Dr. Carol O'Donnell

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HIGHER EDUCATION:

* **Doctor of Education (Ed.D.)** (120 credits; QPA 4.0) 2007
Curriculum & Instruction (Science Education & Research Methods)
The George Washington University, Washington, DC 20052
The Graduate School of Education and Human Development
Department of Teacher Preparation and Special Education
Degree Conferred: August 2007

Dissertation Title: *Fidelity of Implementation to Instructional Strategies as a Moderator of Curriculum Unit Effectiveness in a Large-scale Middle School Science Quasi-experiment* - Awarded the American Educational Research Association (**AERA**) Division C Learning and Instruction **Graduate Research and Excellence Award**, March 2008.

Doctoral-level Research Courses (24 credits; QPA 4.0)
Rasch Practical Measurement; EDUC 302: Analysis of Variance (ANOVA); EDUC 306: Multiple Regression; EDUC 307: Qualitative Research Methods; EDUC 314: Multivariate Analysis; EDUC 281: Program Evaluation; EDUC 293.10: Structural Equation Modeling; EDUC 220.14: Hierarchical Linear Modeling (HLM). Workshops include: Alternatives to Randomized Control Trials (RCT's), Quasi-experimental Designs, Propensity Scoring, Regression Discontinuity; Meta-Analysis, Sub-Group Analysis, Single Case Design.

* **Master of Science, Geosciences** 2003
Mississippi State University
Department of Geosciences; (60 graduate credit semester hours) QPA 4.0
Masters Thesis: Meromixis at Mono Lake (field work: Mono Lake, Sierra Nevada, CA)

* **Bachelor of Science, Science Education (K-8 Certification)** 1983
University of Pittsburgh, School of Education (QPA 3.75)

WORK EXPERIENCE:

* **Smithsonian Institution** August 24, 2015 - present
Smithsonian Science Education Center
Director (Senior Executive) SY-1701-00
Washington, DC

- Director and Senior Executive of the Smithsonian Science Education Center, one of 31 units within the Smithsonian that focuses on the Smithsonian's mission to increase and diffuse knowledge. Responsible for all operational activities and planning for the unit, including building awareness for P-12 science education reform among State and district leaders, as well as Ministries of Education internationally; conducting programs that support the professional growth of P-12 teachers and school leaders; and, overseeing all research and curricular resource development, philanthropic development, and administration. This includes planning the development of new education products and the revisions curriculum units from the *Science and Technology Concepts* (STC Elementary and Secondary) curriculum; providing professional development to teachers and education leaders; working with district and State education agencies

(SEAs) to develop state-wide reform efforts using the Leadership and Assistance for Science Education Reform (LASER) model proven to be efficacious in a 5-year randomized control trial (Alberg, 2015); convening the unit's National Advisory Board Meetings; and, ensuring fiscal responsibility and fundraising for the unit, which includes working with unit Senior Leaders to prepare federal grant proposals and assist in obtaining additional resources from private foundations and corporations. Recruit and hire staff and oversee the preparation of progress reports. Responsibilities also include national and international thought leadership; development and execution of the unit's strategic plan; implementation and evaluation of the unit's products and services; and establishment of productive relationships with State Education Agencies (SEAs), Local Educational Agencies (LEAs), senior educators nationally, and Ministries of Education internationally. Information available: http://ssec.si.edu

* **US Department of Education** September 4, 2007 – August 23, 2015

Office of Elementary and Secondary Education, US Department of Education (2011 – 2015)
Group Leader, Office of State Support, GS-15-5 (Series 1720)
Supervisory Education Program Specialist
Washington, DC 20202

