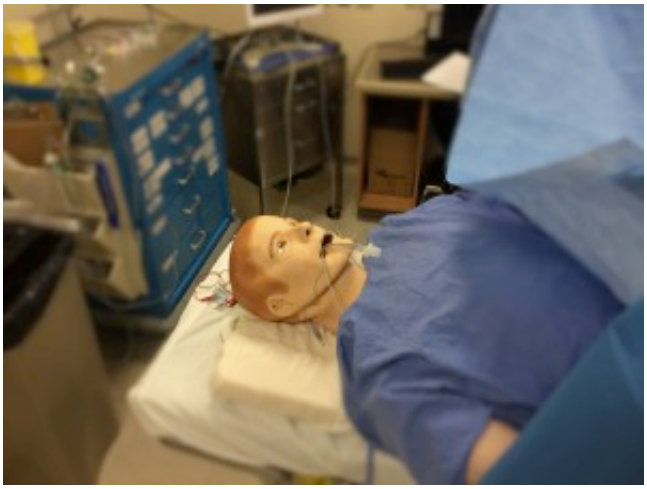
Simulation in marine and medical training: Less medical error – and more lives saved.

When a medical emergency strikes in a remote location, or on a ship or oil rig, the doctor on board might end up performing a life-or-death procedure that they haven't performed in years – or ever. As if that wasn't stressful enough, this doctor will also have to deal with all kinds of other demands—communicating with ship staff, taking instructions from a doctor over a telemedical device and, if they are on the ocean, their "emergency room" might even be moving!

We use the term *cognitive demand* to refer to how much is being asked of your brain at once. As you have probably already gathered, marine emergencies place a lot of cognitive demand on marine doctors (doctors on oil rigs and ships). How well they meet these demands depends on how familiar they are with the tasks and the marine conditions. This is related to working memory – the part of the brain that pulls up stored information and combines it with new information to get things done.



The problem is, too much cognitive demand, as is the case with new task and novel conditions, wears the working memory out – and mistakes happen. This phenomenon is called the *Cognitive Load Theory.*

Obviously, the less of cognitive demand or load placed on a doctor, the better. Ideally, doctors can find complex procedures comfortable, almost second nature, so that they can confidently perform them without getting fazed by motion and other distractions demanding a piece of their working memory.

One way to achieve this comfort level is simulation-based training—that is, replicating a real scenario for training purposes. (Think, for example, of doctors practicing stitching on rubber glove

before they move on to human flesh.) Training doctors to perform emergency procedures on mannequins in moving simulators *before* they're sent out to their moving workplaces can ensure doctors aren't dealing with cognitive overload when the time comes to perform the real thing in the real place.

To understand how simulation helps, we first have to understand how information is stored in our minds. We are constantly being bombarded with stimuli; our attention filters out which stimuli are relevant, and which aren't. Information that passes the relevance test gets routed to the working memory. Here, that info combines with other information to allow learning and other complex mental processes (like analyzing or reasoning) to take place. However, the working memory has limited storage space. New information can only sit there for a short period of time. It then has to either get refreshed, or put away in the long-term memory. If neither of these things happen, that new information disappears from our minds.

Our working memories are busy places, and can only work with four elements of information at a time. When you first start learning, every element is a new element of information. The beauty of learning, though, is that as you learn more, you can combine elements to form other, bigger elements. Think back to when you first learned to read. Early on, the letters "O," "N," and "E" represented three separate elements. Once you learned to read, those three elements combined to form one element – the word "one."

You can combine as many elements as you want and store them in the long-term memory, a place with much larger – in fact, an unlimited – storage capacity. Combining elements is what scientists call *schema formation*. In the above example, the word "one" is a schema, a picture or mental map in your brain. Schemas allow you to pull, from your long-term memory, entire chunks of information logically grouped together when you need them.

How does this apply to our offshore doctors using simulation to battle cognitive overload? If they are doing a new procedure on an oil rig, it can feel a little like trying to combine the elements of "O", "N" and "E" in the working memory. If, however, they've done a simulated version of a procedure enough times, then they will have combined it into a schema and can pull it out of their long-term memory to do the procedure. The working memory still has things to deal with – their fellow doctor's voice on the screen, for example, or the ocean waves – but the working memory isn't responsible for trying to work out how to do the procedure itself. The result: less medical error – and more lives saved.

Publication

Simulation as a suitable education approach for medical training in marine and off-shore industries: theoretical underpinning.

Dubrowski A
Int Marit Health. 2015