

The focus of my research, teaching, and service can be roughly summed up in two questions: "What does it mean for someone to use scientific information well in their daily life?" and, "How can we assist people in using scientific information well, whatever that might mean?" The dominant approach in this area of research uses a structural argumentation framework; reasoning is judged in terms of how a person uses evidence to support claims. A "good reasoner" can identify and state a claim, collect relevant evidence and decide whether it supports or refutes the claim, and determine whether there is enough evidence to decide whether to accept or reject a claim. An alternative approach is a pragmatic one, in which the quality of reasoning is determined by the practical consequences, shaped by reasoners' goals, available resources, social dynamics, and so on.

The importance of this debate for cognitive science and education is that the two approaches can arrive at quite different evaluations of people's reasoning, suggest key differences in the underlying cognitive mechanisms, and point to very different approaches to education and the teaching of critical thinking (Brem, 2003). Types of evidence (e.g., experiments, anecdotes) tend to have relatively stable values, purposes, and uses in a structural model, but vary greatly on these dimensions in a pragmatic model depending upon the goals served by the argument and the constraints and opportunities created by the situation. Cultural norms, social dynamics, and goals that are external to the establishing of claims and evidence are relatively unnecessary to and therefore unrepresented in a structural model, but are essential to a pragmatic model. This opens up the possibility that there may be better paths for them to take than one that parallels a researcher's approach, and that if they fail to do what the research-savvy person would, it is not necessarily a mistake, nor evidence that they cannot "think scientifically."

Thus, structural and pragmatic models can come to quite different conclusions regarding the skills needed to be an effective reasoner, the processes underlying effective reasoning, and the appropriate criteria for assessing performance. Though less prevalent, the pragmatic approach is growing in influence, and I believe I have played a role in its achieving greater prominence. I have strived to contribute to this debate by (a) helping to delineate the structural and pragmatic views, (b) identifying and describing pragmatic factors that affect people's use of scientific information, and (c) examining the theoretical and practical implications of pragmatism for the study of reasoning and argumentation in education and cognitive science. I have tackled these goals as a researcher, teacher, and as a professional serving the public by assisting others in using scientific information in service of their needs and interests. Finally, because my work is inherently interdisciplinary, drawing upon psychology, philosophy, linguistics, artificial intelligence, anthropology and sociology, as well as domain-specific content, I have worked to build bridges through cross-disciplinary collaboration, the use of multiple methodologies, and publishing in multiple fields.

Research

I have developed two related lines of research. The first examines the cognitive mechanisms implicated in everyday reasoning, and the effects that scientific information has on this process. The second examines possible origins of people's conceptualization of science and scientific information, and the social and personal consequences. I will briefly review what I believe to be key developments along each of these two lines; for a full accounting, please consult my *curriculum vitae*.

Regarding the first, in 2000 I published an article with Lance Rips that challenged the structural view by showing that patterns of reasoning could be experimentally manipulated by varying perceived resource availability. Strategies considered inferior when a reasoner had access to rich sources of information became acceptable when that reasoner lacked access to such sources. Thus a person who does not reason "scientifically," i.e., in a way that is structurally normative, may not be lacking the ability to do so, but may be responding to pragmatic factors. This paper was published in *Cognitive Science*, the first journal of cognitive science, and ranked 26th by ISI among

journals in the ISI category *Psychology, Experimental*, despite its being a multidisciplinary journal that also covers such fields as philosophy, computer science, linguistics, and anthropology.

Studying pragmatic factors is difficult in an experimental setting, given the centrality of practical consequences and environmental factors. For this reason, I followed this work with several field-based studies observing the evaluation of scientific information, and analyzing existing standards for electronic environments. This led to a 2001 first-author publication in *Discourse Processes* that brought together a cognitive scientist, a biochemist, and a critical theorist, an unlikely combination even in interdisciplinary studies. My analysis of existing standards led to a sole-authored 2001 publication in the electronic rhetoric journal *Kairos*. An experimental hypertext, it allowed me to link to the sites analyzed, giving readers access to my data sources, as well as providing a fairly comprehensive catalogue of resources in electronic information literacy. My online research has also led to procedures for handling online data, about which I published a sole-authored article in *Practical Assessment, Research and Evaluation*. As of 25 May 2004, it had been viewed 5,597 times, and is linked to at Websites in countries such as Canada and Israel.

