Chemical Education Today *Editorial* The Art and Science of Science and Art **John W. Moore**
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Citation Moore, John W. *J. Chem. Educ.* **2007,** *84,* 7.

Teaching may be an art, but there are many good reasons for applying science to make it less so.

Is teaching an art or a science? Like both it requires creativity and hard work, but can it be quantified sufficiently to satisfy a scientist? I thought about this while reading an article in the business pages of the *New York Times* that described attempts to predict what makes one piece of art worth $37 million while another by the same artist is worth only $1 million *(1)*. Over the past five years David W. Galenson, a professor of economics at the University of Chicago, has applied quantitative tools to this question and come up with some interesting results—results that are highly controversial.

According to Galenson, most artists produce their best work either very early in their careers or very late in their careers *(2)*. Those who produced their best work early were conceptual innovators. They conceived of art in ways that were different from what had gone before and they typically thought that great art could be produced quickly and easily, once the artist had arrived at a firm idea of what the work would be. Examples of conceptual innovators are Gauguin, Picasso, and Warhol. Those who produced their best work near the ends of their careers were experimental innovators. They worked hard to develop their art by trial and error, experimenting with new techniques over many years and often not completing works they thought needed more work to achieve perfection. Examples of such late bloomers were Pollock and Cézanne. Two of Cézanne's works, each a still life but one painted when he was 56 and the other when he was 34, sold on successive days a few weeks ago for $37 million and $1 million respectively nicely supporting Galenson's predictions.

It seems to me that this division of creativity into two classes also applies to the students we work with on a daily basis. Some are quick studies and apparently assimilate new ideas effortlessly. Others have to work really hard to develop thorough understanding. It is easier to deal with the former. They are the students of whom I have heard it said that they would learn whether they were taught well or badly, so why worry so much about teaching? Far more rewarding, though, are the students who work tenaciously to learn. They (and we as well) take great satisfaction from their hard-earned knowledge. It is encouraging to have support for the idea that such students may be just as creative as their more immediately brilliant contemporaries. Even if it requires many years for their creativity to reach fruition, they may well contribute as much or more to society. There is a strong tendency to think that only the quick studies are really creative, but we ought not sell the experimental innovators short during our brief time as their mentors. To do so might lose much talent that could otherwise improve our society.

Galenson's quantitative predictions of the prices of art and his accompanying attempt to build a theory of creativity that extends beyond visual arts to writing and other creative endeavors, have drawn both strong support and considerable ire. Galenson's supporters find his application of statistical methods to a field that appears inherently non-quantifiable exciting and useful. On the other hand, many art critics and art historians hold that art and creativity are far more complicated than a quantitative theory can encompass and that any statistical analysis must fall far short of modeling human judgment.

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We often apply this latter kind of thinking to the study of teaching and learning. These are very complicated endeavors and it is difficult to measure quantitatively nuances that may be important keys to student learning. Galenson's work shows that this is a poor argument for not applying scientific methods to improve teaching. If statistics can be applied to the evaluation of quality of art, why not to the quality of teaching? Although we'd like to believe that teaching and learning are complicated enough that only our great skill and creativity—perhaps inherited at birth—enable us to do it well, the truth may be much more mundane. As it has been for many other things, it may be that a scientific, experimental approach is the best way to learn to teach well. Teaching may be an art, but there are many good reasons for applying science to make it less so.

Literature Cited

1. Leonhardt, David, The Art of Pricing Great Art, *New York Times*, November 15, 2006, p C1.
2. Galenson, David W. *Old Masters and Young Geniuses*, Princeton University Press: Princeton, NJ, 2005