Study of Child-Invented Health Educational Games on Dengue Fever

by

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Abstract

The study’s goal was to demonstrate the ability of an eight-year-old child to create educational games on the topic of dengue fever control. A naturalistic descriptive case study method was employed. The child had two dengue fever educational game creation activities. The study demonstrated that a child could develop functional games related to dengue fever control. The study, however, revealed knowledge gaps, and mixed methods for dengue fever-related mosquito control. The games’ construction was consistent with the child’s cognitive level. The case study revealed that a child-centred educational game creation may be both diagnostic for a child’s topical knowledge and cognitive development, but also serve as a learning tool for children. This activity may also be an informational tool for formative research for dengue fever control.

Keywords: Dengue fever, children’s educational dengue games, cognitive, informational tool, dengue fever control.

Introduction

Elementary school-age children have demonstrated abilities in the invention of a wide range of games to cover such topics as general science(1), social studies(1,2), mathematics(1,2) and environmental studies(3). Child-invented games tended to increase in complexity with rules and content as children increased grade levels from first grade through third grade in one study(1).

Children’s invented games provide a host of potential benefits. Previous studies on children’s invented games described the following benefits: promotion of child-centred learning, problem-solving and cooperation, in-depth learning of specific topics, increased confidence in learning, an assessment of children’s cognitive processes, promotion of organization in learning, and learning through fun activities(1,2,3).

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The results of previous studies in child-invented games supported the theoretical approaches of Piaget in the importance of active learning, cognitive stage appropriate learning and the value of games in child-centred learning\(^4\). The previous studies also supported the importance of play or the fun element in learning\(^5,6\).

A child-created educational game may serve as a diagnostic tool for content understanding and learning/cognitive gaps for key health issues and problems. Therefore, this study seeks to examine a child’s invention of educational games related to the problem of dengue fever control. This study will examine child-invented games as possible educational materials for children and as potential diagnostic tools for content, understanding and also cognitive/learning gaps related to the dengue problem. The study will also examine these issues through progressively increased pre-game creation instructions, from the first game creation to the second game creation.

**Background and significance of dengue**

Dengue fever and its more severe form dengue haemorrhagic fever are rapidly increasing around the world. Nearly half of the earth’s population lives within the dengue zone. Though primarily found in the tropics, indigenous dengue cases have recently been diagnosed in all continents except Europe. This caused Gubler to state: “Dengue fever is currently the most important arbovirus disease of humans”\(^7\).

The number of globally reported dengue cases has nearly doubled in the past decade\(^8\). Dengue has re-emerged after scores of years of absence in such locations as Texas, USA, on the North American mainland\(^9\), and Hawaii, USA, in the Pacific\(^10\).

The Philippines has seen a rapid rise in dengue cases. In 1989, there were approximately 3 dengue cases per 100,000 pop. By 1998, it had jumped to over 45 cases per 100,000 pop. The total reported number of dengue cases and deaths in the Philippines for 1998 were 31,297 and 493 respectively\(^11\).

Dengue is transmitted by the *Aedes* mosquitoes. These mosquitoes are day-biting. They especially inhabit domestic water and rain-filled containers near buildings\(^11\).

Dengue is especially a concern in terms of treatment and prevention. Currently there are no antiviral medications to treat dengue\(^12\). Also, there are no marketable vaccines for dengue prevention\(^13\). Dengue primarily targets school-age children\(^11,13,14\). Therefore, school-children were the principal recipients of a series of health education programmes in one Philippine city. In addition, school grounds and buildings as potential mosquito breeding sites were given attention in some of the Philippine campaigns\(^15,16\).

The prevention and control of dengue centres on the control of dengue-carrying mosquito breeding sites. Potential breeding sites include such containers as flower pots, storage containers, jars and cans inside and outside of buildings. Containers are usually divided into categories as disposable or reusable. The reusable containers need covering and regular cleaning. Health educational programmes directed towards
Methods

An eight-year old Filipino-American child who had lived the majority of his life in a dengue-endemic city of the Philippines was asked to draw and describe two games related to dengue fever. The child had prior knowledge about dengue. This study was organized during the child’s first week of third grade. Parental consent and the pupil’s assent was obtained prior to the initiation of the study. The case study took place in the child’s home.

Instructions for the first game

Make a game about dengue fever. The child had paper and pencil to create the game. After approximately one-half hour the child completed the game design. After the completion of the game the child was asked to describe the game, its play and its rules.

