First Grade First Aid:
A Cognitive Study on Mental Models for Medical Attention

ED 333A
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Learning Problem

Preventable injuries are the leading cause of childhood death and permanent injury. (American College of Emergency Physicians Fact Sheet, [http://www.acep.org/1,167,0.html](http://www.acep.org/1,167,0.html)) Playground- and bicycle-related injuries occur most often among young children, between the ages of 5 and 9 years old. Bicycle- and sports-related injuries also affect older children and adolescents, in addition to overexertion. More severe injuries occur during individual sports and recreational activities. ([http://www.musckids.com/health_library/adolescent/sis.htm](http://www.musckids.com/health_library/adolescent/sis.htm)) Medical professionals have often commented that the initial treatment response by those nearby when an injury is sustained or acute sickness occurs saves lives or makes a tremendous difference in the severity of injury or long-term health of the child.

This is very important to note since as children become older, they are likely to have more freedom from their parents and begin to develop their own networks that often do not involve direct parent participation. Once they have been taught the skills necessary to play sports or for example, ride a bicycle, they may spend lots of time playing with their friends instead of their parents. Children might be playing basketball at a neighbor’s house, on the playground after school, or on any of the many fantasy adventures that take them exploring in areas that may not have an imminent dangerous appearance, but serve as the stage for random accidents. An treasure hunt might take groups of children into the woods where there are no wild beasts to eat them, but old, debris such as broken glass under leaves might cut them severely. Parents cannot watch children all of the time, and they provide all types of equipment to prevent injuries, but accidents happen. If adults are not present, children are left with the responsibility of figuring out how to help their friends. Often they can run for help and get immediate assistance. In the event that there was a journey in the woods behind somebody’s house, proximity to help is not favorable. The children have large, quick decisions to make and sometimes they make good ones, and sometimes they make bad ones that seemed good at the time. In these situations, the injured child could be left while someone goes for assistance, treated adversely, not seek assistance immediately, or go into shock. In the worst case, the child dies, or is left with a lifelong injury that changes his or her life. In the best case, the emergency room or treatment can fix whatever is wrong and complete healing takes place. If the child is hurt or dies, often the friends feel as if they are at fault because they find out what they could have done too late. In their minds, if they had known how to affect a change they would have tried to help their friend, and very well had a positive impact on the outcome.

I propose that while children are introduced to very simple first aid education, they are not able to activate their knowledge in situations where applicable. They often understand concepts on a superficial level, but they do not conceptualize how they fit together in the complex system of the body. They have preexisting knowledge of pain, bleeding, swelling, and organs, but they do not grasp the underlying relationships because their current curriculum does not bridge these. Without these bridges, students are often paralyzed from moving from problem diagnosis to solution or active measures of assistance.
Learning Goal

The goal is to give the students a deeper understanding of the relationships between systems in the body so that they might effectively perform strategic thinking when first aid accidents occur. They currently have a cause-and-effect schema about their bodies, but it is not very complex. If asked why they bleed when they get cut, some of them might respond with ‘Because I got cut.’ If you ask them why it hurt, they might say ‘Because I got cut,’ or associate pain with bleeding. Actual reasons for the bleeding is because of broken skin and blood vessels, and reason for the pain is the communication between the brain and the site of the trauma. Students are not able to transfer their separate system knowledge into an interdependent system.

Traditional curriculum for health education usually introduces body systems separately and does not integrate their functions for practical use until high school or higher education. This researcher proposes that a simulation software that shows relationships between systems and that symptoms represent signals to or from body systems would give students a mental model that they might be able to use to navigate various situations in emergency and their own personal health on the long term. Once students have a large picture of the whole body, they might be less intimidated by emergency situations because they know more than what is happening, but why it is happening and how to solve problems. If the students do not have a problem-solving component in their health education curriculum in the K-12 years, they may never get the opportunity to deepen their understanding of the body systems because their career may not lead them into this arena of educational training.

