult to adopt.

6.2.1.5 Awareness that doesn't lead to action

In the initial screening, it was found that all of the participants never had any training directly related to disaster preparedness. There were only a few people who had some sort of first aid training. This finding gives an overall impression that the participants were not well-informed. However, in the interviews, they have explained how they had heard various TV and radio programmes that actually broadcast weather warnings and suggestions related to keeping safe in the most trying moments. Even though they may not be actively participating in a training programme, they should be able to gather sufficient information from those informative programmes. Various probes were used during the interview to find out more on this.

Some of the sections from the interviews are presented below, which gives a better idea on the issue where awareness doesn't lead to an action. The first one is from the pilot study – Bagerhat Sadar. This 24 years old, literate, male participant explained the situation he faced during cyclone Sidr in 2007.

> ***I: Talking about Cyclone Sidr. Was there prior notification from the local authority?***
>
> ***A:*** *We didn't really hear any publicity (for example- use of hand mike to announce there is an emergency). But there were alerts aired in the frequent interval in the TV.*
>
> ***I: What precaution you had taken when the danger signals were aired?***

A: *We are used to it. We waited till it gets to 7, 8.9 and possibly 10. These signals are not serious to us as this is more important for the fishermen at the sea.*

I: Why that is not a big deal as the warning itself is labelled as 'dangerous, higher danger'?

A: *We are used to such signals. Most often there is only strong wind and rain.*

This is quite intriguing, even though the warning signal is labelled as 'high danger' as people can only feel strong wind and heavy rain, it does not make the intended impact. It is to be noted that, these higher warnings are not just meant for seashore areas or river banks; they are meant for the whole area which is hit by a cyclone. It seems the local knowledge or local ways of interpreting these signals are connected to what they can actually see and hear. This is one of the reasons why despite the national broadcasting station's attempt to safeguard people, at times it falls short. There is some awareness among people (as they can rightly identify the warnings are addressed to them) but they are not well aware of the warning signals, and possible impact of the cyclone hit; thus, they end up taking decisions based on their vague understanding.

This participant was further probed to find out whether there were other points where he could have gained knowledge of preparedness.

I: I am going to go back to our training programme. Considering Bangladesh is a high-risk country for a natural disaster. What you have learnt in school, college or university regarding disaster preparedness.

A: *There was very little content on disaster preparedness when I was at school. In college, I went to commerce and from then on all courses was subject specific there was nothing about disaster preparedness.*

I: Can you explain a bit more regarding what you learnt at school about disasters?

A: *(Pauses)…(Thinks)..well there was a chapter on disasters in the 'Social Science' may be in class 8. There were some definitions. Some generic guidelines as what to do if such things happen.*

I: Can you recall the guidelines?

A: *No. But we did memorise them for the exams.*

I: Hadn't you thought this could be of importance and you should remember it?

A: *Haven't thought about it that time. We were not told by the teachers.*

This corresponds with the literature that there is a scarcity of concrete information in the textbooks which predominantly shapes understanding of a person who goes through the national curriculum. Also, the education system is based on recall value of the information. Thus, exams get higher priority, and things learnt in this process hardly translate into life skills.

Another interesting account is from one of the participants of the pilot study.

I: TV programme related to natural disasters is one of the ways to improve awareness. You said there are warnings, pre-disaster advices shown on the TV. Don't people act on these?

S: *They would if they knew they should. Plus, those advice disappear after the event. Relief will come for few days then things will go back to normal. What I had noticed this year when Cyclone Mahasen's (2013) warning was released, the local government straight away took most vulnerable people to safe shelter. But that should not be the only activity. There is no pre-disaster training, not even a post-disaster instruction…*

[Bagerhar Sadar, P3, Female, 49 years, Literate]

It appears from this account that the TV warnings or guidance is treated as unnecessary pushed content. If this is the case, then it won't result in the necessary actions as this awareness building activity is not anticipated and not carefully followed.

Disaster awareness is a life skill that may not bring a job or make money but can potentially save lives. It was found through the interviews that, the participants, in general, lacked basic awareness and they were unaware of this. By basic, the researcher means, information regarding nearest safety shelter, things to do in a pre-disaster situation and a post-disaster situation. The decisions they take is on the spot, at the moment's flow. It doesn't always go through the required thought process. It was quite surprising that many did not even know where the nearest safety shelter was.

I- Do you know where is the nearest cyclone shelter?

S- *No, I have no idea.*

I- So what you will do, if you have to leave the house all of a sudden?

S*- I will follow the others. Together we will figure out something.*

[Afrah, P47, Female, 48 years, illiterate]

Similarly, in Bhairab even among the literate participants,

I- Do you know whether there is any cyclone shelter near your house?

RDR- *No, I do not know.*

[Bhairab, P10, Male, 23 years, Literate]

Another interesting finding was many of the participants were not aware of the cyclone warning flags and the warning levels. Some of the participants explained that announcements such as 'Number 7 danger warning' and 'Number 10 high

danger warning' are very hard to differentiate especially from indoors. Thus, even though they might be listening to the broadcast and be aware of the cyclone, they will not hasten to prepare to leave for a much stronger shelter. This delay can eventually have fatal consequences.

> ***I- Do you follow the weather forecast broadcasted from radio and television?***
>
> ***M-*** *Yes, I do follow. Normally they would be just turned on and tuned to a channel. They normally start early to tell people in those areas of impact to take safety precautions. But before I didn't know what those warnings mean.*
>
> ***I- How helpful are those warnings to you?***
>
> ***M-*** *Well to be honest with you before I don't know the meaning of the warning flags. Today I actually came to know what these warnings actually mean. When we listen about these on the TV, we don't pay much attention. But now I have a better idea of these warnings. This will be very useful for me.*
>
> ***[Karapara, P2, Female, 24 years, Literate]***

Another similar account was found in Nagori:

> ***I- So what happens when you hear the weather warnings on the TV?***
>
> ***RS-*** *Nothing much. I carry on with my household chores. These warnings are quite common, and they are broadcasted for the whole country. Sometimes those warnings are not even meant for us. I might turn on the TV midway of that warning broadcast, so I will have no clue whether it's for our location or for some other location.*
>
> ***I- What you do in such case?***

RS- *Follow my instinct. If it's heavily raining with high wind, it is likely that something is happening in our location. Nowadays I can call my family to find out where they are.*

[Nagori, P2, Female, 50 years, Semi-literate]

It is quite revealing that, though this participant like many others knew the warnings but it did not translate into an appropriate action because he was not aware about it in depth. In that socio-cultural context, just saying it is of high risk won't yield the same intended meaning. A disaster training of any sort needs to connect these warning signals with real life scenarios. For instance, on a number 10 warning it should be clarified that, the strong wind is powerful enough to blow someone off the ground, also it is sufficiently robust to destroy a weakly built house. This illustration could result in some action.

6.2.2 Theme 2: Socio-cultural traits shaping awareness and decision-making process.

Through semi-structured questions in the interview, the participant's social identity was established. This was done through asking specific questions related to age, gender, literacy in general and then other cultural elements such as type of family, dependency, decision-making authority were probed. This ethnographic process of understanding the selected locations and population has resulted in rich data which sheds light to understanding how they think and make their judgements. Within this theme five contributing subthemes are presented below:

6.2.2.1 Literacy and voice- is there any indication of how the literate members behave and make decisions. Do the illiterate or less literates have less voice?

One of the most anticipated elements was issues surrounding the gender of the participants. Careful considerations were made to ensure there is a balance in the participant's gender. In total there were 61 female and 44 male participants. Since

the early 90s, Bangladesh govt. has heavily invested resources in improving literacy across the country. An especial focus was given in the primary sector and also towards getting girls in school and ensuring they complete at least the primary schooling. As a result of this, towns have seen good progress in improving literacy rates but the same cannot be said for the rural areas (as was found during the fieldworks) where education is still not available to all. This is mostly due to poverty and partly due to the social outlook. In between 18+ to 35 year-olds irrespective of the gender there was higher literacy rate. However, the males had a better ratio compared to the female group. Among the 35+ year old participants, there was a significantly larger number of semi-literate and illiterate participants. These pre-90s groups of people most likely hadn't had the right resources and were more to be poverty struck. During the interviews, many of this age group explained how they had to leave education in the middle because they had to help their family in their agriculture or with household chores. Worst of all is this, in general, happened against their own choice. Lack of education has a direct connection with the disaster awareness context. As one of the participants stated with sorrow:

I- Who is the decision maker in your family?

A- *My husband takes all the decisions.*

I- Do you have a role in the decision making?

A- *No, why I will have a say, I am not even educated. I studied only class one. My husband completed school exam. He knows more than me.*

[Afrah, P45, Female, 41 years, Illiterate]

It is very common in the rural areas that the women stay at home, and the men go to work. Women are the ones who reside in the home and have a better idea of the household. In an emergency situation, the male members of the family will have very little idea of the household goods. As many of the core decision making male members do not really have hands on expertise in making a well planned decision during an emergency, this can not only delay the process of safeguarding each

other but also cause serious harm. A disaster training programme thus needs to accommodate this need and in the local level, such training programmes should create a bridge to foster communication among all the members of the family.

Participants who were literate had better control in the decision making. It was found in the interviews that, women who were literate would take an active role in the decision-making. Also, they stated their husbands at times would seek advice and increasingly joint decision making is becoming the norm in the families where both husband and wife are educated to some extent. In many cases, the female participant stated that in an emergency situation she would call her husband to discuss and decide the best course of action. Once the plan is agreed by both, she will start getting important things together. This empowerment was made possible through education. Education has enabled this group of participants in bringing their voice in the decision making.

In cases where the female member is semi-literate, her scope of voice is reduced to some extent. One classic example came through the interviews.

> ***I- So, who is the main decision maker in your family?***
>
> ***AB-*** *Mostly my husband.*
>
> ***I- Do you take the decision of any sort in the family?***
>
> ***AB-*** *Yes, I do. I decide what to cook. Before I used to ask him but now I know what he likes.*
>
> ***I- Any other decisions where you can take an active role?***
>
> ***AB-*** *Yes also when he goes to bazaar for shopping, I make the list of things that we need.*
>
> ***I- Say if you were to take a decision related to post disaster situation, how would you do that?***
>
> ***AB-*** *Well, I won't feel comfortable in taking such serious decision. I will let him take the decision.*

[Afrah, P34, Female, 28 years, Semi-literate]

Even though this participant is included in some decision making, but they are probably not the most important ones. This uncertainty is an outcome of less literacy. As there is a clear gap in education, this participant perceives decisions taken during a disaster event are crucial and as she has less education, she decided that, she may not be the best person to make the decision. While the male counterpart is most likely to think similarly. Through the interviews, a positive relation between literacy and voice in the decision making was clearly found.

6.2.2.2 Psycho-social shaping of decision making

This sub-theme follows up of the previous sub-theme. In the previous one, illustrations were made to show how the decision making may not always be pushed down by the male members of the family. Sometimes it is just the psychological shaping of the society that leads to such framing of decision takers. This psychological shaping in the majority cases would control the voice of the people. Historically there has been an extended period of women's oppression in the Bangladeshi society, and this has continued for generations. Only since the beginning of the 20th century, have women in Bangladesh started to truly get wider acceptability across the society. However, there are still continuing cases of gender oppression.

In the locations that were covered, in all the families, it was a male member of the family who was the main decision maker. In a majority of cases, it was the male member who was the only economically active member of the member too. This economically active status, in general, gives them an upper hand in the family as the society perceives that without his contribution the family would come to the streets. Household chores and homemaking in the rural areas largely remains undervalued, if valued at all. From rural parts to the town areas this trend improves, but there is a sense of negligence even in that valuation.

I- I meant, who takes major decisions in your family?

S- *I take the decisions.*

I- Does everyone accept the decision?

S- *Yes. Why they won't? I am feeding them. I work day and night so that I can provide for them.*

I- If your decision is wrong, then?

S- *My wife can make suggestions if she wants, but it's me who decides the action.*

[Karapara, P25, Male, 36 years, Illiterate]

This is not an isolated situation. Across the locations, similar thoughts were present predominantly in the illiterate and semi-literate head of the families. Another account is presented below from Afrah, where the illiterate female member of the family explains why she agrees to decisions made by her husband.

I- Who is the responsible one to take a decision in the family?

KB- *As my husband is the head of the family, we agree to his decisions.*

I- Do you have to accept all his decision without any say?

KB- *Yes.*

I- Why it is such?

KB- *He is my husband. I live on his earning. He is also eldest in the family.*

[Afrah, P41, Female, 38 years, Illiterate]

Despite this participant's knowledge of the family and house, she won't get an opportunity to participate in the decision-making process. As female members of the family spend more time with the children, the children also get this sense that they have very little scope to do anything on their own. One of the participants

mentioned she had seen reluctance among her grown up children who would not participate in any family activities.

> ***I: So, is there any issue related to family participation?***
>
> ***S:*** *Not really. But our children often don't co-operate. They have grown up adults they should also take part in these activities. They will mostly be laid back doing their stuff. if there were trained then they would be serious about their responsibilities.*
>
> ***[Bagerhat-Sadar, P3, Female, 49 years, Literate]***

Also, in many families, elderly family members had bigger roles to play by approving decisions made by the only earning member of the family (son). This also at times lead to delays. It was also identified in the interview that, there had been a shift in the local knowledge, as many of the current generation had chances to go to the town or in the capital city and get a better education. This resulted in a much progressive forward-thinking outlook which may not be justified in the 'local' way of thinking. These thoughts include, common practising of 'parda' (female has to maintain distance from all males who are not in the family) and the way decisions are made holistically.

Families that have mixed with people from town or cities generally would take a much more open approach towards decision making and are likely to involve all family members with a full right to present their views. This creates a two-fold issue: firstly, in such families the elders feel insulted or not being valued as their ideas or suggestions are often overturned collectively by the family members and secondly, in such families, members who are not that educated feel shyness or a mental block to suggest their own ideas as they feel their ideas might be overturned too. So, they choose the non-humiliating option of silence. These issues have an overarching impact on the way decisions are made in the most trying times. It was highlighted in the literature review that less educated people have less developed cognitive structure and they struggle to navigate through complex information. Through the interview data, it can be now added that it is not just the

education but also the psycho-social shaping that has a role to play in the way decisions are made. A disaster preparedness programme will be incomplete if these lost voices are not included in the discussions.

6.2.2.3 Gender dynamics in regards to awareness and safety

Some of the elements of this sub-theme were covered in the two previous themes. As found in the literature review, in Bangladesh historically the safety of women during emergencies has been a concern. According to the traditional way of thinking, women are safe from external harms when they are confined in the house. With time there has been some flexibility in that thought. However, any incidents that might take place outside of the house, in a temporary accommodation can further reinforce the traditional belief that women should better stay at home. Female participants across the locations who suffer annual flood and/or cyclone, explained that their husbands get busy in making sure there is enough money or arrangements for money (including short-term loans), transportation means and safety in general, the female members have to carry on doing the daily activities as such there is no change. The food has to taste the same, drinking water needs to be arranged, and also they need to ensure the safety of their children. Personal hygiene was also a major challenge for many of the participants who had stayed in temporary accommodation. Many who hadn't even gone to any safety shelters had heard how difficult it gets to secure young girls from undesirable attention from strangers of all ages. These stories make the families resistant in leaving everything behind. This is certainly a practical awareness which may not be in the best interest of ensuring safety. Any disaster preparedness training created for that population should address these practical concerns.

6.2.2.4 Reactive than Proactive - wait for something to happen

It was revealed in the interviews that, many of the participants had access to television and radio where they can hear weather forecasts. Many participants did mention that they listen to the warnings but decide not to react straight away (even

to the higher warnings) as they don't always understand where the warnings are applicable. One such instance as was expressed by one participant was, at times when the warning is made for coastal areas, it may also be applied to the nearby locations. However s/he hasn't got a clear idea what areas are meant by saying 'coastal and nearest areas'. Another problem is that these warnings are not well understood by a majority of the people. So, the intensity of the warnings gets devalued. Even then there is an overwhelmingly common trait of being reactive. This is how a disaster has been commonly treated in Bangladesh. Once a catastrophe occurs, it takes a while for the relief goods to reach the location, not always the most needy ones are reached. Rehabilitation programmes take months, sometimes longer to find a suitable alternative. What does not happen at all is to reach to these people and make them better aware of how to face a similar event in the future. Individuals who faced disasters remain exposed to further iterations of the same mistakes, as preparedness training is a choice that remains unoffered to the mass.

Throughout the interviews, another contributing factor towards reactive thinking came out. It was the role of religious beliefs in shaping the disaster preparedness awareness. This research was not only bound to Muslims but had participants who were practising Christians, Hindus and Buddhists. Though this wasn't explicitly looked into while selecting the samples, this wide spectrum of participation ensured at least there were representatives from each of the most common practising religions in Bangladesh. There were some indications such as the following:

I: Do you have a safety/evacuation plan of any kind in your family?

A: *No there is no such plan.*

I: What if something happens with little or no early warning?

A: *Don't know. That will be a bad situation.*

I: Have you thought of such scenario and a possible course of action?

A: *No. Not really. I will do what seems right at that time. Allah will help.*

[Bagerhat-Sadar, P2, Male, 24 years, Literate]

This was not just a voice of the literate participants, but similar ideology resonated with many of the semi-literate and illiterate participants. Particularly among the later one's reliance towards the almighty was found to be very common. It was due to the fact that, they have seen how astounded they can be at the onset of an emergency and it is not uncommon for them to think of it from a religious angle. Whatever religion they practice there was a tendency to show some alignment towards a wish for the almighty in deciding the fate of them. In one interesting case one of the participants' spoke his mind:

P5: *I was never aware of facing any disaster. I believe in Allah. I know that the almighty will take care of me and my family. When I started the training, I thought, what can this even teach! But I was wrong, I learnt, I also have to take some necessary steps to make me and my family secure. Allah is always there to help, but we need to help ourselves too. This training made me understand the importance of being aware. This will help me a lot in the future.*

[Bhairab, P5, Male, 38 years, Semi-literate]

In his overwhelming response to the effectiveness of the training, he has pointed out to an invaluable message for the community that the almighty is there to help, but they need to act on their part too. Being naïve and not preparing for the future cannot be offset by just a blind belief. Any training made for such population is required to acknowledge this fact and create a case for them to understand the importance of awareness and preparedness.

6.3 FINDINGS FROM THE PARTICIPANT CAPTURED IMAGES

Participants were asked to capture images surrounding their residence that they perceived as potentially hazardous elements during a natural catastrophe such as

cyclone or flood. Images taken by the participants revealed intriguing geographical factors. Some of the findings were in reality beyond the geographic factors, and those elements (codes) were significantly supported by the participants' explanation. These were not separately categorised but interpreted from the geographic perspective (especially subtheme 5). Therefore a single theme 'Geographical Characteristics of Disaster Preparedness' theme was devised from the visual data.

Theme: Geographical Characteristics of Disaster Preparedness

Subthemes:

1. Location of the house
2. Build of the house.
3. Communication channels
4. Unplanned surroundings
5. Where is safety ensured (Location)

In the following sections, these subthemes are discussed sequentially from an analytical point of view.

6.3.1 Theme: Geographical characteristics of disaster preparedness

In any natural disaster, geographical factors play a key role in the way that particular event affects a locality, the resources available to them and also the aftermath of an event. Thus, understanding of disaster preparedness is impossible without having a decent geographical knowledge. Delocalised and generalised training are prone to failure if it undermines geographical factors. Findings from the images were contributing to the understanding of the way disaster preparedness is understood in the selected localities. This single theme has following five subthemes:

6.3.1.1 Why location of the house is important to the participants?

All the research locations had different geographical characteristics. Bhairab was close to the river and thus was more prone to cyclone and flood. Nagori was in

highland so had less concern with the cyclone. Afrah and Karapara were closer to the cyclone prone areas. With those differences in mind, the researcher did not have a prior understanding of to what extent location of the house will be important element in disaster preparedness.

The participants tried to capture the location of their home by capturing images of their surroundings including pond(s), bamboo poles and muddy paths. This was a common trait and was mostly among the first or the second image shot by the participant. During the interview, many interesting facts came to the forefront such as the background history of creating their house in the location where it is now. Many of the participants have restructured their house in the last 15-20 years with an intention to build a stronger house to keep them safe from cyclones or flood. In terms of location of the house, people gave more attention towards closeness to their own land which they use for agricultural and fisheries purposes. Participants with houses close to the main road or close to other houses felt more optimistic and believed they are less susceptible to disasters. The next sub-theme also connects to the location but further engages extrinsically with the materiality of the house.

6.3.1.2 What is the role of the build of the house?

Disaster preparedness understood from an etic perspective, will most likely be, preparedness is directly related to their level of knowledge and understanding of the disasters shaped by their past experiences. During the photo taking activity, there was rarely a case when the participant hadn't captured an image of some aesthetics (looks, build) of their residence. This intrigued as to how it connects with capturing a possible hazard during a disaster.

In this page and the following page a selection of participant taken images of their residences are presented:

Figure 14: Participant has taken images of their residences, part 1

Figure 15: Participant has taken images of their residences, part 2

Images taken by the participants included house pictures of ‘Kutcha’ houses where the primary construction materials are mud and thatch. ‘Semi –Pucca’ houses where the building materials for the ceiling or the walls are mud and thatch. Finally, ‘Pucca’ houses where the building materials are brick, mortar and other permanent materials. There was a contradicting emic finding that to what extent people interpret disaster and disaster preparedness relates to his/her own house. Those who are living in a ‘Kutcha’ house expressed their feeling of vulnerability as they can easily lose their house in a cyclone. Participants living in a kutcha house further explained during photo elicitation interview that being ‘poor’ makes them feel hopeless at times. This feeling of hopelessness to a greater extent contributes to their lack of awareness. A majority of this group of people also had strong religious views in ensuring safety.

Figure 16*: First picture of the task taken by P28 of Afrah*

This image depicted a ‘Semi –Pucca’ house and the participant focused on the trees close to the house. The participant explained they grown accidentally and s/he had fear that they can fall on the house or his/her family members. Images of similar ‘Semi –Pucca’ houses were also commonly found, and in general, these were owned by people who have been economically sound in the last 5 years, and they

have invested money in upgrading their social status through their house. There were also participants who wanted something stronger than their existing house. Other participants with 'Semi –Pucca' houses have inherited them. Not necessarily people who are living in such accommodation were educated or technologically better off.

A small number of the participants lived in 'Pucca' house. The locations of such houses were varied. Some were close to the main road connecting to the town. There were also cases where the house was in the outskirts of the town and close to the participant's ancestral residence. The majority of the families living in such houses were small with their sons/daughters living in the town or city who would just occasionally visit them. Also, the majority of the young participants who lived in such house were found to have received some formal education.

Captured images of the participants' houses revealed the way people interpret the built environment – one that is well known to them (their residence) or the one that is not well known but is advocated as safer. The common notion of safety before a cyclone is moving to the 'Cyclone Shelter', as this can save people from the wrath of nature. What was found during the photo elicitation interview was that people were more reluctant to treat a 'Cyclone Shelter' as the absolute 'safe' place. It is because, first they have to reach to that location (more on this will be presented in the next sub-theme) and as the capacity of the shelters is not very clear to them, they are in doubt regarding whether all the family members can safely stay there. There is also very vague idea about the facilities available for them in those shelters. All these factors contribute to the thought that, their own house is a rather safe place. In general, participants had more trust on their own built house regardless of its strength. An underlying reason for this distrust in the shelter was also rooted in the socio-political systems. There were concerns about the suitability of those premises as many lack regular maintenance and the safety measures are not regularly inspected. Surprisingly, across the locations, the majority of the participants had no idea of the nearest cyclone shelter.

6.3.1.3 Communication channels

In the first sub-themes, it was revealed that location is a key element in shaping disaster preparedness. In the following sub-theme, type of house, also explained how the participants were most likely to choose their home over a 'Cyclone Shelter'. This intrigued the researcher to explore this case further. After all, there will be hardly any disaster preparedness guide that doesn't say 'Cyclone Shelter' is the best option to ensure safety during such event. Discussions during the photo elicitation interview revealed, this is not a straight forward process for people who needs to leave home and go to such shelter. They need to use a communication channel and a medium. In general, common transports in the research locations are rickshaw, van, cycle and tempo (auto rickshaw). Among these cycle and rickshaw can carry fewer people. To move with family members, they have to go the main road and wait for the next available vehicle and also there is no standard fare and often they have to negotiate the price, which often goes up with unfavourable weather and other conditions.

Through the images it was found that, the roads are often not well maintained and disrepair is a common issue in rural, hard to reach locations. This applies also to the connecting paths which are often an individual's liability who are not well to do and can't invest in road repairing. Requesting the local govt. to conduct the repair is also a very time consuming affair in those locations. It is very common to see such paths submerged in water when there is a heavy rainfall. Let's imagine for a moment, a condition where there was a heavy rainfall not long ago, the roads are expected to be muddy, slippery, and alongside these, the roads can be of appalling state with missing blocks and in a damaged condition. In such a scenario will one take the courage to leave everything behind to look for a suitable vehicle to reach the cyclone shelter – a place he or she is not even well aware of? These dilemmas are important factors for a disaster preparedness training to consider and be careful of. If training commands people to leave everything back and reach to shelter where everything will be fine, it will disconnect from the experienced reality and disengage itself from the people it intends to make aware.

Figure 17: First picture of the task taken by P6 of Baintala

This image captured by one of the participants in Baintala illustrates a single bamboo pole which is shared with a group of houses. People have to walk on this pole to connect with the connecting street to the main road. Both sides of the pole have deep water. This is an aftermath of the wide popularisation of fish farming in the area since the 1990s. A large number of agricultural lands which were abandoned because of increased salinity were converted to Shrimp farms. The participant explained as there is no electricity in that area, it is even worse at night as people have to carry either a torch or a lamp to cross the pole. This picture depicts the gap between reality and the best practice. In a case where the recommended action is to leave the house and take protection in a cyclone shelter, crossing this pole with kids, elderly and people with mobility issues will mean this will be a bigger risk for them. This image justified the participant's choice to say inside a rather weak built house.

6.3.1.4 Unplanned surroundings

Literacy rates of the chosen locations of Bangladesh were significantly behind the national average. This is due to a lack of availability of resources, access and financial instability of the mass people. Lack of literacy has its impact on various aspects of their life. One of such is a lack of planning. What I found through the images was that some houses were built very close to the river bank. During a flood

or water surge, they are the most vulnerable people. Despite knowing the danger, they are unable to take action as they live a hand to mouth life. This was very common among the poor people living closer to the rivers. While this was the story of the poor group, those who in recent years have reinvested in a better house, they also had issues with not planning the layout thoughtfully. Narrow exit points and an entrance separated by a thatch layer does not contribute much to safety rather it might cause bottlenecks in a situation where fast movement is expected.

