Imagine science without theory. We would have nothing but a slew of empirical data with no framework upon which to make sense of our observations. Some progress would be made toward understanding the universe and learning how to exert control over the natural world, but it certainly would not be as dynamic and efficient as with theory-driven science. In fact, it is probably not possible for the human mind to merely accept scientific data without attempting to theorize about the underlying causes of the phenomena.

Now consider teaching. Is teaching scientific in that it is theory driven or is it largely an empirical process? For many, teaching certainly is an empirical process. We begin our teaching careers by teaching as we were taught, with changes along the way as we experiment with various techniques.

What if teaching could be changed so that there is a theory base behind our actions, where theory and experiment mix together to form a science of teaching? Could this improve the quality of teaching? I, for one, believe the answer is yes. And I am not the only one who advocates a scientific approach to teaching, as there is a small but growing community of science educators who are attempting to develop curricula by following theory and theory-driven experiments.

Theories about how students learn should be curriculum drivers. Vygotsky’s theories of education are a great place to start to gain an understanding of the theoretical underpinnings of Peer-Led Team Learning (PLTL).

Lev Vygotsky (1896-1934), born in Byelorussia, was a psychologist who lived during the Marxist era of the former Soviet Union. His works were not known in the West until the 1962 publication of his book *Thought and Language*. It is very interesting that Vygotsky was a critic of Piaget, given that Piaget’s works have had the greatest influence of any psychologist over chemical educators. Nonetheless, both Vygotsky and Piaget were constructivists, and both theories can be used to understand student learning.

The most important concept from Vygotsky’s works, as applied to PLTL, is the *zone of proximal development*, or ZPD. Vygotsky defined this concept as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.” The lower end of the ZPD is defined by what the student is capable of doing independently. This is what would be measured by a classic IQ test. The high end of the ZPD reflects what a student can do when given hints and guidance during the problem-solving process.
With the ZPD concept, Vygotsky puts forth a new way of viewing intelligence. Instead of a static point, it is a range where the traditional view of intelligence defines the low end of the zone. Vygotsky believed that the width of a student’s ZPD is a better predictor of potential for success in school than is traditional IQ.

Problems above the upper end of a student’s ZPD cannot be solved, even with assistance. Problems at the lower end can be solved independently. Thus, problems within a student’s ZPD are those more difficult than those that can be solved at a student’s present level of development, but can be solved with tutoring. As a student learns to solve such problems, the lower end of their ZPD is redefined at a higher level, and the student grows. It is therefore imperative to work within a student’s ZPD. This represents our overarching goal in the peer-led team learning model: peer leaders help students to work within their ZPD.

Classroom time in traditional curricular models rarely is used to challenge students to work in any fashion, let alone within her/his ZPD. Much of it is passive notetaking and listening to others solve problems. The PLTL model restructures this time so that some of it is spent in the optimal learning setting, as defined by Vygotsky. It is important to note that Vygotsky specifically stated that “more capable peers,” or workshop leaders in the PLTL model, can be used to promote learning within the ZPD.

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