The Communication of Disaster Information and Knowledge to Children Using Game Technique: The Disaster Awareness Game (DAG)

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ABSTRACT:The specific vulnerability of children and by extension, the need to promote disaster awareness among children as an integral part of disaster risk-reduction strategies is an emergent theme in the disaster management fraternity. The challenge however, is in the design of awareness-promotion tools that are relevant to and appropriate for the specific learning needs of children. The Disaster Awareness Game (DAG) on which this paper is based has been designed to address this challenge. Preliminary testing of the Game among Caribbean school children suggests that it is appropriate for and effective in rising levels of awareness and consequent behaviour of children in disaster situations. In light of the preliminary nature of these results further testing of the DAG is imperative if confirmation of its reliability is to be obtained.

Key words: Game Technique, Risk Information, Disaster Awareness, Risk Reduction, Children, Risk Communication

INTRODUCTION

The relationship between hazards/disaster impact and sustainable development is increasingly being highlighted in risk reduction initiatives. This relationship is especially evident in developing countries where a single catastrophic event can reverse developmental gains by several years. A concurrent and compelling argument is that provision of and access to appropriate information and knowledge is a critical ingredient in the risk reduction menu and advancement of the Millennium Goals. Traditionally, generation and dissemination of disaster information and knowledge has adopted a top-down centralized process. In that regard, decision-making in relation to this knowledge has traditionally been the forte of the intellectual community and disaster management planners. The shortcomings of this approach in terms of its ability to maximise participation of and partnership with communities

has spawned the emergent paradigm of community-based disaster management planning as the more efficient strategy for disaster loss-reduction. This new approach has the capacity to galvanize mass participation in disaster management decision-making, thereby creating the public 'buy in' that is a prerequisite for creating the culture of awareness that is necessary for disaster risk reduction.

Occurring in conjunction with the shift from macro-level to community-based disaster management planning has been a shift in mitigation emphasis from structural to non-structural measures. In that regard, recent emphasis on disaster management planning has been on preparedness, prevention, emergency response and recovery planning. The effectiveness of the community-based approach is hinged on the provision of appropriate information and knowledge to the widest cross-section of society

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through the design of appropriate mechanisms for the communication of disaster-related information. Communication of disaster information is central to efforts for public education, early warning, evacuation planning, and post-disaster relief (Rattien, 1996 cited in Nielsen & Lidstone, 1998). Although the new initiatives for reducing the impacts of hazards have gained momentum, it is still true that in many developing societies the process of comprehensive disaster management has lagged. This can be attributed to a number of factors such as:

i) Paucity of information on hazards and their impacts that can inform disaster management knowledge;

ii) Absence of appropriate measures for the dissemination and assimilation of disaster related information;

iii) The absence of an appropriate socio-economic environment for the implementation of disaster mitigation initiatives and;

iv) Discrepancies in methodological approaches to the implementation of disaster risk-reduction initiatives.

These gaps in the disaster management environment especially of developing countries have resulted in incongruities between the types of information that are generated and the needs of the people who require loss-reduction information. It is in this context that information and knowledge management have emerged as key considerations in the formulation of disaster management initiatives. Thus, "how to do?" has become more focal than "what to do?" in the design of strategies for disaster risk-reduction. Unlike traditional top-down approaches, the new paradigm acknowledges and accommodates the role of local knowledge and good practices in informing the 'how to do' of disaster loss-reduction. Disaster information and knowledge can be effective in risk-reduction only if it addresses the social complexities and variations that constitute the disaster management profiles of societies. Societies are not internally uniform, especially with regard to vulnerability, mitigation needs and the capacity to access and assimilate disaster information. For instance, not only are the specific vulnerabilities of children greater than that of adults but their capacity to absorb and apply disaster information is significantly different from that of grown-ups.

The comparative vulnerability of children to the impact of hazards and disasters is being increasingly documented. This is especially true in developing societies where scarcity of resources has undermined the capacity for development and implementation of effective measures for the promotion of awareness among children (Fothergill, 1996). The specific vulnerability of children has been highlighted by recent catastrophic events. For instance, the October 2005 earthquake in Pakistan that killed over 16,000 children as a result of the collapse of school buildings underscores the need for due consideration and promotion of measures that will allow school children to protect themselves during such events. Other examples of this specific vulnerability include the mudslides on Leyte Island in the Philippines that caused more than 200 deaths among school children; the March 2005 earthquake in Western Iran that destroyed 130 schools and directly affected 36,000 children; the 2002 earthquake in the Mose region in Italy where 26 children were killed after the local school was destroyed (ISDR, 2007). The most recent reminder is the China Earthquake in which at least six schools collapsed killing thousands of students (CNN, 2008).