- Served as nationally recognized expert in the program area of teaching, teacher and leader effectiveness, and teacher quality. Managed portfolio of teacher quality programs including Title II, Part A Improving Teacher Quality State Grants of the Elementary and Secondary Education Act (ESEA); Title II, Part B Mathematics and Science Partnership (MSP); Teacher Incentive Fund (TIF); Javits Gifted and Talented Program; Teacher Incentive Fund STEM; School Improvement Grants (SIG); Title III Language Instruction for Limited English Proficient and Immigrant Students; and Title I, which together represent multi-billion dollar federal investments. Provided coordinated policy development, performance management, technical assistance, and data analysis services to all States through a State support team structure. Helped to deepen partnerships with States and more effectively support their implementation of key reforms to improve outcomes for all students. Provided professional leadership and guidance to Department and outside officials in planning, developing, evaluating and carrying out these educational programs. Supervised a staff of 17 and oversaw professional development for 85 people, which includes Program Team Leaders (who oversee the day-to-day work of Program Officers in their respective programs) and Program Officers (who monitor grantees within their respective programs). Reported directly to the Director of the Office of State Support and the Assistant Secretary of Education, Deborah Delisle.

- Integrated new developments, research findings on student learning and best teaching practices into ongoing programs and new initiatives. Provided analytical support and advice on short and long range priorities, strategies and policies; long term problems resistant to solution and the impact of major legislative and administration actions. Resolved major conflicts with other ED programs, other agencies and organizations. Represented OESE in negotiation of volatile problems and issues. Developed solutions that are consonant with overall legal requirements and policies. Advised officials on program plans and priorities that are fundamentally significant in establishing, meeting and evaluating mission objectives, policies, and overall program goals. Advised officials on the continuation or abandonment of specific programs and the far-reaching consequences. Developed a range of alternatives for the solution of policy problems on which even the top national experts disagree and on which political leaders and interest groups have strongly held views. Conceived, conducted, and coordinated high-priority planning studies, which provide in-depth analysis on issues of national importance and influence key department decisions. Developed and coordinated the preparation of information and decision memoranda, which define broad educational program options, assess their utility, integrate and analyze relevant information, and recommended course of action for the department. Prepared, contributed to, and encouraged others to prepare articles,

reports, and similar documents, which develop, interpret and disseminate vital education program data and information. Participated in a variety of high level Department-wide or government-wide task forces and committees, often serving as leader of such groups. In this capacity, served as a catalyst in stimulating new ideas and analyzing advanced concepts for the solution of complex educational problems.

Office of the Deputy Secretary, US Department of Education (120 Detail Feb 15 – June 15, 2011)
Implementation and Support Unit
Race to the Top: School Turnaround Technical Assistance Lead
Washington, DC 20202

- Selected by the US Department of Education Office of the Deputy Secretary through a highly competitive process to serve a 120-detail in establishing a new *Implementation and Support Unit* designed to support comprehensive reforms implementation to states awarded grants through American Recovery and Reinvestment Act (ARRA) programs that require Governors' and Chief State School Officers' involvement. Served as *Technical Assistance (TA) Lead* to advance *Race to the Top* states' reforms, including STEM-related issues overseen by Michael Lach. Managed School Turnaround Community of Practice (CoP); information resource gathering and dissemination; mining data; and sharing information with non-grantee states. Worked directly with the Program Officers, Program Implementation Team Leaders, senior ED leaders, and other State-funded Education Programs to ensure collaboration and understand programmatic intersections.

Institute of Education Sciences, US Department of Education (2007 – 2012)
National Center for Education Research (NCER)
***Research Analyst*, GS-14-4**
Program Officer, Cognition and Student Learning
Washington, DC 20208

- Serve in the capacity of Program Officer for the Cognition and Student Learning Program of the National Center for Education Research (NCER), Institute of Education Sciences' (IES), which was established by the Education Sciences Reform Act of 2002 and supports rigorous scientifically-based research that addresses the nation's most pressing education needs, from pre-K-16. Responsibilities include developing, implementing, managing, and monitoring research activities carried out by *Cognition and Student Learning* grantees and cooperative agreements funded by IES. Conduct scientific reviews of research plans and products; analyze data and synthesize information from education research and related areas; prepare written products to convey research-based knowledge and information to a variety of audiences; engage in dissemination and outreach activities, publishing scholarly work and attending scientific conferences. Certified Contract Officer Representative (COR). Security Clearance. Permanent Civil Servant with Competitive Service Status as of 2011.