Design Principles

1. **Interactions with material systems and concepts in the domain that understanding is about and social interactions in which learners discuss their understanding of those systems and concepts.** *(Greeno et. al, p 27)*

   Computer software can be used to demonstrate abstract concepts that would otherwise be hard for students to create in their minds without a priori images. Movement and relationships in systems are easier to synchronize with models. Group discussion and problem solving gives a broader opportunity for recognition of strong principles.

2. **Build on pre-existing knowledge.**

   Students already have some basic knowledge of the mechanics of the body. They are provided equipped with definitions and paired-associations throughout the K-12 curriculum. Two of the National Health Education Standards are highlighted below for our purposes.

   **Health Standard 1:** *Students will comprehend concepts related to health promotion and disease prevention.*
Health education standards from the American Association for Health Education have performance indicators that provide instruction of basic structure and function of the human body systems in kindergarten through fourth grade. Instruction in grades five through eight should provide the students with the ability to explain how health is influenced by the interaction of body systems.

Health Standard 6: *Students will demonstrate the ability to use goal-setting and decision-making skills to enhance health.*

As a result of instruction in grades kindergarten through four, students should demonstrate the ability to apply a decision-making process to health issues and problems.

3. **Find out how concepts are structured and create instructional representations to capture all aspects of the structure.** *(Case)*

**Proposed Design Study**

The suggestion is to use a specially designed age-appropriate version of the course materials and objectives for an Emergency Medical Technician or First Responder course because it takes pre-existing knowledge and creates a variety of applications and problem-solving strategies. It requires a higher level of understanding than just knowing what the systems or organs do. Students have to create new schema out of the functions and the interrelationships to be effective first responders. The goal is not to create elementary and secondary rescue workers, but to increase the students’ understanding and problem-solving skills by focusing on a topic that might be beneficial outside of their academic environments. It may be very ambitious to expect children to automatically take on a mature role in emergency situations, when often the nature of children is to seek adult guidance and require nurturing themselves so they cannot provide support to an injured party. However, empowering them with understanding will allow those that desire to and can act with the information to be good decision makers and helpers.

**Phase I: Curriculum design**

The curriculum has to be designed for the purpose of the study, but it should originate from an EMT or First Responder course and place emphasis on skills that children should developmentally be able to accomplish or perform. Examples of these skills would be to characterize color, responsiveness, detect bleeding, and maybe splinting or bandaging. The core content and objectives should be new to both groups and identical for both groups, but its presentation will be different. We propose two groups, an experimental and a control. The control group shall receive content in the traditional method of instruction with videos, demonstrations, and case studies. The experimental group shall have content presented in a mental model fashion with software simulations and physical models, and problem solving exercises. System knowledge will be the main prong of the curriculum design and the ability to demonstrate strategic knowledge is a byproduct. The curriculum should span ten weeks with daily sessions. Sample topics to be covered:
- Nervous system
- Cardiovascular System
- Circulatory System
- Skeletal System
- Musculoskeletal system
- Digestive System
- Immune System

Specific scenarios could include: Diabetes, Bleeding, Sprains, Brain injuries, Choking, Asthma, Anaphylactic shock, broken bones, Impaled objects, bicycle accidents, allergies, etc.

We would also like to include spaces in the exercises for student past experiences, current events, or student-created scenarios as analysis examples. These exercises would be arenas for group discussions.

Phase II: Pre-Assessment

A. Test Questionnaire:

   a. Develop a test questionnaire to use to test the students. We would include basic, straightforward questions about functions of the systems and organs and their relationships on the test. It will include choices for some answers and require written answers for other questions. Some examples of questions are as follows:
      i. What does the heart do?
      ii. Why do you bleed when you are cut?
      iii. Can you bleed and not know it?
      iv. If you were with your friends and one of them fell out of a tree, what would you do?

B. Interview:

   a. The interview will comprise of questions about their background and scenario-based questions that involve children in accidents or open-ended responses. We would present a dummy and impose imaginary injuries on it, and ask the students what their diagnosis of the problem is and what they would do to help. If they can demonstrate any action they would take, we would record them. This double method of assessment will give us a conceptual measurement mechanism and a mode of demonstration of problem-solving application.
      i. The dummy (Chuckie) is hurt. His finger is bent backwards because the basketball hit it. What do you think you should do to help him?
      ii. Can you help Chuckie at all? How?
      iii. If you have to leave him, what should you do before you go?
Create a continuum of weaknesses and strengths and place students in it. Then we want to create concept goals of vocabulary, laws, theories, and procedures for first responders.