In developing societies, where the largest proportion of the population falls within the youngest age cohorts, the potential impact of catastrophes is significantly multiplied. These impacts extend far beyond the immediate because the death of each child represents the loss of 40-70 years of productivity and contributions to social development in societies which can least accommodate these losses (Wisner, 2006). In light of the preceding discussion, it is evident that promotion of awareness among children is a critical need for effective reduction in social and economic loss from disasters. Children represent the greatest human resource investment for the future so; the protection of children from the impact of natural and human-induced catastrophes must include two distinct yet interrelated sets of priorities: (i) disaster risk education and (ii) school safety. These priorities are potential multipliers for overall disaster risk-reduction initiatives.

The Hyogo Framework identifies Knowledge of and Education on disaster risk reduction as ONE of the FIVE priorities for action in order to achieve

disaster-resilient communities and nations. Likewise, UNISDR has consistently campaigned to make disaster awareness and risk reduction integral to school curricula whether in formal, informal, or non-formal education. The objective here is to promote disaster risk education in national school curricula in countries which are vulnerable to natural hazards.

Disaster education is therefore recognized as an essential element in sustainable development since it accelerates the progress of societies toward disaster resilience (UNESCO, 2004; Shobeiri and Prahallada, 2007). This view is reiterated in the Hyogo Framework for Action Report (2005), where it is stated that "education for creating a culture of disaster resilience is an interactive process of mutual learning among people and institutions. It encompasses far more than formal education at schools and universities, and affects all aspects of life through the concerted effort to overcome universal barriers of ignorance, apathy, disciplinary boundaries and lack of political will present in communities. Education also involves the enhancement and use of indigenous knowledge for protecting people, habitat, livelihoods, and cultural heritage from natural hazards." The report further postulates that history teaches that inadequate disaster reduction awareness and preparation repeatedly lead to preven table loss of life and damage in all major natural disasters and that preparation through education is less costly than learning through tragedy.

According to the ISDR (2007) Report, schools are the best venues for inculcating collective values. Recently, there has been a renewal of focus, at both the national and global levels, of the importance of using public education as a strategy for disaster mitigation. The 1990s Decade for Natural Disaster Reduction emphasised the importance of governments 'educating and training their citizens to increase awareness' (Press, 1989). Likewise, it is widely recognized that an educated public is better able to prepare for, and adapt and respond to, hazards, and that education for disaster reduction is complex yet essential to any properly implemented, centrally managed hazard strategy.

The implementation of disaster loss-reduction programs in schools is being touted as a key

element in long-term disaster risk-reduction strategies. This is in recognition of the contribution that children can make in reducing losses during catastrophic events. This contribution is demonstrated in the famed Indian Ocean Tsunami case where a child is credited to the saving of several lives because of her recollection of the warning sign of a tsunami form a geography lesson at school (ISDR, 2005). It is in this context that children can be regarded as important resources in disaster risk reduction, as they perform the role of conduits of knowledge-transfer from classrooms to their communities, thus contributing to more resilient societies. Wisner (2006) echoes this view in his statement that "at all levels, pupils and students from primary schools to post-graduate level can actively study the safety of their own schools and work with teachers and community members to find ways to protect themselves. They can also spread the methods of participatory vulnerability and capacity assessment and hazard mapping to the broader communities surrounding schools and other institutions of education and research of which they are a part". Similar sentiments are expressed by the ISDR (2006), in the statement that 'disaster loss-reduction education for children fosters awareness and better understanding about the immediate environment in which they and their families live and work. Since children are widely known to be influential and effective communicators, lessons learned at school will later be transmitted to the home' (UNESCO, 2004). The value- added of current disaster education intervention in schools' curricula is that children who access disaster education will, once they become adults, have a greater understanding of disasters, of the effects of human actions and of the consequences of poor environmental management, as well as of the need to promote a new kind of development path that is in greater harmony with nature (ISDR, 2002). In other words, education for disaster reduction is an integral part of education for sustainable development, as education, knowledge and awareness are critical to building the capacity for hazard loss reduction (Wisner, 2006).

Children are now not regarded merely as potential victims of hazards and disasters but increasingly, as catalysts for loss reduction. However, providing children with the relevant

knowledge and appropriate media for gaining access to this knowledge presents a number of challenges, especially as this relates to design of teaching/learning methodologies that are in sync with the mental capacity and learning modes of children. Specifically, these challenges include:
(i)Determination of the existing level of awareness prior to curriculum design as a means of establishing the level of intervention required.
(ii) Design and development of appropriate tools for evaluating the existing level of awareness and also the knowledge gained from interventions.
(iii) Ensuring that the techniques employed for imparting disaster knowledge to children are sufficiently interesting and interactive to hold their attention.

The design of methodologies for educating children in disaster loss-reduction issues requires a number of critical considerations. These are highlighted in the following section.There is general consensus that the tens of thousands of children who lost their lives in the Indian Ocean tsunami of 26 December 2004 might have survived had they been equipped with the relevant information and skills for disaster reduction and response. It is in that context that a survey conducted by the Asian Disaster Reduction Centre (ADRC) indicated a consensus among respondents that the integration of tsunami disaster education into school curricula is the most effective way to utilize lessons for preventing or mitigating a similar tragedy from recurring (Suzuki, 2006). The mainstreaming of disaster education in schools must take into account key considerations related to; i) curriculum development, ii) pedagogy, iii) tailoring of disaster information to the mental capacity of children, iv) measurement of level of awareness, v) children's attention span, vi) mode of communication and vii) inclusion of children in the decision-making process.

