

Knowledge in this world is not clean. It is hard fought, a rough scrabble of empirical facts clustered into models and theories. The models themselves are tenuous, lasting only as long our observations permit. To teach facts seems like hearsay, a disingenuous trade. This however, is exactly what I do.

Of all the hard sciences, physics has arguably undergone the most radical changes over the last century and continues to surprise those who claim its dormancy. The clockwork mechanics of the heavens once considered true, have been replaced by the unsettling indeterminacy of quantum mechanics along with the warped perceptions of general relativity. On the scale that humans can observe, the world is clearly not what it seems. Yet we continue to teach both theories, old and new, true and false. It is not a failure of the pedagogy, nor is it due to the inadequacies of those teaching. The answer is more subtle, and presents profound insight to our understanding of the world and our mastery of it.

We learn by building. At a young age we build categories, partitions to place our observations in. These blocks are built haphazardly, overlapping with no thought to overall structure. The process can not continue indefinitely; we have a finite cognitive capacity. Our brains however, are finely adapted to build up, tear down and structure data until it can be explained in the least number of categories. Often at the end, what is left is depth rather than breadth. Categories are built from each other, assembling complex concepts from simpler components. We see the same strength in a concise mathematical formula or a profound literary quote. These statements that

encapsulate a broad collection of observations form a larger, more important building set. These blocks are the basis of our collective observations and the edifice that we assemble from them is called knowledge.

This presents a unique opportunity as a teacher, giving us two choices. We can build the internal structure in our students, embedding the current state of knowledge in their heads. This amounts to smashing and reassembling their structure as we see fit. While superficially effective it misses the larger point. Despite the fact that the student can categorize observations and place them into the correct bin of knowledge, they lack the experience of building and razing the structure itself. Knowledge itself becomes static. The alternative is simple. Build smaller models and present them to the student for deconstruction. When finally reassembled the assimilation of ideas may be identical but the process is radical.

In physics we teach old ideas for this very reason. They are toys to be explored, played and disassembled. I've come to understand that the truly unique and novel ideas come from this process and sought to share this with my students. While our structure of knowledge may be fragile, our strength lies in the ability to reform it in the shadow of previous achievements. Sadly most educational initiatives encourage only the acquisition of knowledge (evidenced by their heavy emphasis on testing). The idea is simple however, and the prospect to build the next generation of thinkers is more than alluring. To those who teach and those with a desire to discover, a shift in paradigm is all that's required.