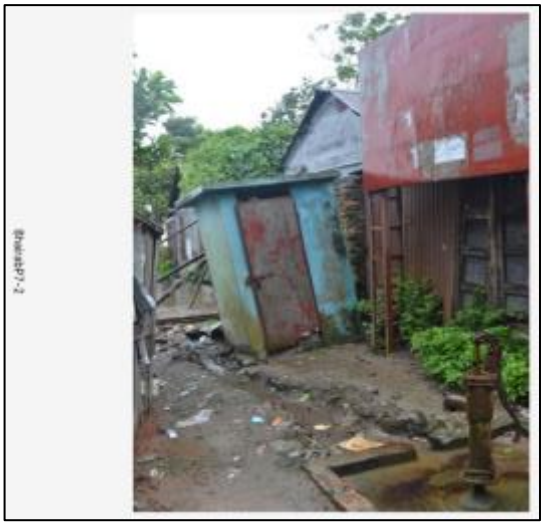

Figure 18*: Second picture of the task taken by P7 of Bhairab*

This image focused on a brick and mortar sanitary toilet in disrepair. Even though it was built with bricks, strangely it was in the track of the hand pump's drainage line which eventually weakened the whole base. It is prone to severe damage in the future and also can cause unfortunate accidents.

Figure 19*: Third picture of the task taken by P41 of Afrah*

The participant explained that the house was built in a low land and water clogg is a common phenomenon there. If the participant wants to use an alternate route other that the front entrance, it will be a big issue. Also, despite it is a brick and mortar house but having this area water clogged for a long time will impact the house's strength in the future.

Figure 20: Images captured by participants across the locations depicting unplanned nature of their backyard

Through the images, participant's also revealed that backyard is a largely neglected part of the house. In many cases, unused stuff was dumped in the backyard. Also, where there is a small pond, the edges are not paved. Because of this setting, the only available exit route they have is through the front entrance.

Figure 21: Third picture of the task taken by P6 of Bhairab

Through this image and discussion the participant explained how s/he feels that the randomly layered brick can be easily missed leading to an accident.

Figure 22: First picture of the task taken by P38 of Afrah

Another important find was the unplanned tree planting. NGOs and government have made people aware that tree plantation is of great importance. There are even occasional free seed giving ceremonies. The participant explained that they do not always take into consideration advice given to them regarding where to plant those seeds. Sometimes they grow in odd locations and cause trouble.

6.3.1.5 Where is safety ensured (Location)

Connected to the previous images which were around the surroundings and locations of the house, there were also a good number of images across the locations that depicted the 'Gate' of the house, be it made by iron, bamboo sticks or thatches. The slightly raised base of the house was captured by many participants. Through these images, participants expressed what is safety to them, and in this process, the importance of location came to the forefront. The class gap was evident as those with a better house, perceived to be better prepared as they are secured behind the gates.

There were images of their livestock which are unconditionally part of their life. These domestic animals are sources of their income, and they explained, the animal's safety is also as important as the other human members of the family.

Figure 23: First picture of the task taken by P25 of Karapara

Such as the cattle in this picture is deeply connected with the participant. This image is not a representation of a hazard but of a complex scenario. The participant further explained that the intention of capturing this was to show its importance in his/her life and how s/he won't go anywhere leaving them.

Figure 24: First picture of the task taken by P14 of Karapara

Images of family members with less mobility were also taken by some participants (as above). This was quite startling as this was not really a hazard. However, the participant explained it is not always possible to move them around, and the surroundings are unsuitable for disabled people. The participant explained that her safety is the participant's priority and the complications the participant will face in trying to move her to the cyclone shelter. The participant later explained why he would rather stay at home rather than trying to move in haste.

6.3.2 Importance of visual data to the researcher

Visual data sources were introduced in the MSP-1 stage to support the semi-structured interviews. In the course of this research, visual data was found to be of more importance in revealing important aspects (as presented in the previous section) of the overall perception of disasters and disaster awareness. Visual data was a key to the gateway of understanding the design aspects of a localised disaster preparedness training. Through the cyclic process of the research, with the span of time and iterations, there were continuously more opportunities to interpret and use the visual data.

While the tablet device as a multimedia device has a range of usage built in within the system, having custom made activities that goes beyond the interface added a new dimension to their participation. In Bangladesh, as of now, no empirical research has been conducted with the tablet device, this research with tablet device enabled to explore various approaches to get the participants more engaged.

Visual data collected through one stage of research could be used within the content without using third party images. Also as the images were taken from the same or similar location, participants could easily connect with those images. Images taken by the participants revealed why the location of the participants, type of houses they reside in and the resources they have, has a greater role to play in the way disaster preparedness is conceived. The photo taking activity liberated the

participants and worked as an icebreaker to understanding the theoretical world of preparedness and the reality of the preparedness.

In the semi-structured interview, the researcher was in general in charge of the proceedings as to which questions will be asked or which probes will be used but in the photo elicitation interview the participants' answers lead to cues . With the visual data, the participants were just given an explanation of the task, and no further instructions were given in relation to the image taking activity. This enabled the researcher to look into their understanding of the preparedness from a different lens. Having three different sets of data was also helpful in establishing the credibility of the collected information.

6.3.3 Importance of visual data to the participants

Inclusion of this data type and data production strategy enabled the device to be used in alternate meaningful ways. This ensured the device's capabilities are better utilised. Also images being different from the textual and verbal language enabled the participants to bring their tacit knowledge forward which otherwise they would not know existed or if existed then there was a degree of hesitation to speak about it. Participants who might not have understood the importance of looking at their life closely with the preparedness or a safety lens had the possibility of capturing their expressions in metaphorical terms. People who do not pay much attention to their daily life and pass the days as a routine often "know it when they see it". This category of people can easily associate an image with their thoughts, feelings, and experiences. For instance: participants were associating their thoughts and feelings with the unplanned tree planting. One participant gave a vivid account of his memory on how seeds were planted by his late grandmother and how that little plant has grown into a big tree in the last 10-12 years. Now this tree is a communicator between him and his family to the grandmother as her presence is heartily felt through the existence of the tree. When it was contextualised with the safety concern, the participant agreed that he thinks someday it might get uprooted

during a cyclone, but there is no way he or his family is going to cut the tree. This rich expression of affection was only possible to extract using the visual data.

The parts that process visual data in our brains are evolutionarily older. Technically, using images, one can probably access deeper sections of one's subconscious mind. Lived experiences at times can be difficult to express with words. This becomes further problematic when there is an issue with literacy. Finding the right words, right phrases can be a problem and can easily get excluded from the participant's talks because of the complexity of expressing the context. An image can help bring such expressions to the front as it gets captured through the observer's eyes and the limitations of the spoken or written word are reduced. In one of the photos, the participant captured the open sky with an intention to represent how the sky gets excessively dark just before a cyclone strikes. Perhaps in that participant's mind, a dark colour of the sky symbolises cyclone .

Carlsson (2001) noted that through images it is easier to represent a situation and express how it relates to a phenomenon. Images are not just 'of' something, but also 'about' something. In this research, the photo taking activity gave the participants a means through which they could better express their understanding of awareness of hazards. As there was no guidance given on what they should capture or what the researcher expects to see, the choice of taking a photo of a thing or a scene was full of complex choices. The choices that they made at the end carried psychological and emotional shades and values.

Images worked as an icebreaker in the power relation in this context. When they were the one in charge of taking the photos on their own, and they were also asked to interpret them they had the potential to liberate their thinking. Use of participant taken images as a prop made the communication flow becomes much more normalised. Through the images participants could connect between who they are, how they think and how they act. These three inseparable elements presented through the images allowed the researcher to get a better understanding of how the participant's mentality works in a pre-disaster environment. As in this

research, images were shot completely from the participant's own perspective, it enabled the female participants and other potentially marginalised participants (those who are adults but cannot take their own decision within their family) to bring their own voice to the interview.

6.3.4 Understanding 'Disaster Preparedness' through the participant captured images

Participant captured images inevitably pointed towards the resource implications of the preparedness which shapes the way 'safety' is perceived. A common perception will be, those who are literate will better understand the concepts of safety and preparedness. In reality in the communities that were visited, the concept of 'safety' and 'preparedness' had varied meanings. Both were deeply connected with the location and family. Being safe did not imply being safe alone. Safety of the individual was less important than the safety of all the family members.

In Bangladesh, literacy is commonly a measurement to predict the level of awareness. Also, it is mostly accepted that elderly people who have seen the life more, better understand the decision-making process and they are the ones who can take crucial decisions. It was also found through the images that the resources that surround an individual play a key role in his/her knowledge construction process. It appeared through the images and participant discussions that not all the literate people were living in a 'Pucca' house. Similarly, not all illiterate people were poor. Those who were living in a well-built house had a conception that they are safe as their house is strong and better maintained than the 'Cyclone Shelter'. Residents of such houses were more likely to ignore weather warnings. Apparently, the notion of safety is not a rigid term. What these (before) untrained participant captured images brought forward was that the notion of 'safety' is fluid. It changes its attributes depending on the person in context's experience and interpretation of his/her surroundings. As simply put, the meaning of preparedness is not same for

the person who lives in a 'Kutcha'[9] house compare to a person living in a 'Pucca'[10] house or another person living in a 'Semi –Pucca'[11] house. A person living in a more well-built house has a feeling of empowerment which has a profound impact on the way they respond to weather warnings. Not to mention in severe cases, they are likely to be the people who will have delayed decision making.

A benefit of having this image taking activity was that through these images a direct connection with the training and their life could be made. A disaster preparedness training that only instructs people to leave home and reach to the nearest 'Cyclone Shelter' overly simplifies the complicated decision making of leaving everything behind. A disaster preparedness training will be incomplete without acknowledging these issues and providing clear guidance on how to address them.

6.4 FINDINGS FROM THE OBSERVATION LOGS

This research involved the use of a newer technology which was completely new to all the participants. Observation of the participants during the training programme across the locations revealed how they interacted with the newer device and assisted each other in the group setting and more importantly how the activities helped them to learn. For the latter in particular, use of observational data was a major factor in this research. This also reciprocates with one of the key principals of the ethnographic research which is to study a less known phenomenon of a chosen population. Field notes taken during the day were also consolidated with the observation log for smoother processing of both. Some of the findings from observation logs complemented findings from the other two data sources. In many cases, rich information was collected from the observations (see Appendix I for a full-length log) which would eventually contribute to the greater possibility of understanding the chosen population across the research locations. From the

[9] Construction materials are mud and thatch.

[10] Building materials used are brick, mortar and other permanent materials.

[11] Building materials for the ceiling or the walls are mud and thatch.

observation logs, three themes and eight sub-themes were identified. These are:

Theme 1: Socio-cultural aspects of participation

1. Participation dynamics
2. The role of respect in participation

Theme 2: Reducing physical barriers

1. Access to the device

Theme 3: Removing psychological barriers

1. Reducing time to learn to use the device
2. Reducing awkwardness
3. Illusive literacy
4. Reducing worries with what-if
5. Peer support than peer pressure
6. Supportive supervision

These themes and sub-themes are elaborated in the following sections.

6.4.1 Theme 1: Socio-cultural aspects of participation

As the use of this device was not common in the chosen locations, it was of general interest to find out how this device was received by the participants and there were a number of elements to judge to what extent socio-cultural elements played a role in the participation of the participants. Two sub-themes capture this:

6.4.1.1 Participation dynamics

First sub-theme was quite an important one. Especial considerations were made to find out in ways the participants would engage with a novel device. In this research, the device and use of the device were completely new to the participants. It was obvious that there would be an amount of amusement and interest in the early days. This introduction of a completely new technology meant they had to negotiate between their known ways of group engagement in learning, especially in deciding who will take the lead, will it be informed by their knowledge (more

educated person takes the lead in the very beginning) or will it be informed by the age (elder member of the group having a first preference) or will it be informed by the gender of the participants (male domination in device handling)? For the researcher the only way to know this was to see how various groups in various locations perform. In Nagori, the highest level of semi-literate and literates was found and they had a very welcoming tendency in sharing and rotation of the devices. Those few who were illiterate received assistance from the literate ones, and this resulted in a very welcoming environment. In this location, literacy or being educated was key to holding a leading position in the groups.

In Sorui, another trait came up. The device would end up eventually to the eldest person's hands. A few of the participants explained this was a way of showing respect for the elderly person in the community. As the training progressed, the device would rotate, but the pattern would be such that the eldest member had the longest time. It did not really affect tasks within the interface, as they were being read out and collectively discussed.

Gender was quite an issue in Afrah and Karapara. As soon as the training started, almost immediately the groups were made as per the gender of the participants. This wasn't prompted by the researcher or informants. In Afrah, there were significant numbers of female participants, and they felt more comfortable to make groups with themselves. In these two locations, competitive participation was seen as if someone was judging their level of knowledge and if they could do well, they will be considered as the top performer among the peers.

In contrast to these, in Bhairab and in Baintala, no specific pattern and grouping mechanism were found. Participants rotated the device without any concern. Contribution in the tasks was not negatively affected by any gender, age or literacy attributes. Bhairab being close to the river bank and Baintala being a location where there is no electricity, the underlying cause for such effortless participation could be that they thought this programme would be extremely useful for them and they should take an active part in learning.

6.4.1.2 The importance of respect for participants

The importance of respecting each other is quite an obvious part of mannerism in any teaching and learning setting. If the research setting is considered, this research had people from mixed gender, mixed age group (often contradictory in their ideas), mixed literate groups (highly educated people often avoid illiterates as they see them as lower class people) and most importantly with either basic or no knowledge of modern technological artefacts contrasted by good understanding of recent technological artefacts. These grouping in any setting would initiate some form of frictions.

It was mutual respect in this case that limited the frictions. The participants, in general, were aware that this training was custom made to attend to their needs and the only way they could benefit from it if they took an active role in the training. Many of them had previously taken NGO led training on other subjects such as micro-finance or sewing. At the beginning of this training, they were explained that there would be no classes and no teachers and mainly they will be required to follow instructions on the screen. With that explanation, they understood they are the ones in charge of their own learning. This empowering unique approach was found to let them forget their differences. There were some issues with the pace at which a literate person would complete the tasks in comparison to the less literate ones. Nevertheless, there were no complaints concerning why someone was going slow or too fast.

6.4.2 Theme 2: Reducing physiological barriers to ensure participation

Socio-cultural elements were the first contributing factor in participation. This theme relates to enabling participation by ensuring there is access to the device, the interface and the training in general. For people living in technologically disadvantaged locations access to the technological artefact is the foremost thing to ensure participation. This was ensured for all the participants through the creation

of small maintainable groups. However, physical access to the device is not the only proponent of participation. The device has to make sense to the participants too. The tablet device being lightweight and portable did not create any major issue in carrying it around and using it to take pictures. Its sheer portability offered the participants a way to move around and be more active in participation across the research locations.

6.4.3 Theme 3: Reducing psychological barriers to ensure participation

As much as reducing the physical barriers is important, so is reducing the psychological barriers to participation. Five elements were observed in the training settings that contributed to this reduction. They are:

6.4.3.1 Reducing time to learn to use the device

Each technological artefact has unique ways in which it can be operated. If it takes a long time to learn to use the device, it becomes a barrier as it becomes unintuitive, undesirable and uninteresting. These negativities in the training programme can potentially affect learning. What was observed was that people took significantly less time in learning how to use the touch functions. If we think of teaching an illiterate person to use a computer, s/he has first to know how to use the keyboard and mouse and only following this they will get access to the interface and also s/he will need to learn a completely new language or innovate some ways to understand the machine. Here, with the touch screen tablet device and an interface made entirely in the native language those concerns were less of a worry. For someone who is illiterate, s/he would likely have trouble with the native language but the impact was minimized by having a 'Read to me' function where the whole content was read out to them. Signs and images carried a local resemblance, so it wasn't that alien to them. This reduced the time to learn to use the interface of the training.

6.4.3.2 Reducing awkwardness

The feeling of awkwardness is another common reason for reduced engagement and drop out from training programmes administered in rural areas in Bangladesh. If the introduction of the new technological artefact was as such that it would require prolonged time to get used to and there would be many ways in which the participant could get it wrong, then it would eventually lead to feeling awkward. Also, another element to it would be the content. If the content was too critical for their level of understanding and thinking, then it could have created additional pressure to them. The cyclic process was extremely useful in improving the training process. For instance, in the MSP-1 stage, in Baintala, the participants were asked to take photos of items that they would put in an emergency kit. The whole group thinking that these images will be shared with people from abroad and also the other participants may get to know what they were picking started to take pictures of the shiniest and newest things they possessed. This was an unintended outcome of a rather simple task. After the initial observation, this method was required to be modified so that the participants could state what they would actually pick in an emergency situation and with such modification they eventually opened up and shared their thoughts without any hesitation. Similarly, in the same location, participants were asked to learn 'Cardiopulmonary resuscitation process' (CPR) with expert supervision. Though they were happy to watch the steps within the interface but they were not keen on demonstrating. First, the researcher thought that it might be an issue with the gender, but the participants were reluctant to participate in this task despite having female only groups and a female first aider. When they were probed on this, they explained that they think it is something a doctor should do and they are afraid to try that on their own. This task was skipped once all the participants agreed to do so. Adaptability to various research locations is important as ultimately if the training tries to overdo it then it can create awkwardness and deter participation.

6.4.3.3 Illusive literacy and cognition

This was one of the key findings from the observation. In Bangladesh, as of the date when this thesis is being written, there is no clear definition of technological literacy. Also, the traditional literacy, the way it is defined and measured is not time bound. So once someone is labelled as a literate person that remains with the person till he dies. What was found in one of the locations (Afrah) was that many of the literates had eventually lost their fluency and could only read with pauses and mumbles. This pattern was repeated across the other types of literacy; many semi-literate participants forgot how to read fluently. Surprisingly, they were not even aware that they couldn't read fluently anymore. This created quite an interesting scenario, as this distracted the other participants. They became curious in discovering their decay in a skill that they had gained through hard work, but eventually it had been forgotten.

Another issue that was found among the illiterates that even though there was a 'read to me' function, all the illiterate people did not understand what was read to them, at the same pace. This showed the way they were making sense was to listen to bits of words and connect it with their ideas. This cognitive processing was not the same for all the participants, so some might have been processing a complete sentence, or some might be listening to only a few words. So, just a 'read to me' function was not sufficient for the local needs.

6.4.3.4 Reducing worries of what-if scenarios

It was found across the locations that, participants used to think a lot and had lots of questions in their minds. Many of the questions were of 'what-if' kind. Some of them are: 'What if I touch the wrong button?', 'What if I touch too hard, will it break?', 'How long will a screen display the content?', 'What if we don't know the answer?' and most commonly 'What if I don't understand?' These questions are in isolation perfectly legitimate question. If this training was conducted in any other part of the world, there would be a high possibility that many of these questions

would be asked there too. Before visiting each of the research location the informants and the facilitators (where applied) were made aware of these queries, and this assisted in the quicker response to the participant's 'what-if' queries. Giving them assurance that they can use the device in whatever ways they can and they won't be liable even if it breaks made many of the participants open up to the programme.

6.4.3.5 Peer support than peer pressure

Through the observation logs, various points of psychological stress factors in their participation were found. These were participation in the tasks, contribution in the tasks and completion of the tasks. In cases where there was additional pressure from the other group members, participants would get startled at times. When there was enough support from the other members and when they did not rush towards completion, there was a good flow of healthy discussion and content was gone through with much care. Across the locations, there were more supportive engagements than rushed completion. In a group, the participants while attempting any task, listened to each other and gave every single member chance to speak. This was imperative in ensuring the tasks were completing on time. There was no rush, but if they were busy in competing with each other's views, then it would take significantly longer time to go through the tasks and also it would become important to manage the conflicts.

6.4.3.6 Supportive supervision

In the interventions, it was crucial to ensure the participants are following what was demonstrated to them. Also, if someone was lagging behind, it was important to give them additional support so that s/he can catch up with the pace. Multiple demonstrations were required at times which was pivotal in ensuring they understand the content. As the training was quite short in nature and the interventions were within a small period of time, there was less time for ice breaking activities which could have been incorporated within the interventions.

However, as both male and female trainers were available, they could feel comfortable in the demonstration stage. In general, there was no complaint or negative feedback for the trainers.

6.5 CONSOLIDATED FINDINGS

Three primary data sources were used in this research, and so far, interpretation of the findings was presented separately. This was purposefully done to give a precise identification of contribution of the data sources in addressing the research problem. As far the methods are concerned, semi-structured interview and photo elicitation interview gave an opportunity to get closer to the participants. Whereas observation was not intrusive at all, and this was independent of the other surrounding activities. However, interesting observations resulted in specific probing questions during the interview process. This gives an idea of the complexity and interventions of the methods. It will be fair to say, if all three methods were placed independently of each other, then it would limit the interpretation of the research findings. A holistic approach helps to understand how the methods together revealed the characteristics of the researched locations. Some of the important findings which had a contribution from at least two data sources are summarised below:

6.5.1 The intersection of the interview and visual data:

6.5.1.1 Case 1: Understanding of the disaster preparedness and safety from a local point of view

For this case, both interviews are considered. In the interviews, probes were used to understand their conception of preparedness and safety. Their accounts would have instances recalled from past events and how they have reacted to it. This could give one way of interpreting their probable current understanding, but it was incomplete without exploring some probe to attempt understanding their actual

knowledge of preparedness and safety. So the data collected through interviews were complemented by the participant taken pictures which gave the researcher an opportunity to look through their eyes and the images supported by the participant explanations would further guide an understanding of the localised concepts and practices about disaster preparedness. The way closed fences with no access meant safety, the revelation that the communication systems are so poor and the cyclone shelters are at places so far that they won't even consider moving out unless the local officials make arrangements to relocate them could not be better understood if it wasn't captured in images.

6.5.1.2 Case 2: Understanding of importance of type of house and location in the decision making process

Perhaps one of the most revealing characteristics of the studied population was an understanding of how the type of house they reside in and the location of their house, contributed primarily to the decisions they make during an emergency situation. With just the interview data this trait was not revealed. Through the participants showing what they understood as hazardous, and then in the follow-up photo elicitation process, questions could be asked to establish the connection.

It was found people living in well-built houses would be less concerned about weather forecasts and they are most likely to ignore evacuation warnings till the last moment. The way the house is constructed (built materials, foundation, etc.) gives them a superiority feeling which informs their decision-making process. Their level of uncertainty raises when they are too far from their residence. Despite this, there exists no emergency plan that can guide them in unfortunate events.

Those who are living in Katcha (mud and thatch built) houses, they sometimes lack basic technological artefacts like radio or TV that can make them aware of the graveness of the events. However, not all people living in the Katcha houses had the same traits. Some do have radio, TV and even a basic mobile phone that is shared among the family members. They are normally located in vulnerable places which

also make it near impossible to access vehicles during an emergency. These instances were better understood with the participant taken images alongside their commentary on those during the photo elicitation interview.

6.5.2 The intersection of the interview and observational data:

6.5.2.1 Case 1: Understanding the psycho-social characteristics of participation

To understand the way participation is taking place leading to completion of the training was profoundly detailed in the observation logs. As identified and presented earlier the way participants engaged in discussions and activities had common traits. These traits did not always corresponding to previous knowledge. The way the device would go from one person to another, and the reason behind where the device was heading to had cultural elements to it. Regardless of the novelty of the device, the participants found out a way of localising the way it is used within the groups. As these were unanimously found in the majority of the research locations, it gives an idea of the way social hierarchy works in Bangladesh. While these traits were observed, why this was happening was not inquired during the task. If that was done, it would be intrusive and could potentially have affected the way teaching and learning were meant to take place in that setting. It was during the interview; such questions were brought forward. Enquiries were made to understand the dynamics between the participants. By combining both data sets, an informed judgement could be made by the researcher.

6.5.3 The intersection of the visual and observational data:

6.5.3.1 Case 1: Using the tablet device and actually being able to use it as a learning instrument

This connection is not with the subject of the captured image and the research, but the process and the end product (image). Observation in the photo taking activity

was important as it logged findings with the participants' level of acceptability and comfort with the device to take pictures. Also, the image in itself could tell about their ability to take pictures. What if it was zoomed to an extent where nothing could be recognised? What if any participant accidentally covered the camera and took photos? These small but potential adverse issues were identified with the help of both the visual data and the observation log.

6.5.4 The intersection of the interview, visual and observational data:

6.5.4.1 Case 1: Understanding the learning and teaching using the tablet device

One of the major finding through all the data sets were to understand the uniqueness of using a newer technology in motivating and facilitating learning for people irrespective of their academic and technological literacy. As identified through the thematic analysis of each dataset, there were clear elements which would not be found if they were not merged. The photo taking activity would have failed to make any clear contribution if it wasn't connected to the participant's understanding of the hazardous surroundings. Similarly, as they opted out of demonstrating CPR could not be well recorded if the observational logs were not maintained. Their common traits eventually came up by going through the interview transcripts and the observational logs. These together have informed how the learning and teaching activities can be designed.

6.6 CHAPTER SUMMARY

This chapter has summarised, presented and analysed the fieldwork data that were collected in this research. Three key primary data sources which required different techniques and different ways of interpretation have resulted in a better understanding of the chosen locations. Analysis of each data set separately and in combination contributed to the revealing how a tablet device based disaster preparedness training programme can be conducted and in what ways participants

can get engaged in the process, demonstrate and accumulate new knowledge and skills. In the following chapter how the findings from all the data sources provided an understanding of the research problem and research questions will be thoroughly presented.

7. CHAPTER 7: DISCUSSION

7.1 INTRODUCTION

In the previous chapter, findings from the research were presented with data extracts. Interpretation and analysis of the themes and subthemes in the light of the collected data was also presented. In this chapter, the findings of this research are connected to the existing literature or knowledge. Furthermore, how these research results have contributed to the knowledge will be elaborated. This chapter doesn't explicitly link the literature, knowledge gaps and the findings directly to the research aim and research questions that were sought out to be answered. These links will be dealt with in the following concluding chapter.

7.2 REVISITING PURPOSE OF THE STUDY

In this research, the researcher has explored the possibility of using technology assisted learning with a newer (to the participants) artefact- a tablet device to provide disaster preparedness training to people of disaster prone areas in Bangladesh to make them more responsive, vigilant and informed decision makers in the event of the most likely natural disasters that the region is prone to. The first element of this process was to identify the newer technology with a better scope of content dissemination. Ways in which the content could be developed considering the local needs were worked on. With the choice of teaching strategies informed by a series of relevant theoretical standpoints, it was to be seen whether the newer technological artefact can indeed better contribute to the attainment of disaster preparedness skills. Within the periphery of the research boundaries best possible efforts were made to examine these above-identified elements.

7.3 A SUMMARY OF THE FINDINGS

Findings from the research have brought out some of the less explored and unexplored elements of using technology led training in rather technologically disadvantaged locations.