There is much interest in curriculum and teaching practice as vehicles for promoting disaster-related knowledge among children. However, the incorporation of disaster education into existing school curricula cannot be ad hoc, but must be approached within the context of an overall educational system whose strength and functionality is reflected in each constituent curriculum. Interventions for the promotion of disaster education must therefore ensure effective interface with the existing components of the system if the initiatives for risk-reduction education are to be realistic and feasible (Wisner, 2006).

Pedagogy refers to the art of effectively imparting knowledge and, as such, the infusion of disaster education in school curricula requires appropriate pedagogic considerations. Traditional, school curricula are largely academic in their orientation. However, disaster education is not merely an academic exercise but a knowledge transfer system that can make the difference between life and death, between economic progress and impoverishment and between sustainable development and environmental degradation. It is in this regard that those to be entrusted with imparting disaster information to children should themselves be adequately and appropriately trained, not only in relation to the content of such knowledge but also in relation to the methodologies of effective communication. If this can be achieved in relation to school curricula, the multiplier effect on the wider society in terms of increased levels of awareness will be astounding (Wisner, 2006).

The tailoring of information towards specific groups is a critical component of pedagogic methodology. As such, disaster information for children must therefore take into consideration issues such as age, level of literacy, local language/ dialects and cultural factors, in order to maximize the detail and wealth of the collective information. Rationalization is critical to the success of any intervention. In that regard, the promotion of disaster education in schools must be informed by the existing level of knowledge among children. This necessitates evaluation of targeted students to establish their existing knowledge in relation to hazards and disaster. Depending on the age group, it is important that the evaluation technique is in sync with their level of literacy as well as mental capacity. It is widely recognized by educators that games are an effective mode of communicating information to children of all abilities, and as such game techniques can be an effective tool in the measurement of levels of disaster awareness among children.

Attention span is an important consideration in the education of young children. The tendency is for a positive relationship between attention span

and the level of interactiveness of the teaching technique. It is for this reason that games, simulations and skits are effective tools for the imparting of disaster knowledge to children. It is important however, that detail and accuracy of information are not sacrificed for interactiveness. Children of the same age can respond differently to techniques employed for their education. Careful consideration must therefore be paid to the mode of communication used in the dissemination of disaster risk information to young children and must cover a range of interactive and visual techniques and, as far as possible, include hands-on and experiential learning methods (Wisner, 2006). Ideally therefore, a disaster-relevant curriculum would not only impart knowledge related to the relevant natural hazards themselves, but in addition, would ensure that various media are utilized in the dissemination process so as to allow for the production of understandable and accessible information (e.g. posters, murals, simple drawings for primary school children) for all levels of children's mental abilities. The United Nations Convention on the Rights of the Child (CRC) recognises that a child "is a subject of rights who is able to form and express opinions, to participate in decision-making processes and influence solutions, to intervene as a partner in the process of social change and in the building of democracy." Most disaster risk-reduction measures have excluded the input of children although it is widely recognised that children are among the most vulnerable groups to the impact of disasters. In relation to disaster risk-reduction, children can play a critical role in informing the contents of risk-reduction measures as well as the techniques for imparting related knowledge. Children's participation leads to better outcomes and policies in development planning and programming. In order to ensure cost-effectiveness in donor funding and to make the most of limited resources, it is vital to involve all members of the community at all stages of a programme. Spending money on children's participation brings dividends because it leads to improved effectiveness and a focus on the needs of the most vulnerable (Plan UK, 2004). Consultation with children and those who teach and work with them must therefore be integral to the promotion of disaster awareness. The DAG

was designed for the promotion of disaster awareness among children, taking into account the considerations aforementioned.

MATERIALS & METHODS

The Disaster Awareness Game (DAG) is a process that combines a number of tools and techniques designed to:
(i)Measure levels of hazard and disaster awareness,
(ii)Educate children as well as adults about hazards and disasters that are relevant to theirenvironment,
(iii) Encourage positive behaviour at all stages of the disaster management cycle and,
(iv)Dispel myths about hazards and disasters.

These tools include lectures/presentations on local hazards and the relevant disaster management context, a board game with related question cards and a score sheet that is used to evaluate levels of awareness prior to and after exposure to the game. The board game also helps to inform players of the consequences of poor environmental behaviour especially as these relate to hazards. The Disaster Awareness Game was designed to fill major gaps in the capacity of Caribbean disaster managers to communicate disaster risk in an increasingly vulnerable environment. In light of inherent complexities in effectively communicating risk in such an environment, the need for interactive involvement of stakeholders is being recognized as a worthwhile option for effective risk communication. Game techniques are proven to be an excellent method of achieving required stakeholder participation irrespective of age group or educational level. The DAG was undertaken during a 2 day workshop in the Turks and Caicos Islands and St Vincent and the Grenadines. The validation methodology was undertaken in four stages:
i.Pre-Game Survey – This stage is intended to evaluate the existing levels of disaster awareness among the target population using a questionnaire survey.
ii.Initial Game Exposure– This represents the second stage of the pre-test through exposure of the target population to the DAG.
iii.Provision of Disaster Management Information – In this stage, participants are provided with disaster management information on hazards that are pertinent to their environment.

iv. Post-Game Assessment – This stage was intended to evaluate the impact of the DAG and the provision of disaster information on the level of awareness among participants.