One day later the child was asked to create another game related to dengue. Instructions for the second game were based upon gaps in details that were lacking from the child’s first game responses. No feedback was given to the child after the first game and prior to the second game.

Instructions for the second game

The child was asked to make a new game about dengue. The child was asked to make another drawing. The child could use the design of the first game as a basis for the new game or use a different design. Prior to the second game creation the child was further instructed and asked the following:

- The game should include how mosquitoes can best be prevented.
- The game should include something about where mosquitoes grow.
- The game should include something about removing or covering containers.
- How does someone win the game?
- What are the rules of the game?
- What should a student learn from the game?
- What makes the game fun?

It took the child approximately thirty minutes to complete the second game. No time limit was given to the child for game creation.

Results

See Figure 1 for the design of the first game. The child gave verbal instructions as to the play of the game. The child stated the following:

“If you land on the mosquito space you get a mosquito token. If you land on the hospital you are cured and you take away the mosquito. The person with the least number of mosquitoes is the winner. The person with the most mosquitoes is the loser”. In addition, the child indicated “if you land on a house with screens you lose a mosquito”.

The components of the game included a die, and up to five players (drawn as “stick
men”). The game board included three symbols. The symbols were called “signs” by the child. The three symbols were as follows: a cross, which symbolized a hospital (indicated as good), a drawing of a mosquito (referred to as bad), and a square with a line down the middle represented a house with screens.

The child did not indicate on the game’s board design nor verbally state anything about removing or covering potential mosquito breeding-site containers.

With respect to winning the game the child stated, “By being the first one to go to the most spots. A person needs to go to all three spots.” The child later indicated that “spots” referred to the buckets with mosquito eggs. These “spots” were the circular end points on the game’s board design.

With respect to rules, the child indicated in writing, “The most ones who kills the baby mosquitoes wins. But the ones who do not kill the most baby mosquitoes loses.” The child was then asked how the baby mosquitoes were killed? The child responded “by landing on it” (in reference to the buckets where the mosquito eggs were located). The above rules actually related to the winning process.

See Figure 2 for the design of the second game. The child’s responses to the seven questions and instructions were as follows:

- Dengue could be prevented “by going into the bucket of mosquito eggs and killing the baby mosquito eggs or by walking on the mosquito eggs”.
- With respect to where mosquitoes grow the child stated that, “they grow in water.”
The child was then probed about the mechanics of movement around the game board. The child indicated that each player should start at a common location. The players would each proceed back and forth to each of the three buckets and then finally end at their designated finish point. The child indicated that points would be scored for landing on the buckets with mosquito eggs. However, points would be lost by landing on the mosquito space. Landing on the space with the mosquito indicates receiving a mosquito bite. The child further indicated that if a player “gets too much mosquito bites you also lose”. The child also indicated that landing on the spot with the hospital symbols was positive, it indicated a “cure”. The child indicated that a player will receive 10 points by landing on the mosquito eggs, lose 10 points when landing on the mosquito space (referring to receiving a mosquito bite) and gain 9 points by landing on the “cure”/or hospital space. The child further stated that landing on the space with an arrow indicated that the player could move ahead one extra space. The drawing of a figure represented a “stick man” with a spray gun. According to the child the “stick man” represented a player. No rules about order of play or moral obligations related to play were given.

- In response to the question, what should one learn from the game the child responded, “To have fun. It helps kids know about rules so that kids won’t get mosquito bites. Like covering the buckets.”

- According to the child the game is made fun “by being the winner.”

Discussion

The results of this study were consistent with the literature in the selection of game category. Board games were the preferred form of created game for early to mid-grade level elementary school children.

Rules of the study’s invented dengue games were essentially procedural. That is, the rules dealt with the mechanics of playing the game and with a focus on winning the game. This was consistent with the literature that third graders were capable of designing procedural or winning rules. Furthermore, no winning rules were made for the games of first or second graders. However, the dengue games invented in this study did not contain social or moral rules. This was in contrast to a previous study where approximately one-third of second graders had moral rules in their invented games.

Parlett classified board games into five categories. The two invented games could be classified as combinations of thematic and racing games. The principal theme for both games was dengue fever control. The games also included the element of a race, for example, being the first to complete the course of the game design. Both games employed the element of chance (e.g. landing on a “good” space or “bad” space on the game board was dependent upon the roll of the die) rather than skill (knowledge or abilities either in game tactics or in content about the game’s topic of dengue control). The chance element may provide a fun element for children.

Both child-invented dengue games lacked titles. Most game instructions created by the child were orally given. Thus, the game board design may have been more
important to the child than the games’ instructions.

