

Science and Culture: Cartoons to better communicate science

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Words often fail when teaching science. Although some scientific concepts lend themselves to easily articulated descriptions and definitions, others consist mostly of a language of symbols only decipherable by knowledgeable experts.

Diagrams can help. However, some researchers and science educators believe another medium, known more for its entertainment value than its educational value, is often superior. Cartoons, they argue, catch the eye, engage the reader, and incorporate narrative in ways that make them important teaching tools.

Medicine has made use of illustrative drawings for half a millennium, a way of graphically demonstrating physiological objects and processes. However, the use of cartoons or comics—simple, often humorous drawings, or strips of them—is a recent phenomenon. Social sciences researchers have found in studies that they can be very effective when done well, offering a level of engagement few other media can match.

“Diagrams extract critical information. Comics can do that as well,” says Barbara Tversky, professor of psychology and education at Columbia University Teachers College. “Comics can also be very effective in tutoring, setting up social relationships. They can tell stories.”

Cartoons are particularly good at showing spatial and temporal relationships, she adds. “That’s hard to do and to do well.” The panels commonly used in comics can show processes and offer explanations in a step-by-step fashion, and can break up time into sensible units, showing what happens in each unit. (See, for example, Fig. 1.) Cartoonists typically find visual ways of connecting panels to each other, Tversky notes.

“I take great pains to strip away extraneous information and leave the main thread of the narrative,” says Larry Gonick, a cartoonist who provided “Science Classics” for *Discover* magazine and has drawn for *Science* magazine. “Students often discover relationships among things that may not be obvious when freighted with details.”

Studies suggest cartoons can be valuable, but it’s difficult to say whether they are actually a more effective medium than text or diagrams or whether the students are simply enjoying having something different in the classroom.

One study in a Catholic high school in the Philippines followed 78 students enrolled in an environmental science course; 38 were taught conventionally, and 40 were taught with cartoons. The study ran for 4 months



Some argue that comics like this one offer a valuable teaching tool for science concepts. Image courtesy of Larry Gonick.

during the summer; students attended 80-minute classes, three times a week. The students were then measured using standardized tests that gauge an understanding of concepts. Those using the cartoons showed “a significantly better conceptual understanding on environmental education topics than the conventional approach,” the researchers wrote (1).

The cartoons came from conventional media—newspapers and magazines. In one case, testing suggested that a cartoon about land use and deforestation, featuring a dialogue between a lumberjack and a fox, helped students facilitate a better understanding of land use controversy, taking into account, for example, the benefits of biodiversity and the tradeoffs inherent in using land to generate feedstocks for biofuels (1).

Another study, in Greece, tested 179 students age 10–11 and made use of a cartoon-style multimedia method using computers and animation (2). Questions and answers were all in cartoons, with a cartoon rabbit describing the scientifically accepted description of phenomena—for example, the difference between melting and dissolv-

ing, or the relationships between mass, volume, and density.

Based on testing, the researchers concluded that the use of animated cartoons significantly increased the young students’ “knowledge and understanding of specific science concepts, which are normally difficult to comprehend and often cause misconceptions” (3).

One newer method, called “concept cartoons,” developed by Stuart Naylor and Brenda Keogh in England in the early 1990s, uses simple drawings designed to challenge such misconceptions in science. One, for example, has cartoon characters in a boat talking about whether the depth of the water would have any effect on how well the boat floats.* Naylor and Keogh’s company, Millgate House, now sells their product.

Some textbooks already routinely use cartoons as tools for explanation—for

example, a popular undergraduate textbook called *Biological Physics* by University of Pennsylvania scientist Philip Nelson has not only detailed illustrations by David Goodsell but cartoons as well.

However, there is some resistance. “My opinion is that [cartoons] are completely underutilized in the scientific realm,” says Manu Prakash, an assistant professor of bioengineering at Stanford University and an amateur artist. He laments that many find them frivolous, noting that science instructors and scholars need every communication tool they can muster. “Our role is to engage society,” Prakash says, “and if we shy away, we will not be taken seriously in the long run.”

*Keogh B, Naylor S, British Educational Research Association Annual Conference, September 15, 1996, Lancaster, UK.

1 Espinosa AA (2013) Media cartoons: Effects on concept understanding in environmental education. *World J Environ Res* 3(2): 13–32.

2 Kaptan F, Izgi Ü (2014) The effect of use concept cartoons attitudes of first grade elementary students towards science

and technology course. *Procedia Soc Behav Sci* 116: 2307–2311.

3 Dalacosta K, Kamariotaki-Paparrigopoulou M, Palyvos JA, Spyrellis N (2009) Multimedia application with animated cartoons for teaching science in elementary education. *Comput Educ* 52(4):741–748.