DAG is an educational disaster game technique that is designed to evaluate levels of hazard awareness in order to determine and prioritize interventions for disaster education. In addition, the DAG evaluation process is intended to encourage positive mitigation and response behaviours, as well as to dispel myths about disasters in a fun yet intellectually stimulating environment. An overarching theme of the DAG is the relationship between attitudes to disaster information and social vulnerability. Playing of the game is intended to assess the level of knowledge of players within the context of the disaster management cycle. In that regard, the game navigates its players through preparedness, prevention, mitigation, emergency response and recovery/rehabilitation. There is a strong emphasis on measures that can be employed to mitigate impact and by extension contribute to the sustainability of households, communities and nations. The weakness/gaps in the answers given by players are not interpreted negatively but are instead regarded as opportunities for the design of appropriate interventions for risk-reduction. Key issues considered in developing the DAG for school children included design concept, reading and comprehension ability, age range, usability, attention span and learning considerations.

The DAG game consists of 3 levels; Basic, Intermediate and Advanced levels and is adaptable to any stage of educational attainment. The board game layout is identical for all levels: the level is determined by the degree of difficulty of the questions contained on the game cards. Currently, the DAG is in an electronic format which allows its users to adapt and format the game for different ability levels by adjusting the degree of challenge of the questions, the types of hazards and related questions in order to reflect local vernacular and hazard experience/exposure. The flexibility of the game allows users to format it to reflect specific areas of disaster management which decision makers might need to highlight. The adaptation discussed in this paper was targeted at Grade 5 primary school children and was tested in two

Caribbean countries namely, St. Vincent and the Grenadines and the Turks and Caicos Islands. To date, the DAG is available in English, with translations into Japanese currently underway.

The board component of the DAG process was designed to ensure that players are evaluated on the hazards and related management issues that are relevant to their environment (Fig. 1). For this reason the contents of the board component are adjustable and dependent on the environment of the players. Once the content of the DAG board was developed, the next step was to determine the degree of difficulty of related questions. Like the board component, the level of difficulty of the game cards can be easily and electronically adapted to suit the player's environment. In the game design for children, reading and comprehension ability were key considerations. In that regard, consultation with educators of young children preceded the development of the question cards.

Since the preliminary game was intended to be tested on grade 5 (9-12 year old) primary-level children, the consultation process established the reading and comprehension ability of this age group and the question cards were designed accordingly. The questions on the game cards coincided with the hazard content of the board game, thus covering similar stages of the disaster management cycle. The construction of the questions using a multiple choice format was one of the outcomes of the consultation with educators. Likewise was the limitation of response options to three (3). Further fine-tuning of questions occurred in relation to simplicity and straightforwardness. Appropriateness of the questions for the targeted students was further assessed by circulating draft questions and response options among a panel consisting of child educators and disaster managers. The age range consideration for playing the game is informed by knowledge of the mental and comprehension ability of different age cohorts. Based on this knowledge, it was decided that a minimum age of 9 years was required if the game was to be effective in the promotion of disaster awareness among children.

