

# David McArthur

## Contact Information

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## Education

University of Toronto, B.S. in Psychology, 1975.  
University of Michigan, PhD. in Psychology, 1980.

## Research and Professional Experience

July 2011-Present – *Consultant on Educational Technology*. Works with the National Science Foundation and GoH LLC to advise on new federal programs in cyberlearning and educational technology; and with RAND to conduct evaluations of NSF's National Science Digital Library program. Supports selected clients to write proposals to federal agencies and large non-profit foundations. Recent clients include the School of Information and Library Science at UNC-Chapel Hill, the Shodor Foundation, and EMEC. Also continues his own research program in the areas of educational technology and cyberlearning research and policy.

October 2008-July 2011 – *Director of Research, University of North Carolina, School of Education*. Worked with the Dean to develop new strategic directions and partnerships for research in the School, and with faculty to identify funding opportunities and prepare research proposals. Enabled faculty to successfully compete for grants from National Science Foundation, National Institutes of Health, the federal Department of Education, and North Carolina's Department of Public Instruction, as well as from a wide range of non-profit foundations.

September 2006–October 2008 – *Senior Researcher, GoH LLC*. Worked as a consultant to NSF's National Science Digital Library (NSDL) program. Developed plans to transition part of the NSDL to an independent non-profit enterprise; established a framework and plans for NSDL program evaluation; and helped to determine the roles that NSDL could play in fulfilling NSF's emerging cyberinfrastructure program agenda.

November 2003-September 2006 – *Program Director, Division of Undergraduate Education, Directorate for Education and Human Resources, National Science Foundation*. Participated in the development of new program initiatives and research directions for higher education at NSF. Made conference and workshop presentations about current education program directions in the Foundation, and led the review of social science proposals in the Division of Undergraduate Education.

June 2003-November 2003 – *Research Scientist, North Carolina Central University, School of Library and Information Sciences*. Continued work on the iLumina digital

library, and on the National Science Digital Library, as the Chair of the Sustainability Standing Committee. Organized a workshop on business models for the NSDL, and presented invited papers on digital library development. Co-led a team to develop a proposal for a new NCCU new PhD. program in Information Science.

2002-May 2003 – *Consultant, University of North Carolina at Wilmington*. Developed the *iLumina* digital library, and participated in the National Science Digital Library program, supported by NSF. Led the Sustainability Standing Committee of the NSDL, developed a website on sustainability tasks and issues for the NSDL and related digital library initiatives, and organized a workshop that brought members of the NSDL together with representatives from key educational publishers.

1998-2002 – *Senior Consultant, Collegis, RTP, North Carolina*. Conducted research on digital libraries and distributed learning technologies funded through NSF grants, and applied this work to help construct innovative e-learning environments and web-based courses for institutions of higher education. Led a working group on metadata vocabularies for the IMS Project on learning technology standards.

1989-1998 – *Senior computer scientist, Information Sciences Department and Human and Material Resource Policy Department, RAND, Santa Monica, California*. Developed a program of research at RAND on educational technology policy, and continued to create and evaluate computer applications in education.

1987-1989 – *Research computer scientist, Information Sciences Department, RAND, Santa Monica, California*. Led NSF-funded research projects in computers and education; implemented and assessed innovative tutoring systems in high-school classrooms; and conducted related education research funded by the federal Department of Education, ARPA, and RAND.

1980-1987 – *Computer research associate, Information Sciences Department, RAND, Santa Monica, California*. Developed object-oriented languages for artificial intelligence and simulation. Conducted NSF-funded research in computers and education.

1977-1980 – *Teaching Fellow and Research Associate, Psychology Department, University of Michigan, Ann Arbor, Michigan*. Carried out research and teaching in cognitive psychology, adaptive systems and artificial intelligence.

## **Principal Areas of Research Interest**

*Cyberinfrastructure and learning*. The design of educational tools and environments that will leverage emerging high-performance computing systems, rich information repositories, and visualization environments, linked together through pervasive computational grids. This includes research on the organizational and social changes and risks of such innovations, and the use of cybertools to describe and visualize the evolution of topics in science to support science policy.

*Educational Technology Policy and Program Evaluation*. The review of on-going federal programs that support the development and deployment of technologies for learning in formal and informal educational settings, with the dual goals of improving

existing programs and providing a foundation for policy decisions related to new ones. Recent work has also investigated the use of innovative text-mining and visualization tools, applied to federal and public datasets to understand NSF's cyberlearning investments and to characterize their impacts on knowledge production and practice.