* **The George Washington University (GWU)** Jan 17, 2003 – present

Physics Department (August 2005 – present)
Professorial Lecturer (teaching 1 course per semester)
Washington, DC

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Graduate School of Education and Human Development (GSEHD)
***Research Scientist* (January 2003 – August 2007)**
Project Director, Scaling up Curriculum for Achievement, Learning, and Equity Project (SCALE-uP)
Funded by IERI (NSF, NIH, US Dept of Ed)
Washington, DC 20052

- Directed all aspects of 5-year, $5.7-million large-scale interdisciplinary research study investigating effectiveness of reform-based physical science curriculum materials (addressing topics such as conservation of matter, cause of seasons, motion and forces). Managed multi-million dollar budget funded by NSF, US Dept of Ed, NIH. Directed multi-level project; oversaw all aspects of recruiting, hiring, and managing 32 research staff (including Research Assistants, Research Aides, Post Doctoral Scientists, and Research Scientists). Worked collaboratively with 3 GWU faculty Principal Investigators (PI's) across two GWU schools (Graduate School of Education and Columbian College of Arts and Sciences) and project partner, Montgomery County Public School (MCPS), including MCPS teachers and staff. Worked closely with PI's in planning, conducting, supervising research activity, including developing assessment instruments focused on motion and forces and causes of seasons, using assessment criteria as a design framework, aligning assessment items to content standards, standard setting, creating rating guides, and validating assessments through videotaped interviews of students using assessments. Other responsibilities included defining constructs necessary for addressing research questions related to fidelity of implementation (FOI); developing and validating series of instruments for studying FOI on large scale. Lead and convened meetings; created and maintained schedules and timelines; and tracked project progress. Maintained clear written and oral communications with GWU staff (budget, research, etc.), and external individuals involved with project (Advisory Board, consultants, service personnel.). Wrote proposals, Internal and Annual Reports, and publications related to grant in concert with faculty involved in research. Communicated with media and gave national presentations about SCALE-uP results. Reviewed research materials related to grant. Worked with MCPS to create professional development programs for teachers involved with study and developed FOI instruments. Oversaw multi-million dollar budget and expenditures using University Enterprise Accounting System. Used computer skills such as SPSS, Atlas.ti, word processing, database and spreadsheet, Internet and communication skills.

* **Smithsonian Institution / National Academy of Sciences** September 1992 - January 16, 2003
National Science Resources Center (NSRC)
Washington, DC

Senior Research Associate (Senior Education Program Specialist)
Director of the Curriculum Research & Development Center

- Director of Curriculum Research & Development Center responsible for overseeing NSF and Kellogg Foundation proposals, planning the development of new education products and the revisions to 24 curriculum units from the Science and Technology for Children (STC) curriculum. Convened planning meetings and Working Conference for 64-member Advisory Board made up of cognitive scientists and education researchers and scientists. Coordinated the development team, arranged for the recruitment and professional development of the staff and field-test teachers, assured fiscal accountability, and oversaw the preparation of progress reports. Responsibilities included development and execution of the plan-of-action, implementation of the evaluation plan, and establishment of productive relationships with State Education Agencies (SEAs), Local Educational Agencies (LEAs), and senior educators nationally. Prepared reports and proposals and assisted in obtaining additional resources from private foundations and corporations. Information available: http://www.nsrconline.org/pdf/2003_ar.pdf

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Research Associate (Education Program Specialist)
Curriculum Developer, **Science and Technology Concepts for Middle Schools (STC/MS)**

