

# Scientific intuition and learning science

## A dialog with a teacher

Intuition is a guessing process, naturally invoked by the brain in its search to respond to a situation. The “situation” is not a physics law. It is a scenario involving physics laws that the intuition tries to predict, based on an aggregate of previous experiences that comprise the “personal control zone” or “picture of the world”.

The intuition is not wrong when equating constant motion with a constant force. This is reality. Laws are building blocks embedded in real scenarios. They do not “stand naked” in reality. Their ultimate function is to predict myriad of scenarios that they are involved in. They are taught in order to be a powerful tool in analyzing nature and its phenomena.

When teaching science we focus on teaching the laws, but too little emphasis is placed on inquiring, analyzing and resolving scenarios. Scenarios presented to students to exemplify laws are too often artificial and non consistent with reality, and thus defy intuition.

The function of intuition is to accelerate the convergence of thoughts to the right track when analyzing scenarios. Scientific intuition is not borne. It is nurtured by continuous comparison with new evidence and new inference. When done right – there is a compatibility of intuition with scientific evidence and learning is a true understanding. When proving intuition wrong and deliberately separating the intuition from the textbook – the student has dual worlds: the formulated laws, and his intuition. He may be excellent in solving textbook problems but very poor in analyzing and resolving scenarios and systems and in creating new ideas.

A Sheppard (like King David) knows how to throw a stone with a sling. He knows well that when leaving the circular motion of the sling, the stone flies straight (otherwise he would not have killed Goliath), but when he comes to learn circular motion from formulas and asked for the stone’s trajectory he very often predicts a circular path. He lives in two worlds and has no reference to his own reality. He has to calibrate his mathematically formulated intuition, not his natural one.

I may summarize:

- The process of teaching: present the concept of the law within actual scenarios that are familiar to the student cognitive perception, use it to conceptually analyze the scenario and only then present and exercise the formal law, calibrate the scenario and reduce the model to abstract formulas.
- The purpose of teaching: exercising laws or analyzing systems/scenarios. The latter is the essence of science, and of engineering and many other functions in life. When researching phenomena – the only way is to start with observing its behavior as a whole and then hypothesizing the balance of forces generating it, a process that involves guessing, estimating, comparing – and involves scientific intuition.