*Digital libraries.* The development of technologies to create digital collections, and services for sharing digital resources across broad user communities. This work was supported by several grants from the National Science Digital Library (NSDL) program in the National Science Foundation.

*Educational technologies and learning.* The design, implementation and evaluation of innovative technologies for learning in both K12 and higher education. Past work has been on interactive learning environments in public schools; recent efforts have focused on online and distributed learning in higher education.

*Object-oriented languages and simulation applications.* The development and application of object-oriented languages in various areas of decision-making. Past work included the architecting and implementation of object-oriented simulation languages in Lisp.

*Adaptive and Learning Systems.* Past work focused on the investigation of computer-based learning systems, especially genetic algorithms their design and limitations. This work also included assessments of the relationships between machine and human learning processes, their relative strengths and weaknesses.

## **Selected Publications and Presentations**

- McArthur, D., and Crompton, H. (accepted). Understanding Public-Access Cyberlearning Projects Using Text-mining and Topic Analysis. *Journal of the American Society for Information Science and Technology*.
- Crompton, H., and McArthur, D. (2011). Understanding and Describing NSF's Cyberlearning Projects. Submitted to the 15th World Multi-Conference on Systemics, Cybernetics and Informatics: WMSCI 2011, July.
- McArthur, D., and Crompton, H. (2010). EHR's Cyberlearning Projects (FY07, FY08, FY09). Final NSF Report.
- Khoo, M., McArthur, D., and Zia, L. (2009). An Agency Perspective on Digital Library Evaluation. In G. Tsakonas and C. Papatheodorou (Eds.), *Evaluation of Digital Libraries*. Cambridge, UK: Woodhead Publishing Limited.
- McArthur, D., and Zia, L. (2008). From NSDL 1.0 to NSDL 2.0: Towards a Comprehensive Cyberinfrastructure for Teaching and Learning. Proceedings of the 2008 ACM/IEEE Joint Conference on Digital Libraries (JCDL), short paper. <http://doi.acm.org/10.1145/1378889.1378902>
- McArthur, D. (2008). NSDL: Past, Present, Future. Proceedings of the 2008 ACM/IEEE Joint Conference on Digital Libraries (JCDL), panel.
- McArthur, D. (2008). National Science Digital Library: Shaping Education's Cyberinfrastructure. *IEEE Computer*, February, 26-32.

- Heath, B., McArthur, D., McClelland, M., and Vetter, R. (2005). Metadata Lessons Learned from the iLumina Digital Library, *Communications of the ACM*, Vol. 48(7), 68-74.
- McArthur, D. (2004). Learning from the Invention and Impact Listservs. In *Invention and Impact: Building Excellence in Undergraduate Science, Technology, Engineering, and Mathematics (STEM) Education*. Washington, DC: American Association for the Advancement of Science.
- McArthur, D., and Giersch, S. (2004). Flexible Business Options, Diverse Revenue Models: Sustaining Digital Libraries for the Future. International Association of Science and Technology for Development Conference on Communications, Internet and Information Technology, October.
- Fox, E., Crane, G., Griffin, S., Larsen, R., Levy, D., McArthur D., and Shigeo, S. (2004). Digital libraries settling the score: 10 years hence and 10 before: Digital libraries settling the score: 10 years hence and 10 before. Proceedings of the 2004 Joint ACM/IEEE Conference on Digital Libraries (JCDL), panel. <http://doi.acm.org/10.1145/996350.996439>
- McArthur D., and Giersch, S. (2003). Workshop on Exploring Business Models for the NSDL. National Science Foundation, Washington, November 14. <http://nsdlbizmodel.comm.nsdlib.org/>
- McArthur, D. (2003). NSDL Report: A Review of Business Options for the National Science Digital Library. [http://nsdlbizmodel.comm.nsdlib.org/doc\\_tracker/docs\\_download.php?group\\_id=82&id=126](http://nsdlbizmodel.comm.nsdlib.org/doc_tracker/docs_download.php?group_id=82&id=126)
- McArthur, D., Hanley, G., McMartin, F., Moore, R., Wattenberg, F., and Wittenberg, K. (2003). Challenges and Approaches to Sustaining Digital Libraries and their Collections. Proceedings of the 2003 Joint ACM/IEEE Conference on Digital Libraries (JCDL), panel.
- McArthur, D., Giersch, S., Burrows, H. (2003). Sustainability Issues and Activities for the NSDL. Proceedings of the 2003 Joint ACM/IEEE Conference on Digital Libraries (JCDL), poster. <http://portal.acm.org/citation.cfm?id=827226>
- McArthur, D., Giersch, S., and Parker, A. (2003). Why Plan for E-learning? Strategic E-learning Issues for Institutions of Higher Education. *Planning for Higher Education*. 31(4): 20-28.
- McArthur, D., Giersch, S., Wittenberg, K. and Luby, M. (2003). NSDL & Educational Publishers' Workshop Report. (Columbia University, October 2002), <http://publishers.comm.nsdlib.org>
- McClelland, M., McArthur, D., Giersch, S., and Geisler, G. (2002). Challenges for Service Providers when Importing Metadata from Digital Libraries. *D-Lib Magazine*, April.
- Geisler, G., Giersch, S., McArthur, D., and McClelland, M. (2002). Creating Virtual Collections in Digital Libraries: Benefits and Implementation Issues. Proceedings of the 2002 Joint ACM/IEEE Conference on Digital Libraries (JCDL), long paper. <http://doi.acm.org/10.1145/544220.544265>
- McArthur, D. (2002). Investing in Digital Resources. In J. Narum and K. Conover (Eds.), *Building Robust Learning Environments in Undergraduate Science, Technology, Engineering, and Mathematics: New Directions for Higher Education*. New York: Jossey-Bass.