- Responsible for researching, developing, and writing teaching units in Earth Science (*Catastrophic Events*) and Space Science (*Earth in Space*) which incorporate findings from the cognitive science literature applicable to 6^{th}-8^{th} grade classrooms; developing unit outlines; designing unique experimental science and technology modules, materials, and apparatus with consideration for national program objectives and policies; trial-teaching units in classrooms; drafting field-test editions of teacher's and student guides; coordinating field testing of units in schools nationally; and, revising units for publication. Supervised the work of consultants, including editors, illustrators, science writers, technical advisers, and photo researchers. Planned and conducted national professional development institutes and workshops; served as a resource to publishers; represent the NSRC and Smithsonian Institution at meetings of international, national, state, and local organizations and conferences. Provided guidance to school districts in implementing STC/MS curricula and developing teacher training. Information available: http://www.nsrc-lasercenter.org/pdf/2002_ar.pdf

Research Associate
Curriculum Developer, Science and Technology for Children (STC)

- Responsible for researching, developing, writing teaching units in Earth Science (*Land and Water*); Life Science (*Ecosystems*), Physical Science (*Changes*), and Technology (*Motion and Design*); developing unit which incorporate findings from the cognitive science literature applicable to K-6 classrooms; author outlines and supporting video scripts; trial-teach units in Washington, DC Public Schools (DCPS) classrooms; draft field-test editions of teacher's and student guides; coordinate field testing of units in schools nationally; and, revise units for publication. Supervised work of consultants, including editors, illustrators, science writers, technical advisers, and photo researchers. Planned and conducted national professional development institutes and workshops; served as a resource to publishers; represented the NSRC at meetings of national, state, and local conferences. Provided guidance to districts in implementing STC curricula and developing teacher training.

* **Spotsylvania County Public Schools**, VA — September 1987 - January 1990
Science Teacher
Battlefield

- Science teacher: Responsible for team teaching science; leadership positions held: Science Textbook Adoption Committee, Computer Curriculum Revision Committee, and Grade Level Chairman. Staff Development Instructor: Produced and presented professional staff development and science instruction to educators and students in grades K-12; presented on a wide range of topics, including oceanography, energy, math manipulatives, computer curriculum, time management, content area writing, food chemistry, ecosystems, micro-organisms, and chemistry.

* **Prince William County Public Schools**, VA — September 1983 - June 1987
Teacher
M. L. King, Jr.

- Teacher; concentration in Science, Math, and Writing; leadership positions held: Science Fair Coordinator, County Science Fair Judge, Science Curriculum Revision Committee, Science Self-Study Chairman, Holistic Scorer of County Writings, Literature Enrichment Chairman, County Math League Test Coordinator, and Student Cooperative Association Advisor.

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* **University of Pittsburgh Medical Center** September 1979- August 1983
Medical Research Assistant
Liver Transplantation / Department of Gastroenterology
Pittsburgh, PA

- Administered experimental immunosuppressant, Cyclosporine, to liver transplant patients and monitored reactions.

CERTIFICATIONS

***** **FAC-COR Certification** - Certified Contract Officer Representative - Re-certification Course 2016; acquisition planning, solicitation, award, and contract administration.

GRANT INVOLVEMENT:

* **US Department of Education** pending
Education Innovation & Research (EIR)
Smithsonian Science for Makerspaces: Addressing the Digital Divide by Helping Rural Students' Transfer Computational Thinking Skills Along the Technology Spectrum: From No-Tech to High-Tech
Grant #: U411C20XXXX
$4.4 million proposed budget
Position: PI
Calendar Months: 2.0

* **National Science Foundation** pending
INCLUDES
NSF INCLUDES Planning Grant: Scaling-Up! Building Networks and Enhancing Diversity in the K-12 STEM Teaching Workforce
Grant #:2040784
$100,000 proposed budget
Position: PI
Calendar Months: 0.5

***** **US Department of Education** Oct 2019 – Sept 2024
Education Innovation & Research (EIR)
Smithsonian Science for the Classroom: Improving Student Achievement Across State Borders and State Standards
Grant #: U411C190055
$4.6 million awarded to the Smithsonian Science Education Center
Position: Co-PI
Calendar Months: 2.0