Main results of the research:

1) Provided insights into how removing physical and psycho-social barriers and facilitating user-friendly engaging ways to associate with a (newer) technological artefact can lead to meaningful learning. **[Research Finding 1]**
2) Established the needs and demonstrated a set of ways in which localised content and interface can be created that preserves the local values and cultures and ensure end users are not overtly exposed to foreign contents. **[Research Finding 2]**
3) Assisted in determining the ways in which the invisible, ubiquitous teaching functions mix with both the technological artefact and technologically disadvantaged people within a social learning setting to deliver a training programme with minimal supervision. **[Research Finding 3]**
4) Provided insights on how by improving knowledge of available resources and fostering a proactive nature of the action (rather than reactive), faster decision making can be achieved. **[Research Finding 4]**

Within these key results, there were also minor findings that contributed to these major results. In the next section, these key results are further explored with respect to the existing literature as identified in Chapter 2.

7.4 AN EXAMINATION OF THE SIGNIFICANCE OF THE FINDINGS IN RELATION TO THE EXISTING RESEARCH

7.4.1 Confirmation of a lack of understanding of disaster and disaster preparedness

This ethnographic action research was situated in Bangladesh. The results in regards to the prior knowledge of disaster preparedness among the chosen country were broadly consistent with reviewed literature. Academic content reviewed by Bashiullah (2008), Rabbi (2008), Khan (2008) and Islam (2010) identified that topics related to disaster preparedness are poorly covered in the national textbooks.

Participants during the pilot study and also in both phases of the main study commented on how they read very little on natural disasters, and the content hardly intrigued them to understand further the complexity of the impact of a cyclone or flood which extends beyond the national resources. Overall understanding of the disaster preparedness was two-fold. Well known, localised knowledge (beliefs of the local community) was found to be more personalised than generalised. This is because no two instances of disaster survival are the same. The way the decisions are made during such events depends on personal circumstances. However, the findings of the research do not support Paul & Rahman's (2006) claim that, during a cyclone people get busy with securing and saving his/her life rather than other family members who are needy such as weak, elderly or even disabled. The authors also mentioned that disabled family members at times are left behind when a family retires to a shelter during a cyclone. Throughout this research, there were no such cases where the participant has mentioned leaving any family members behind. Also, there were participants who clearly mentioned that they would refuse to leave house without taking the weak, elderly or disabled members of the family. A good number of people, further elaborated that moving out in an unfavourable condition can be life threatening for the weaker family members, thus all the family members would rather stay at their residence and face the odds. Within the scope of the sampled participants, there was not a single case that indicated of lack of affinity toward a specific family member which could contribute to Paul and Rahman's claim.

The post-disaster events are, in general, a community effort in getting back to their normal life. The clear disconnection of the textbook approach of disaster awareness became evident across the locations. Research findings support claims of Yap et al. (2011) that, lack of knowledge leads to ignorance of the early warnings. The research finding problematizes the concepts of 'disaster' and 'disaster preparedness' by identifying the differences the localised versions bear to it. For instance, a disaster would, in general, imply the emergency situation has gone beyond the community and national scope. It was found that to the participants it was the disruption of their daily life and being unable to get back to their normal

life constructs a disaster to many. The aftermath of losing their livestock is a disaster to many. Disaster does not always add up to loss of life per se. Despite everyone being safe, finding everything they have owned are destroyed is a disaster to most. These localised interpretations are important to consider for disaster preparedness training.

7.4.2 Provided insight on how a newer technology can positively influence learning

In section 2.2.1.3 and 2.2.1.4, a number of projects were reviewed which started off with having a newer or unfamiliar technology introduced among technologically disadvantaged people. Those projects had a technologically deterministic proposition- which was that by making technology accessible to the people a particular problem (improving literacy, teaching maths or just the gaining necessary ICT skills) could be solved. Such push strategy of technological intervention did lead to uncertain outcomes at times, and there were critiques of such approaches who couldn't justify these projects making a sustained positive impact (Warschauer, 2003; Shah, 2011; Kraemer, Dedrick & Sharma, 2011). There were also ethical concerns of what measures were taken to ensure the exposed population were safeguarded (Cohen, 2009; Clark, 2013). Selwyn (2013) and Tahoma (2015) have clearly conveyed their understanding that any technology led intervention will be prone to failure if it neglects the need for that piece of technology in the local context.

A technological artefact bears some form of affordance; it is made to fulfil a particular purpose with a certain boundary. It is important to consider the fit of a newer technology in the local context. English predominantly being the language of the digital world, it is important to look at how content can be designed for a group of people or a country at large where English is not the first or even the second language. These considerations have a greater role to play in the device selection stage, in the content creation stage and in interaction devising stage. This research has demonstrated the growing concern of not appropriately valuing the importance

of local conditions, local culture and language in content development as a valid concern which requires careful consideration and immediate attention. The success of a training programme created for improving decision-making during a disaster event cannot ignore the need for localised content which will require thorough research of the locations where the research will be situated and a clear understanding of the people's level of knowledge before attempting such approach.

As this research went from one location to another, the importance of having a newer technology (the tablet device) became more evident. A few of the participants had experienced part of what a tablet device offers in isolation. For example, multimedia content through TV, reading writing instructions through computers, listening functions through radio and also feature phones with internet connectivity. The tablet offered them all of those functionalities integrated in one device which raised enormous curiosity. This curiosity motivated participants across the literacy spectrum to get to know the technology from a closer proximity. It became even more interesting when the purpose of the technology became educational as people of those communities most likely hadn't encountered that technology in such a setting before. The main reasons why they actively participated were because they clearly understood the training's potential of improving their decision making ability. The used artefact had a pulling impact on the participants. Findings from this research indicate learning can certainly be satisfying for them as long as it is not rushed, dictated or forced which is very common in those technologically disadvantaged locations.

7.4.3 Confirmation of a need to have localised content development

Understanding the importance of localisation is critical to developing a training programme as this affects the content selection process. Unless the main terminologies are understood in local terms, there will remain a possibility of creating a disconnect with the training recipients. Also, the content in itself needs to be localised, such as - a place that is prone to cyclone and flood needs to get preference in knowing about those two natural disasters rather than other natural

disasters in more length and breadth. This is the first study, to the researcher's knowledge, which examined the way 'localised' disaster preparedness content can be delivered to the common people using a technological artefact.

In Bangladesh, ICT programmes oriented towards similar population makes use of used computers and laptops in a majority cases. However, the content development still is highly influenced by what would normally be expected from a western perspective as was found in the Bangladesh government launched disaster preparedness training aimed at all. That programme though covered a good range of topics but they were far from inclusive and were too complex and complicated for a common person to understand. Also, it is very common for contents to be a translated version of the western format. While the western format can inform the content creation but having just a translated version does not always do justice to the original (Thies, 2015; Squires, 2009). This was also observed during the interview transcription process because at times the professionally translated English version was not the exact representation of the Bangla version. It could potentially be due to the high contextual nature of Bangla language and low contextual nature of the English language. Similar issues can occur if foreign content is transported in Bangla without careful considerations. Thus, 'Localisation' is one of the key concepts in the content creation process that needs to be understood to ensure technological artefacts regardless of their type and the content they carry, can be better integrated with learning and teaching.

7.4.4 Informed the limitations of Minimally Invasive Education (MIE) pedagogy

Initial stages of the research were partially informed by Mitra (2000)'s Minimally Invasive Education (MIE) teaching pedagogy which has been previously used mainly within children's learning settings. Dangwal & Sharma (2013) demonstrated that it could also be used in an adult learning setting yielding positive outcomes. As explained in the literature review, this being a documented teaching strategy used

in a similar socio-cultural context was an important consideration for this research. Identified shortfalls of the existing MIE approach could have been answered through this research, and if possible the existing approach could have been strengthened with findings from this research. It seemed this was quite a challenging task given the following key issues as identified during this research:

7.4.4.1 In the MIE approach, the importance of content is non-existent

Technological artefacts have a central role in educational settings, but there are additional considerations such as the role of the content that is provided via these artefacts. When the researcher was learning about the way the MIE technique was used in the 'HiWEL' project, the following stated by Mitra (2006) gave a clear indication of the low value placed on the content:

> *'We saw that the quality of educational material put on these computers is not a very important factor to their being used. Slum children will use whatever they have.' (p. 64)*

Majority of the HiWEL participants could barely read and write in their native language, but were subsequently exposed to content created in English. This was apparently not a problem in the MIE based projects as Mitra (2006, p. 88) claimed;

> *'… Illiteracy does not seem to be a drawback… Computers can be learnt by illiterates in much the same way…'.*

Regardless of the scope of the HiWEL project, based on the review of the learning theories it was anticipated that having unplanned content could create barriers to learning by increasing 'cognitive load' and also confuse the learners in the knowledge construction process. This research gave an appropriate opportunity to test whether such claims were valid.

With the support of the findings of this research, it can be said that indeed placing low value of the role of content in a technological intervention in an education setting can be dangerous. For example, not teaching the right way of doing the first

aid (treating wounds and CPR) and not guiding participants to take the most appropriate stuff in an emergency kit or even not adequately guiding them on creating an emergency plan, can have fatal consequences. When a minimally guided environment is used to assist in gaining such skills, content disseminated through the artefacts becomes one of the most important factors.

7.4.4.2 Role of a teacher is unappreciated in MIE

In the earlier sections, some of the covert teaching functions within a technology led intervention in an educational setting were explored and explained. In the most talked about interventions in recent decades, OLPC and HiWEL, teachers were sent to the back of the operations as the users (or participants) were placed in the self-teaching mode with little or no visible presence of a teacher (Mitra, 2000, 2005). Grand claim such as, learning in MIE happens irrespective of the 'existence of the schools or teachers' (Mitra, Dangwal & Chatterjee, 2005, p. 15) are oblivious to the fact that, the physical presence of a traditional teacher may have been greatly reduced in MIE, but that doesn't necessarily mean the teaching functions were completely absent. Some teaching functions were dispersed within the computers and facilitators which were less acknowledged, and less clearly stated in describing how the teaching functions altered in the HiWEL project.

This research had opportunities to consider the teaching functionalities that are rather 'omnipresent' within such less intrusive learning environments but gets less importance in documentation process of teaching pedagogies that limits the physical presence of the teacher. Findings of this research indicate that these functionalities can perform well if they are recognised and well thought through.

Interventions from an expert trainer or teacher are a key to the success of the programme. To ensure the intervention points are suitable for progressing to the next level careful thought must be given. Mitra rightly suggested intervention points can be determined by monitoring the learner progress. However, as the teaching functions were not well documented in MIE, who it was or who was

monitoring the progress in reality and to what extent the monitoring took place is difficult to understand, and thus it is complicated to replicate in other settings. There was a presence of trackers in the system and the presence of CCTV at the location. There wasn't any mention of maintaining a database with photo ID's to manage the users. Thus, who conducted the interventions and to what extent s/he was part of the system overall remained undisclosed (Mitra, 2000).

The less than satisfactory documentation jeopardised the academic roots of the MIE approach as it made it tough to transfer this approach to other similar research work. Throughout this research, various teaching functions were identified from the content planning to the content dissemination stage, and in this research, they were documented and tracked. The role of the teaching function within the fieldwork (from observation to conducting interventions) were thought out and justified for each stage. Two main points of interventions were required in this research (MSP-1, MSP-2): one at the very beginning of the training to guide participants in how to use the device, including how to take pictures using the device which was later used to demonstrate their spatial awareness of an emergency situation. In the final intervention, a qualified professional trained them in aspects of first aid.

MIE's theoretical weakness was identified in the literature review chapter. The current state of MIE did not clarify the content requirements, did not assign roles of the teaching function adequately, and also the pedagogic elements were vague. As explained through 7.4.4.1 and 7.4.1.2 and in the earlier sections, there were significant changes made by the researcher within the existing MIE approach and whether a newer pedagogic approach should be provided to give the strategies used in this research clearer definition will be further explored in the section 7.5.1.1 of this chapter.

7.4.5 Shaping of the teaching functions in minimally supervised learning environment

It was quite evident from the literature review that in a technological intervention more importance is given to physical absence of the teacher rather than acknowledging to what extent the physical presence is compensated by the artefact and what teacher functionalities are nonetheless retained by the 'human' teacher. Informed by the literature review, section 2.3.3, it was important to clearly identify various teaching functions found in the learning environment. These were clearly identified through a series of checks by enquiring the following:

Diagnostic functions:

a. who is categorising the participants based on initial or diagnostic assessment (literacy, technological literacy etc.)?
b. who is selecting the content to be delivered (Creating the curriculum)?

Perspective functions:

c. who is creating the content to be used in the training programme?
d. who is creating and enabling structures for learning?
e. who is designing the problems in the tasks?
f. who is facilitating the groups (if groups exist)?
g. who is conducting the interventions (if interventions are used)?
h. who is monitoring the system and ensuring all activities are going smoothly?
i. who is assisting with maintenance and troubleshooting of the technological artefact?

Evaluative functions:

j. who is assessing the completion of the activities?

The findings of this research contributed to the academic debate about the displacement of the teaching function in such a technological intervention. This research did not aim at 'eliminating' the physical presence of the teacher or

completely ‘replacing’ the teacher with the artefact, but had curiosity in observing the way some teaching functions were disbursed to the artefact and facilitators.

Throughout the cycles of the fieldwork, it was found that the content design required multiple revisions and evaluations by those who had current knowledge of the locations and understood the local needs. Content design for such technologically disadvantaged locations is crucial because if the content is too mainstream and bears less connection to the local reality it is unlikely to satisfy the participants or even make them interested in participation. While selecting content, it was also necessary to gather information on the existing materials and resources so that an informed understanding could be formed in regards to the content creation. It was found during the research that content should build up by acknowledging local knowledge as that made it easier for the participants to connect with it. This sophisticated involvement is a teaching function. In this research, the content selection as a teaching function was dispersed among the researcher, the supervisory team and a group of general and expert evaluators.

Designing problems in the tasks need to be localised. A place where there is no risk of an earthquake, it would be quite irreverent for them to engage in an earthquake related activity. Setting tasks and interactions is also part of the design process. The way tasks can be formulated requires knowledge of the teaching pedagogies and also having a critical lens to be able to go beyond the traditional ways of delivery. Whether the interactions are suitable for the chosen location and group of people is similarly needed to be evaluated. Findings of this research affirm that to ensure a greater participation it is of utmost importance that the participants are well aware of the interaction strategies. The way this information can be passed on to the participants is crucially dependent upon the person who will assume this teaching function of initial guidance which is a part of the facilitation[12] process. Even though the participants are placed in groups with an artefact, and they go through the

[12] The role of the facilitator in an adult learning setting is to assist learners in the knowledge construction process without being directive (Brookfield, 1986).

same content, it is the individual that has to make sense of the content to actively participate in the group. For this reason, facilitation becomes an important aspect of the learning process.

Teacher function was also embedded with the process of selecting and creating the content and the interface. To ensure the technology was used in a meaningful way particularly in the educational setting there was a need to have a facilitator who would reassure weak participants (if necessary), guide the learners to operate the device (if required), keep the participants on track and focused, handle the unexpected issues with the interface and device (if they occurred) and importantly continuously monitor the progress of the groups in the tasks ensuring timely session completion. This less obtrusive monitoring function ensured that the participants had a reference point especially if something unexpected occurred. Bearing in mind that it was a newer form of technology for them, it was expected that they might be hesitant in handling the device in the beginning. To eliminate or mitigate such negativity which could result in dropout from the training the presence of a facilitator(s) was crucial. The facilitator(s) can be multiple people or the same person depending on his/her level of expertise. Despite having multiple facilitators, there can still be a need for separate expert trainers to conduct more specific interventions (as required in the first aid training session in this research).

Some of the teaching functions such as monitoring and observation of the progress are key to measuring success. Some of the tasks could potentially be monitored within the device using the software's monitoring mechanism. This was tried in the pilot stage but dropped in the subsequent stages due to the complexity of the device being used in a group setting. It was difficult to understand individual progress such as the number of times the interface was used, time spent on an individual slide/page and task completion time through the standard monitoring system. As there were interactions designed that had activities beyond the interface, the monitoring system required to be humanly monitored. It became necessary to be vigilant of the high performing and low performing participants. It was anticipated that every single participant would not learn at the same speed or

progress at the same rate. It was found in this research that the way different groups of literates, semi-literate and illiterate participants interact and make sense of the topics are complex. There are many borderline cases where current way of grouping of literacy types can be confusing and of high risk within the learning environment. For instance, in this research, within a group of literate participants, some had totally forgotten to read and write, but they still possessed documentary evidence that they are literate. Within their community, this literacy is likely to be a thing to be proud of. Thus, they might resist any public statement that they can no longer be termed as an illiterate. To go beyond this documentary evidence and assess the true level of literacy is a challenge and this should be a teaching function.

While a traditional literacy check is an important issue to tackle by the teacher, there is another major underlying problem. In many of the developing countries, there is an absence of a definition of 'technology literacy'. Also, there are no clear and concise measurements of understanding various types of technological literacy (this is further elaborated in section 7.4.7). This is problematic for the design perspective. In the research location, in Bangladesh, no such definition or categories existed at the time when this research was completed and this thesis was drafted. This is a considerable problem for any technological intervention in that location. To ensure the training has achieved its goal, it is important to consider whether there is a technological fit between the exposed participants and the chosen device. Devising a group within such context is a complicated task. It will require an understanding of both the current technologies and the time requirement of learning to use such technologies within that social context. This categorisation also becomes a teaching function.

In the previous technology led projects, the importance of the intervention points was less elaborated and explained, it is important to note that understanding when the participants are ready is a key to achieving success with a training that uses such interventions. The interventions were crucial milestone points in this research. During the interventions the participants were able to go beyond their acquired knowledge and learn something far more complex and useful in a disaster tackling

scenario. A teacher in this case had two important decisions to take. Firstly to determine suitability of the intervention points based on the participant's progress and readiness. Secondly to conduct the interventions. The concept of 'Zone of proximal development' as explained in the literature review was used to determine the necessity of the interventions.

It is not usually expected that the teacher or other personnel related to the teaching process will be a troubleshoot expert. Considering the remoteness of the locations and technological backwardness there may be a case that it will be hard to get expert technicians. Tablets devices in general are robust, other than exceptional mechanical failure, basic troubleshooting (Frozen screen, no sound, no camera display etc.) can eventually become an integral teaching function. However, for complex maintenance tasks other experts might need to get involved.

7.4.6 Contributed in critical understanding of the UI design for the less literate people

Ahmed et al. (2015) conducted a comprehensive review of the interfaces developed to make them usable by less literate people in the developing countries and found that a common approach in developing interfaces in such contexts is to use less text so that the literacy requirements are reduced. This reduced text needs to be compensated for by other means which come in the form of visual elements and audio (supportive and not as the main component). The same authors also acknowledged that it remains an issue to find visual elements that represent the local culture that are easily understandable by those less literate people.

The literature review indicated that there are important cognitive considerations for the interface design aimed for the semi or illiterate users (Medhi et al., 2006). If the illiterate users were expected to have issues with navigating a hierarchical content then would a simplified representation of the content came across as too simple and less useful to a literate user required further exploration.

During the MSP-1 stage in this research, it was found that having literate people using an interface and content designed for the semi-literate or illiterate people can give the participants a feeling that the content is too simple to be learned in a social setting. Thus, the trade-offs between the primary intended users and secondary users in the interface design process are vital in ensuring it is fit for purpose. It can be best understood by some illustrative examples. Some of the interfaces used within desktop computers and laptop(s) are presented below:

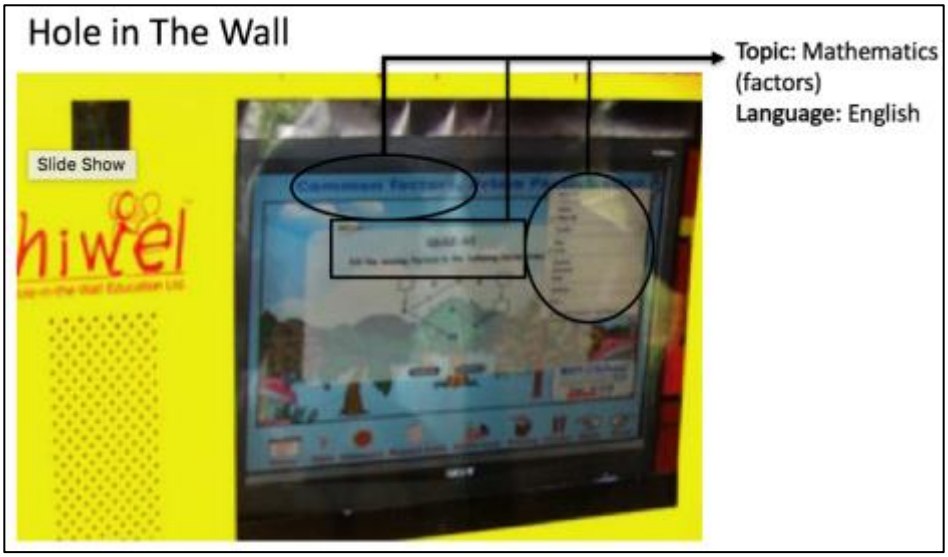

Figure 25: A screenshot of a mathematics application of the Hole in The Wall experiment (1999).

Figure 26: A screenshot of an image editing application (left) and a desktop screen (right) of the One Laptop Per Child project (2005).

Figure 27: A screenshot of a language teaching application (left) and the generic interface (right) of the One Laptop Per Child project (2010).

These three projects targeted people with limited or no literacy in their native language but they were presented with an interface and content in English, a language that was unknown to them. Even though these projects are about 5 years apart, it appeared that there had been very little consideration given to the importance of localised content and interface development.

More UX (User Experience) focused research has taken place especially in India (Parikh, Ghosh & Chavan, 2003; Medhi et al., 2006; Cuendet et al., 2013) and some in Bangladesh (Ahmed et al., 2015) where a number of UI (User Interfaces) have been designed by researchers that used laptop and mobile devices to attempt to reach out to the less literate people.

Interfaces created for less literate users to be used within laptop(s) and mobile devices are presented below:

Figure 28: A screenshot of a prototype of an accounting software for less literate Tamil people in India (2003).

Figure 29: Interface of an educational app for OTPC-Thailand. (On the left, for learning "things that have life", and on the right, for learning "parts of a tree/plant")

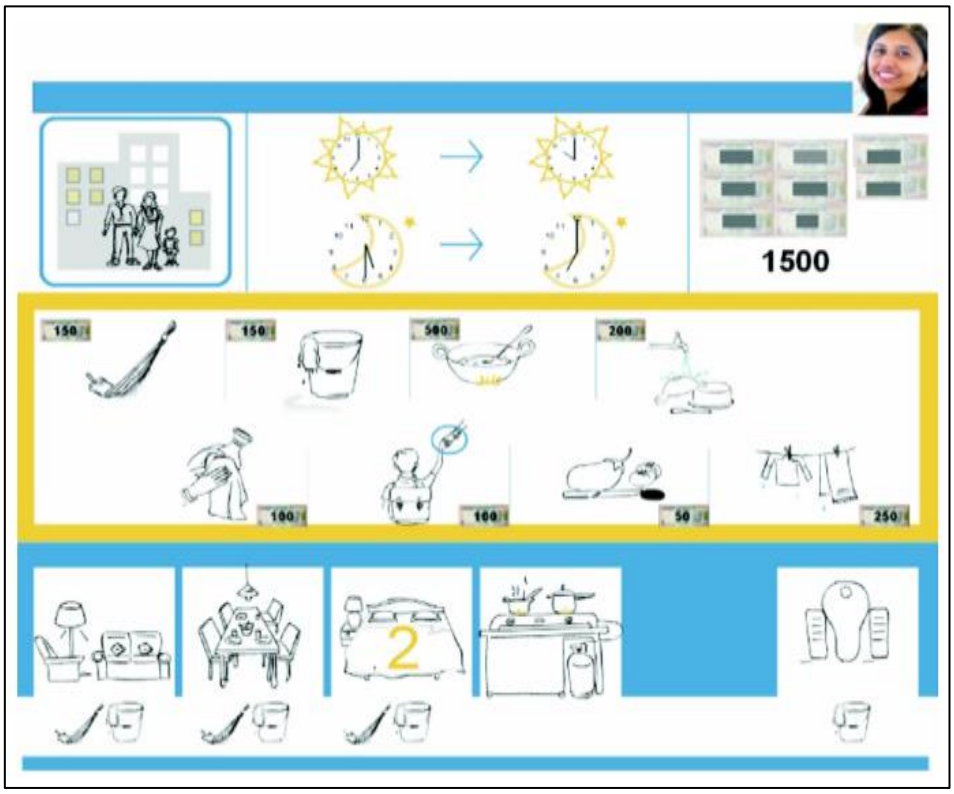

Figure 30: A screenshot of a desktop based job search application for the less literate house helps in India (2006).

Figure 31: A screenshot of VideoKheti, an agricultural mobile app for the less literate farmers in India (2013).

Figure 32: A screenshot of Shurid, an easy to use mobile app for the less literate rickshaw pullers in Bangladesh (2015).

7.4.6.1 Is text free UI a better alternative?

Parikh et al. (2003) found regardless of whether the people were comfortable reading the texts, it should be in the local language as it gave the targeted users a 'greater sense of familiarity and ownership'. However, in the later years, Medhi et al. (2006, 2013) and Thies (2015) argued that a text free UI was an ideal option for the less literate people. Thies (2015) claimed:

> *One of the greatest challenges in designing for low-literate users is that they are unable to read text. Textual interfaces are therefore unusable. (p. 61)*

In this research it was found, textual representations were not an issue for the participants and on the contrary, an interface without much text could have ended up being super minimalist and potentially lead to confusion and most importantly alienated the participants by making them feel they didn't know what they saw on the screen. Thus, the research finding corresponds with Parikh's statements and disagrees with the text free UI considerations of Medhi et al. (2006) and Thies (2015).

7.4.6.2 Local numeric symbols work but not always the foreign ones

Figure 28 to Figure 32 illustrate how universal symbols were used instead of excessive texts in those interfaces (In Figure 28: dates, balances and transactions, in

Figure 30: the clock, prospective salary, customised salary per unit of work, in Figure 32: the mobile phone numbers). Medhi et al. (2006) found her target population were somewhat familiar and comfortable with numerical symbols, as was also found by Parikh et al. (2003). Considering this less literate context, the most appropriate expectation will be that even if they are comfortable with identifying numbers, that will be in their native language, not in English.