The primary attraction of the DAG as an education tool in the promotion of disaster
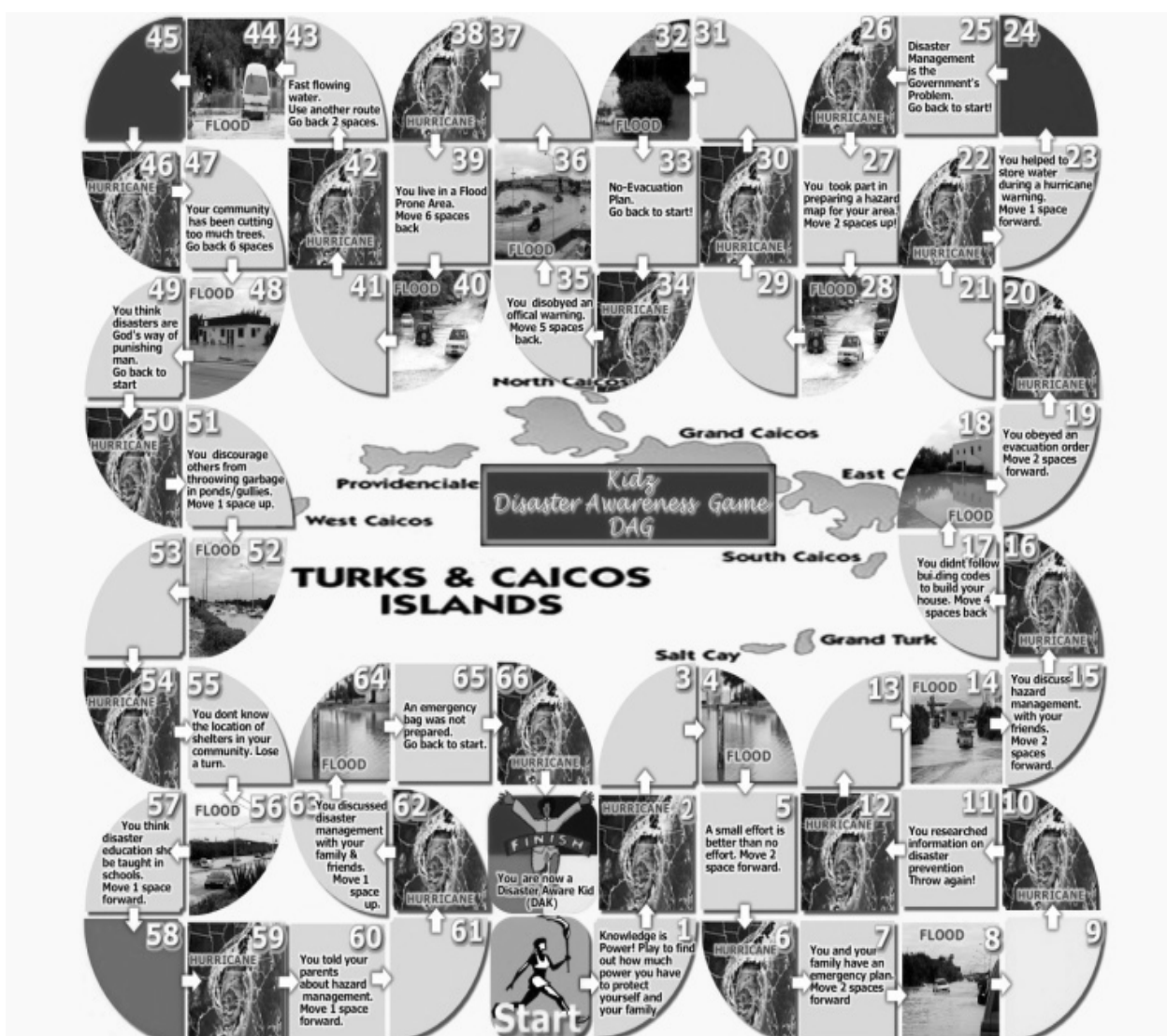
Fig.1. DAG Board-game Component for the TCI

awareness and risk-reduction is its low resource-demand, simple technology and cost effectiveness. The inputs are low cost and easily available so the DAG process can be easily implemented in poor societies where resource availability is a major constraint. Additionally, the digital format of the board game allows facilitators to adapt and modify the game in accordance with the requirements of the local environment in which it is being played. Similarly, the game can be easily modified to concentrate focus on single or multiple hazards as well as on specific components of the disaster management cycle. This level of flexibility can be effective in prioritizing the focus of the disaster management education in schools. In addition, the board game and question cards can be translated into multiple languages in order to ensure greater universal relevance.

The DAG is intended to promote disaster education in a relaxed and exciting environment of mental competitiveness and enjoyment. In order to prevent boredom, the length of play although flexible, was limited to one hour. Various means of stimulating interest among children were incorporated into both the board game and the game cards. Colourful pictures, clip arts, graphics and attractive text were extensively used. Since the game is not intended to be a formal examination of players' knowledge, the design of the game cards (Fig. 2). was intended to instil confidence in players by providing the correct response option as well as a brief explanation for the response.
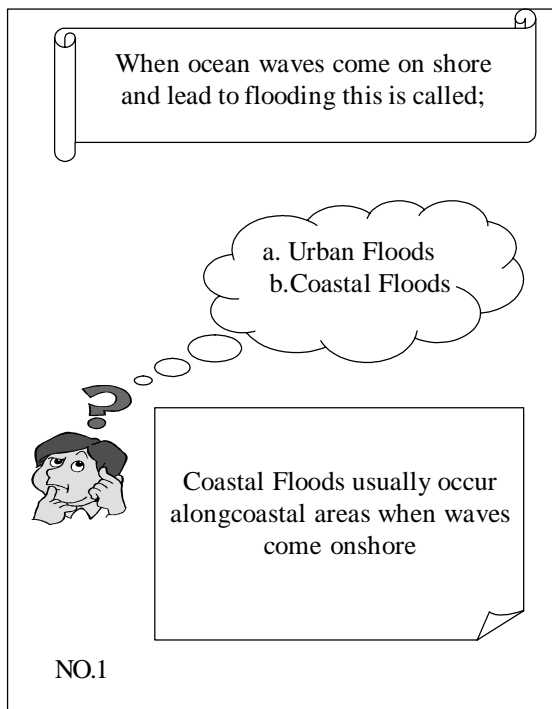
Fig. 2. Game Card Sample

Positive disaster management behaviours are encouraged in the game by rewarding players with moving one place forward for a correct response and two places backward for an incorrect response. Players can also advance if their game pieces fall on a position that suggests positive disaster management behaviour. Likewise, backward movement (penalty) can occur if the game piece falls on a location that indicates detrimental disaster management behaviour. This system of reward and penalty helps to reinforce the learning of positive disaster management behaviour. The pedagogical effectiveness of the DAG can be influenced by prevailing dispositions of children especially as these relate to meta-cognitive skills, reading ability and general learning attitudes. In order to achieve the objectives of the game, it was imperative that the rules of the game be clear, complete and concise so that they could be easily grasped by players (Fig.3).