Given my goals, I have attempted to balance my publication of research articles with the practical pieces for practitioners and lay people. This includes a 2000 first-author publication on critical thinking in *Practical Assessment, Research, and Evaluation*. As of 25 May 2004, the article had been accessed 21,926 times since publication. It has been cited as a resource by the North Central Regional Educational Laboratory's *enGauge® 21st Century Skills: Literacy in the Digital Age*, and is linked to by Websites in a number of other countries, including Canada, Australia, Sweden, and Greece. In 2003, I published a sole-authored discussion of structural and pragmatic theories in *Trends in Cognitive Science*, the top-ranked journal in terms of impact by ISI in *Psychology, Experimental*.

The second thread of my research program has focused on identifying and tracking specific cognitive and cultural influences on reasoning with scientific information. For example, my colleagues, students, and I have explored the moral, social, and personal consequences of accepting evolutionary theory. While there has been much research on the religious conflict between evolutionary theory and creationist or intelligent design theories, little work exists on secular implications, such as racism, violence, and selfishness. In our first study, we were surprised to find that whether a participant personally accepted evolutionary theory, they believed that evolutionary theory has serious negative consequences, such as providing justification for discrimination and selfish acts. In a follow-up study, we found that Biology teachers frequently have similar worries, and we examined how they deal with these concerns in their classroom and their personal lives. The first study led to a first-author publication in *Science Education*, ranked 13th by ISI in *Education and Educational Research* and the 2nd highest ranked of science education journals. The second study led to a second-author publication with my graduate student as first-author; it is in press at the *Journal of Research in Science Teaching*, ranked 11th by ISI, and the highest ranked science education journal.

My research has been funded primarily through grants from the National Science Foundation. Beginning with a post-doctoral fellowship from NSF, I have received approximately 500K in sole-PI support from NSF, including the highly competitive Early Career Award, of which I was the first recipient in the history of ASU's College of Education.

Research-Related Service

I have applied my research to assist in the dissemination of science to lay people. In my largest project, I was approached 3 years ago by the Gilbert Unified School District through one of my graduate students, who is also their Title 1 Coordinator. Together, we wrote a grant to examine how formative quantitative data from the reading assessment tool *Reading Renaissance* affected academic performance and the school environment. Using longitudinal and retrospective quantitative methods, and qualitative methods, we have documented the changes in reading performance in the school as well as how teachers, students and parents conceptualize reading. This

has led to changes in the way teachers approach assessment, and has provided me with the opportunity to influence the development of *Reading Renaissance*, which is used in over 55,000 schools in the US. Through the project, we have brought 90K in funding to the university, and approximately the same amount to the district in software, hardware, and professional development.

My research-related service also includes serving on the Editorial Board of *Practical Assessment, Research and Evaluation*, and as an associate editor for *Journal of Research in Science Teaching*. I am an ad hoc reviewer for approximately 14 journals and publishers, and 3 professional societies. I have served as a panelist for the National Science Foundation, a reviewer for the National Aeronautics and Space Administration, and I am a member of the Research Review Board for *Renaissance Learning*. At a local level, I provide fundraising and grantwriting assistance to my community partners, by attending and presenting at public functions and board meetings, writing for community newsletters, and providing data to help them in their fundraising and development efforts. I have participated in grantwriting and reviewing workshops for both faculty and students through the Center for Learning and Teaching Excellence, and for the past 3 years I have spoken about grantsmanship at the Fall ASU New Faculty Orientation.

Teaching

My teaching and mentorship are marked by an emphasis on student autonomy, multidisciplinary scope, and an emphasis on understanding the philosophical and theoretical rationale behind any empirical inquiry. (Student evaluations are summarized in the table below.)

Two courses, EDP 542 (Research Methods) and DCI 591 (Foundations of Inquiry), train students in the philosophical foundations and practical procedures of research. I designed EDP 542 to introduce the wide range of methodologies available to the educational researcher, addressing not only how to do research, but the ways in which different methodologies address different questions, and how scholarly work is constructed under different approaches. DCI 591 is more philosophical in tone, co-taught by 3-4 faculty members from different disciplines and epistemological stances. I also co-teach in the Spencer-funded "Discipline Based Scholarship" training program, mentoring graduate students in the development of interdisciplinary dissertations. This program has provided dissertation-year funding for 8 students in education and psychology, approximately 50% of the students who have completed the seminar.