Universal (Hindi-Arabic) Symbols	0	1	2	3	4	5	6	7	8	9	10
Modern Devanagari Symbols (Hindi)	०	१	२	३	४	५	६	७	८	९	१०
Bangla Symbols	০	১	২	৩	৪	৫	৬	৭	৮	৯	১০
Tamil Symbols	௦	க	உ	ங	ச	ஞ	ண	எ	அ	க	ய
Thai Symbols	๐	๑	๒	๓	๔	๕	๖	๗	๘	๙	๑๐

Table 9: Symbolic variations of numerals

A closer look at the above table depicts that, the symbolic representation of the numerals varies significantly in the local language with only a handful having similarity with the universal symbols. Sometimes when there is similarity it can be a wrong flag and lead to errors in input or selection by the participant or user (In Bangla, number 4 symbol is identical to number 8 of the universal symbol and Bangla 7 is very similar to the universal symbol 9). From a user experience perspective, this was most likely seen as a defect. Thus, those interfaces that aimed to cater for less literate people committed a crucial design error. In an ideal scenario, interfaces targeted towards less literate people should have all texts in

the native language. As these initiatives are spread over the years, this raises concern on to what extent the local needs are truly valued as the subjective bias of the initiators (that the universal symbols of the numerals will be understood by the less literate people) prevails in the design process.

Findings of this research clearly indicated needs for using 'local' language in the design to optimise the learning engagement. The interface that was constructed in this research corresponded to this localised text representation and the less literate participants were able to identify Bengali numbers quite well.

7.4.6.3 Use of prominent colours in the interface is helpful

Use of prominent colours was found to be a major design consideration by Parikh et al. (2003). Similarly, in the interface used in this research, prominent colours being a representation of the local colours (colours of the national flag, trees, sun, etc.) were helpful for the participants to feel connected to the interface and the provided greater affinity to the content. Use of less prominent colours on the screen with more whitespaces enabled participants to focus on the main content and not get diverted by prominent colours.

7.4.7 Identified a potential issue with the current way of defining literacy in Bangladesh

This research identified that the way we perceive literacy from an external point of view, is not always the accurate way of looking at it. In the late 90s, there has been an extended effort by the Bangladesh government to improve overall literacy rates across the country. In Bangladesh, significant funding was allocated across the country to attract people regardless of their age and gender to participate in primary education programmes and attain a base level of literacy, at least to a level where they can sign their names.

Literacy is a complex and multi-faced concept that continuously evolves with the socio-cultural context (McMillan, 1996). Bangladesh Bureau of Statistics in the past (prior 2008) used the self-assessment definition of literacy in censuses and surveys in measuring the general literacy level i.e. the respondents reporting (by self or proxy declaration) as capable of writing a letter in any language were treated as literate (Bangladesh Bureau of Statistics, 2013). By identifying its limitation to give a valid measure of national literacy rate and to provide the capacity of international comparison a standardised definition was sought by the bureau. UNESCO proposed a definition of literacy which was taken as the standard:

> *"Literacy is the ability to identify, understand, interpret, create, communicate and compute using printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve his or her goals, develop his or her knowledge and potentials, and participate fully in the community and wider society." (Bangladesh Bureau of Statistics, 2013, p. 4).*

Once a person is termed a literate or a semi-literate it stays with them forever, at least socially. Bangladesh Bureau of Statistics (2011) clearly identified that the use of literacy skill in everyday life through reading and writing is not very encouraging and is an indicator that even the literate persons do not use their skills for further improving their skill through the day to day activities. Bangladesh Bureau of Statistics (2013) judged literacy from a functional point of view in 2013 and surprisingly found that completion of the primary education was not a guarantee of attaining functional literacy. It was also found that among the respondents, who had no formal education at all, 17.4% were functionally literate.

Findings from this research work further reinforce the need for understanding actual levels of literacy in practice so that the participation experience can be better designed. In one of the research locations, a literate and semi-literate group turned out to be a group containing a few semi-literates (who struggled a lot to read continuous sentences) and mostly illiterate people. This anomaly occurred because

they once were able to read, but they had hardly used their reading skills in the past, and to their surprise many found during the training that they couldn't read with fluency anymore. Given this situation, it gives an alarming indication of the dangers of generalising literacy.

It was also found in the early stages that, there exists no official definition of technological literacy in Bangladesh. With the progress of technology deployment in Bangladesh, it will be in the best interests of those projects to formulate a way in which technological literacy can be defined. Also, Bangladesh statistics bureau should make provisions to collect data on personal technological literacy (such as what current technologies they have access to, whether they are using a mobile phone) when they conduct nationwide surveys.

7.4.8 Confirmation of issues with hierarchical navigation and content representation

The findings of this research also support the findings of earlier work by Mehdi & Cutrell (2012) and Medhi et al., (2013). Through the observational field data, it can be said that illiterate people indeed have a limited skill set to navigate through complex contents, and also there are issues with interpretation as they tend to take more time in breaking a sentence into multiple parts and trying to understand it as a whole. Regarding using the technology, as the content provided through the interface was mostly linear, the claims made by Medhi et al. (2013) regarding the hierarchical navigation of contents could not be further justified. This can be worked on in the future. However, research findings illustrated in 7.4.6 and 7.4.7 indicates the illiterate participants most likely won't progress at a similar pace. Thus the embedded 'Read to me' function may not serve its purpose on its own. Though it was not anticipated, this finding corresponds to the claims of Tuovinen and Sweller (1999) that exposing participants to unfamiliar content with no supervision for undecided hours might lead to cognitive overload.

7.4.9 Contribution in understanding the complexities of an inclusive learning practice

This research finding reinforces the recommendation (UNICEF, 2003; Ahsan & Mullick, 2013; Ahsan & Burnip, 2007; Hill & Rahaman, 2013; Kibria, 2005; Malak, Begum, Habib, Shaila, & Moninoor, 2013) for improving ground level practices concerning inclusive learning. Like the previous two key findings – erroneous understanding of the literacy levels and absence of categorisation of technological literacy suggests, achieving an inclusive learning environment is a myth, especially in Bangladesh. The research findings correspond with findings of UNICEF and CSID that the concept of inclusive learning is not well received in Bangladesh (UNICEF, 2003; CSID, 2008). While that remains true, what this research found is the exclusion boundaries need to be understood so that there is no negative impact on the participants. For instance, mentally disoriented people were not included in this research, this is partly because the teaching and learning were in a group setting and having such person included in the group could cause chaos. Similarly, disabled people were not included as there weren't enough resources to cater for their special needs. Finally, under 18s were also excluded. This was also done purposefully for two reasons. Firstly, to what extent this training can be taken to the under 18s and what cognitive impact it will have on them were not conclusively researched, and it would have been unethical to include minors in this research and secondly, there was a pragmatic ethical consideration that gaining permission would probably have been difficult.

Findings of this research contribute to understanding how an inclusive learning setting can be created even in challenging contexts. The group formation mechanism, the way groups were facilitated, and participation ensured during the interventions, the activities that were managed and maintained across the varied group of participants were better documented and thought through in this research (detailed in section 6.4.1.1) which differs from the ad-hoc uncontrolled grouping as found in the existing projects reviewed in the literature. Finding of this research indicated the importance of ‘heterogeneous’ group formation (with people of all

genders, literacy skills and technological literacy) in the knowledge construction process.

Findings of this research also suggest inclusion is just not tied to access to a device or to ensure a well-balanced participation from both gender groups, but also providing the content that is developed for the chosen location and people of that location in mind. This particularly connects to the cognitive capabilities of the participants. If the content is too complicated and complex, then, regardless of its relevance, the content becomes useless to the receiving participants. One such instance was the CPR training block within this training in the MSP-1. It was identified that many die during flood and cyclone in Bangladesh because of not having someone capable of conducting a CPR. From this identification, content was created within the interface which would demonstrate the CPR stages, also within the intervention, it was planned that the participants would be taught this technique. In the MSP-1 stage, this idea failed to materialise, and the participants expressed the point of view which was they were shy and not willing to demonstrate. Because of its perceived importance, it was also included in one of the interventions in the MSP-2 stage. In MSP-2 the research went into many locations, so the expectations were positive. However, many excuses started to come forward and mostly to do with this task been seen as something a doctor does alongside more expected comment about shyness. The content in the interface in relation to the CPR was surprisingly not questioned or objected to. This shows two dimensions of inclusive content design. While the content displayed within the interface was not obtrusive the same thing in the real demonstration was obtrusive for the participants which was due to their underlying feeling that it is a job of a doctor and not for a common person. These localised decisions are significant findings of this research that make a contribution to knowledge. These incidents will be helpful not only in disaster risk reduction training but also for medical training in the future where such initiatives might be taken to spread first aid awareness among the rural people.

7.4.10 Contribution to the dissemination of the disaster risk reduction techniques

The research findings also contribute to the current disaster risk management initiatives within the region that also deals with the use of current ICT technologies. The placement of an unfamiliar technology in an educational setting and by using the initial curiosity to drive learning is likely to be replicated in similar contexts. One interesting observation was that the participants liked the videos of cyclones hitting localities and the emergence of a cyclone. This was in line with the UNESCO's (2007, p. 37) anticipation that,

> *Video is an effective mechanism to deliver practical information about cyclone preparedness to the people of the coastal community*

Videos used in the training were highly engaging, and the participants felt that because not many of them had seen how the cyclone actually forms and spread havoc the video was an eye opener for them. They were able to see how the situation could escalate within minutes and how every single minute is precious. This was connected with the importance of early sightings which is mostly ignored in those locations. With VR technologies now gaining mainstream attention. There is further scope in providing a more realistic impression. Such trials were conducted in 2016. However, as such 360-degree videos of cyclones in the chosen locations are rare this does need some time to be converted into a reality. However, those who participated in an early demonstration commented that they would feel they were in the middle of the scene and it did intrigue them (Tarek, 2017).

Understanding of the emergency plan, emergency kit and first aid skills are transferable skills. The way the common mass attained these skills will inform current local disaster risk reduction and disaster risk management measures. This study reinforces the recommendation for the introduction of such training among the mass as this will enable faster response not only during disasters but also in other emergency events (Mathbor, 2007; Mallick, Rahaman & Vogt, 2011).

7.4.11 Inform the development of interfaces in language other than English

Findings of the research can contribute considerably to the development and evaluation of a better inclusive software or application. Such as to understand a participant's actual literacy level, a literacy scan can be placed during the recruitment or the introduction days for each participant. This scan would not replace the way their literacy is labelled in reality, and their current state can just be a code to avoid (potential) negative reactions from other peers. Literacy scan would potentially inform the starting point of the programme for that individual, and a more informed group can be made. A presence of a technological literacy audit is necessary, and thus, it needs to be created and put in place so that the participants can be sorted in the best possible groups. At present, no such mainstream mass oriented initiative involves such novel use of technology in disaster risk reduction. It is true that having a technological artefact can be a costly choice initially, but the actual potential of using it in innovative ways cannot be overturned. In the literature review section, it was stated that, with OpenGPS project trying to map the Bangladeshi territories, in the future it is most likely that such application can be made that can enable a user to identify his/her location during a disaster and allow him/her to notify chosen contacts on their whereabouts. Also, a GPS fencing can be created so that people within a custom chosen boundary are kept informed of the sudden onset of a cyclone. This will particularly be useful for fishermen and their families who live dangerously on the river banks. These situations are not just found in Bangladesh. Very similar issues are found in India, Pakistan and Nepal. Findings of this research can inform similar interface and content development initiatives in those countries.

Also, there need to be further considerations in modifying the contents. Whereas in this research a linear model of content dissemination was used, in the future versions, a more complex hierarchical content representation can be utilised. This will enable the participants to jump to advanced level contents, based on their knowledge and skills as found in the early screenings. This will reduce the training time and ensure the level of understanding can create a bridge to directly connect

with the most relevant content within the training programme. These considerations remain to be tried and tested in the future. It can be assumed that the training will be highly replicable in similar geographic locations and beyond.

7.5 IMPLICATIONS AND PRACTICAL APPLICATIONS OF THE RESEARCH

Studies related to disaster management are mostly interdisciplinary where two or more academic disciplines are combined into one research activity. This is because 'Disaster' or 'Emergency' is yet to receive full recognition of a discipline across the universities in an international context (Phillips, 2003). Complexities of researching within this field require the amalgamation of theoretical understanding of education and technology in the broader contexts. Thus, the results of this research are not tied up with just one discipline; rather it contributes to theoretical and applied knowledge of both disciplines.

7.5.1 Contribution to theoretical knowledge:

From a theoretical perspective, this research also has a number of fundamental contributions to the knowledge:

7.5.1.1 Teaching pedagogy

Considering the limitations of the 'Minimally Invasive Education' in regards to selection and creation of the content, not giving a clear identification of when to conduct the interventions and moreover for not differentiating the learner needs in the teaching process; it becomes difficult to follow the pedagogy in other contexts. Maybe it worked in the 'HiWEL' project, but that pedagogy is hard to replicate elsewhere.

It was identified in the literature review that the contemporary literature has overlooked what mental impact MIE may have on children or adults. In this

research, the participants were found to have some experience of the impact of the disaster(s). This experience for some was too vivid and connecting. For some, it was something they have grown up with. For some, it was just another occurrence of the year. It will be justifiable to say they knew quite a bit about the disasters and this is in line with the Dewey's (1938) view of learning through experience. Their way of interpretations might have been different, but they had their ways of seeing it and describing it. As expected in the literature review, through the semi-structured interview and photo elicitation interview it was found indeed, their learning in this process were not just informational but also, they could use this opportunity to learn better ways to face a disaster which is a form of 'transitional learning' (Wildemeersch & Stroobants, 2008). Furthermore, for some who had less experience of disasters going through the video clips of seeing a cyclone hitting the seashore houses were rather 'transformational' (Mezirow, 1990; Kegan, 2008). In this research, it was found the pragmatic experiences played a key role in connecting with the content, and the importance of the experience of the participants cannot be undervalued or ignored. This positively corresponds with Kolb's (1984) experiential learning theory.

As the targeted participants were most likely to have a weak educational background. It was important to consider the extent to which the presented content will push them. Koole (2009) argued that well implemented mobile education could assist in the reduction of cognitive load for learners. Also, she has acknowledged that, it's hard to determine how to 'chunk' information, understand different patterns, decide the amount of information to provide and present the information so that it can potentially help learners to retain, retrieve, and transfer information when needed. This was indeed the case in this research; there were also instances where the illiterate participants found it difficult to follow the voiceover as they were trying to understand what was said to them and connect it with the displayed content. Thus, the importance of cognition or cognitive abilities requires thorough consideration in such training. Findings of this research gave a few cases that informed claims of Kirschner et al. (2006) which are essential to consider in similar learning environment. Kirschner et al. (2006) claimed the aim of

all instructions is to alter long-term memory. If nothing has changed in the long-term memory, nothing has been learned. Findings from this research indicate, this is not an absolute truth, as many simple instructions require an action and it is not required to make a long-term change in the memory. For example in the interface, for those who had difficulty in reading the text they were directed to click on the 'Read to me' button. This required just an action and no long-term storage in the memory. Similarly, in a picture taking activity, touching the camera button to take a picture action, did not require a long-term memory storage. From a pedagogic point of view the findings of this research demonstrated it is important to acknowledge that, there should be informed understanding of the ways in which content can become too demanding for the learner and create discomfort or bring a negative impact on learning in general.

In this research, across the locations, it was found that a large section of the community has no access to education, which is partly due to their financial condition, but also, the society that they are born in hardly allows them to pursue education once they miss their first opportunity to get a formal education. Many of the participants noted how the some of the local NGOs are trying to bring training programmes based on local needs, but they are often handed over to inexperienced trainers. Programme delivery strategy in itself is at times the cause of failure. In such cases where existing systems are failing, technology has the potential to bring positive changes if the implementation is thought through by the people who are initiating it.

Medhi found people with little or no education have less developed cognitive structures which have a profound impact on the design of the user interface and content presented via the interface (Medhi et al., 2013). If those people are the targeted learners, then from the learning and teaching point of view, it requires further attention in designing the content dissemination, which will also have an impact on the teaching approach. This is because the current approaches are not immediately oriented towards the less literate people of developing or poor communities. Kearney, Schuck, Burden & Aubusson (2012) recognised the need for

examining the pedagogies that are suitable for mobile (the researcher assumes the tablet device also falls under the same category) based learning and Traxler (2007) conceptualised mobile based learning from the perspective of participant's experiences rather than the affordances of the technology tools. This research had an opportunity to use both the affordances of the technology and the participant's previous experience to contribute to the learning process. It was found, by exposing participants to a newer technology and having peers all around there was always a moment of interruption one way or the other. Some interruption was in the form of assistance with navigating or using the technology; some interruption was in the form of seeking further clarification on a text or multimedia content presented within the interface, interruptions in relation to the tasks posed via the interface and lastly ad-hoc interruptions by peers which don't always have a rationale.

This research setting or any similar learning environments thus will always be 'highly invasive or intrusive'. What becomes more important in such a 'highly invasive' setting is to consider, to what extent we need a teacher, a trainer or a facilitator in the real learning environment. Bearing in mind, finding such a person can be a problematic case, the supervision requirement needs to be carefully tailored to the content and instructional design to limit lengthy supervision needs to a bare minimum. Thus, 'Minimally Supervised' may be a more appropriate way of recognising such a pedagogic approach.

Intriguingly these people were not completely isolated from modern technologies. Being technologically disadvantaged did not limit them from having a television (though it may be an old CRT set) or a mobile phone (either basic or just a feature phone). It appeared that when a new technology (the tablet device) was taken within that technologically disadvantaged location, people took it with much amusement. The participants were curious. The closest thing to this was the TV in their living room as it can play multimedia content and in terms of operation, it was comparable to the smartphones that they had seen advertised on the TV. As some participants were not aware of that technology and hadn't encountered it in an educational setting before, it carried all the hype and imagination that normally one

would expect a child to have when s/he encounters a new toy. A new piece of technology paired with ‘minimal supervision' further motivated the participants as they felt empowered. To the researcher, learning initiated and mediate through a new technology in a non-native context is nothing less than a disruption in the way the less literate people have seen or experienced learning before with technology. Learning of this sort can be called as ‘disruptive learning', and the researcher defines this type of learning as below:

> *Disruptive learning can be termed as learning through the novel use of a newer, unfamiliar, alien technology within a technologically disadvantaged population, which radically changes the way they perceive learning in their native context, leading to the shared reflective exploration of existing knowledge to construct new knowledge and sharing among their peers and artefacts.*

The researcher’s way of seeing disruption is not same as ‘the theory of technological disruption’ of Clayton Christensen. A disruptive technology, for Christensen, as laid out in his book ‘The Innovator’s Dilemma’, is one that typically facilitates the production of a new market for products and services and eventually succeeds in disrupting an already existing market (Bower and Christensen, 1995). Though in recent year’s Christensen’s ‘theory of technological disruption’ has seen growing criticism from those who argue that disruptions are much less common and harder to pull off than Christensen and those who follow him believe (Danneels, 2004; Markides, 2006). Danneels (2004) also suggested that Christensen did not provide a precise and consistent definition of the term disruptive technology. The researcher's way of seeing ‘disruption' is confined to the learning context and not beyond that.

A question that arises is, whether any technology stimulated learning is ‘disruptive learning'? When technology is used in an existing learning setting the expectation is that it will enhance the learning process (Gulek & Demirtas, 2005; Wong, 2012). There are inherent attributes of a technological artefact which can have a

supporting role in the educational setting (Hammond, 2010; John & Sutherland, 2005).

Those who are the left behind people of the community with no formal education have a way of thinking in general that they cannot get into learning in a formal setting. The factors behind this thought process are mainly – lack of time, lacklustre effort, lack of motivation and interest. It was found in this research that, regardless of its affordances, a technological artefact in such scenarios can disrupt their negative thoughts and generate enough interest to motivate participants to try out the educational offering. This research reinforces the idea that if the experience of learning can be made interesting by taking out the negativities that have become associated with traditional learning elements, participants will soon be motivated enough to give time and effort in the learning process.

It was found that if the technological artefact is accepted (acceptance depends on the local socio-cultural values) by the local people, then it can foster learning among the deprived ones. I will illustrate this with a few instances: if a technological disadvantage community is already used to seeing ‘paper' as a mean by which reading, writing and sharing of information is done in that community, then, no matter how customized a newer training programme is made that uses paper-based materials as its primary medium, it will not attract as much attention as one using a novel medium and there will be less enthusiasm to start with. Similarly, television has been seen as a medium for distance education for decades. More or less every country in the world has some kinds of educational programmes aired through the TV. In a disadvantaged location, if that is now used as a primary mean of providing education, it is much less likely to cause any attraction. This was also found in the research locations as the participants mentioned how the TV would give weather warnings on the background but they will carry on with their current activities. Similarly, there are many locations within the developing and under developed countries where desktop computers are inexperienced. In such places, a desktop computer has the potential to create a positive learning impact. Similar can be said for the cheaper smartphones. This interpretation is more socially rooted

and can lead to a ‘pull effect’ of the technological artefact rather than a more common ‘push effect’.

To sum up, ‘minimal supervision’ and ‘disruptive learning’ are the two crucial elements that create the base of the teaching pedagogy that is informed by this research. Commonalities observed throughout the research locations give an indication to the stages involved in the teaching pedagogy which the researcher intends to term as ‘Minimally supervised disruptive learning'. Further elaboration of this is provided in section 8.6 of the conclusions chapter.

7.5.1.2 Rapid ethnography, visual data analysis and action research

Pink & Morgan (2013) suggested exploring more ways of intervening in the participant’s life to compensate the reduced field engagement in a rapid ethnographic research strategy. Pink who is one of the key authors in visual anthropology has elaborated on many such methods in enhancing field participation through engaging senses (Pink, 2006), video ethnography (Pink, 2007), photo elicitation methods (Pink, 2013). While such methods are useful when the data collection happens within a short timeframe, use of such methods is still at the crossroads of a niche and a mainstream method (Grady, 2008).

Those above mentioned methods have their own high risks. Photo elicitation is highly technology oriented. Understanding of the basic functions, capturing images, ensuring they are accurately sorted, work on a mechanism to disseminate the images to the participants (whether to print or to display on the device) and even ensuring there is enough battery or charge available in the device to complete the process are some of the key challenges. These challenges aside, it is difficult to have a prior expectation from the participants that they will understand the task and will be able to capture data as they intended (Pink, 2013). As suggested by Hatten et al. (2013) use of participant taken images normalised the communication process between the researcher and the participant.

Kolb (2008) acknowledging the importance of self-generating images followed by an interview for the participants in contributing to reconstruct their ideas and social attributes, mentioned they contribute far deeper in the social research. In this research, there were participants from various spectrums of life with different characteristics. As the researcher's expectation was not only to get the literate participants, there were many illiterate participants who probably never thought of disaster preparedness from an academic perspective. They were aware of the research questions, but what themes the researcher might end up constructing remained unknown. Participants were put in the centre of the visual data production. It emerged that residing within technologically deprived area did not limit their participation in the photo taking activities. Though there were some cases of less focused or blurry pictures, nevertheless the point and shot style of photo taking were quite easy for even the most technology novice person. Through the images, participants have managed to portray their social identity and some participants adequately captured their emotional attachments to the emergency situations. The findings indicated, regardless of the possibility of the participants been illiterate or less literate did not undermine their capability of taking an active role in contributing to the photo elicitation task. This will enable future researchers to make an informed decision on the scope of using photo elicitation interviews in mainstream research projects.

Lastly, the use of action research has enabled the researcher to gain a better understanding of the research premises, contexts and understand the potential growth of the research components. During the time of this research, continuous advancement of technology in the rural areas were easily noticeable. In the beginning, during the pilot stage, a few participants had feature phones, and the majority had basic phones; in the midway, during the MSP-1 phase, many had feature phones, and only a few had basic phones. In the last phase, during the MSP-2, a few had Internet enabled phones, and there were growing the number of feature phone users. This meant they were already used to taking pictures. Two of the participants were also active in online social networks. The whole use of rapid ethnography was complimented by the action research as it further enhanced

understanding of the researched population. Such combined use of these research strategies have not been tried before in the chosen location. As they successfully amalgamated, it can be tried in similar research contexts in comparable geographic locations.

7.5.2 Contribution to applied knowledge:

This research has also contributed significantly to applied knowledge. Bangladesh being one of the least developed countries has only recently has seen the growth of mobile network across the country. The leading mobile network operator 'Grameen Phone' currently covers (2G connection) more than 99% of the population and 90% of geography and its 3G networks are spread across all 64 districts of the country covering 80% of the population and 71% of geography (Grameenphone, 2017). Mobile phones are now affordable and reaching to furthest corners of the country (LightCastle Partners, 2014).

Bangladesh has recently made a move towards digitalisation, and the present government has started backing the mass development of digital content and applications (Islam & Grönlund, 2011). This research was first of its kind tablet based disaster preparedness programme in Bangladesh (there was none available in the world when this research commenced). This gives it an enormous possibility to provide initial guidance on good practices and critical findings. Some of the key contributions are presented below:

7.5.2.1 Creating a tablet based disaster preparedness app in Bangla

This research gives clear guidance on using native Bangla interface in tablet devices (both Android and Apple devices). Though there are some mobile interfaces which are designed in Bangla, there aren't any interfaces for tablet devices that are developed in Bangla and intended to be used in the tablet devices. Due to the time constraint, instead of creating a full-fledged app for the most popular tablet OS platforms iOS and Android, the content was published using the Articulate

platform's native app (Articulate player). Even though the interface was accessible through the Articulate player, the way the content was presented, the way activities were designed and implemented both within the interface and beyond the interface will set a benchmark for other researchers who might be doing similar tablet-based research which will have the interface designed in Bangla. The possibility of transforming the current content to an app is extremely likely.

7.5.2.2 Complement currently available digital content on disaster preparedness in Bangla language

In line with the identified scarcity of disaster preparedness related training materials in Bangla in both print and via online media, there is a growing need for having contents that connect with local realities. At the time of the research, the digitally available contents were scanned pdf copies of government and NGO published training booklets, which simply isn't the best-formatted material and they do not do justice to the capability of modern digital platforms. The content and curriculum developed in this research will be shared with relevant government offices, local and international NGOs and they will be disseminated to the others using different platforms in the near future. The curriculum and content created for this research will remain as an independent source of information, which will further benefit organisations that want to run similar training programmes in similar geographic locations.

7.5.2.3 Created a case for defining 'Technological Literacy' in the Bangladesh context

Bangladesh has recently made its move towards having a digital revolution across the country irrespective of the rural and urban classifications. The present government is trying to reach out to every citizen to get acquainted with digital skills with an aim to create a 'Digital Bangladesh' (Islam & Grönlund, 2011). As odd as it may sound, since the beginning of this project to date, there is no precise definition of 'technological literacy' in Bangladesh. This is particularly problematic

for technological interventions, as it becomes a critical task to understand capabilities of the participants to comprehend the way the technological artefact works and also to make sense of the interface.

7.6 LIMITATIONS OF THE RESEARCH

This research was conducted within the planned timeframe and with the available resources. In the following sections, key limitations are outlined which a future researcher should note as some of these might directly affect transferability of this research.