- McArthur, D., Graves, B., and Giersch, S. (2002). Library Services Today and Tomorrow: Lessons from iLumina, a Digital Library for Creating and Sharing Teaching Resources. *Journal of Library Administration*.
- McArthur, D. and Giersch, S. (2001). Accessibility and Metadata in Digital Libraries. Featured article at SMETE.org.
- McArthur, D. Giersch, S., Graves, W., Ward, C., Dillaman, R., Herman, R., Lugo, G., Vetter, R., Knox, D., and Owen, S. (2001). Towards a Sharable Digital Library of Reusable Teaching Resources: Roles for Rich Metadata. *Communications of the ACM* Special issue on Digital Libraries.
- Geisler, G., McArthur, D., and Giersch, S., (2001). Developing Recommendation Services for a Digital Library with Uncertain and Changing Data. Proceedings of the 2001 Joint ACM/IEEE Conference on Digital Libraries (JCDL), short paper.
- Stone, A.M., Bikson, T.K., Moini, J.S., and McArthur, D. (1999). The Arts and Prosocial Impact Study: Program Characteristics and Prosocial Effects. RAND DRU-1887-LADCA.
- McArthur, D. and Lewis, M. (1998). Untangling the Web: Applications of the Internet and Other Information Technologies to Higher Education. RAND MR-975-EDU. (Also available online: <http://www.rand.org/publications/MR/MR975/MR975.pdf/>).
- McArthur, D. and Lewis, M. (1996). Muddy learning: Evaluating Learning in Multi-user Computer-based Environments. RAND DRU-1688-DARPA. (Also available online: <http://www.rand.org/publications/DRU/DRU1688/>).
- Stone, A.M., McArthur, D., Law, S.A., and Moini, J.S. (1997). Arts and Prosocial Impact Study: An Examination of Best Practices. RAND DRU-1686-LADCA.
- McArthur, D. and Law, S. (1996). The Arts and public safety impact study: A review of current programs and literature. RAND DRU-1457-LACDA.
- McArthur, D., Lewis, M., and Bishay, M. (1995). ESSCOTS for Learning: Transforming Commercial Software into Powerful Educational Tools. *Journal of Artificial Intelligence in Education*. (Also available as RAND RP-684-NSF, and online: <http://www.rand.org/publications/RP/RP684/jaied.htm>).
- Klein, S. McArthur, D. and Stecher, B. (1995). What are the Challenges to "Scaling up" Educational Reform? NSF invited paper.
- McArthur, D., Lewis, M, and Bishay, M. (1994). The Roles of Artificial Intelligence in Education: Current Progress and Future Prospects. RAND DRU-472-NSF.
- Lewis, M., Bishay, M., and McArthur, D. (1993). The Macrostructure and Microstructure of Inquiry Activities: Evidence from Students using a Microworld for Mathematical Discovery. Proceedings of the *World Conference on Artificial Intelligence and Education*, Edinburgh, August.
- Lewis, M., McArthur, D., Bishay, M., and Chou, J. (1992). Object-Oriented Microworlds for Learning Mathematics through Inquiry: Preliminary Results and Directions. Proceedings of the *East-West Conference on Emerging Computer Technologies in Education*, Moscow, April.
- McArthur, D., Robyn, A., Lewis, M. and Bishay, M. (1992). Designing new curricula for mathematics: A case-study of computer-based statistics in high school. RAND WD-5930-ED.

