

The whole truth is both too much and not sufficient (Note †)

Lawyers and fans of legal drama will recognise the phrase “the truth, the whole truth and nothing but the truth” as being part of courtroom procedure in many countries, including Australia. Although this commitment by the witness does not mention “relevance”, relevance is required by the rules of evidence. In a different context, students often mistakenly believe that quantity of truth will compensate for any deficiencies in quality and relevance.

The curricula of the various Australian jurisdictions, and the National Curriculum, encourage students to conduct research on the Internet (for example, see References ²⁻⁴). There is a wealth of good information on the Internet; there is also a lot of poor information, and often learners lack the ability to discriminate good from bad. An Internet search reveals sites advocating the Flat Earth theory,⁵ California's Velcro Crop,⁶ the dangers of dihydrogen monoxide (DHMO),⁷ and other interesting ideas.^{8,9} The start-up costs for a website can be negligible, so the quality of Internet sources is highly variable, as there is little incentive to ensure scientific rigour. On the other hand, book publishing is expensive and consumers will not purchase items that are full of mistakes, so there is a commercial imperative for publishers to have a rigorous quality assurance protocol to ensure that printed books and journals are factually correct. As a result, some advocates use vanity publishing, self-publishing, micro-publishing and the Internet, as means of publicising ideas that do not meet the standard of scientific proof required by the mainstream community. Students should learn to interrogate sources to discover if the author has expert knowledge in that area, and if the publisher or website has any quality assurance protocols.^{10,11} In this regard, the Velcro crop and dihydrogen monoxide sites are very useful, as they were deliberately designed to be spoofs.

The issue of relevance is just as important as quality. The abundance of Internet information and the convenient ease of copy-and-paste make it easy to substitute quantity for quality. A few years ago, in response to an assignment question about effect of the carbonyl group on the alpha (α) hydrogen atoms, a student submitted a detailed answer about the sigma (σ) bonding within the carbonyl group when involved in a metal-ligand interaction. Internet searches are limited by the keywords used for that search. The assignment submission was the “the truth, the whole truth and nothing but the truth”, but did not address the assignment question. The correctness and quantity of the information did not compensate for the deficiencies in quality and relevance: the “whole truth” was both too much information and not sufficient information. Useful scientific information has appropriate precision, accuracy and conciseness.

Nobel Laureate Linus Pauling often said that the use of computers is not a substitute for thinking, and the same is true of the Internet. To quote Pauling, slightly out of context: “I thought a bit ... I am sure that if I had been relying on a computer ... some of these ideas, which in fact turned out to be important, would not have occurred to me.”¹²

The Internet is a wonderful resource. It gives us access to databases, to vast amounts of information, to primary and second-hand data, and to summaries and analyses of information. However, it is not a panacea. Like other things, the Internet is a tool, and the usefulness of any tool depends on how it is used. The role of all teachers is to teach their students how to learn and to exercise self-judgement in that learning. The Internet will not replace teachers, instructors and academics, for they will always be needed to guide students on the appropriate use of learning tools on the journey of discovery that we call education.

† Please cite the original publication¹: K. F. Lim, “The whole truth is both too much and not sufficient”, *Chemistry in Australia*, **2013 (November)**, 33.

- 1 K. F. Lim, "The whole truth is both too much and not sufficient", *Chem. Aust.*, 2013, **2013 (November)**, 33.
- 2 VCAA, *Victorian Essential Learning Standards: Science*, Revised Edn, Victorian Curriculum and Assessment Authority, East Melbourne, 2005.
- 3 ACARA, Australian Curriculum, Assessment and Reporting Authority (ACARA), *Australian Curriculum: Science (F-10)*, <<http://www.australiancurriculum.edu.au/Science/Curriculum/F-10>>, 2011 (accessed April 2011).
- 4 VCAA, *The Australian Curriculum in Victoria*, Victorian Curriculum and Assessment Authority, East Melbourne, 2013 <<http://ausvels.vcaa.vic.edu.au/>>.
- 5 The Flat Earth Wiki, <http://www.theflatearthsociety.org/wiki/index.php?title=Main_Page>, last modified 10 January 2013 (accessed 8 September 2013).
- 6 K. Umbach, Umbach Consulting & Publishing, California's Velcro Crop under Challenge, <<http://www.umbachconsulting.com/miscellany/velcro.html>>, 1993 (accessed 8 September 2013).
- 7 Dihydrogen Monoxide Research Division (DMRD), Newark, Delaware, Dihydrogen Monoxide - DHMO, <<http://www.dhmo.org/>>, 1998, updated 2013 (accessed 8 September 2013).
- 8 M.A. Bell, Sam Houston State University, Teaching web page evaluation using hoax sites, <http://www.shsu.edu/~lis_mah/documents/TCEA/hoaxtable.html>, n.d., (accessed 8 September 2013).
- 9 Internet Fact or Fiction, <<http://velcroplant.blogspot.com.au/>>, n.d., (accessed 8 September 2013).
- 10 M.A. Bell, Sam Houston State University, Teaching web page evaluation using hoax sites, <http://www.shsu.edu/~lis_mah/documents/TCEA/hoaxtable.html>, n.d., (accessed 8 September 2013).
- 11 K. F. Lim, M. Horton and T. C. O'Haver, "Making use of IT: Web pages", *Teaching Science*, 2004, **50(3)**, 38-43.
- 12 L. Pauling, "X-ray crystallography and the nature of the chemical bond", in *The Chemical Bond: Structure and dynamics*, ed. A. Zewail, Academic Press, San Diego, 1992, p. 3-16.

Kieran F Lim (林百君) FRACI CChem <kieran.lim@deakin.edu.au> is an associate professor in the School of Life and Environmental Sciences at Deakin University.