***** **Gordon & Betty Moore Foundation** Nov 2019- Jan 2022
Discover, Understand, and Act: Developing Biodiversity! and Sustainable Cities! Community Research Guides for Youth Ages 8-17 and Disseminating them through the Network for Emergent Socio-Scientific Thinking (NESST)
$753,000
Grant #GBMF9029
Position: PI
Calendar Months: 2.0

***** **General Motors Foundation** Sept 2019 - 2021
Integrating Inclusive/Universal Design and Accessibility Strategies into K-12 STEM Classrooms
$350,000

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Position: PI
Calendar Months: 1.0

* **US Department of Education** Oct 2016 – 2021
Office of English Language Acquisition (OELA)
LASER Focused – PD for STEM Teachers of English Learners
Grant #: T365Z16008 2
$1.5 million - $750,000 subaward to Smithsonian Science Education Center from the University of Memphis
Position: Co-PI
Calendar Months: 0.5

* **Gordon & Betty Moore Foundation** June 2016 - 2018
"Mosquito! How do we ensure health for all from mosquito-borne diseases?" Community Research Guide for Youth
$145,000
Grant #GBMF5510
Position: PI
Calendar Months: 2.0

***** **100kin10, Carnegie Corporation of New York** Sept 2016-2018
NY State Engineering and Computer Science Challenge: Improving K-3 NY teachers understanding of engineering education
$198,000
Grant #: 0003329
Position: PI
Calendar Months: 0.5
https://100kin10.org/news/100kin10-announces-winners-of-new-york-computer-science-and-engineering-challenge

***** **National Science Foundation IERI** 2002-2007
Scaling up Highly Rated Curriculum Units for Diverse Student Populations: Using Evidence to Close Achievement Gaps
Interagency Education Research Initiative: National Science Foundation/US Department of Education/ National Institute of Health
02-062 IERI - 0228447 $ 5,724,634
Principal Investigators: Dr. Sharon Lynch, Dr. Joel Kuipers, Dr. Curtis Pyke, & Michael Szesze
Position: Project Director

***** **National Science Foundation** 1997-2003
Science and Technology Concepts for Middle School Students (STC/MS)
Grant #: ESI-9618091 - $3,885,422
Principal Investigators: Dr. Douglas Lapp & Sally Shuler
Position: Senior Research Associate

***** **National Science Foundation**
Science and Technology for Children (STC) 1990-1996
ESI- $5,000,000
Principal Investigator: Dr. Douglas Lapp
Position: Research Associate

GRANT OVERSIGHT:

***** **US Department of Education (FY2012 CR)** 2007-2015

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Office of Elementary and Secondary Education, Group Director
Teacher Incentive Fund (ESEA Title Vd.1): **$393,200,000**
Improving Teacher Quality (ESEA Title IIa): **$2,430,959,000**
Mathematics and Science Partnerships (ESEA Title IIb): **$172,495,000**

Office of the Deputy Secretary, Implementation and Support Unit
Race to the Top Technical Assistance Contract: ED-ESE-10-O-0087 **$43,500,000**

Institute of Education Sciences, Program Officer
Cognition and Student Learning Discretionary Grant Program: **$123,770,395.38**

AWARDS:

* **Winner of the National Alliance for Partnerships in Equity (NAPE) 2020 Unsung Hero Award:** Honors 1 person who has managed major projects or programs and has made a major impact by ensuring diversity, equity and inclusion in education leading to in-demand careers and programs of study.

* **Winner of the "Smithsonian Innovation in Education Award: 2018".** The Smithsonian Science Education Center won the 2018 award for its work on the "Smithsonian Science for Global Goals" project. See: http://www.interacademies.org/48845/Education-Innovation-Award-for-Mosquito

* **Recipient of the University of Pittsburgh Distinguished Alumni Award 2018.** See the University's interview of Carol about this award at: https://www.education.pitt.edu/newsletter/PittEd/index.aspx

* **Nominated for 2014 Bender Teaching Award:** Nominated by the Chair of the Physics Department, George Washington University.