- Robyn, A., Stasz, C., Ormseth, T., Lewis, M. W., and McArthur, D. (1991). Implementing a novel computer-integrated algebra course. RAND N-3326-ED.
- McArthur, D. and Lewis, M. (1991). Overview of object-oriented microworlds for learning mathematics through inquiry. *Proceedings of the International Conference on the Learning Sciences*, Evanston, August. (Also published as RAND N-3242-NSF).
- Stasz, C., McArthur, D., Lewis, M. W., and Ramsey, K. (1990). Teaching and learning generic skills for the workplace. RAND R-4004-NCRVE/UCB.
- McArthur, D., and Stasz, C. (1990). An intelligent tutor for basic algebra. RAND R-3811-NSF.
- McArthur, D., Stasz, C., and Zmuidzinas, M. (1990). Tutoring techniques in algebra. *Cognition and Instruction*, 7(3), 197-244. (Also published as RAND N-3231-NSF).
- McArthur, D., Lewis, M. W., Ormseth, T., Robyn, A., Stasz, C., and Voreck, D. (1989). Algebraic thinking tools: Supports for modeling situations and solving problems in kids' worlds. *Technology and Learning*, 3(2). (Also published as RAND N-2974-NSF).
- McArthur, D., Stasz, C., Hotta, J., Peter, O., and Burdorf, C. (1988). Skill-oriented task sequencing in an intelligent tutor for basic algebra. *Instructional Science*, 17, 281-307. (Also published as RAND N-2966-NSF).
- McArthur, D., Lewis, M. W., Ormseth, T., Robyn, A., Stasz, C, and Voreck, D. (1988). Tutors and tools for algebra. *Proceedings of the Sixth International Congress on Mathematics Education*, Budapest.
- McArthur, D., Burdorf, C., Ormseth, T., Robyn, A., Stasz, C. (1988). Multiple Representations of Mathematical Reasoning. RAND N-2758-NSF/RC.
- McArthur, D, Stasz, C., and Hotta, J. (1987). Learning problem-solving skills in algebra. *The Journal of Educational Technology Systems*, 15 (3), 303-324. (Also published as RAND N-2595-NSF).
- McArthur, D. (1987). Developing computer tools to support learning and performing complex cognitive tasks. In D. Berger and C. Pedzek (Eds.), *Applications of Cognitive Psychology: Computing and education*. New York: Lawrence Erlbaum. (Also published as RAND N-2980-NSF).
- McArthur, D. (1986). Building learning and tutoring tools for object-oriented simulation systems, RAND R-3443-ARPA.
- Steeb, R., McArthur, D., Cammarata, S., Narain, S., and Giarla, W. (1986). Distributed Problem Solving for Air Fleet Control: Framework and Implementation, in *Expert systems: Techniques, Tools and applications*, Klahr, P. and Waterman, D. (eds.), Addison-Wesley Publishing Company, Menlo Park, CA, pp. 391-432.
- McArthur, D., Klahr, P., and Narain, S. (1985). The ROSS Language Manual. RAND N-1854-1-AF.
- McArthur, D., Klahr, P., and Narain, S. (1984). ROSS: An Object-Oriented Language for Constructing Simulations. RAND R-3160-AF.
- Steeb, R., McArthur, D., Cammarata, S., Narain, S., and Giarla, W. (1983). Distributed Problem Solving for Air Fleet Control: Framework and Implementations. RAND N-2139-ARPA.
- Cammarata, S., McArthur, D., and Steeb, R. (1983). Strategies of Cooperation in Distributed Problem Solving. RAND N-2031-ARPA.