7.6.1 Limitation of the programme participation:

One of the locations (Fultola) in MSP-1 did not deliver as expected. As the literate and mature members of the groups convinced the rest of the participants that this training would not lead to employment and within the proposed dates, a local NGO also started running a hygiene training programme which was paying cash for participating. This created participation dilemma among the others as they were educated but jobless and needed money which had prevailing importance to them. Also, due to the lack of control mechanisms in the interface the (literate) participants could go through all the content giving them an impression that they had seen all the content and the training could be termed as completed. This was also an unforeseen limitation which was rectified in the subsequent interface revisions. The fieldwork went as planned in the other location. The researcher devoted the leftover time to interview local policy makers to understand why there are an inferior number of cyclone shelters, how the disaster management is planned and overall improvement of the local communication system so that the time loss could be minimised. These documentations though were not included in this thesis but they were important to the researcher to better plan MSP-2 fieldwork.

7.6.2 Limitation of the software platform:

Even though the interface had gone through several evaluation stages, it did have its limitations. Firstly, the interface was created using Articulate Storyline software which would give output in HTML5 which was available on the Android operating system or iOS. In both cases, the content was required to be accessed through the Articulate player. Developing a custom-made content using third party software is dangerous as it becomes highly dependent upon the way the primary software is updated and developed further over time. It would be far more useful if a native Android app or a native iOS app were created for this which would give more liberty of choosing various functions and developing it further using Bangla language.

7.6.3 Limitation of the Interface:

The interface was minimalistic, and some evaluators negatively commented on its simplicity. Some wanted the interface to be richer in colours, shapes and animation. The available apps created in native Bangla at the time of this research were at an early stage and were of basic standard. Moreover, those apps were not intended for the tablet device. As this was first of its kind initiative to have Bangla content within the tablet device interface purely, it had limited scope to get inspiration. Inspiration taken from other foreign language apps was not always replicable with the current expertise of the researcher.

Also, the way content was presented within the interface was linear. This was grounded in the previous findings that the less literate people had difficulty in navigating through hierarchical contents. This was also found in the early stages of the research. Thus, even though the content representation was very linear, it was kept the same. However, if this work is replicated in large groups or with a huge number of participants, the groups can be formed in a way that such hierarchical design can be made accessible to only a selected group of participants. This can be done by having a preliminary skill scan where the prospective participant's literacy

and technological literacy skills will be checked thoroughly prior getting them engaged in participation.

On numerous occasions the 'Read to me' function assisted people who were struggling to read. It was also observed that some participants would try to read the subtitles while they were listening to the clip. However, whether having 'Same Language Subtitle (SLS)' increases acceptability of the content and improves literacy as claimed by Kothari et al. (2002), Findlater et al. (2009) and Knoche & Huang (2012), could not be conclusively judged as the content dissemination process did not intend to improve literacy skills.

Regarding customisation, content can be further customised in a way that a male, a female member or even head of the family, adult member of the family, junior members of the family can get customised content for them. This will be more suitable for locations where there will be a sufficient number of tablet devices to make such customised groups. If that can be done, it has to be seen whether it yields better performance. This was beyond the scope of this research.

7.6.4 Limitations of the activities:

Activities or interactions within the interface could be further developed. Some of the tasks such as drag and drop or matching blocks were aesthetic less pleasing, and the design of these activities could be modernised keeping the simplicity intact. Also, more novel ways (for instance - use of GPS, group calling etc.) of getting the participants to interact with the device can be explored.

Activities beyond the device were limited to photo taking. As detailed in the section 6.2.14 (para 4-5), during one of the photo elicitation activity tried in MSP-1 stage, participants demonstrated noticeable concern in capturing their personal items which they would have picked for the emergency kit but they due to societal factors they decided to pick items that are rather new, shiny or comparatively have a

better look. The researcher did not anticipate this issue and in the MSP-2 stage this task was completed in a non-intrusive way.

Holding the larger tablet devices was problematic at times for some participants. These can probably be further improved in the future. Especially the GPS capabilities which at present at its infancy in Bangladesh, can potentially be well utilised once the maps are well developed. This will enable the participants to know locations of their family members if they are in proximity. This sort of functional training can only be provided when that feature is ready to be deployed.

First aid activities were well received by the participants except the CPR activity as detailed in section 6.4.3.2. Though this resistance was found across the research locations, it cannot be taken for granted that this resistance will exist in future years. So, if similar studies are replicated some checks should be made to understand whether the local people have developed understanding in regards to the importance of knowing basic CPR techniques.

7.6.5 Limitations of the methodology:

While the chosen method had served to the expectation of the researcher and the supervisory team, alternative options could have been tested. Over the cyclic process, there was a significant amount of quantitative data collected which could have been dealt with using statistical tools. However, up until the MSP-2 stage, the total number of the participants was limited and this was not suitable for statistical analysis. The researcher was more inclined towards an interpretive study of the locations. For this reason, use of such tools was not incorporated in this research.

Within the emic and etic perspective of the ethnographic research which had a rapid format, several interesting and intriguing findings were observed which justifies the use of the methodology. In future iterations, the rapid format can potentially be replaced by a full-fledged thorough ethnographic study conducted

over a longer timeframe which might reveal more information in regards to the studied population.

The action research aspect of the research has helped in improving the content, interface and interaction techniques over the time. This was especially useful for the researcher as this allowed him to make informed judgements in regards to the selection of the above. Further ways of engaging participants in the fieldwork using a tablet device might emerge in the future. The content and interface evaluation stages also ensured the developed content and interface represented the location, and there was nothing that could hurt the local sentiments. This was particularly important as the majority of the technology led interventions did not always think of the people where the research is located.

7.6.6 Limitations of the research locations:

At the end of the process, there were a handful locations that could be reached within Bangladesh. These locations had some similarity in their core characteristics but these cannot be conclusively taken for all the locations of Bangladesh as people living in different geographic regions of the country might depict unique characteristics which did not come across in the locations where this study was situated. For this reason, general findings of this research should be taken as a close guidance, and future research works can reveal more deferring characteristics.

7.7 CHAPTER SUMMARY

In this chapter, major research findings were summarised. How the findings connect with the existing literature and to what extent expands the limitations of the literature review was critically evaluated. Broader applications of the research and its applicability are also presented which will allow future researchers to further explore the research findings in different contexts.

Limitations of the research were holistically presented with possible ways to expand the researcher further. In the next, concluding chapter, how the researcher has eventually carried out the task set at the first chapter will be further detailed with a reflective account of the researcher.

8. CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS

8.1 INTRODUCTION

In Chapter 6 and 7, findings from the research were presented and discussed to understand how they connect with the existing knowledge and how it further contributes to the expansion of existing knowledge. To sum up the research proceedings, this chapter will be dedicated to consolidating the findings regarding the research questions and research aim in general. Also, a reflective interpretation will be presented to give an account of the way the research has taken its shape throughout the duration of the doctoral study and also how the researcher has gained skills to conduct research on a larger scale.

8.2 REVISITING RESEARCH AIM AND RESEARCH QUESTIONS

The aim of the research was ***"to investigate how technology-assisted learning can be utilised to inclusively train disaster preparedness in a developing country – Bangladesh"***, and research questions were:

RQ1: How can technology be used in rural areas to teach disaster preparedness using a tablet device?
RQ2: How content can be designed for the tablet device to teach a mixed group of learners?
RQ3: Can people with minimal supervision and minimal computer knowledge adopt learning using a tablet device?
RQ4: Can decision-making be improved leading to greater awareness among the community by using a tablet device based learning?
RQ5: Can bottom up disaster training raise overall awareness for disaster management?

8.3 ANSWERING THE RESEARCH QUESTIONS

8.3.1 RQ1: How can technology be used in rural areas to teach disaster preparedness using a tablet device?

From the research findings, it can be claimed that a tablet device with a touch screen can be (positively) used in rural or technologically disadvantaged locations by reducing physical and psychological barriers and support provided by peers, guidance and facilitators.

The physical barriers can be reduced by ensuring access and also by having a user-friendly technological artefact that is easy to operate and content can be disseminated through an easy to adapt interface. Psychological barriers in technologically disadvantaged locations are found in varied forms such as – feelings of awkwardness, worries with the know-how of the learning setting and assumptions of probable complications in learning to use the device. This can be reduced by clear guidance, peer and facilitator support.

8.3.2 RQ2: How content can be designed for the tablet device to teach a mixed group of learners?

The action research cyclic process allowed the researcher to continuously develop the content in relation to feedback gained from the multi-dimensional evaluators. Ethnographic observation informed suitability of various tasks and activities that were used in the training. From the research findings, it can be claimed that content can be designed by having a thorough understanding of the local people, culture and traditions. Selection of the content has to be representative of the locality and the measures in which they access the content (the interface) have also to be carefully crafted so that the varied group of learners who most likely haven't been part of any formal education system can take an active part in the learning process.

The importance of having a robust evaluative process is found to be critical in the design phase, and this should at least include two important groups - a group of experts with good knowledge of user experience and user interface design in the chosen native language and a group of common people with an understanding of the local socio-cultural factors.

8.3.3 RQ3: Can people with minimal supervision and minimal computer knowledge adopt learning using a tablet device?

With a rapidly extending mobile network in the rural areas, it was found in the research that, new technologies (from a feature phone to a smartphone) are increasingly becoming affordable and accessible. In locations where this research was situated, a keen affinity to such devices was found. It was observed that the locals easily adopted tablet devices and the touchscreen completely removed additional barriers (such as - learning to use a keyboard and a mouse to operate a desktop computer or a laptop) of participation.

The research findings indicate adaptability of learning is affected by at least four key issues: a) access to learning, b) unavailability of experienced trainers and programmes, c) use of standardised content that overlooks local needs and values and d) lack of engagement and feeling of belongingness to the programme (related to the previous issue).

Meaningful learning can take place when these four major impeding issues are ideally removed or at least minimised. During this research, it was found across the research locations that a newer form of accessible technology could raise sufficient hype that if carefully filtered can generate ample motivation for even the least educated person to try out the new learning setting. From this finding, a separate need of a customised pedagogic approach was also established that can guide a practitioner to remove those impeding factors to create an engaging learning environment.

8.3.4 RQ4: Can decision-making be improved leading to greater awareness among the community by using a tablet device based learning?

Through the research work, participant's attention was drawn towards potential dangers and resources to help to mitigate the dangers, etc. From the tablet based disaster preparedness training, it was found that there are at least five aspects of awareness can be enhanced leading to better decision making. These five aspects are: a) understanding of the spatial arrangements surrounding the local residence, b) knowledge of accessible resources (through an emergency plan shared with the family and an emergency kit), c) knowledge of basic life saving skills (first aid & CPR), d) communicating about disaster preparedness among the family members and where possible have clear understanding of different roles each family member will play in such scenarios and e) being proactive than reactive. Through 'b', 'c' and 'd' decision making can be improved in a way that will be beneficial for all the family members and through 'a', 'c' and 'e' people will be able to provide faster response to an escalating emergency scenario.

8.3.5 RQ5: Can bottom-up disaster training raise overall awareness for disaster management?

The research findings indicate overall awareness can be improved at least in the short term by being more proactive which is in the form of the five aspects of awareness enhancement which is elaborated in section 8.3.4. The complex nature of psychological, physical, social and cultural dimensions of participation as found in the research strongly suggest that at the core of bottom-up training towards awareness or preparedness is a design where the multi-faceted construct and context of participation is taken into account.

Such 'bottom up' nature of empowerment of local people does have an added advantage of being able to 'understand' the importance of the early warnings and be prepared to follow or coordinate with the volunteers assigned by the local NGO and government departments. It has to be noted that, to what extent the

participants who completed the disaster preparedness training have improved awareness was not tested in a real-time scenario or checked in a realistic drill mainly due to the time and resource constraints.

8.4 CONTRIBUTION TO KNOWLEDGE

The multidisciplinary contribution of this research as presented in the 'Discussion' chapter are listed below:

a) Informed the limitations of Minimally Invasive Education (MIE) pedagogy
b) Established a need for a new teaching pedagogy for less literate people in less technologically advanced locations
c) Developed an interface and designed content for less literate people living in less technologically advanced locations
d) Informed disaster risk reduction (training) practices and inclusive education in Bangladesh context
e) Informed use of photo elicitation in rapid ethnography

A brief summary of these contributions are presented below:

8.4.1 Informed the limitations of Minimally Invasive Education (MIE) pedagogy

One of the major contributions of this research was the identification of the limitations of MIE (Mitra, 2000, 2005) as a teaching pedagogy. From its weaker and non-acknowledged theoretical base to ignorance of the importance of contextualised content were elaborated with findings from the available secondary literature and informed by the results of the research.

The MIE approach advocated a learning setting which can operate without the physical presence of the teacher. However, it was found in this research that, this was rarely the case with the 'HiWEL' project. The research findings suggest that

despite the lack of physical presence, the teacher did not disappear. 'Invasion', if that is what it is, still took place, it was just that the educational intervention/invasion was embedded in the a) content b) course design c) intervention processes, facilitation, guidance, peer support. It was just as much a teaching intervention (invasive) but it was just that some of the visible functions of the teacher were distributed among the facilitators and some were dispersed and embedded in the artefact.

In this research, the altered teacher functions in the customised technology which assisted the learning environment were clearly identified and acknowledged, and a case is made that despite the absence (or minimal presence) of the teacher, the teaching functions remain deeply embedded in the elements that facilitate learning. Based on the findings, the researcher argues that, in a learning environment where a teacher's presence is limited but there are regular interruptions from peers and the artefact is continuously used, it becomes highly invasive. A simple 'invasive' notion is insufficient because the more fundamental considerations are to what extent a teacher, trainer or facilitator is required and to what degree can direct supervision and guidance be reduced.

8.4.2 Established a need for a new teaching pedagogy for less literate people in less technologically advanced locations

Use of the technological artefact (here the tablet device) in a learning setting should have a thought-out role to take. Gulek & Demirtas (2005) and Wong (2012) stated how it is a general expectation that when technology is used in an existing learning setting, it will enhance the learning process. A range of projects was reviewed which aimed to bring changes in the way teaching and learning is seen in developing countries. In line with the suggestions of Hammond (2010) and John & Sutherland (2005), this study contributed to this growing area of research by exploring to what extent learning is encouraged by having a (newer) technology. The empirical findings indicate a suitable but unfamiliar technology supported by localised content can enable teaching with 'minimal supervision' and can 'disrupt'

the way learning is perceived by the people of that chosen locality. Unfamiliarity generates excitement and encouragement that can be transformed into motivation for training completion. A pedagogic approach can be proposed that acknowledges the importance of the socio-cultural aspects of content development as part of teaching strategy, enables multi-layered learner-centric activities, and through minimal supervision, and guided interventions ensures the learning is complete. Informed by the empirical findings of this research, the researcher was able to produce generic stages of a teaching pedagogy which assists in disruptive learning through minimal supervision (further elaborated in section 8.6).

8.4.3 Developed an interface and designed a content for the less literate people living in less technologically advanced locations

Findings of this research expand the current literature on interface design in less technologically advanced locations. The findings are significant because it confirms the limitations of less literate people to adapt to hierarchical navigation and content representation (Mehdi & Cutrell, 2012; Medhi et al., 2013). Identifying the limitations of the previous and contemporary interface designs (Parikh et al., 2003; Medhi et al., 2006; Cuendet, Medhi et al., 2013 and Ahmed et al., 2015) the research findings have categorically contributed to the way localised elements (known colours, native texts and graphics) should be used in an interface created for less literate people. If these are neglected, then there is a greater risk of alienating the interface from the targeted participants. An optimally localised interface design will connect with people easily, reduce awkwardness and ensure engaged participation.

The research findings strengthen the need for localised content development to have a meaningful impact on the lives of the targeted people. The participants actively connected with the videos of cyclones hitting localities and the emergence of a cyclone. Many of them had seen how a cyclone spread havoc but through the video clips they were able to see how the situation could escalate within minutes

and comprehend why every single minute is precious in that situation. The training curriculum and customised content for this research will remain as an independent source of information, which could further benefit organisations that want to run similar training programmes in similar geographic locations. The way the content was presented, the way activities were designed and implemented both within the interface and beyond the interface will set a benchmark for other researchers who might be doing similar tablet-based research which will have the interface designed in Bangla.

8.4.4 Informed disaster risk reduction (training) practices and inclusive education in Bangladesh context

The findings of the research were consistent with those of Yap et al., (2011) and Palttala et al., (2012) who identified that poor understanding, and insufficient skill adoption leads to delayed decision-making during disasters. Furthermore, the findings clearly indicated that the common person's definition of 'disaster' and what it was to be 'prepared' for disasters were different from the standardised versions (see Chapter 6, section 2.1.2). Disaster to some was a life changing event that one has to live with for the rest of one's life. To some other participants, disaster was an indication of the interrupted regularity of life, unavailability of communication channels for prolonged periods and also the fear of food deprivation. Some were reluctant to divide between man-made and natural disasters as at the end, to them, disaster is a line between being alive and dead. In general, across the locations, safety was not a subjective personal construct, but it was collective. Ensuring safety appeared to be associated with some degree of a feeling of togetherness which helps them to get on with their post-disaster lives positively.

These differences also have implications in creating a disaster preparedness training programme. Research findings contradicted Paul & Rahman's (2006) claim that during a cyclone people get busy with securing and saving his/her life rather than other family members who are weak, elderly or even disabled. The research

findings connected disaster awareness to the type of residence the participants reside in, distance of their residence and the main road and availability of transports and cyclone shelter.

Mathbor (2007), Mallick et al. (2011) recommended the introduction of disaster preparedness training for the mass of the population as a means to enable a faster response not only during disasters but also in other emergency events. Through this training, the participants have gained an understanding of an emergency plan, emergency kit and first aid skills which are transferable skills. Disaster preparedness contents of this research complement the existing digitally available Bangla contents (scanned pdf copies of government and NGO published training booklets).

The research findings reinforced recommendations given by UNICEF (2003), Kibria, 2005, Ahsan & Burnip (2007), Ahsan & Mullick (2013), Hill & Rahaman (2013) and Malak et al. (2013) to improve ground level practices concerning inclusive learning. Rural people in general, were found to be not using their literacy skills in everyday life through reading and writing, thus with time, there is a greater chance that they might lose that ability. Similarly, the absence of a definition of 'technology literacy' is problematic for technological interventions, as it becomes a complicated task to understand capabilities of the participants to comprehend the way the technological artefact works which affects categorisation of the participants. Findings from this research work reinforced the need for understanding actual levels of literacy in practice so that the participation experience can be better designed.

8.4.5 Informed use of photo elicitation in rapid ethnography

In rapid ethnographic research, a researcher often needs to find innovative ways to explore the participant's life in a short time to compensate for the reduced field engagement. In this research a novel way was employed by letting the participants use the tablet device to capture images which were used later to reveal a great deal about their interpretation of disaster preparedness. As Grady (2008) stated use of

such methods is not yet mainstream. In this research, the photo elicitation technique was deeply rooted in the context and the use of this technique provided an additional visual data source which later significantly contributed in the data analysis stage. This research finding confirms that this technique can be used even where the participants are less literate or have less knowledge of current technologies.

8.5 REFLECTIVE ACCOUNT OF THE RESEARCHER

Before the researcher embarked on this research, he was aware of the socio-cultural context of two of the six research locations to some extent and the other locations were not known to the researcher. In rural areas of Bangladesh, literacy rates are quite poor in comparison to the national average. Thus, to what extent the locals would accept the customised content was not known. During the content and interface development phases a set of standardised general and expert evaluation systems were actively used, it was expected that the participants were likely to accept it. Also, regarding participations, several pieces of the literature suggested customised training run by NGOs were not always successful among the rural population and in particular among the female members of the community. There were some concerns about getting the female participants engaged throughout the process. As far the participation is concerned, the majority of the locations generated enthusiastic participation for both genders. There was also an odd case, where the training was abruptly discontinued due to issues beyond the researcher's control (clashing with another local NGO-led training programme which was providing cash for participation and a lack of control mechanism within the interface) at that given time. However, this gave a further idea on how to make the system more robust and also it amplified the need to have a diversified group of participants. In the subsequent iterations, these issues were largely minimised and the similar problem did not occur.

Within the cyclic phases, the researcher found opportunities to improve the content and activities. Data and insight gathered from one iteration were useful for

the next iteration. It also gave the researcher a clear and concise idea to ensure the participants were not getting diverted or were not engaging in out of context discussions. Thus, from the pilot study to the MSP-2 stage, there was a logical growth of the way activities were designed for participant engagement. In the iterations, where a previous research location was close to the proposed location, ex-participants were invited to the first day to share their stories and explain what they have expected from the training and to what extent they have learnt something new. This approach further motivated the participants.

The researcher's selection of the tablet device was experimental in nature as at the time of the research it was not yet a mainstream technological artefact in Bangladesh. The researcher has acknowledged its potential to be a portable learning station for the rural people with less literacy and technological literacy skills. Interestingly, across the locations, the participants agreed that the tablet device was very easy to handle and their expectation of a new technology being tough to learn was put to rest. This positive acceptance allowed the researcher to be confident about developing the content further and using it in other research locations.

The design process has also gone through significant changes over the period of this research. To develop the content insights needed to be taken from the national texts, available international texts and also from the data collected from the previous phase. All of this information was fed into the process of revising the content and design. The design process was also complicated, as the researcher had to think from the perspective of a less literate or even an illiterate person. Having a rich multimedia content was the most likely expectation, but these could easily bog down a less literate person. Various cognitive load considerations were one of the major elements of the content and interface design.

Choosing the right platform was a crucial task. With the current offerings of tablet devices there are multiple operating systems (OS) which guide the whole development process, and also the language had to be Bangla. To what extent

Bangla was compatible with the OS ecosystem also had to be checked. Both Android and iOS systems were reviewed and the chosen distribution platform Articulate player had an app for the iOS initially which also became available for the Android operating system in 2015. This availability enabled the researcher to try the content in different tablet devices with different configurations. Throughout the process, it was found that an array of tablets could successfully deliver the content. The same content could be provided through a £20 worth table device to a more expensive tablet. There were some trade-offs identified in choosing the cheaper one, especially in the quality of the display, the video playback and the camera lens quality. However, they did not affect completion of the training. Even with basic cameras, the majority of the participants managed to take decent photos as per the expectation.

Tasks were designed in a way that would enable the participants to think 'out of the box' and connect those activities with their experiences. This way of introducing new content within a known context was very useful. This contextualisation helped to take away the awkwardness in learning, and also it enabled the participants to feel like they were part of something that was close to their life, and it was far more important for them to learn as it was most likely going to benefit them.

8.6 RECOMMENDATIONS FOR FURTHER RESEARCH

This research was conducted in six locations during the research period. The sample size was sufficient to reach to informed judgements in regards to those chosen locations of Bangladesh, and some of the issues identified in the findings chapter indicate that they are most likely to be found generically in other locations of Bangladesh. However, to further generalise the research outcomes in the future the excluded participants especially those who have any form of disability could be included with customised engagement requirements. The research could also be extended to other countries with similar levels of technological development and a need for disaster preparation.

The content and interface were embedded within a third-party software platform, but initiatives can be taken to develop a comprehensive independent application (or 'app') for iOS and Android tablet devices. The app can have an integrated diagnostic skill scan to find out literacy level and technological skills at the beginning of the training programme. In the case of multiple participants, group learning option can be added whereupon confirmation of the total number of the participants, the interface will conduct a separate diagnostic skills scan and based on this the content can be presented in a hierarchical order. The results of the diagnostic scan can also suggest the probable group leader. This will ensure better micro management of the groups. This complex development option was not explored in this research, however, having this functionality within the app can recommend a more suitable starting point for the participants.

While the interface has a significant role in ensuring the targeted people are not made feel awkward and deviate them from participation, based on the literature review and the findings of this research, the researcher claims that,

> *A custom devised teaching and learning project can only be successful when it is used in a relevant context with supportive guidance and materials. A teaching pedagogy that strives for the minimal presence of a teacher and deals with such learning environment must be supported by well-articulated content.*

Commonalities observed throughout the research locations also gives an indication of the stages involved in an optimal teaching pedagogy (see chapter 7 section 5.1.1, chapter 8 section 5.3) to be used in such customised learning environment which the researcher proposes to term as 'Minimally supervised disruptive learning'. A set of stages for this pedagogic approach is provided in Appendix Q. It has to be noted that, the scope of this teaching pedagogy within technologically disadvantaged populations has not been tried and tested beyond this research work. Thus, there is further potential to try this approach in similar socio-cultural areas. The researcher also suggests further investigation into how supervision can be researched as a

teaching feature that is dispersed and integrated into technological artefacts, course designs and educational processes around technologies.

8.7 SUMMARY OF THE CONTRIBUTIONS

This research has made notable theoretical and practical contributions. This was the first initiative of its kind to integrate 'localised' content in a tablet device to be used by mainly technologically disadvantaged and less literate and illiterate people. The contributions of this research are significant for disaster risk management practitioners primarily those based in Bangladesh, but with the possibility of replication within the neighbouring countries which share similar socio-cultural traits.

From the theoretical perspective, this research has significantly contributed to understanding the current limitations of the 'Minimally Invasive Education' pedagogic approach (Mitra, 2000, 2005; Mitra & Dangwal, 2017). In doing so, this research has established the substantial importance of 'localised' content and a culturally relevant interface design which are critical to participant engagement and knowledge construction processes. An otherwise obscure literature regarding the relationships between MIE and similar 'minimally' guided pedagogies was identified and set out in this research. Steering away from simple 'technological deterministic' propositions, it was found that if the content is suitable, if the interface and the device is accessible and easy to learn to operate, a technological artefact is capable of positively 'disrupting' the way less literate people imagine or perceive educational engagement in their native context. This phenomenon established a need for a new teaching pedagogy for less literate populations in less technologically advanced locations. The pedagogic recommendations are provided in the Appendix Q.

From a practical perspective, this research made several major contributions in the field of interface and content design for less literate people. Although there is an array of work especially by Medhi and her peers on this issue (Medhi & Cutrell,

2012; Medhi et al., 2006; Medhi et al., 2007) it was found that the majority of the critically acclaimed user interfaces for less literate and illiterate people have largely ignored the local language and presented the numerals in the standard 'Arabic' format with a common understanding that everyone knows the universal numerals. Based on the empirical findings of the research, this is an uncertain approach as there is a potential for confusion due to the universal numeral's similarity with local numerals which may not represent the same number. This phenomenon revealed in section 7.4.6.2 will be a crucial finding for all the current technology-based projects that are dealing with people whose first or second language is not English. The research findings are in line with the claims in Parikh et al. (2003) which stand in contradiction to the claims made by Medhi et al. (2006, 2013) and Thies (2015) that textual interfaces are not suitable and unusable for the less literate and illiterate people. The use of local language in an interface was found to give a sense of familiarity and ownership among the less literate participants and this undoubtedly has the potential to inform similar research projects across the globe.