Student evaluations by course, aggregated over all semesters taught (0 to 5 scale, 5 maximum).					
	mean	median		mean	median
edp504/edp540 (n=40)	4.19	5.00	spf591 (n=12, co-taught)	4.58	5.00
edp510 (n=26)	4.65	5.00	edp310 (n=84)	4.67	5.00
edp545 (n=17)	4.76	5.00	edp591/psy591 (n=13, co-taught)	4.92	5.00
edp542 (n=14)	4.77	5.00			

The content-based courses I teach, such as EDP 540/504 (Theoretical Views of Learning), EDP 545 (Higher-Order Cognition), and EDP 310 (Educational Psychology), not only help students build content knowledge, but to encourage them to consider epistemological and methodological underpinnings, relevant political, historical, and cultural forces, and the value to themselves and their communities. Students pursue topics of personal and practical interest; this has led to the several projects of professional quality. For example, one student moved from a practicum-based to a research-based program on the basis of her work in EDP504/540, resulting in a *Journal of Research in Science Teaching* publication. Another, an ASU-West librarian, used EDP542 to develop an information literacy and critical thinking assessment for the Criminal Justice Program, implemented in April of 2003. Others have developed new activities for their own classrooms, honed thesis and dissertation proposals, and created cross-departmental networks with other students.

Due to circumstances I describe below, students in our program found themselves without readily available mentors. To address this, I created EDP 591 (Learning Sciences Lab), which provided an informal colloquium format for received peer feedback and mentoring. Students developed conference, dissertation, and thesis proposals and finished products; we also covered professional development issues such as vita preparation, and writing IRB proposals. Now that we are once again a full faculty, and students have a cadre of more advanced students to turn to for modeling and mentorship, we will move to a more rigorous presentation format; the "Spring Colloquium Series" will begin in the 2004-2005 academic year.

I currently oversee 5 doctoral students. All but the newest addition to my lab have presented at national conferences, and have written grants, technical reports, and proceedings papers with me. I have graduated two students to date; one is now a school counselor in the Phoenix area and has published her thesis. The other is now an Assistant Professor at ASU-West, has published several articles from her dissertation, and has been approached by the editor of an educational psychology textbook for use of her work in their curriculum. As a result of my mentoring work, I received the Graduate and Professional Student Association *Outstanding Mentor Award* in 2003, and the Preparing Future Faculty *Exemplary Mentor Certificate* in 2004.

Teaching-Related Service

I have participated in faculty development at ASU, demonstrating the uses of technology in the postsecondary classroom, and helping other faculty develop computer-based projects for their classes. I presented at the 2002 Wakonse conference, and conducted three workshops for the Center for Learning and Teaching Excellence on computer-assisted project-based learning.

Peer Institutions & Service to the Program and Division

As part of the review process, we have been asked to provide a basis for comparison by identifying peer institutions with similar expectations and environments for junior faculty. I have found this difficult, as our Division has been beset with challenges that have made it an unusual place for junior faculty. Therefore, I will instead describe the environment in which junior faculty have been operating for the past 5 years, and let readers identify points of comparison themselves.

During the 1990's, the Division lost several faculty to retirement, sudden illness and other events. This left several programs with few senior faculty; in some cases, none at all. This was case with the Learning Program, which had only myself as a tenure-track faculty member from 2000 to 2002. When I joined the faculty in 1999, we had \$1,000 in external funding, according to the Educational Psychology self-study report. We had 1 student actively pursuing a degree, and no written documentation of course requirements, comprehensive exam policies, and the like.

To rebuild the program, I aggressively pursued external funding, recruited graduate students, and made decisions regarding the allocation of internal and external financial aid to support them. I updated our curriculum by revising courses, scheduled courses for maximum enrollment, and revised the core curriculum to reflect new trends in the field. I developed a paper-based comprehensive exam option. I committed all policies to writing, and built a program Website on which to disseminate it. I also successfully chaired a search to replace a retired faculty member.

Today, external funding to the program directly exceeds 100K/year. We average 15 active students each year, have graduated two doctoral students and 2 master's students, and expect to have another 6 students graduate in the next year. Of course, I cannot and do not take full credit for these gains, but I believe that establishing a solid foundation for our program helped to facilitate this growth. An exciting and rewarding environment, it is also an unusual one, making it difficult for me to identify peer institutions with comparable resources, opportunities and obligations for junior faculty. I leave it to the reader to judge whether my record would be considered tenure-worthy at institutions they believe to be appropriate peers.