Instructions for Playing DAG

- *Number of Players*:

Two or more players. (It can also be played in teams so that the entire class or large groups can participate).

- *Game pieces*

-Game Board

-1 Dice

-1 game piece per player

-50 question cards per hazard (which should be shuffled before each new game).

-1 Score and answer sheet per player or group

- *To Start Playing*:

Begin the game by placing all game pieces in the starting box.

Each player will be required to roll a 6 in order to begin playing the game. After getting a 6, the player will be required to roll the dice a 2nd time and move their game piece forward by that amount of squares according to the number rolled on the dice.

- *Playing the Game*:

Should a player land in a box with a hazard picture, a moderator or another player is to take a similar question card from the top of the card deck and ask the player the question or disaster scenario. For each correct response provided, players will be rewarded by being asked to move **1** space forward, while for each incorrect response players will be asked to move **2** spaces backwards. While moving forward if a player land on a hazard picture, he/she will not be required to answer another hazard question. However, if while moving backwards if a player lands on a hazard picture he/she will be required to answer another hazard question. The players will also move backward or forward or loose a turn if they land on any of the marked disaster scenario boxes on the board. If a player lands in a blank square he/she will not be required to answer any question, but is regarded as safe.

- *Winning the DAG*

The first player who reaches the finish box or the person who has the most correct responses after 60 minutes is the winner. If the number on the dice is higher than the number of spaces between the player's position and the finish line, the player must advance to the final space and then move his/her game piece back as many spaces as are left over from the number on the dice. For example, if you are 2 spaces away from the finish line and the throw of the dice gives you 5, you must move your game piece to the finish line and then go back 3 spaces.

Fig. 3. Instructions for Playing DAG Board Game

RESULTS & DISCUSSION

Confirmation is a critical component in the development of any evaluation tool. With regard to the DAG the confirmation process was intended to identify and eliminate any glitch in the process. The DAG was tested on Grade 5 students in two countries in the Caribbean, St. Vincent and the Grenadines (SVG) and the Turks and Caicos Islands (TCI). One school was selected for assessment in each of the countries. The Marriaqua Government Primary School was selected in SVG and the Ona Glinton Primary School in the TCI. 42 students were evaluated in SVG while 33 students were evaluated in TCI. Two-day workshops were organized for testing of the DAG in each of the targeted countries. The goal of the workshops was not only to evaluate existing level of disaster awareness within the context of the DAG but also to enhance awareness. Participating grade 5 students in SVG varied in age from 9 to 12 years with the mean age being 10.9 years. In TCI ages also varied from 9 to 12 years with the mean age being 10.2. The evaluation process in the workshop involved a pre-game survey of students, an initial game exposure, provision of disaster information using various mode and post-game assessment.

The involvement of students, their teachers and parents as major actors in disaster prevention and emergency preparedness and the fact that workshop activities received the support of both Ministries of Education and National Disaster Management Organization in each country, as well as coverage and publicity provided by the media, contributed significantly to the smoothness of the evaluation exercise and the quality of data generated. The long-term relevance of the DAG is related to emerging efforts by Caribbean countries to bench-mark the comparative disaster management status among countries as a means of rationalizing and prioritizing disaster management interventions. In that context, the DAG can be utilized as a bench-marking tool that allows comparison of levels of disaster awareness among children of similar ages throughout the region and thereby inform the type and level of disaster intervention required.

At the start of the workshop, a questionnaire was administered to participating students and their level of awareness assessed based on the correctness of their responses. The questionnaire was designed to assess not only the children's level of awareness but also risk perceptions, factual knowledge and physical preparedness for hazards to which their communities are vulnerable. In that regard, the questions relevant to students in SVG were related to hurricane, volcano, landslide, and mudslide and flooding. Those relevant to TCI students focus on hurricane and flooding. The questionnaire was also designed to assess children's prior exposure to specific hazards and to disaster education programmes designed to increase awareness, knowledge and preparedness which may have been provided by local disaster management officials, media or by school teachers.

At this stage of the evaluation exercise, students were coached on the rules of the game and were allowed to play without any additional information provided to them. The idea behind this exercise was to complement the measurement exercise undertaken in the pre-game survey. In essence therefore, the initial game exposure provided a reliability check for the pre-game survey. A score card was kept to record the correctness of responses but more importantly, it could be used as a baseline for determining levels of awareness at this stage. At the end of this exercise, game scores of participating students were compared with the results of the pre-game survey in order to establish reliability.