* **US Department of Education Winner of the Team Leader Award, Teacher Quality,** Office of Elementary and Secondary Education (OESE), 2014

* **Winner of AERA 2008 Division C Graduate Research and Excellence Award:** Winner of the American Educational Research Association (AERA) Division C: Learning and Instruction Graduate Research and Excellence Award for *Fidelity of Implementation to Instructional Strategies as a Moderator of Science Curriculum Unit Effectiveness* dissertation research; Committee Co-Chairs: Dr. Sherri Brown and Dr. Rebecca McNall Krall; commemorative plaque and $500.00 awarded at the AERA Division C Business Meeting Ceremony in New York, NY on March 26, 2008.

* **NARST 2008 Outstanding Dissertation Award:** National Association for Research in Science Teaching (NARST) Outstanding Dissertation Award 2008 (2nd place) for my dissertation: *Fidelity of Implementation to Instructional Strategies as a Moderator of Curriculum Unit Effectiveness in a Large Scale Middle School Science Quasi-experiment*; Award Committee Chair: Dr. Daniel J. Ford.

* **NARST 2004 Outstanding Paper Award:** Advanced to the final round of the National Association for Research in Science Teaching (NARST) Outstanding Paper Award October 2004 for the paper: *When Numbers Get in the Way of Student Understanding in Science: A Video Ethnography Examining the Co-occurrence of Scientific Measurement Discourse and Interactional Trouble*.

* **Winner NOAA 2003 Mark Trail Award:** Recipient of the 2003 National Oceanic and Atmospheric Administration (NOAA) National Weather Service Mark Trail Award for my 2001 Teacher's Guide and Student Guide and curriculum module called, *Catastrophic Events*. (See "National Weather Service Honors Curriculum Developer," *Spotlight on Science at the Smithsonian*, vol. 1, No. 17, p. 3, June 16, 2003 and

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"2003 Mark Trail Awards Presented on Capitol Hill". Available: http://kingfeatures.com/2003/06/2003-mark-trail-awards-presented-on-capitol-hill/.)

UNIVERSITY FACULTY EXPERIENCE:

* **The George Washington University** Fall 2005 - present
Physics Department
Washington, DC
Professorial Lecturer
ASTR 1001 SCALE-UP pedagogy (Fall & Spring 2005 - present); ASTR 001-31: Expanded Laboratory (Fall 2009); ASTR 001-33: Laboratory (Spring 2009); ASTR 001-12: Stars, Planets, and Life in the Universe – Experimental Course Combining Lecture & Laboratory 1-41 (Fall 2008); ASTR 001-33: Laboratory (Spring 2008); ASTR 001-38 Laboratory (Fall 2007); ASTR 001-37: Laboratory (Spring 2007); ASTRO 001-10: Stars, Planets & Life in the Universe Lecture (Fall 2005).

The SCALE-UP student-centered active learning environment was developed by Beichner at NC State to extend the "studio physics" approach to large enrollment classes. GWU implemented SCALE-UP in the Spring 2008 semester for two sections of our first-semester calculus-based introductory physics class and one astronomy class. I was responsible for developing this experimental Astro course and have been asked to expand this pedagogy into the Astro 1002 course for the Spring 2012. Comparisons between these sections and a large (concurrent) regular lecture section were based on pre- and post-tests, identical classroom exams, and a Survey of Attitudes showed statistically significant differences between the classes in favor of the SCALE-UP student-centered pedagogy. These results were presented at peer-reviewed conferences.