Secondly, from the practical perspective, when this research commenced there were no Bangla content and interfaces made for tablet devices. Systematic development of the content and interface greatly contributes to filling this void. A clear and concise design log was produced which will give future researchers a good starting point and insights on how to create an interface and localised content for a challenging group of participants. Disaster preparedness content and activities created in this research enriched the existing literature and fieldwork engagement practices found in Bangladesh which was rightly critiqued as insufficient by Bashiullah (2008) and Rabbi (2008).

Finally, the researcher believes that through this unique initiative to provide disaster preparedness training using a newer and unfamiliar technological artefact, people who are technologically disadvantaged, less literate, financially challenged and plagued with gender discrimination, could learn important lifesaving skills which have the potential to resonate through their lives and beyond. One of the participants said during the pilot study:

Disaster is not new to us, but a disaster preparedness training is!

At least once this training was completed this was not the case anymore to the participant. Observing that they could learn to create an emergency plan, an emergency kit, show spatial awareness of an emergency and finally learn basic first aid skills, was one of the biggest contribution to knowledge. Practically and realistically it is possible to empower rural people with disaster preparedness skills regardless of their literacy, gender and familiarity with technological artefacts. The researcher believes that disaster preparedness should be a social priority, and it is still to be seen, how in the coming years, findings from this research can inspire practitioners and field workers in providing better and efficient disaster preparedness training.

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APPENDIX A: RESEARCH PLAN FOR THE PILOT STUDY

Day	Researcher Activity	Participant Activity
Day 1 06/07/2013	**Briefing [Intervention 1]** *Recruitment confirmation, guidance on using the device, introductory session, understanding disaster, recurring natural disaster and disaster risk profile of Bangladesh.*	Follow all the topics of LO1 with a focus on the following: • Understand what is required of them during the study. • Develop understanding of the common disaster risks.
Day 2 07/07/2013	No Intervention (Observation) [Interview at the end of the session]	Follow all the topics of LO2 with a focus on the following: • Take part in the discussions on pre-disaster awareness building. • Understand what to do when things doesn't go as planned.
Day 3 08/07/2013	**Facilitate the emergency plan creation activity** **[Intervention 2]**	Follow all the topics of LO3 with a focus on the following: • Disucss which health and safety will need priority during a disaster. • Understand how safety for vulnerable people in the family can be ensured. • Create an emergency plan for family (where to meet, where to take shelter).
Day 4 09/07/2013	No Intervention	Follow all the topics of LO4 with a focus on the following: • Understand the importance of collective effort. • Discuss and understand role of different family members in a disaster situation.
Day 5 10/07/2013	Debriefing. [Survey, Interview]	Follow all the topics of LO5 with a focus on the following: • Understand how technology can be used to ensure safety including knowledge of assistance from various organisations.

APPENDIX B: EXPERT EVALUATOR REPORT OF THE CONTENT AND THE INTERFACE

1. * Please read the project description below and complete this evaluation form, which consists of three set of criteria. For each of the sections provide your detailed feedback.**

***** You will be sent a separate link to connect with the content.**

Project Details: This project is a 'Disaster Preparedness Training' programme aimed at technologically disadvantaged Bangladeshi people. Demographics of the participants for this project are outlined below:

Participant Age: 18+-35+, Participant Gender: Male, Female, Participant Education: Illiterate, Semi- literate to literate, Participants ICT Skills: Limited to Advanced, Participants Language: Bangla

Participants will access the content through an interface created for tablet device provided to them by the researcher. Teaching strategy be learning within a group setting with a limited presence of the educator. Knowledge construction will be through the social participation of the participants. Interface design will allow the content to be accessed using any standard tablet device. Therefore, for testing purpose, you can use your tablet device. You are requested to carefully examine the interface including the content to comment on the suitability of the interface and the content to the targeted population. Disclaimer: This evaluation is part of doctoral research; the university logo is used with LJMU REC permission.

Please Enter Your Details Below:

		Response Percent	Response Total
1	Your Full Name:		
2	Your Email Address:		

SET A: Quality, comprehensiveness and appropriateness of the content

2. Do you think the content is relevant for the targeted age, gender, education level and goes beyond the existing school/college curriculum to the related disaster preparedness topics? If 'Yes'

please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

3. Do you think the content uses participant's previous knowledge and assist developing practical and logical thinking?If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

4. Do you think the content considers moral and socio-cultural context and information provided in the content is accurate and free from linguistic errors? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

5. Do you think the content is enriched by thoughtful use of multimedia and is not overloaded with information? * Overload of information means the information takes significant amount of time to understand and is hard to retain. If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so

6. Do you think the content is free of any gender, age or education related prejudice? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

SET B: Learning and Teaching Perspective

7. Do you think the way content is designed will encourage self-evaluation and self-reflection also promote group discussion and peer participation?If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

8. Do you think the training programme will provide a complete learning experience and enable acquisition of topic specific competency (e.g. First Aid, Emergency Plan, Emergency Kit etc.)? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

9. Do you think the content is appealing for the target group and arouses interest; additionally are activities interactive and will encourage and engage participants in critical thinking and enquiry? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

10. Do you think the content design and delivery of the content is well constructed, adequate gaps are also provided to facilitate learning? If you think a alternate way would work better you can

suggest it here. [For your information: the total delivery of the content will be in 5 days with 2 gap days where participants will take photos, create emergency plans with family members to demonstrate their understanding of various issues related to disaster preparedness]

SET C: Interface, Usability and Miscellaneous factors

11. Do you think the interface is simple, user friendly and presents the content in an organised manner for the target population?If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

12. Is there any awkward feeling in general to use the interface? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

13. Do you think quizzes and other assessments within the interface are intuitive and useful for knowledge construction? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

14. Do you think cultural aspects (pictures, image backgrounds, clips) of the interface design are satisfactory? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

15. Do you think functional navigation are clearly visible and there are no broken functions (e.g. buttons not leading to intended content)? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

16. Without revisiting the content again, List items those you remember from the content presented in the interface. Also state to what extent you remember them.

17. After going through the content, which one you thought is most useful and why? Will it be useful in your life, in terms of 'disaster preparedness'?

18. After going through the content, which one you thought is least useful and why? If you could change the content what would you replace this 'least liked content' with.

APPENDIX C: SAMPLE EXPERT EVALUATOR REPORT OF THE CONTENT AND THE INTERFACE MSP-1

Page 1: Expert Evaluation Form

1. * Please read the project description below and complete this evaluation form, which consists of three set of criteria. For each of the sections provide your detailed feedback.**
***** You will be sent a separate link to connect with the content.**

Project Details: This project is a 'Disaster Preparedness Training' programme aimed at technologically disadvantaged Bangladeshi people. Demographics of the participants for this project are outlined below:

Participant Age: 18+-35+, **Participant Gender:** Male, Female, **Part**icipant Education: Illiterate, Semi- literate to literate, **Participants ICT Skills:** Limited to Advanced, **Participants Language:** Bangla

Participants will access the content through an interface created for tablet device provided to them by the researcher. Teaching strategy be learning within a group setting with a limited presence of the educator. Knowledge construction will be through the social participation of the participants. Interface design will allow the content to be accessed using any standard tablet device. Therefore, for testing purpose, you can use your tablet device. You are requested to carefully examine the interface including the content to comment on the suitability of the interface and the content to the targeted population. Disclaimer: This evaluation is part of doctoral research; the university logo is used with LJMU REC permission.

Please Enter Your Details Below:

Your Full Name: xxxx

Your Email Address: xxxx

Page 2: SET A: Quality, comprehensiveness and appropriateness of the content

Q2. Do you think the content is relevant for the targeted age, gender, education level and goes beyond the existing school/college curriculum to the related disaster preparedness topics? If 'Yes' please note suitable

evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

- The content and its presentation is accessible regardless of the age or gender. However, since it is kept open for people of any level of education it may be irrelevant for people who are well educated and already knows how to prepare for emergency situations, or have had training in first aid.
- I do not know enough about existing school/college curriculum to the related disaster preparedness to say whether this particular content goes beyond that or not. However, my understanding is that more content and interactive exercises will need to be added before it can be considered a significant advancement in technology assisted minimally invasive education for disaster preparedness without physical presence of an educator.

Q3. Do you think the content uses participant's previous knowledge and assist developing practical and logical thinking? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

No.

Through group discussions participants are asked to come up with what they think are some of the important things to do in order to prepare for a disaster they have had previous experience of. Thus, there is an element of using participant's previous knowledge. However, right after that participants are just simply presented with some to-do list to help them prepare for a disaster. The material is not presented in a way that links what people know previously from experience and with what they are told to do, and thus does not assist in developing practical and logical thinking. One way to do so would be to ask the participants the problems they faced or saw/heard someone else facing, and what they think about how that problem could have been avoided and then compare their suggestions with the actual proposed solutions/steps.

Q4. Do you think the content considers moral and socio-cultural context and information provided in the content is accurate and free from linguistic errors? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

- The content is largely acceptable within the moral and socio-cultural context, except one minor detail that could be improved upon:
- The drawings representing family pictures on the slides for the 2nd day has little resemblance with a typical Bangladeshi family and how they dress. This, in my opinion, shows that the content, in this particular instance at least, glossed over the socio-cultural context.
- There seems to be some minor linguistic error in the content:
- The slide titled 'দল ভিত্তিক আলোচনা'for the first day spells the following words incorrectly in the paragraph(below are the words in their correct spellings): 'সর্বশেষ, দুর্যোগ'

Q5. Do you think the content is enriched by thoughtful use of multimedia and is not overloaded with information? * Overload of information means the information takes significant amount of time to understand and is hard to retain. If 'Yes' please note suitable evidence from the content or add a self

reflective note. If 'No' briefly explain why you think so
• The use of multimedia seems minimal in the content, and is not intrusive for the most part. • However, I have found the first slide right after the start of the lesson on the first day where there is video of gusty winds in action to be quite distracting while reading that particular slide. Touching the video makes it stop, but it was nonetheless distracting in my opinion. • The exercises to match sentences from right to left could be improved upon. The current presentation in my opinion is confusing in the way they are presented, in their content, the way to submit the answers, in not letting participants advance and see the correct answer or go to the next slide unless they get all of them correct. These types of interactive exercises could be very useful if done in a more user-friendly manner. • The content is not overloaded with information. Everything that is presented is easy to understand, not not hard to retain.

Q6. Do you think the content is free of any gender, age or education related prejudice? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.
I have not found anything to suggest that there is any level of gender, age or education related prejudice in the content.

Page 3: SET B: Learning and Teaching Perspective

Q7. Do you think the way content is designed will encourage self-evaluation and self-reflection also promote group discussion and peer participation? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.
The content has elements of group discussion and peer participation. However, nothing in the design showed that outcomes of those group discussions and peer participation is integrated in any way to the rest of contents that come afterwards, especially considering the fact that this is said to be a 'minimally intrusive education' done only through the tablet device in a social setting. Someone could just skip the group discussions and peer participation parts, and do no self evaluation or self reflection in finishing the training. In my opinion, more needs to be done to conclude that the content is designed will encourage self-evaluation and self-reflection as well as promote group discussion and peer participation

Q8. Do you think the training programme will provide a complete learning experience and enable acquisition of topic specific competency (e.g. First Aid, Emergency Plan, Emergency Kit etc.)? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.
No. The information contained in the content is simply too minimal to suggest participants will acquire any level of competency in First Aid or Emergency Plans.

Q9. Do you think the content is appealing for the target group and arouses interest; additionally are activities interactive and will encourage and engage participants in critical thinking and enquiry? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.
No. Although there are some interactive activities they are too few and not very well done to engage participants in critical thinking and inquiry.

Q10. Do you think the content design and delivery of the content is well constructed, adequate gaps are also provided to facilitate learning? If you think a alternate way would work better you can suggest it here. [For your information: the total delivery of the content will be in 5 days with 2 gap days where participants will take photos, create emergency plans with family members to demonstrate their understanding of various issues related to disaster preparedness]
This depends on how much time the participants are expected to spend each day on a lesson. If the group discussions are to be carried out with any seriousness by the participants the 2 gap days seem necessary and adequate. The number of interactive exercises should be increased in amount as well as in varieties, and its design improved upon. Input from group discussions will need to be integrated into the training, otherwise whatever discussions family members do in the gap days and whatever they come up with will have very little relevance in terms of the actual information conveyed to them through the content. The first aid section should be more through in terms of its content. In my opinion, the actual information in the content as well as its design should be more enriched before concluding this to be a well-constructed training material facilitating minimally invasive learning.

Page 4: SET C: Interface, Usability and Miscellaneous factors

Q11. Do you think the interface is simple, user friendly and presents the content in an organised manner for the target population?If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.
• The user has no easy way to go back and check the contents of a previous slide. This even while reviewing the content I found not very user friendly. Considering the fact that some slides have steps numbered 1,2,3,4,6,7 etc. and some steps are in a different slide due to space restrictions it makes sense to have a way to navigate to the previous slide and see the steps back and forth. • The content should also be viewable in the portrait mode. Right now this forces the user to hold the device in the landscape mode(on iPad 3) which I personally don't like when I am reading something. I prefer landscape mode usually only when I am watching some video. • The interface is otherwise simple, user friendly and presents the content in an organised manner.

Q12. Is there any awkward feeling in general to use the interface? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

The interface was does not have swipe gesture to turn pages back and forth which would be something natural for people who have experience with using tablet devices previously. Lack of a 'go to the previous page' button and portrait mode also contributed to some awkwardness in general while using the interface. Although these may not be applicable to participants who have not used any tablet devices before or are not very efficient in using them.

Q13. Do you think quizzes and other assessments within the interface are intuitive and useful for knowledge construction? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

No.

- The exercise to match sentences in the lessons for the first day seemed awkward to use. I believe there is room for improvement in the presentation of such quizzes that would make it more intuitive and useful for knowledge construction.
- The second exercise to select the right element to use for stopping blood seemed to accept all answers, and no direct feedback was given as to whether the participant selected correctly or incorrectly.
- The third exercise to put emergency items in the emergency kit was non-responsive.
- The submit button which was a bit outside of the actual content seemed a bit inconsistent with the rest of the design and presentation of the items.
- The design of the quizzes, assessments has room for a lot of improvement before they can become intuitive.

Q14. Do you think cultural aspects (pictures, image backgrounds, clips) of the interface design are satisfactory? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

- Yes, cultural aspects including the use of red/green color seems to be appropriate. However, as noted earlier the picture used to represent a family could use a more traditional tone.
- The use of the color red/green similar to the way Bangladeshi flag is to represent the 'পড়ে শোনাও' section seems to be a nice thing.
- The white background, and dark colored text seems to be a good combination as it made the contents easy and clear to read.
- The contents are not too cluttered and are spaced appropriately that make it easy on the eye to get to the information without much distraction.

Q15. Do you think functional navigation are clearly visible and there are no broken functions (e.g. buttons not leading to intended content)? If 'Yes' please note suitable evidence from the content or add a self reflective note. If 'No' briefly explain why you think so.

- The exercise for emergency kit preparation seemed to be not working.
- The second exercise to select the right element to use for stopping blood seemed to accept all answers,

and no direct feedback was given as to whether the participant selected correctly or incorrectly.

- The third exercise to put emergency items in the emergency kit was non-responsive.
- The submit button for exercise one should also accept incorrect matches and show what the participant got wrong in the exercise besides the correct answer. The submit only accepts correct and completed exercise which is not intuitive.
- I do recommend a back button to navigate to the previous slide.

Q16. Without revisiting the content again, List items those you remember from the content presented in the interface. Also state to what extent you remember them.

1. Group discussions: pick three steps that you could take to better prepare for the last natural disaster you encountered.
2. Exercise to match items correctly. I remember three of these. One to match sentences, one to match the correct element, one to pick the correct items(not working).
3. Some steps to prepare for cyclones/floods. I do not remember the exact steps except for preparing emergency bag, and sending people of special needs and care to be sent earlier to the shelters, and how to prepare salines.
4. First Aid Slide on how to stop bleeding.
5. First Aid Slide for resuscitation.

Q17. After going through the content, which one you thought is most useful and why? Will it be useful in your life, in terms of 'disaster preparedness'?

- The information that we should send disabled, elderly, children and pregnant women to safe shelters before any possible natural disasters ahead of time in the list of steps to take in preparing for such natural disasters. This seems to be a very important step in preparing for disasters as it would be very difficult for such people to find safe shelters once a disaster commences.
- The identification of all such vulnerable people and taking action ahead of time to secure the safety of the such people seems to be a very important and crucial reminder in the context of disaster preparedness training.

Q18. After going through the content, which one you thought is least useful and why? If you could change the content what would you replace this 'least liked content' with.

- The instruction to keep ‘Enough money’ in the emergency kit. I personally find this to be the least useful information in the content.
- It is the least useful in my opinion because most people already know how to handle their money well anyway. Whether to keep it in emergency bag, or in ones’ wallets is a matter that should be left entirely up to the good judgement of people who own it.
- I would not necessarily replace it, but it occurred to me as the least useful when compared to other very useful information in the content.

APPENDIX D: GENERAL USER EVALUATOR REPORT OF THE CONTENT AND THE INTERFACE

1. * Please read the project description below and complete this evaluation form, which consists of three set of criteria. For each of the sections provide your detailed feedback.**

***** You will be sent a separate link to connect with the content.**

Project Details: This project is a 'Disaster Preparedness Training' programme aimed at technologically disadvantaged Bangladeshi people. Demographics of the participants for this project are outlined below:

Participant Age: 18+-35+, Participant Gender: Male, Female, **Participant Education:** Illiterate, Semi-literate to literate, **Participants ICT Skills:** Limited to Advanced, **Participants Language:** Bangla

Participants will access the content through an interface created for tablet device provided to them by the researcher. Teaching strategy be learning within a group setting with a limited presence of the educator. Knowledge construction will be through the social participation of the participants. Interface design will allow the content to be accessed using any standard tablet device. Therefore, for testing purpose, you can use your tablet device. You are requested to carefully examine the interface including the content to comment on the suitability of the interface and the content to the targeted population. Disclaimer: This evaluation is part of doctoral research; the university logo is used with LJMU REC permission.

Please Enter Your Details Below:

		Response Percent	**Response Total**
1	Your Full Name:		
2	Your Email Address:		

2. How would you describe your level of satisfaction after using the interface and the content?

3. Is the navigation through the content simple, easy to use and understandable? If yes why you think it is so, you can provide evidence from the content or the interface.

4. Is the content written in a simple, easy to understand language and there are no language errors? If there are errors please give reference to the relevant section. If there are no errors then explain to which extent the content is easily understandable.

5. Do you think the content is biased towards any specific section of the population and not encourages fair participation? Please justify for your choice.

6. Do you think topics are engaging and can contribute to better understanding of the scenarios and situations presented? Please state to what extent you would think this can help the participants.

7. Do you think It is easy to connect with the content based on previous experience and skilled gained from this training will be important for the targeted people? Please briefly explain how you think participants can actually get benefited by this training.

8. Without revisiting the content again, List items those you remember from the content presented in the interface. Also state to what extent you remember them.

9. After going through the content, which one you thought is most useful and why? Will it be useful in your life, in terms of 'disaster preparedness'?

10. After going through the content, which one you thought is least useful and why? If you could change the content what would you replace this 'least liked content' with.

APPENDIX E: SAMPLE GENERAL USER EVALUATOR REPORT OF THE CONTENT AND THE INTERFACE MSP-1

Page 1: User Evaluation Form

1. * Please read the project description below and complete this evaluation form, which consists of three set of criteria. For each of the sections provide your detailed feedback.**

***** You will be sent a separate link to connect with the content.**

Project Details: This project is a 'Disaster Preparedness Training' programme aimed at technologically disadvantaged Bangladeshi people. Demographics of the participants for this project are outlined below:

Participant Age: 18+-35+, **Participant Gender: Male, Female, Participant Education:** Illiterate, Semi- literate to literate, **Participants ICT Skills:** Limited to Advanced**, Participants Language:** Bangla

Participants will access the content through an interface created for tablet device provided to them by the researcher. Teaching strategy be learning within a group setting with a limited presence of the educator. Knowledge construction will be through the social participation of the participants. Interface design will allow the content to be accessed using any standard tablet device. Therefore, for testing purpose, you can use your tablet device. You are requested to carefully examine the interface including the content to comment on the suitability of the interface and the content to the targeted population. Disclaimer: This evaluation is part of doctoral research; the university logo is used with LJMU REC permission.

Please Enter Your Details Below:

Your Full Name: xxxx

Your Email Address: xxxx

Page 2: Evaluation Questions

Q2. How would you describe your level of satisfaction after using the interface and the content?

- The interface lacks high resolution picture. It also appears flat. It is well known that an attractive interface can easily draw more people to try out a software. For example, there could be transition

effect when slides are changed. Try to use same font style for similar sections of the content. For example, use same font style for all headers in all slides. Make sure there are more settings for advanced users.

- The content could be richer. I guess this is just tip of the iceberg. Elaborate sections - don't just specify 'do this' also specify 'why to do this'.

Q3. Is the navigation through the content simple, easy to use and understandable? If yes why you think it is so, you can provide evidence from the content or the interface.

- Though the navigation is simple and easy to use, there is no obvious way to go back to previous slide. Instead of having two different way to advance to next slide and only one way to go back to previous slide, there could be just two buttons - one for advance and another for going back.
- I think the navigation is simple and easy to use because the interface is very clean. Most of the center of the window contains original content and there is a panel at the bottom for navigation and other assistance (like 'Pore Shonao').
- I haven't tested the interface in tablet. Make sure swiping right advances to next slide and swiping left takes to previous slide.
- The last slide of Day 3 doesn't stay on screen – automatically advances to next slide.

Q4. Is the content written in a simple, easy to understand language and there are no language errors? If there are errors please give reference to the relevant section. If there are no errors then explain to which extent the content is easily understandable.

- There is a mistake in Day 3 slide 2 – There is a space missing between two words. Check item number 2.
- Day 3 slide 4 – The picture of this slide is wrong. This slide should contain a picture depicting properly placed position of hands.
- Day 4 slide 1 – There is a missing closing parenthesis in this slide.
- Other than that, the language is easy enough. The instructions are simple. The instructions came with pictures – this will be very handy to understand the concept. Having videos in some slides is useful too. Also, it's good to have the "Pore Shonao" feature for those who are illiterate.

Q5. Do you think the content is biased towards any specific section of the population and not encourages fair participation? Please justify for your choice.

I think that the content is not biased towards any specific region of the country. It is true that cyclone affects mostly around coastal area, but other disasters like flood occur throughout the country. The slides on first aid will be helpful for everybody. These common disasters attack Bangladesh almost every year to some extent. So having good knowledge on the events and recovery is important for all regions of the country. Most of the area of the country is covered by village. Though the cities are not affected like villages, having some slides dedicated for city people will be good as flood is a common disaster for cities.

Q6. Do you think topics are engaging and can contribute to better understanding of the scenarios and situations presented? Please state to what extent you would think this can help the participants.
The topics are interesting in a sense that most of the people in Bangladesh are familiar with these kind of catastrophic events. There are many people already faced these events. The topics include a description of events, how to deal with it and how to recover from it. It is fun to learn new things. The presentation and organization of the contents make it easy to grab. Those who have lacking on the knowledge presented in the slides will definitely be assisted. There are a lot to learn from the instructions. Taking advantage of pictures, sound and videos make it engaging.

Q7. Do you think It is easy to connect with the content based on previous experience and skilled gained from this training will be important for the targeted people? Please briefly explain how you think participants can actually get benefited by this training.
• People will better understand if they made any error during any disaster they experienced. There are bunch of actions and how-to's presented in the app. There are useful advice too. The experienced people will be able to make better decisions based on the slides next time they face similar disaster. They will be prepared. Overall, this will make them efficient at helping themselves. • People with no experience will be trained and they can be prepared in advance. It is good that the age of target audience is wide. This way everyone can be benefited to some degree.

Q8. Without revisiting the content again, List items those you remember from the content presented in the interface. Also state to what extent you remember them.
• There was a topic on disaster. This topic included a video of cyclone, asking for group work, the meaning of warning signals, where to take shelter and what do to during cyclone or flood. • Another topic was about preparing every family member for emergency situations. It described how to communicate with each other during catastrophic events, how to gain specific skill like swimming etc. • The third topic was about using first aid. It described various first aid techniques and how to heal an unconscious person. • The fourth topic was about preparing a polythene bag for emergency. It included various items to be put in the bag.

Q9. After going through the content, which one you thought is most useful and why? Will it be useful in your life, in terms of 'disaster preparedness'?
I think that the first aid section is most useful. This is very generic topic and can be applied not only to emergency situations but also to many other cases. This section should be much elaborated. It is critical that people understand how to use first aid kit, how to preserve them etc. This section can also include first aid treatment for fire burn, animal attack, earthquake victims, road accident etc. This topic can be enriched using videos. When this section will be full of first aid treatment for several disaster scenario this topic will be beneficial to everyone.

Q10. After going through the content, which one you thought is least useful and why? If you could change the content what would you replace this 'least liked content' with.
• My least liked topic is preparing a bag for emergency. This topic doesn't applicable for everybody, for example, people living in the cities. Food items in an emergency bag may spoil if preserved for long time. Batteries may damage too. • I'd replace this section with 'Communication during Disaster'. This topic would describe how to communicate with family members, what is broadcasted in radio/TV during disaster, where to find medical help, where to find food and general groceries etc. This topic may also include how to improve national coverage of a disaster during disaster so that victims can get better help faster.

APPENDIX F: DESIGN LOG

Note: This design log presents most of the key sections and some generic sections of the interface. These elements are not orderly presented and does not intend to give a full & detailed account of the design phases. Dates of changes are removed to reduce clutter. Rather this is presented to give the reader an idea of how the designs have evolved over the time through the cyclic process.

<table>
<tr><th>Pilot Study Interface</th><th>Main Study Phase 1 Interface</th><th>Main Study Phase 2 Interface</th></tr>
<tr><td> 
</td><td> 
</td><td> 
</td></tr>
<tr><td colspan="3">Element Updated: Start Screen
Change Phase: 1st revision from Pilot to MSP-1:
The pilot version had some inconsistent colour codes: sky blue, dark blue, and navy blue was put together in a non-eye pleasing way. In the modified version extensive colour use was minimised, and all the texts were clearly visible. The centre object which participants need to touch to start the programme was pointed using a finger pointer. There was also a little animation added that in the background of the pointed finger so that it becomes apparent for the user to be aware of the demanded action.
Change Phase: 2nd revision from MSP-1 to MSP-2:
In this final MSP-2 version, the University Logo is removed as it had English words which could distract the participants. Creative common licensing has also been removed for same reason. It wasn't quite an important element as the content was not disbursed publicly.</td></tr>
<tr><td> 
</td><td> 
</td><td> 
</td></tr>
</table>

Element Updated: Day 1 - Main Page

Change Phase: 1st revision from Pilot to MSP-1 & MSP-2:

The title of 'Day 1' was changed from 'Disaster and Bangladesh' to 'Disaster and Awareness' because the old one seemed too broad for the locality as it dealt with the bigger picture. However, the primary aim of this training was to build awareness and make the participants better prepared, so this change is made to reflect the aim of the training.