The initial exposure to the DAG was followed by formal but interactive discussions related to the relevant hazards, their impact and management. These discussions were facilitated by simple power-point presentations, videos and other interactive learning techniques. The post-test assessment consisted of a second exposure to the DAG and evaluation of the students' performance in light of their previous exposure as well as to the disaster management information provided. The results of the post-game assessment are discussed below and focus on the influence of the DAG exercise on i) awareness of local hazards, ii) risk perception and iii) preparedness and mitigation.

Analysis of data generated in the DAG exercise suggests that levels of awareness about local hazards increased after exposure to the DAG.

Although the results of the pre-game survey suggested high levels of hazard awareness especially with regard to students in SVG, the reliability check provided by the initial game exposure contradicted this. The conclusion here is that students either did not comprehend the questions on which the analysis is based or deliberately inflated their knowledge of hazards and disasters in the pre-game survey. The correctness of responses on the game score sheet was used as a comparative measure of the extent to which exposure to the game enhances disaster awareness (Table 1a & 1b).

Table 1a. TCI- Comparative Levels of Disaster Awareness Before and After Exposure to DAG

Hazard	Before Workshop %	After workshop %
Flood	64.8	86.8
Hurricane	65.4	83.4

Table 1b. SVG - Comparative Levels of Disaster Awareness Before and After Exposure to DAG

Hazard	Before Workshop %	After workshop %
Flood	69.2	74.6
Hurricane	75.0	83.0
Volcano	54.0	80.2
Landslide	51.0	92.0
Mudflow	43.0	83.0

In the case of the TCI, the level of awareness in relation to hurricanes and floods increased by an average of 20 percent following exposure to the DAG. For SVG, awareness increased by over 24 percent in relation to the 5 hazards to which that country is vulnerable. While it can be concluded that the DAG process contributed significantly to the enhancement of disaster awareness among the sampled children, caution must be exercised in relation to the reliability of these results. This is because there is a time-influenced tendency of knowledge attrition in relation to an experience/event. In that regard, the reliability of these results can be confirmed only through continuous evaluation of levels of awareness over an extended period of time. These results are therefore to be interpreted as preliminary. People's perception of risk is a major factor in the determination of vulnerability because this perception informs the decisions that will either mitigate or aggravate vulnerability. This is especially relevant for school children who might be away from adult supervision for extended periods of time en route to and from school. Table 2a&b indicate a notable increase in risk awareness for both TCI and SVG samples in relation to floods (Table 2a) and hurricanes (Table 2b), following exposure to the DAG..

Table 2a. TCI & SVG Flood Hazard Risk Perception

Variables	TCI			SVG		
	Pre-Test	Post-Test	% Increase	Pre-Test	Post-Test	% Increase
Perceived vulnerability of country	75.8	84.8	9.0	90.9	100	9.1
Perceived vulnerability of community	56.3	90.9	34.6	81.3	90.8	9.5
Perceived vulnerability of home	43.8	60.6	16.8	68.8	80.5	11.7

Table 2b. TCI & SVG Hurricane Hazard Risk Perception

Variables	TCI			SVG		
	Pre-Test	Post-Test	% Increase	Pre-Test	Post-Test	% Increase
Perceived vulnerability of country	87.9	93.9	6.0	87.9	95.9	6.0
Perceived vulnerability of community	81.8	90.9	9.1	93.9	98.5	4.6
Perceived vulnerability of home	63.9	72.7	8.8	78.6	90.9	12.3

In the case of flooding, the risk awareness of the TCI sample increased by an average of 20 percent, while that of the SVG sample increased by approximately 10 percent. The smaller increase in risk awareness for the SVG sample is a reflection of higher levels of existing flood awareness in the pre-test evaluation. That level of awareness is a function of greater exposure to flood events when compared with the TCI sample. Analysis of post-test data for the TCI indicates that the most significant increase in flood risk awareness related to the vulnerability of communities. This reflects lower levels of exposure to and experience with flooding in the communities from which the students originated. In the case of SVG, the most significant increase related to the perceived vulnerability of homes because, although students have a high level of exposure to flooding, the site-specific location of their homes makes direct impact from flooding unlikely except in extreme high magnitude events owing to generally steep elevations of this environment.

In the case of hurricanes, the increase in risk perceptions following exposure to the DAG was generally lower than for flooding. In the TCI, hurricane risk perception increased by approximately 7.8 percent while for SVG the increase was 7.6 percent. The main explanation is that existing levels of hurricane awareness before exposure to the DAG were significantly high for both samples. The similarity of the increase for TCI and SVG reflects a similarity

in the character and dissemination process of hurricane information throughout the Caribbean and especially within the Caribbean Disaster Emergency Response Agency (CDERA: CDERA is the umbrella disaster management organization for the Caribbean Region) participating states to which the TCI and SVG belong. Compared to information on other hazards which affect the Caribbean region, information on hurricanes is the most developed and most accessible. In that regard, students in both the TCI and SVG would have been exposed to similar hurricane-related information.