Both games revealed the child’s content understanding about dengue. These content topics reflected upon the child’s understanding about dengue transmission and dengue-carrying mosquito control measures. Most of the child’s information was correct. However, some conceptual issues needed correction or revealed incomplete information. The following discussion will cover these issues.

**Game One discussion**

The child understood that mosquitoes were in some way related to dengue fever. The exact connection to disease transmission was not specifically stated. However, the child knew that mosquitoes were in some way related to dengue. Mosquitoes were perceived as “negative”. The child mentioned hospitals as a “cure”. There is no actual “cure” for dengue as in an antibiotic or antiviral medication. However, fluid replacement therapy and anti-fever medication can certainly aid a person through a dengue illness\(^\text{12}\).

The child understood the importance of screens in the control of dengue. It appears that the child inferred that screens protected people from mosquito bites. The public health literature suggested that screens might be an important protective factor in dengue prevention\(^\text{19,20}\).

The child created simple but straightforward relationships in the game. They were as follows with respect to dengue: mosquitoes were negative, screens were positive and hospital also positive. This could be described as an example of the concrete level of cognitive thinking described by Piaget\(^\text{4}\).

**Game Two discussion**

With respect to disease transmission the child understood the importance of eliminating the mosquito eggs (earliest stage of mosquito life cycle)\(^\text{13}\) as exemplified by game board drawings of “eggs” in buckets and comments made about “killing the baby mosquito eggs”. However, the child incorrectly understood that stepping on them in a bucket could destroy mosquito eggs. The game’s mechanics, however, reflected on the importance of the control of the mosquito eggs, the earliest stage of the mosquito life cycle.

Just as in the first game the child indicated that landing on the adult mosquito was negative while landing on the game board’s hospital space had positive consequences. This time, the child indicated that the adult mosquito space referred to a mosquito bite; thus, demonstrating the child’s view of disease transmission by mosquito bite.

The child indicated in discussion the importance of covering containers as a means of preventing dengue. Covering reusable water containers is a recommended means of controlling the dengue-carrying mosquitoes\(^\text{17}\). However, the child in the current dengue game study did not integrate this concept into the game. Another concept of dengue-related mosquito control that was missing was that of the removal of disposable mosquito breeding site containers\(^\text{17}\).

An incomplete understanding of the mosquito life cycle may result in the stress on less effective control measures, such as an
emphasis on adult mosquito control through insecticide spraying. Winch et al., in their study of beliefs related to dengue control in Mexico, suggested that “people do nothing to control dengue because they do not understand the life cycle of the mosquito”(21).

Previous studies of both a combined parents-teachers group and also students in the Philippines yielded the rating of the importance of controlling adult mosquitoes over mosquito larva control(15,16). It is therefore interesting to observe that the child drew an insecticide spray gun in the hand of the figure representing the player. Insecticide spray guns or spay cans are used for adult mosquito control. This appeared to be in conflict with the child’s earlier statement about “killing the baby mosquito eggs” as a key method to prevent dengue. The drawing of the player with the insecticide “spray gun” in hand is consistent with the beliefs about dengue-related mosquito control held by other age groups(15,16).

A major manufacturer of insecticide spray has begun a dengue information campaign in Philippine elementary schools(22). Without the emphasis on mosquito larval control, such a dengue campaign will be incomplete. In actuality, an over-emphasis on insecticide use and other commercial protective measures may actually reinforce the notion among elementary school-age children that removal or covering mosquito breeding sites was subordinate to other dengue control measures.

Dengue fever and dengue haemorrhagic fever are important child health concerns for children in the Philippines and other dengue-endemic countries in the tropical zones(7,11,14). Dengue is an important theme for children’s games in dengue-affected areas. However, children can learn from game designs from other cultures and countries(23). It may be valuable for children to learn about themes affecting people in other countries and cultures through the vehicle of educational games. Dengue may be an important theme for children living outside the dengue zone to learn about as well.

**Recommendations and conclusion**

These dengue game exercises may be conducted as home or school activities. Also, they may be conducted individually or in groups. The children’s play of these prototypes may result in suggestions for game refinement. These refinements may result in more workable games as educational tools.

The dengue game invention exercises for a child in this study may have multiple uses. These activities may be diagnostic of a child’s understanding of a topical knowledge (in this case dengue), provide a child-centred educational tool at the appropriate educational age level, measure a child’s cognitive level, and provide potential formative research information for dengue prevention and control programmes.

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References