- Cammarata, S., McArthur, D., and Steeb, R. (1983). Strategies of Cooperation in Distributed Problem Solving, in *Proceedings of the Eighth International Joint Conference on Artificial Intelligence*, Karlsruhe, Germany, pp. 767-770.
- McArthur, D., Steeb, R., and Cammarata, S. (1982). A Framework for Distributed Problem Solving", in *Proceedings of the Third Annual National Conference on Artificial Intelligence*, Pittsburgh, pp. 181-184.
- Thorndyke, P., McArthur, D., and Cammarata, S. (1981). AUTOPILOT: A Distributed Planner for Air Fleet Control, in *Proceedings of the Seventh International Joint Conference on Artificial Intelligence*, Vancouver, pp. 171-176.
- McArthur, D. (1982). Computer vision and perceptual psychology. *Psychological Bulletin*, 92, 283-309.

## Research Grants and Contracts

(Unless otherwise noted, these include only projects on which Dr. McArthur was Principal Investigator and principal proposal author.)

*Cyberlearning Synthesis and Taxonomy Creation.*

Subcontract No. GOH/UNC 09P2123; February 2010-August 2010.

Contract amount: \$39,058.

*Integrating Digital Library Resources into Online Courses.*

NSF Grant: 0226217; October 2002-October 2004.

Connie McKinzie (Principal Investigator), David J. McArthur (Co-Principal Investigator)

Grant amount: \$375,000.

*A Digital Library of Reusable Science and Math Resources for Undergraduate Education.*

NSF Grant 0002935; May 2000-May 2003.

William E. Graves (Principal Investigator), Charles R. Ward (Co-Principal Investigator), Deborah L. Knox (Co-Principal Investigator), G. Scott Owen (Co-Principal Investigator), David J. McArthur (Co-Principal Investigator)

Grant amount: \$1,143,282.

*Evaluating Innovative Computer-Based Educational Tools for ARPA's CAETI Program.*

Advanced Research Projects Agency; September 1994 - March 1996.

Contract amount: \$200,000.

*The Urban Parks Initiative: Designing a Participatory Evaluation Model.*

Lila Wallace Reader's Digest Fund; January 1995 - January 1996.

Contract amount: \$100,000.

*Building Education and Training Technology on Commercial Software.*

Defense Modeling and Simulation Office; September 1993 - March 1995.

Contract amount: \$400,000.

*Microworlds for Learning Through Mathematical Inquiry.*

NSF Grant MDR-9055573; July 1991 - March 1994.

Grant amount: \$580,000.

*A Novel Course in Algebra and Statistics Integrating Computer Tools.*  
US Department of Education Grant P168090023; October 1989 - October 1991. Grant Amount: \$430,000.

*Computer-based Tools for Learning Algebra.*  
NSF Grant MDR-8751515; September 1987 - February, 1991.  
Grant amount: \$902,000.

*The Cognitive Skills of Tutoring in Algebra.*  
NSF Grant MDR-8751104; February 1987 - February 1989.  
Grant amount: \$350,000.

*An Intelligent Tutor for Basic Algebra.*  
NSF Grant MDR-8470342; July 1985 - March 1988.  
Grant amount: \$500,000.

### **Honors and Awards**

Director's Award for Collaborative Integration. (National Science Foundation, 2006).

Director's Award of Excellence. (National Science Foundation, 2005).

Departmental Associate, Psychology Department (University of Michigan, 1979).

Rackham Pre-doctoral Fellowship (University of Michigan, 1979).

D. M. Springer Award (University of Toronto, 1975).

A. E. Laing Award (University of Toronto, 1971).

### **Professional Organizations**

American Educational Research Association (Special Interest Groups: SIG: Advanced Technologies for Learning)

American Psychological Association

Association for Computing Machinery (Special Interest Groups: SIGART, SIGCHI)

IEEE (Institute of Electrical and Electronics Engineers) (Working Groups: LTSC)

### **Professional Activities (last 9 years)**

Reviewed grant applications for the National Science Foundation (2001, 2006 - 2011).

Reviewed proposals for the NSDL Annual Meeting (2007 - 2008).

Reviewed books for ACM's Ubiquity <http://www.acm.org/ubiquity/> (2002 - 2004).



Reviewed papers for the *Journal of Artificial Intelligence in Education* (1995-2004).

Led National Science Digital Library (NSDL) Sustainability Standing Committee (2002 - 2003).

Led NSDL workgroup in Intellectual Property and Sustainability (2001 - 2003).

Participated in NSDL workgroups in Collections, Services, and Standards and Metadata (2000 - 2003).