The role of preparedness and mitigation in disaster risk-reduction has emerged as a dominant paradigm in disaster management, particularly because of relationships to the sustainability of development in both developed and developing countries. Increasingly, preparedness and mitigation are being promoted at the household and community levels and, to that end, children's knowledge of preparedness and mitigation issues have become a critical component of this prevailing paradigm.

Preliminary analysis of the DAG indicates significant increase in children's knowledge of preparedness and by extension, mitigation measures in relation to floods (Table 3a) and hurricanes (Table 3b) for both samples. In the case of flooding, knowledge of preparedness/mitigation measures among students in the TCI increased by an average of approximately 22 percent while

Table 3a. TCI & SVG Flood Hazard Preparedness/Mitigation

Variables	TCI			SVG		
	Pre-Test	**Post-Test**	**% Increase**	**Pre-Test**	**Post-Test**	**% Increase**
Understand what to do to prepare	87.9	100	12.1	81.8	95.2	13.7
Understand what to do to evacuate safely	69.7	97.0	27.3	87.9	95.5	7.6
Understand what to do to recover from the damage	66.7	93.9	27.2	66.7	95.2	28.5

Table 3b. TCI & SVG Hurricane Hazard Preparedness/Mitigation

Variables	TCI			SVG		
	Pre-Test	**Post-Test**	**% Increase**	**Pre-Test**	**Post-Test**	**% Increase**
Understand what to do to prepare	93.9	100	6.1	93.9	97.6	3.7
Understand what to do to evacuate safely	75.8	96.9	21.1	75.8	93.9	18.1
Understand what to do to recover from the damage	69.7	90.9	21.2	69.7	92.9	23.2

in SVG the increase was nearly 17 percent. In relation to hurricanes, preparedness/mitigation knowledge increased by 16 and 15 percent for TCI and SVG, respectively.

The difference in increase between the two locations might be explained by similar factors to those of risk perception. The increase in preparedness/mitigation knowledge was evident in children's ability to list items that should be included in an emergency evacuation bag as well as how these can be used during an emergency. Additionally, children demonstrated a better understanding of hazards and their impacts and an extensive knowledge of measures that can be taken to mitigate the effects of hazards, after exposure to the DAG. Exposure to the DAG also assisted students in identifying ways in which they can assist their parents with disaster preparedness activities. Most were able to compile check-lists to remind their parents of preparations required to mitigate the impact of specific emergencies.

Evacuation knowledge also increased following exposure to the DAG, although more so for the TCI than SVG. This is mainly because of a higher occurrence of pre-test evacuation knowledge among students in SVG. Most of the students in the Marriaqua Valley where the sample school is situated would have had previous repeated experience of evacuation during flooding and hurricane events. The dearth of hurricane experience in the TCI would have impeded the development of this knowledge in children. It is for similar reasons that recovery knowledge was higher for students in TCI. This augmentation in

students' level of awareness of hazard preparedness and mitigation strategies can be accredited to the exposure of students to a number of lectures and the use of the DAG board game as a tool to buttress disaster management issues.

CONCLUSION

The importance of hazard awareness promotion through the provision of and access to disaster information and knowledge is increasingly being recognised as a critical strategy for the mitigation of the social, economic and environmental impacts of disasters and by extension, the enhancement of the process of sustainable development. Interventions for promoting disaster awareness must of necessity take into consideration the complexities in the disaster profile of the environment in which the intervention is intended. One aspect of that complexity relates to the provision to children of appropriate and relevant information that can enhance their safety during emergency events. Given that the capacity of children to comprehend, assimilate and apply information is different from that of adults, special design considerations must be given in the development of tools targeting disaster awareness promotion among children.

The DAG was designed with due consideration to the specific needs of children in terms of the provision of disaster information and knowledge. The results from preliminary testing of the DAG indicate that these design

considerations are for the most part effective in promoting awareness among children. Gaps in the design considerations have been addressed and the tool will undergo a second round of testing. The game can also be used as a tool for the identification and prioritization of interventions for promoting disaster awareness. This is especially relevant in the Caribbean region where scarcity of economic resources dictates the need for prioritization. In that regard, the DAG has the capacity to establish ranking among countries in terms of the level of awareness among children. Investment in people is an essential element of any programme. Building capacity is required at every level of society to reduce the impact of disasters. Information, education, and knowledge are key, as well as appropriate technology. Thus, it is essential that disaster preparedness feature as a component of any community development intervention.

Given the number of children affected by disasters yearly, it is essential that studies and policies now take account of the needs, views and capacities of children explicitly and consistently by including them in the disaster planning process and empowering them to help themselves and others around them. Educating children about hazards and mitigation strategies will help to create a safe local habitat for children to develop to their full potential, with the knowledge that if disaster strikes, they and their community are well prepared. However, in order to achieve this objective we must ensure that learning is fun, interactive and appropriate for the level at which it is being disseminated, as was demonstrated during the DAG workshops in SVG and TCI.

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