

Developing a Framework for Understanding Scientific and Technological Thinking: Notes from a Workshop

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On March 24, 2001, Alexandra Kincannon, Ryan Tweney and Michael Gorman convened a workshop on cognitive studies of science and technology at the University of Virginia (Gorman, Kincannon, & Mehalik, 2001). We assembled a multi-disciplinary group of practitioners to discuss the latest research and methodologies, identify the stumbling blocks to advancement in this area, and think about directions for the future. The workshop was dedicated to Herb Simon, who was slated to participate.

Two questions became central themes. First, how can we combine *in vitro* experiments with *in vivo* case studies of actual practice? Results obtained in the laboratory may have low ecological validity. Fine-grained case studies are often domain-specific and hard to generalize.

Second, how can we deal with academics attachments to their own hypotheses and methods? Researchers tend to overgeneralize hypotheses developed under specific *in vitro* or *in vivo* conditions.

One way of avoiding this kind of overgeneralization is to combine *in vitro* and *in vivo* methods. With help from workshop participant David Klahr and others, we developed a preliminary framework based on the idea of searches in multiple problem spaces, and identified which had been investigated *in vitro* and which *in vivo*. For example, hypothesis and experiment spaces have been investigated both *in vitro* and *in vivo*, but function and design spaces have only been studied *in vivo*. This approach helps identify areas for future research.

The workshop illustrated that frameworks can be shared and that *in vitro* and *in vivo* studies have to complement one another. Theories need to deal rigorously with the distributed character of scientific and technological problem solving. We hope this workshop will suggest directions for future applications as well as research.

See <http://repo-nt.tcc.virginia.edu/cogwkshop/index.html> for more information about the workshop and the participants.

Acknowledgments

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References

Gorman, M. E., Kincannon, A., & Mehalik, M. M. (2001). Spherical horses and shared toothbrushes: Lessons learned from a workshop on scientific and technological thinking. In K. P. Jantke & A. Shinohara (Eds.) *Discovery Science: 4th International Conference Proceedings* (pp. 74-86). Berlin: Springer-Verlag.