Phase III: Study Participants

We propose the study will get lots of information from a group of middle school students, specifically seventh graders because they have had many of the courses that give them basic health knowledge. Their ability to handle nervousness and still function in a helpful capacity might be higher than younger children. They also are socially networked to do lots of things where many adults might not be present, and they participate in informal recreational often without supervision. They themselves might have had experience in which they have been injured or can bring past experiences as learning opportunities. We would take two seventh grade classes in the same school district so that educational curriculum prior to seventh grade will be comparable. We will take a sample of the 7 students from each class as our subjects, but the entire class will participate in the respective curriculums.

Phase IV: Study Protocols and Assessment

1. Inform parents of the study and get permission for student participation as subjects since content might be considered graphic.
2. Evaluate student acuity to perform in hypothetical situations as this could taint result if students do not demonstrate conceptual understanding in the dual modes of assessment.
3. Two classes: 7 student sample
4. 10 week curriculum of daily sessions
5. Both classes will have weekly quizzes so that we can track incremental changes in understanding and make sure that subject objectives are met within individual domains.
6. Use the same test questionnaire and interview questions in the pre- and post-assessments. Add student examples from the course, and create some challenge questions to observe how well the student recognizes symptoms, creates diagnosis, and hypothesizes measures for treatment.
7. Combine qualitative data from interviews with quantitative data from tests in overall assessment of understanding. Integrate concept goals created after pre-assessment in post-assessment evaluation.

The assessment will hopefully show us how students learn the systems of the body and integrate them for application to real-world situations. If the simulations, models, and problem-solving exercises prove to better prepare students for handling emergency situations and/or understanding their individual health, then curriculum designers of such interdependent subject matter might consider a less disjointed approach to instruction.

If the answer the question “Can you bleed and not know it?” changed from “No” to:
“Yes, if the skin isn’t broken, but turns blue, it could be a bruise. If the skin had broken, it would just bleed regularly. But, you can bleed on the inside—uhm, internally, when you get hurt, and you don’t know unless you go to the doctor and get some tests run.”

Also, say that in the second interview, when the student is asked what they would do when Chuckie’s finger gets bent backwards, they say,

“I would keep Chuckie calm if I could because he could go into shock. I would ask Chuckie if it hurts because he could have nerve damage, and then I would see if it has started swelling and changing colors. I wouldn’t try to move it because we don’t know if it is broken, sprained, or dislocated. I would get him some ice for pain if he had any, and then I would immobilize it with some sticks or put his hand in a newspaper, and we would go to an adult or the emergency room.”

Our conceptual goals from the pre-assessment would include: bruise, internal bleeding, swelling, distinguishing known from unknown, separating what I can do and what somebody else should do, immobilize, seek treatment. Ask about pain, check bleeding, pain management, recognition of connection between systems and signals, and we could consider that transfer to a higher level of understanding and creation of new schema that is used for specific situations.

If the control group answers the same questions with fewer correct answers on the questionnaire, inability to demonstrate first responder confidence on Chuckie, and fewer concept goals in their responses, then it would lead us to imply that mental models are a better approach to for these objectives and subject domains.

**Prospective Design Solution**

These potential findings would serve as a basis for considering integrating simulations, models, and problem-based learning into curriculum and supplemental materials for health education. This can be done on all levels, but if middle school students can grasp significant concepts using this method, then EMT or First Responder classes might also benefit from an updated curriculum to go along with their updated equipment. We suggest showing the layers of the systems and then using processes or diseases to show connections. This software can be tailored to all grade levels. For instance, for first through third graders, a demonstration of a bee sting will highlight all involved systems. The communication of pain signal to the brain and back to the site is nervous system. The swelling and or possible fever at site is the work of the immune system, and both system colors will light up on the screen as the example is played. This solution is a combination of system and strategic knowledge, both demonstrators of cognitive understanding.