The window border was eliminated to allow more whitespaces. Bottom menu layer was changed too. In the old version, the predominant colour was blue which was changed to green and red for the modified version. These new colours were very familiar with the population in general because these are the colours used in the National Flag of Bangladesh.

In the new version 'Read to me' function, was added for inclusivity that will aid participants who may find it hard to understand. A finger pointer was added to both the buttons which added a visual cue for the participants that they can use those functionalities. There were also added tooltips which informed them about the function of those buttons.

Change Phase: 2nd revision from MSP-1to MSP-2:

The title of the day remained same. An animated sun was added to give further information about the content to be studied. The animation was a bare minimum to reduce distraction. As per the feedback of the evaluators and the participants a back button was added with revamped 'read to me' button. Buttons were aligned in a way that was suitable for the participants to understand.

An introductory slide was added which explained, why it is important to be aware of disasters and be prepared. The content of this slide reinforced that awareness and preparedness can minimise various losses.

Element Updated: Descriptive content & a discussion task

Change Phase: 1st revision from Pilot to MSP-1 & MSP-2:

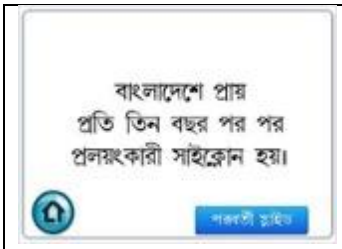
Large text blocks explaining common disasters of Bangladesh which were not so necessary for the training as identified in the pilot study, were deleted.

It was replaced with a more relevant much-focused discussion. This discussion advised the participants to form a group to discuss on the last disaster they have faced and which 'three' (just to give them an anchor) steps they could have taken to be better prepared. The idea was it would set the scene for the participants to understand the needs for disaster preparedness planning and training.

Change Phase: 2nd revision from MSP-1to MSP-2:

The existing task was modified to have two discussion topics rather than only one from the previous version. The 1st discussion was, how they think they can tackle disaster better together. The 2nd one was, in personal capacity what things they wish to change or introduce to ensure better safety.

After the discussion activity another transitional slide was added which explained why it is important to be aware of disasters and be prepared. The content of this slide reinforced that awareness and preparedness can minimise various losses.



Element Updated: Video clip and embedded quiz and results slide

Change Phase: 1st revision from Pilot to MSP-1:

In the pilot stage a video clip showing early footage of cyclone was played, participants were required to watch the video. In the revised version a more detailed video clip of cyclone was added. This was an early clip of cyclone with the sound. So, the participants could have a sense of how it sounds and looks like in the early stages.

With the video the participants was also presented with three drag-drop questions which were relevant to the cyclone scenario.

Drag and Drop Properties were:

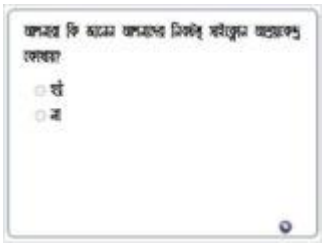
1. Reveal drag items one at a time
2. Allow only one item in each drop target
3. Delay item drop states until interaction is submitted

This drag-drop quiz will add value to the knowledge construction process as this engagde the participants to think beyond the video and provided a realistic perspective about the scenarios presented in the quiz section. Result slide was also provided so that they can have a better understanding of the actual results.

Change Phase: 2nd revision from MSP-1 to MSP-2:

A slide was added to introduce the next topic.

Tasks remained same, other than the new buttons.



Element Updated: Cyclone Warning Flag

Change Phase: 1st revision from Pilot to MSP-1:

This was two pop-up quizzes:

1. 'Is it important to know warning system of Cyclone?'

   This was a leading question; thus it was considered to be replaced after the pilot. However, this question was asked during the interview.

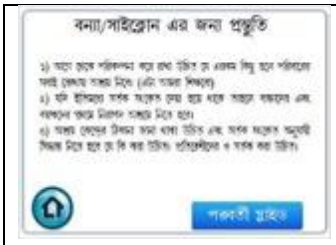
2. 'Do you know where the nearest Safety Shelter is?'

   This was placed as a question for the interview.

As identified in the pilot study that some of the elements that were taught (Day 2 of pilot –Cyclone and Flood) can be more elaborated with more information particularly important for the region, a slide on the cyclone warning flags were added. On the right hand side of the slide, different flagging position and its meaning was presented. This added to the systematic knowledge creation process as this would help the participants to identify the scenario in real life and they will be also able to know about other possible warnings.

Change Phase: 2nd revision from MSP-1 to MSP-2:

The existing one was spread in two slides now. In the first slide, more local appropriate title of that disaster was added ('Cyclone' is replaced with more local word). In the last version, only the introductory warning signal was explained. In this one, all the major signal related warnings were covered.



Element Updated: Day 1 - Preparedness for Cyclone

Change Phase: 1st revision from Pilot to MSP-1:

These slides in the previous version were purely textual. In the modified version they were made more inclusive by adding more graphical representation with it.

Preparation for flood and preparation for cyclone has distinct differences which were not taken into consideration before, but in the main study, they were presented separately. On top of each picture there was a counting number, and on the bottom, there was a description of that item. Participants could zoom the picture if they were not sure what that is. The read to me function enabled the less literate group to understand these steps with ease.

Change Phase: 2nd revision from MSP-1to MSP-2:

Recognisable and memor**able** steps thoroughly explained the major preparedness planning for Cyclone. Cyclone preparedness plan was sketched out in 4 steps.

1) Packing valuable items in a bag and keeping it safe
2) Creating and taking emergency kit to the shelter
3) Knowing about safety shelter
4) Keeping mobile on and making sure charger is also there to charge the mobile where possible.

In MSP-2 stage, the stages were further distributed and only 2 in one screen. Number and description of that element were presented side by side.

Was not available in the pilot stage.	 	   

Element Updated: Day 1 - Preparedness for Flood

Change Phase: 1st revision from Pilot to MSP-1 & MSP-2:

The major preparedness planning for **a flood** was thoroughly explained by recognisable and memorable steps.

1) Making sure the habitat is built on a highland with suitable trees around in a safe distance.
2) Save dry foods for flood season
3) Make sure family members knows to swim
4) Be aware of nearest safety shelter.
5) Stock water purification tablets.
6) Learn to make oral saline to combat dehydration and diarrhoea which are a very common cause of death during floods.
7) Keep the communication means open and available. Mobile phone and charger should be

with you at all times.

On the right side box, the process of making oral saline was briefly explained with each step described clearly in a graphical way.

Change Phase: 2nd revision from MSP-1to MSP-2:

The major preparedness planning for **the flood** was thoroughly explained by recognisable and memorable steps. One additional stage – tree plantation was added as it can contribute to minimise the impact of the flood.

1) Making sure the habitat is built in a highland with suitable trees around.
2) Plant trees
3) Save dry foods for flood season
4) Make sure family members knows to swim
5) Be aware of nearest safety shelter
6) Stock water purification tablets
7) Learn to make oral saline to combat dehydration and diarrhoea which are very common cause of death during floods
8) Keep the communication means open and available. Mobile phone and charger should be with you at all times.

In MSP-2 stage, the stages are further distributed and only 2 in one screen. Number and description of that element are presented side by side.

Element Updated: Stages in Family Disaster Preparedness Planning

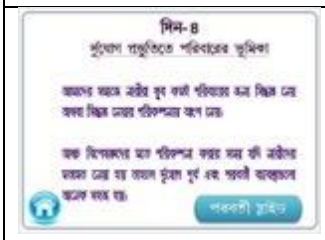
Change Phase: 1st revision from Pilot to MSP-1 & MSP-2:

These two slides introduced the stages involved in a family disaster preparedness planning process. Stages were further presented in identifiable easily understandable steps.

1) Finding out which disasters are common for the region
2) Locate a nearby place where all family members can meet in an emergency
3) Also, have a common contact outside the locality as a point of contact.
4) Keep all the details (phone numbers, address) of the family members in one place
5) Note names of the necessary medicines and dosages that are used by family members.
6) Make sure the plan is accessible to the family members as well.

Change Phase: 2nd revision from MSP-1to MSP-2:

The content remained the same. Use of the local image substituted foreign image references. In MSP-2 stage, the stages were further distributed and only 2 in one screen. Number and description of that element were presented side by side.

	Not available in the MSP-1 stage.	

Element Updated: Role of family members in Disaster Preparedness

Change Phase: 1st revision from Pilot to MSP-1:

Day 4 of the pilot study content elaborated specific role of the family members in disaster preparedness. In the slides, gender role was discussed especially signposting that woman can play a major role during a disaster. Next slide discussed the role of female members in disaster preparedness. In the first slide, it reinstated the fact that women are equal to men regarding their decision-making ability. Even as they spend most of the time in the household, they are better aware of the family. The following slide just continued from the first slide and stated that, as a majority of the population is female, kids and infants who are managed by female members it is important to train them and empower them so that they can handle the scenario without getting stressed and making wrong decisions. The theme of the content was too broad and thus, even though, gender role was an important aspect, was replaced to be later included in the discussions.

This was a pop up YES/NO quiz that asked the participants whether they think female members should have complete awareness of disaster preparedness. This was somewhat a leading question, and it was felt in the pilot study that this is a broader issue and was decided to be discussed in a different setting (i.e. in the interview).

Change Phase: 2nd revision from MSP-1to MSP-2:

In day 2, as per the MSP-1 feedback, another section was added that outlined roles of family members in disaster awareness and preparedness. From three particular viewpoints, the involvement of family members was explained. Used pictures were from public sources. The role of the female members were explained here. From the sidebar, the participant could click and navigate to other two characters.

Few things that are explained here were:

a) As they mostly stay at home, they will be better aware of the ins and outs of the home, so it is better for them to ensure all the needful are in easily accessible place.

b) Be mentally prepared to leave the house if needed.

c) Ensure safety of kids and elderly or disabled family members.

Was not available in the pilot stage.	a)  b)  c) 	  

	d)  e)  f) 	  

Element Updated: First Aid

Change Phase: 1st revision from Pilot to MSP-1:

In the MSP-1 Day 3, basic first aid training for disaster was added. This was identified during the pilot study as an important aspect which participants were unaware of so a whole day is dedicated for that with direct intervention from the researcher.

a) This particular group task asked the participants that which cloth (one being dirty and other being clean) they would use to stop bleeding.

During the pilot, it was found that in a disaster event they would just use any cloth to stop bleeding which can lead towards other complication like an infection. So this task was designed to make the participants aware of that. They were required to first discuss with other peers and then conduct the drag drop. This would allow social interaction and assist in knowledge creation.

<u>Drag and drop properties</u>

i. Return item to start point if dropped outside the correct drop target

ii. Snap dropped items to drop target (Stack random)

iii. Allow only one item in each drop target

iv. Delay item drop state until interaction is submitted

b) This slide explained the process that they can follow to stop bleeding:

The process mentioned here are:

i. Put pressure on the wound and use a clean cloth to do so

ii. If the wound is on the arm or leg, raise limb above the heart to help slow bleeding.

Resuscitation was deemed a critical element for the participants because many family members don't know swimming and are at high risk during flood or cyclone in the coastal area.

c) The first stage of Resuscitation- Check responsiveness, was explained here with an animated clip.

d) Second stage- Positioning for compressions were explained here with an animated clip.

Steps were:

i. Make sure the victim is lying on his back on hard surface

ii. Put the heel of one hand in the centre of the victim's bare chest.

iii. Put the heel of your other hand on top of the first hand.

iv. Straighten your arms & position your shoulders directly over your hands.

e) Stage 3: Compressions were explained here with animated clips.

i. Push hard and fast 4 to 5 cm with each compression

ii. At the end of each compression, allow the chest to recoil completely

iii. Deliver compression at a rate of 100-120 compression per minute

In the previous version, there was prompt of creating an emergency plan which to include contacts, contact phone numbers and a common meeting place. This was now placed on day 2. In the main study, there was a direct intervention on day 3 in which the first aid procedures was demonstrated.

Change Phase: 2nd revision from MSP-1to MSP-2:

A simple slide was introducing next topic.

Drag drop elements were better graphically used.

The content remained the same.

Element Updated: Emergency Kit

Change Phase: 1st revision from Pilot to MSP-1:

For the main study, the pilot study version was changed for a more specific topic 'Creating an Emergency Kit', this was deemed more necessary for the targeted population as they were often unaware of the things they should have with them if they had to evacuate their habitat.

Day 4 for the main study started with a group discussion where participants were asked to discuss together and decide which items they would pick from the right-hand side and put in the bag on the left.

Options given are:
1. Dried food, 2. Water, 3. Medicine, 4. Torchlight, 5. Battery-operated radio, 6. Books, 7. Mobile phone

These options would allow them to think of possible elements for their disaster kit. And as they would be engaged in a group discussion they could use their previous experience as a point of reference.

Next slides explained the possible contents of the emergency kit. This topic was not covered in the pilot study but was deemed important as the participants were not aware of what they should have in their emergency kit.

1st slide presented two of the elements:
1. Identity cards of all the family members, 2. All the necessary medications

2nd Slide added another 2:
3. Torch and replacement battery, 4. Sufficient water. Three litre/person for 3 days.

3rd Slide added another 2:
5. First aid kit as explained in day 3, 6. Battery-operated radio

4th Slide added another 2:
7. Mobile phone and charger, 8. Some money

These would work as the bare minimum for their emergency kit.

Change Phase: 2nd revision from MSP-1to MSP-2:
The content remained the same.

APPENDIX G: A FULL TRANSCRIPT OF A SEMI STRUCTURED INTERVIEW

Identifier: Afrah, MSP2, P11	**Interviewer:** I
Gender: Female	**Participant:** SB
Age group: 18+-35 year	**Time:** 25:28

I- As explained in the participant information sheet, we will have an interview session today, where I will be asking you several questions regarding disasters, disaster preparedness and about this training programme. You are requested to think before you answer. Take your time to answer. If you require a break in between the questions please inform me. You may refrain from answering particular questions if you wish. If you okay with that, I can proceed with the questions.

SB- Yes, I understand. You can go ahead.

I- How many years you are living in this village?

SB- I was born here. My parents, grandparents are also from here.

I- I see. Can tell me about your family?

SB- I have husband, one daughter. After marriage, I have moved to live with my husband.

I- Are you living with his family?

SB- No, his parents have expired. It is just us. Sometime, my mother will come to see me and stay. Same for his family as well. At times his young brothers will come and stay.

I- Thanks. What your husband do?

SB- He is a handyman in a local shrimp firm.

I- Do you do anything?

SB- I take care of our kids and housework. Also, I have a few chickens that I take care of.

I- Who is the decision maker in the family?

SB- He is. He always takes good decisions.

I- Did you face a natural disaster in the past?

SB- I have faced once.

I- Can you try to tell me what happened during that time?

SB- We had to pass our day in great misery. There was a school which was the safety shelter, but we could not go there as it is far away. Already heavy rainfall started and people around us was rushing to get back to their home. Luckily, all of our family members were in the house. One of our big tree fall on top of the roof causing damage to the already fragile structure. I feared the roof will collapse and we will be exposed to the heavy rainfall. I had my infant with me so I was scared to death. We had to take shelter in the corner side of our house. It was hard for us and a really trying moment. Eventually rain started to come through the damaged part of the roof and we knew this is getting dangerous. Ignoring the heavy rain, we made our way to the nearest mosque. This was a 15 min walk which seemed very difficult to reach as the wind was blowing against us. We were there for one night with our infant. When we came back home our house was severely damaged and all our stored dry food stocks were wasted. We had lost everything and was left with only a small sum of money which wasn't enough to rebuilt what we had lost in a matter of few hours.

I- How many hours the cyclone SIDR lasted?

SB- It was half of the night I believe, but it felt like days. I think, it started from in the evening, around the sun set time and finished before the Fazar *(morning)* prayer.

I- What was the aftermath of the SIDR.

SB- It wasn't just one day affair. It left deep scars in our life. The SIDR vanished everything that we built over the years. Our home was destroyed. I lost my chickens, our trees. Lucky, we survived. We were at a state of shock. It wasn't just us. Our families across the area was facing the same, especially those who did not have a strong built house. Those who had tin or thatched house were the worst sufferers. The cyclone also caused severe damage to the shrimp firm. We had lost

our house and it looked like he will have no job for months. We were worried to make arrangements to have a temporary place to live.

I- What you did then?

SB- So basically, we were sheltered in that mosque. But this wasn't going to be permanent. We started to fix our house fence with whatever we had. We covered it up around by our own cloth and polythene. There was some assistance from the local NGO and also the local MP visited us. They gave some relief goods. We received some money to assist us with rebuilding. After weeks of staying in that broken house, we managed to fix the roof completely with thatch.

I- Were you ready for the cyclone? did you know something was about to happen?

SB- Well, you know during September, October and November we get to hear many such warnings in the radio. Sometimes it goes bad sometimes it doesn't. My parents used to talk about the deadly cyclones. As I did not face any major cyclones in the past, I did not know how bad it can be. There were some warnings on the radio. My husband had to stay at work. He contacted me and told me to not go out. I asked him to come back as soon as possible to be with me. He said he will come when he finishes his work. He managed to come back before the cyclone hit us.

I- How you communicate?

SB- We have a mobile phone. When he goes work, he leaves the phone at home.

I- How do you recall his number?

SB- It's the first saved number on the phone.

I- Can you read it well?

SB- Yes, I can read the numbers.

I- How he contacts?

SB- I think, if he need to talk urgently he can manage to get one from his co-workers.

I- What if he fails to get a phone, is there a backup plan of what he will do?

SB- No, there is no other plan.

I- If you had a plan for such troublesome times, what difference it could made?

SB- Well, I think if I knew what I am expecting it would help me calm down and get less distressed.

I- Also, knowing common meeting place, another out of the city contact number will help you to get together after a massive destructing event.

I- Do you follow the weather forecasting through any other media?

SB- Sometime I hear them in the radio. That's the only way I get to know the forecasts.

I- Do you take any preparation straightaway when you listen to the warnings?

SB- Not really. I wait for my husband in most cases. After all, I don't want to rush.

I- Was there any local announcements?

SB- When we faced SIDR, at that night from 10 to 10:30 pm, local volunteers used hand mikes to tell us we should leave for the cyclone shelter with minimum things.

I- So what made you to not leave for the (cyclone) shelter?

SB- At that time, we thought of not rushing as it was already very late night and already there was heavy wind and rain. We live far from main locality. The small pathway that connects to the main road leading to the town is dangerous and it gets very slippery after the rain. We had to be cautious as we knew we are not going to get any vehicles at that time. We thought best possible thing was to wait till it is over.

I- Do you think it was a wise decision?

SB- Well, with what we faced later on, I can say it wasn't a very wise decision. But, these happens it was in our fate (sighs).

I- Do you think it would have helped if you were aware of the implications?

SB- Yes, on the first day of this training I saw the clips of the cyclone. It really takes very little time for a cyclone to destroy everything, so we have to act quick.

I- What will you do if you are alone and there is a call for moving out to the shelter?

SB- I will wait for him to come home. I can't take much decision alone. I will get stressed. Also, I cannot just leave without taking him with me. I am sure he will come back to get me first.

I: Do you know your nearest cyclone shelter?

SB- Nearest cyclone shelter is quite far. But we have a mosque nearby, we can go there during an emergency.

I: Did you ever participated in any disaster preparedness training?

SB- No, I haven't and I haven't heard of any such training. I heard of sewing trainings, hygiene training but not a disaster training. Your one is the first in the locality. You should go to other remote places too. They will be benefitted.

I: I will try.

I- Can you tell me which parts of the training are you enjoying?

SB- The way we are just discussing our experiences. All of us who had tragic experiences in the past have learnt our ways to get alone with life. It's almost like reliving that experience that we want to never remember. In those memories, there are also things that we did to stay strong. I am glad I got to see those video clips of disasters. That's an eye opener to me. When you are inside that emergency situation you do whatever you think right at that time. We never get to go back and decide what we could have done better. So, when we were watching the clip, we thought that as soon as possible people should go to safe place and try to keep each other safe.

I- Do you like the setting? The tablet that is guiding you in the discussions.

SB- Yes. In the beginning, I was shocked to know no one will take a class and we will just have that thing most of the time. Now, I am okay with that, we are passing it on to our groups. I think it is just giving us something to see and then rest is among ourselves to discuss.

I- You will also have an interesting session where an experienced person will teach you first aid?

SB- I am very much looking forward to learn new things. I want to remember the things that I am learning here.

I- Hopefully you will remember these all. Looking forward to see you in rest of the sessions.

SB- Yes, I will be here. Thanks so much for coming here to us and providing us this training.

I- Thanks for your participation. Can you please send the next person?

SB- OK. I will.

APPENDIX H: A FULL TRANSCRIPT OF A PHOTO ELICITATION INTERVIEW

Identifier: Bhairab, MSP-2, P7	**Interviewer:** I
Gender: Female	**Participant:** NB
Age group: 35+ year	**Time:** 10:28
Presence of other participants: Yes. P1, P2, P3, P4, P5, P6	

I: This is the last interview of the training. I thank you all for your participation and I hope that you have learned few important things that will help you to keep safe in an emergency and in a disaster event. In this part of the interview I will be taking you through the pictures that you have taken as a part of the training. I will have some questions on those. Please answer them as per your understanding. I will start from the right and go all the way to the last participant on the left.

(All participants of this group): No problem, will do.

I: I will start with LK. How would you describe your photo taking activities?

NB: It was exciting. Before I took pictures only with my phone that has a camera. But, you know the phone screen is tiny. This was a big screen. I thought the tablet might slip off my hand…but it didn't. First activity was interesting where I was asked to take picture of hazardous things surroundings our house.

I: Can you take me through the pictures?

NB: I have taken picture of the surroundings. The first two pictures are the toilets which we generally use. The toilet requires refurbishment but this couldn't be done yet. It has already tilted to left. Also, we have the hand pump closely situated and

the extracted water is channelled through a narrow path which is close to the toilet. This path is muddy and slippery. Even on a normal day at times we slip.

I: Do you think it could have been better designed?

NB: I wish it was better designed and made. When it was built we just used our own ideas to design. Apparently, it did not go well.

I: Can you take me through the next picture?

NB: The third picture is a front view of our entrance. You can see how crammed the entrances are. There are those high slabs which we made so that we can move during flood, has narrowed our entrances. Imagine if everyone decides to move at once. This path will then easily get jammed. You can also see path is watery and slippery. This is a common problem that we have here.

I: Is it always like this?

NB: Yes, mostly. You can see in my next picture. How surroundings of the house are water clogged. There is a problem with planning. I wish there was more accountability of the people who made these. At least we have brick and mortar house, so we are at least safe inside the house.

I: If you have to evacuate the place then?

NB: Me and my family will be the last one to leave. I don't think there is better safety and facility in another place. We put a lot of money in our house. It is safe and well built.

I: And the last picture?

NB: The last picture is a cracked road in front of my house. There are several cracks like this. These cracks appeared last summer when it was too hot. Still they are not fixed. Eventually these cracks will spread and will be another cause of concern.

I: For your emergency kit what you wanted to pick?

NB: I would pick water, cloths, radio, dry food, medicine and some money just in case. Also, I will ensure at least a set of clean clothes are available for each family member. I have a big family so even if we take little bit it will be a lot to take with us. Then there will be other families too. I think in shelters there should be some pre-arrangement of foods.

I: Won't you take anything to communicate with others?

NB: Oh! Yes. I would need to take my phone and charger. I have to ensure the phone is fully charged.

I: Did this training help you to be better prepared?

NB: I have never done such training before but I can see why this is important. Now personally I have plan in my mind regarding what to do in case of an event where I have to act quickly. I know a bit of first aid now. I will also inform my kids to learn swimming as well. If all of us are knowledgeable and is prepared then we can better safeguard ourselves. We can't just blindly rely on others coming to us and helping us. The more we will know will be better for our safety.

I: Thanks all for your time. I hope you liked the training and I hope this will be useful for the you in the future.

NB: Thank you too for providing us the training.

APPENDIX I: AN OBSERVATION LOG (WITH FIELD NOTES MERGED) SAMPLE FROM KARAPARA DAY 1

Location: Karapara	Participation Day: 1, Group 1	Date: 10/08/2015

Using the device:

Aspects	Observation
Are participants appear confident in using the device?	[10:10] Participants are all given hands on training on using the device. They know the navigation options. As the programme started they look confident. [11:34] In the task, where a cyclone related video was played first, upon request of other group member the person who was holding the device could find the icon for playing the clip again and effortlessly manage to replay it twice.
How is the device rotated around the group?	[10:24] Participants have completed the first discussion and it appears that they prefer 1-2 members of the group. Who are kind of taking lead. [11:10] The device would go to other members occasionally but would eventually get back to the lead members and stay there to them for longer period. [11: 58] The device started to move rather slowly. As majority of the conversation and discussion was not related to the device, the participants have now slowed down in rotation.
Gender distribution of the	[10:00] Majority of the participants are female (8) with few male (4). Male members have one group with 2 additional

group	female participants. The other group have 6 female participants.
How is the gender dynamics? Is there anything concern?	[12:22] Overall, there is no negative issues. Participants in the early engagement with the device understood that they are here to learn together by discussing and taking part in the activities. Mutual respect is found among the groups. It appears they know each other thus they are less hesitant.
Are the female members active in using the device?	[12:10] The female group is very vibrant so is the other one. But in the male dominated group the device is less accessed by the other two females. When the female members are saying, "Can I see it again' or "I haven't seen it", the other members would pass the device to her and also try to explain.

Participating in activities within the interface:

Aspects	**Observation**
How discussions were initiated and followed on?	[11:42] The participants are getting engaged primarily through on the screen prompt on a given topic. For both groups the person holding the tablet is initiating the discussion on the topic. The discussions would go quite deep and as well getting carried away by emotional accounts of one or two participants. The story telling is quite vivid as if it just happened yesterday. [12:10] Another discussion just took place. This time one of the initiator was someone who read the questions from a distance. However, the person holding the tablet did not stop her or intervened. She went, "accha accha apnie bolen'' [ok ok, you go ahead and tell]..there was a positive approach, in general.

How the tasks in the device were completed? (individual/ group)	[11:30] The was a clip shown on the early stages of the cyclone with strong winds and how it starts to get devastating. Participants appeared perplexed and probably it connected with their past experiences. The video was repeated several times as 2 participants wanted to see it again. [11:35] The matching contexts in A to B task appeared after the video clip. Both groups got very interested to solve it. Within the groups, they had short conversation before drag-dropping their choices in the device.
Were there disengaged participants? If yes, how the other participants go about the disengaged peer?	[12:02] There was hardly any opportunity for the participants to get disengaged as this was well paced session. If someone was delaying in conveying his/her thoughts he/she would quickly get a prompt by others asking for his/her opinion. This was not like peer pressure but more like a peer support. It is interesting to see how the participants are supportive to each other rather than being competitive and being active in supressing other voices.

Participating in activities beyond the interface:

Aspects	**Observation**
How proactive were they in creating an emergency family plan?	Not scheduled for the day
Do they like the idea of creating or formulating a plan?	Not scheduled for the day
How the photo taking activity went?	Not scheduled for the day
How did the emergency kit activity went?	Not scheduled for the day
How did the first aid activity went?	Not scheduled for the day

APPENDIX J: CONSOLIDATED CODES FROM ALL DATA SOURCES

Below are the codes that informed **RQ3: Can people with minimal supervision and minimal computer knowledge adopt learning using a tablet device?**

Data Source	Open coding	Axial Coding	Selective Coding/ Themes
Interview	No access to training.	Inclusion	Access to the training
Literature Review	Trainers are not always available	Scarcity of getting an experienced trainer	Inadequate state of training and resources especially in rural areas.
Interview & Literature Review	In many cases, trainers are not well prepared.		
Interview & Literature Review	Scarcity of resources leads to poor training	Resources are not always sufficient	
Interview & Literature Review	Training content is not always made for the targeting location. They are made in general and used without any alteration. Many trainers would say, this is not suitable for this location, but you should know.	Need for appreciation of the experiential knowledge and localised content	Reducing psychological barriers to participation
Interview & Literature Review	Contents are dull and monotonous		
Interview & Literature Review	Contents are not always connected to reality	Reducing awkwardness	
Interview & Literature Review	Unfamiliarity to the learning setting makes the training awkward	Inclusion strategies in training are not well practised.	Training must be tailored to reduce awkwardness this includes supportive supervision
Interview & Observation	Gender dynamics affecting participation in education and awareness building	Female members are still marginalised at times	
Observation	Participation dynamics in the learning process	There is the physco-social shaping of participation.	

Below are the codes that informed **RQ4: Can decision-making be improved leading to greater awareness among the community by using a tablet device based learning?**

Data Source	Open coding	Axial Coding	Selective Coding/ Themes
Interview	Perception of disaster varies	Subjective perception	Subjective perception of disaster
Interview & Images	Leaving home for the safety shelter is troublesome	Communication channels are poor	Geographical characteristics of disaster preparedness
Interview & Images	Unplanned things (trees, bricks, wood, discarded household stuff) blocks entry and exit routes	Poor planning and knowledge of layout.	
Interview	Safety shelters are not always safe	Safety in the shelters (for men and women, for grown-ups and children)	Designated safety locations are not always safe
Interview	In joint families' decision making doesn't start with being an adult. Adults have to follow a chain of seniority.	Adults (18+) are not always independent decision makers.	Connection of gender, literacy and voice in the decision-making
Interview	Many adults find them nervous when they have to independently take a decision. They are also most likely to regret their decisions later.		
Interview	Young adults lack recognition in the family. Many within the family still treat them as a child.		
Interview	Head of the family (mostly a man) knows everything and takes the most important decisions.	Decision making is not always a participatory process	
Interview	Grownups and seniors do not discuss preparing for disasters	Disaster awareness is not cultivated in family communication	Current inadequate state of common knowledge of disaster preparedness
Interview	Families don't have a common emergency plan.		

Below are the codes that informed **RQ5: Can bottom-up disaster training raise overall awareness for disaster management?**

Data Source	**Open coding**	**Axial Coding**	**Selective Coding/ Themes**
Interview	Perception of safety varies across locations	Awareness building is not	Notion of safety is not unanimous and is subjective
Interview	Safety awareness not always leading to an action		
Interview	Religious beliefs have some role in awareness	Role of religion	Socio-cultural trait shaping awareness
Interview	People wait for something to happen first. Weather warnings sometimes are deliberately ignored.	Reactive nature of preparedness	
Interview	Awareness not always leading to an action		
Images & Interview	Location of the house haves a role to play in decision-making	Importance of the Geographical characteristics that shapes decision-making	Geographical characteristics of disaster preparedness
Images & Interview	Built of the house haves a role to play in decision-making		
Images & Interview	Available communication channels and mediums influence decision-making		
Images & Interview	Unplanned surroundings affect movement during a disaster		

Note: Codes for RQ2 is not separated as it is separately dealt in Chapter 5.

APPENDIX K: GENERIC ACTIVITY PLANNER AND A SAMPLE PLAN

DAY 1

Activity 1:

1. What steps you think that you can take to better prepare for (natural) disasters?
2. What would be your role in disaster preparedness?

Discuss among yourselves in groups on the above two topics. **[Approximate time allocated 20 min]**

Activity 2:

Watch video clips (Cyclone/Flood), duration: 2min(s)

Then, do a matching activity where 3 items should be matched with jumbled 3 items. **[Approximate time allocated 15 min]**

Activity 3:

To face any disaster successfully with less consequences, it is pivotal that the family members are prepared and coordinated. To ensure all the family members are safe and secured it is important to have a plan in place. If you face any trouble during an unfortunate event how you will maintain connection with your other family members and how will you ensure all are in safe place, **discuss this with your peers and make a plan. [Approximate time allocated 60 min]**

DAY 2

Activity 4:

Drag and drop activity.

A wound is shown. Two choices of cloths (clean and dirty) are available to bandage the wound.

In a group the participants need to decide which type of cloth they will use. **[Approximate time allocated 10 min]**

Intervention Activity:

1. Take 3-5 pictures of hazardous elements that surrounds one's living place. **[Approximate time allocated 10 min/person]**
2. Interview one to one. **[Approximate time allocated 20 min/person]**

DAY 3

Intervention Activity:

1. List items that one would put in an emergency kit (previously, take pictures of the items) **[Approximate time allocated 5 min/person]**
2. Demonstrate basic first aid (bandage only).

   * CPR demonstration was dropped because of social awkwardness.

   [2 in one group, Approximate time allocated 15 min each group]
3. Photo elicitation interview. **[Approximate time allocated 20 min/person]**

Activity planner: Location- Karapara, MSP-2

Total Participant: 26

Groups: G1=6, G2=6, G3=7, G4=7

Day 1:

	Cohort 1	**Cohort 2**	Total Estimated Time Required
	G1 & G2	**G3 & G4**	In Real Time
Activity 1	20min	20min	40 min
Activity 2	15min	15min	30 min
Activity 3	1 hour	1 hour	2 hours
Slides	40 min	40 min	1 hour 20 min
	2 hours 15 mins (session 1)	**2 hours 15 mins (session 2)**	**4 hours 30 min (Total estimated time required for the day) * Two sessions in the day.**

Day 2:

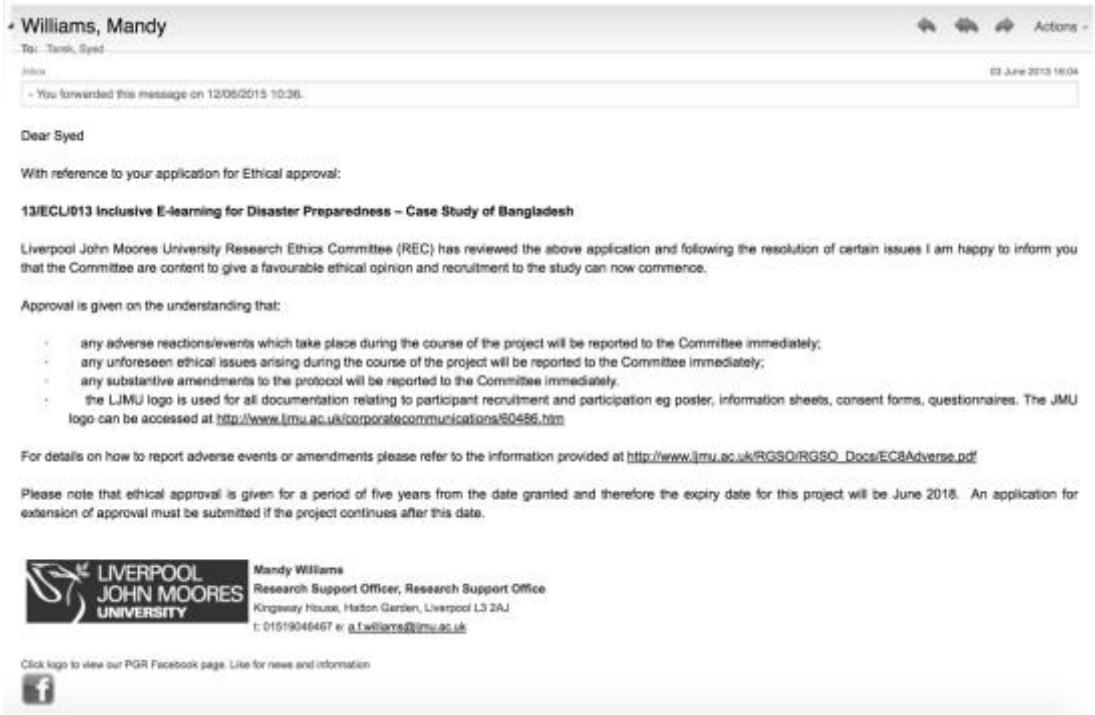
	Individual (26 participants)	Cohort 1 (G1+G2)	Cohort 2 (G3+G4)	No of Assistants	No of Tablet for Pictures	Total Interviewer Including the Researcher	Cumulative Estimated Time Required if there was one interviewer (I) or one device (D)	Total Estimated Time Required In Real Time (Cumulative estimated time/ number of interviewer or device)
Interview (one to one)	20 min			2		3	520 min (I)	174 min
Picture Taking	10 min				3		260 min (D)	87 min
Slides		30 min	30 min					60 min
Activity 4		10 min	10 min					20 min
								5 hours 41 min (Total estimated time required for the day) *** Two sessions in the day.**

Day 3:

	Individual (26 participants)	2 in a Group (13 Groups)	9 in a Group (2 Groups)	8 in a Group (1 Group)	No of Assistants	Total Interviewer Including the Researcher	Cumulative Time per Interviewer (I) /Participant (P)/ Device (D)	Total Time Required In Real Time
Demonstrate First Aid		15 min/ group			1 (Nurse)		15 min (P)	195 min
Listing Emergency Kit Elements	5min						5 min (P)	130 min
Photo Elicitation Group Interview			20 min/person =360 min	20 min/person =160 min	2	3	174 min (I)	174 min
	Cohort 1 & Cohort 2							**8hours 20 min (Total estimated time required for the day)** *** Two sessions in the day.**

APPENDIX L: LJMU REC ETHICAL APPROVAL

Ethical approval for the pilot study:



Williams, Mandy

Actions

To: Tarek, Syed

03 June 2013 16:04

- You forwarded this message on 12/06/2013 10:36.

Dear Syed

With reference to your application for Ethical approval:

13/ECL/013 Inclusive E-learning for Disaster Preparedness – Case Study of Bangladesh

Liverpool John Moores University Research Ethics Committee (REC) has reviewed the above application and following the resolution of certain issues I am happy to inform you that the Committee are content to give a favourable ethical opinion and recruitment to the study can now commence.

Approval is given on the understanding that:

- any adverse reactions/events which take place during the course of the project will be reported to the Committee immediately;
- any unforeseen ethical issues arising during the course of the project will be reported to the Committee immediately;
- any substantive amendments to the protocol will be reported to the Committee immediately.
- the LJMU logo is used for all documentation relating to participant recruitment and participation eg poster, information sheets, consent forms, questionnaires. The JMU logo can be accessed at http://www.ljmu.ac.uk/corporatecommunications/60486.htm

For details on how to report adverse events or amendments please refer to the information provided at http://www.ljmu.ac.uk/RGSO/RGSO_Docs/EC8Adverse.pdf

Please note that ethical approval is given for a period of five years from the date granted and therefore the expiry date for this project will be June 2018. An application for extension of approval must be submitted if the project continues after this date.

LIVERPOOL JOHN MOORES UNIVERSITY

Mandy Williams
Research Support Officer, Research Support Office
Kingsway House, Hatton Garden, Liverpool L3 2AJ
t: 01519046467 e: a.f.williams@ljmu.ac.uk

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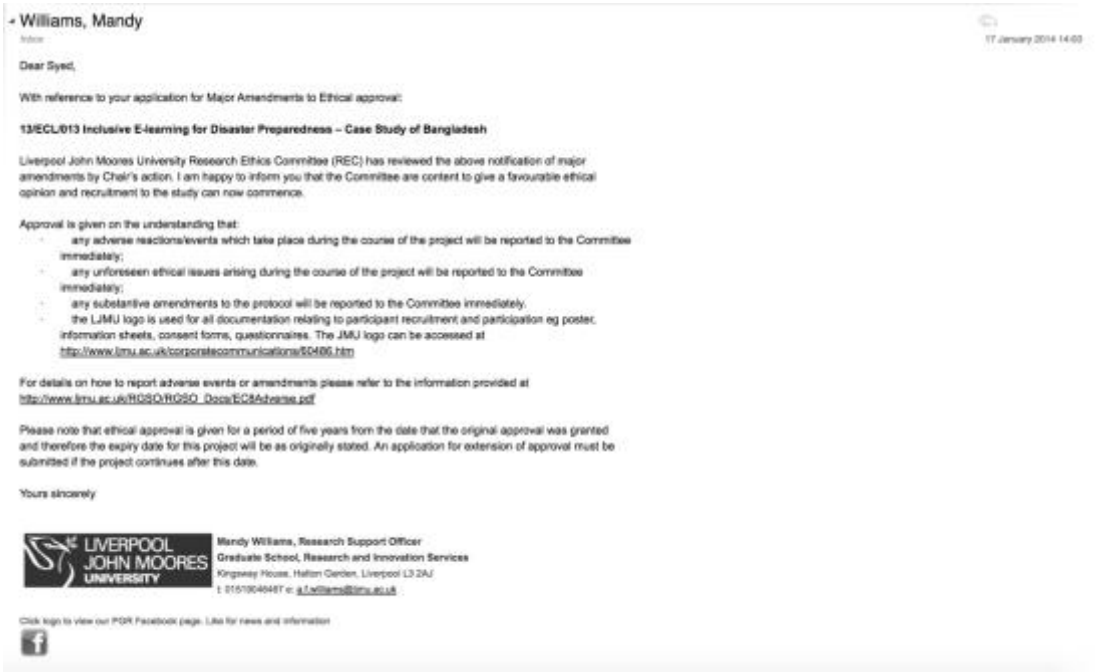
Ethical approval for the Main study:



Williams, Mandy

17 January 2014 14:03

Dear Syed,

With reference to your application for Major Amendments to Ethical approval:

13/ECL/013 Inclusive E-learning for Disaster Preparedness – Case Study of Bangladesh

Liverpool John Moores University Research Ethics Committee (REC) has reviewed the above notification of major amendments by Chair's action. I am happy to inform you that the Committee are content to give a favourable ethical opinion and recruitment to the study can now commence.

Approval is given on the understanding that:

- any adverse reactions/events which take place during the course of the project will be reported to the Committee immediately;
- any unforeseen ethical issues arising during the course of the project will be reported to the Committee immediately;
- any substantive amendments to the protocol will be reported to the Committee immediately.
- the LJMU logo is used for all documentation relating to participant recruitment and participation eg poster, information sheets, consent forms, questionnaires. The JMU logo can be accessed at http://www.ljmu.ac.uk/corporatecommunications/60486.htm

For details on how to report adverse events or amendments please refer to the information provided at http://www.ljmu.ac.uk/RGSO/RGSO_Docs/EC8Adverse.pdf

Please note that ethical approval is given for a period of five years from the date that the original approval was granted and therefore the expiry date for this project will be as originally stated. An application for extension of approval must be submitted if the project continues after this date.

Yours sincerely

LIVERPOOL JOHN MOORES UNIVERSITY

Mandy Williams, Research Support Officer
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APPENDIX M: PARTICIPANT CONSENT FORM

CONSENT FORM (Translated copy)

Title of the research: xxxx xxxx xxxxx
Name of Researcher: *Syed Ali Tarek*
Faculty of Education
Institute: *Liverpool John Moores University*

Selected participants should **'Tick'** ✓ all they agree with

1.	Have you read (or had read to you) information about this project?	Yes/No
2.	Has somebody else explained this project to you?	Yes/No
3.	Do you understand what this project is about?	Yes/No
4.	Have you asked all the questions you want?	Yes/No
5.	Have you had your questions answered in a way you understand?	Yes/No
6.	Do you understand it's OK to stop taking part at any time?	Yes/No
7.	Are you happy to take part?	Yes/No

If any answers are 'no' or you **don't** want to take part, don't sign your name.

- If you **do** want to take part, can you write your name below (If you can't read or write then instruct someone else or the researcher)

  Your name _____ Date _____

- If you require permission from your Head of the family then write their name here if they are providing consent for your participation.

  Name _____ Date _____

- The researcher who explained this project to you needs to sign too.

  Name _____ Date _____

Note: Store this document in participant file for the future proceedings.

v Monday, 08 April 2013 Page 1 of 1

APPENDIX N: DEVELOPING THE INTERVIEW QUESTIONS

Interview questions were developed by keeping in mind the research aim and questions. The following themes and questions were initially generated before the interview took place.

Main themes	Questions	Possible Probes (follow up questions)
Participant's Background Knowledge **RQ4, RQ5**	Can you please tell me a little about the disaster events (flood, cyclone) you have witnessed?	1. How frequent were the events? 2. When the last time you faced such event?
	Do you think you were adequately prepared to face such event?	• *If positive response,* 1. How exactly you have responded? *As per the response to investigate further,* 2. So…you are saying you have done (XYZ), was it only you or others had done similar things? *As per the response,* 3. Why you chose that particular way? • *If negative response,* 4. Do you think you could have saved more resources and or potentially lives if you had prior knowledge about it? 5. Do you think community, organisations and govt. acted

		fast enough?
About learning through Tablet devices **RQ1, RQ2, RQ3**	How you felt about using the device?	1. Mention few things that you liked? Then, 2. Do you think it was similar to using a mobile phone?
	How stimulating were the materials?	1. Can you explain which sections you thought were most useful? 2. How could this have been improved? 3. Which contents you liked most: text, audio, video?
Link towards practicability **RQ 3**	You have learnt to create a family safety plan. Did you figure out a place where you and your family members will join after such event?	1. If you and your family members are going to meet in a specific place after a disaster event, how you will ensure everyone is aware of that place? 2. Will you have this key place information recorded somewhere in your house?
	You have learnt your family members can take crucial decisions in such event. Will you be happy someone else take a decision on your behalf?	• If positive response, 1. How you will ensure they are taking the right decisions? • If negative response, 1. Can you explain why you won't be happy?

Improvement in decision making **RQ4, RQ5**	As you are well aware of key elements of disaster preparedness, do you think you can take initial decisions?	• If positive response, 1. Give me an example, if you see an early sign of cyclone what you will do? 2. So, if you believe there can be serious events have you got the location of nearest safety shelters? • If negative response, 1. Is there any family member who won't give you such permission? 2. Do you think you haven't learned enough to take such decisions? 3. Is it the fact that you don't want to take such risk?

Initially, with one participant, a few generic questions were asked to find out whether the questions were making sense to the participants. The researcher would also rephrase any question which the participant found hard to understand.

APPENDIX O: RESEARCH SCHEDULE MAIN STUDY PHASE 1

Day	Researcher Activity	Participant Activity
Day 1 14/04/2014	**Briefing [Intervention 1]** *Guidance on using the device, introductory session, information on common disasters in the locality,*	Understand what is required of them during the study, why early warning is important
Gap	No Intervention	*Participant Task: Take pictures of hazardous elements in disaster.*
Day 2 16/04/2014	No Intervention (Observation) [Interview at the end of the session]	Understand how to create an emergency plan and communicate that with family members.
Gap	No Intervention	*Participant Task: Create an emergency plan.*
Day 3 18/04/2014	**Demonstration: Emergency First aid. [Intervention 2]**	Learn how to do first aid in emergency scenarios.
Gap	No Intervention	*Participant Task: Take a picture of things that they will put in an emergency kit*
Day 4 19/04/2014	No Intervention	Creating an emergency kit.
Day 5 20/04/2014	Debriefing. [Interview]	

APPENDIX P: ADDITIONAL ETHICAL ISSUES THAT WERE CONSIDERED

Voluntary participation and consent

To ensure the participants are making an informed decision regarding participating voluntarily in the research is largely reliant on the information was given to them. Thus, it is of immense importance to give as complete information as possible to the potential participant. This information should include all the key aspects of their participation. Only after going through that information sheet the participant can give full, impartial consent. Miles & Huberman (2010) argued that a completely true informed consent is impossible for qualitative research as events during the fieldwork and the researchers follow up leads can be changed while qualitative research is in progress.

A detailed information sheet was created that outlined the activities that they will go through during the training days. The information sheet clearly signposted the time, venue, data collection methods, the participants complete right to request to skip certain activity or task and to withdraw from the participation. A signed consent form was created and was used during the recruitment stage (see Appendix M). A local version of the form in Bangla was drafted by the researcher to minimise other issues with misrepresentation of the information sheet. The participants could retain a copy of their consent form so that they can inform the family head or their other family members.

Risk of participation

The researcher must explore possible risk factors for the participants and try to minimise those risks to ensure the participants were not disadvantaged by

participating in the research. Risks can be considered as potential harms caused by injury, emotional distress, loss of self-esteem or embarrassment.

In this research, the participants had to go through content using the tablet, participate in several group discussions, interviews, take pictures and demonstrate some skills. Also, the researcher had to ensure the exposure to screen time was not going to cause physical or mental distress due to long hours of staring at the screen. Activities were designed in a way that would take the participants off the screen and engage in discussions. Overall screen time was not more than 2 hours for each day or session.

Use of tablet devices also has potential health hazards as found by researcher's that from touch inputs to the positioning of the users can be hazardous due to the portability of the device (Stawarz, 2011). As the participants were not exposed to the device for a prolonged period and there were very few scenarios that would require them to conduct complex tapings on the screen, these potential health risks were discounted.

During the interviews, participants were asked several questions related to disaster preparedness during past events, which could have triggered emotional moments and, which did happen in a few instances where the participants started crying explaining their miserable situation during and after the event. In such a case, the researcher had taken a soft, compassionate stance so that the participant was not left feeling embarrassed. The participants came from different age groups and different educational level. Thus they had an unique way of taking certain questions. In all such cases, the participants were never made to feel nervous or unwise. Participants were also made aware that in the group discussions, everyone had to respect other's opinions. If there is a disagreement, then they can have a further discussion to select the best possible outcome. When the participants were asked to take photographs, they have been invited to take the photos in their habitat surroundings. This enabled the researcher to eliminate potential health

hazard of tripping over an uneven road while concentration was completely on taking photos.

Benefit of participation

The major benefit of participation for the participants was in acquiring a handful of skills in disaster preparedness. The content of the training was customised for that locality, so it was straight forward for them to identify, understand and implement the training. It was made clear in the information sheet that their participation was purely voluntary and there would be no monetary incentives. All the participants had access to the tablet device and other stationery required for their participation. It was acknowledged through a formal thanksgiving meeting that the time the participants had taken out from their day to day activity was indeed beneficial for the research. The participants were not made aware of such arrangements prior the completion of the training to avoid any biases that may have arisen.

Confidentiality and privacy

The university guidelines were used to disclose any participant's personal information and especially if photos were to be taken, permission was sought before doing so. Activities did not involve taking pictures of the participants. It was anticipated the social norms might be against taking pictures of women regardless of their marital status; this could be found in the form of disapproval from the other group members or refusal from the female participants. These complex social values were respected, and the local informant had a key role to play in ensuring no one is being taken into an unwanted situation.

Participant information was coded as P1, P2 and P3. One Microsoft Excel log had all the personal information along with the codes for identification purposes. Pictures from the photo elicitation stage were placed in the interview transcripts so that all the required data related to the individual interviewee is in the same place. As further analysis of the interview was not done immediately, this process of

transcription was useful to have a better understanding of the data and have a sense of mental coding prior to using software to assist. To process the interviews a word processor, Microsoft Word, Microsoft Excel and the qualitative analysis software NVivo 10 were used to support the analysis and to help manage the interview data. The researcher has used an encrypted personal laptop to store the data. All the audio, video and pictures were stored in a BitLocker (Microsoft, 2016) encrypted disk drive in the laptop used by the researcher. After raw data was copied over from the temporary storage, it was straightaway copied in the encrypted drive, and temporary storage was formatted to ensure there was no issue of data misuse. The backups of the data were also encrypted and will be kept for a five-year period as instructed by the LJMU REC.

APPENDIX Q: MINIMALLY SUPERVISED DISRUPTIVE LEARNING PEDAGOGY

The stages of 'Minimally supervised disruptive learning' pedagogy are as follows:

1. Selection of community and profiling of the targeted population which will give an overview of the current educational practices and technological advancement at that location.
2. Select a newer technology, which is mostly unfamiliar with the chosen location. The technology must have educational properties. Whether the chosen technology is fit for the selected location needs to be carefully examined.
3. Design content on the local need. Ensure the design reflects and represents the local culture, including choice of wordings and language. Language should be the native language of the local population.
4. Content design process should acknowledge various cognitive considerations and simplicity in the design should prevail.
5. Content must be thoroughly evaluated by locals, local experts and subject experts who can ensure the content is suitable for the location.
6. Set exclusion criteria for participation (if any).
7. Upon recruitment of the learners work on the possible intervention points. These points should be adjustable and will depend upon the learners' progress.
8. Start the programme with detailed guidance on the technological artefact. Ensure at the end of this guidance period, majority of the learners are aware of the functions of the artefact. This process will reduce the need for extensive technical assistance.
9. The artefact should ideally be used in groups of 4-6.
10. Content should facilitate discussions and other activities within and beyond the interface. This is where the experiential knowledge is shared with others

which go through discussions and by understanding each other's opinions alongside the guidance from the artefact it is expected that learner's existing understanding will enhance.

11. Discussions and activities should involve all the group members. A facilitator can be present, but s/he should not interfere as long as a respectful participation is ongoing.
12. The facilitator can assist in rotation of the device in activities that are beyond the interface.
13. Learners, in general, should be able to progress through the tasks independently.
14. Interventions should take place as planned. The learners must be guided to ask questions to learn from the expert, and also the learners must demonstrate the required tasks.
15. At the intervention points, the learners must individually be able to demonstrate the tasks independently. This demonstrations will ensure the learning process has completed successfully. The facilitator can make notes of the progress.