* **The George Washington University** Fall, 2004
Department of Teacher Preparation and Special Education
Washington, DC
Co-Instructor (with Dr. Sharon Lynch)
TRED 247: Science Education Methods (16 graduate students)

* **Oklahoma State University** 2004-2006
Center for Science Literacy
Stillwater, OK
Instructor
Taught series of three-day courses for secondary teachers in astronomy and geology

* **The George Washington University** Summer, 2003
Department of Teacher Preparation and Special Education
Washington, DC
Teaching Assistant TRED 217: Recent Developments in Science Teaching: 2003 (24 graduate students)

SCHOLARLY SERVICE:

* ***American Educational Research Journal*** **Reviewer:** American Education Research Journal (AERJ) Reviewer for Section on Teaching, Learning, and Human Development, June 2004 – present

* ***American Journal of Evaluation*** **Reviewer:** Reviewer for the American Evaluation Association (AEA) Sage Publication journal (AJER); invited to review by Editor, Dr. Robin Lin Miller; 2008 - present.

* ***Journal of Research in Science Teaching****:* Reviewer, invited by Editors, Dr. J. Randy McGinnis and Dr. Angelo Collins, 2007 – present.

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* **Panel Chair and Panel Reviewer:** Small Business Innovations in Research (SBIR) Institute of Education Sciences (IES), U.S. Department of Education; February 13, 2008 and February 2009; Washington, DC

* **Member of Committee of Visitors**, **Geosciences Education Programs, National Science Foundation**: Invited to review, evaluate effectiveness of, and examine Geosciences Education 2003-2006 Fiscal Year Programs; January 31 – February 2, 2007; Washington, DC

* **National Association of Research in Science Teaching (NARST):** Presider, NARST Annual Conference, April, 2007; Strand 4 Division Proposal Reviewer: Science Teaching--Middle and High School (Grades 5-12): Characteristics and Strategies; Fall, 2006

* **The Society for College Science Teaching (SCST):** State Membership Coordinator for Washington, DC area; invited by Dr. Connie Russell; 2006 - 2007

* **American Association for the Advancement of Science (AAAS):** Assessment item reviewer; Physical Science; invited by Dr. Thomas Regan, AAAS, Washington, DC; 2006

* **American Educational Research Association (AERA):** Division C: Learning and Instruction; AERA annual meeting proposal reviewer; Fall, 2006

* **National Science Foundation Final Proposal Reviewer:** National Science Foundation Panel Reviewer, Research and Evaluation on Education in Science and Engineering (REESE) Proposals, June 2006; Program Officer: Dr. Greg Solomon

* **National Science Foundation Preliminary Proposal Reviewer:** National Science Foundation Panel Reviewer, Instructional Materials Development Proposals, Applied Research and Assessment Projects, May 2004; Program Officer: Dr. Patricia Freitag.

MEMBERSHIPS:

* **Council of State Science Supervisors**
* **National Science Teachers Association**
* **National Association for Research in Science Teaching**
* **American Educational Research Association**
* **Cognitive Science Society**
* **Association for Psychological Science**
* **Psychonomic Society**

ADVISORY:

* **UN Broadband Commission: External Expert for Working Group on School Connectivity** 2019-present - External Expert for the Broadband Commission Working Group; serve as an 'Advisory Group for GIGA' a Global School Connectivity Initiative coordinated by UNICEF and ITU. The Advisory Group acts as a key consultation group that provides advisory and advocacy guidance on the development of the GIGA project. The output of the group builds on the work and research of the various members and their real market experience based on projects related to education connectivity, access, demand etc. The Working Group acts as a key consultation group that provides advisory and advocacy guidance on the development and financing of the e-schools initiative which aims at ensuring connectivity of schools is articulated with inclusive and quality teaching and learning and better learning outcomes and employability of learners.

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* **InterAcademy Partnership (IAP), Science Education Programme (SEP) Global Council** 2015 - present

- Selected by the US National Academy of Sciences to serve on the IAP SEP Global Council, representing IAP's more than 130 national and regional member academies who work together to support the special role of science and its efforts to seek solutions to address the world's most challenging problems and harness the expertise of the world's scientific, medical and engineering leaders to advance sound policies, improve public health, promote excellence in science education, and achieve other critical development goals. Serve on the IAP SEP Global Council to promote inquiry-based science education (IBSE) - or "learning by doing" - especially for primary-school-aged children and on improving global scientific literacy among the general population. Collaborate with IAP SEP to develop "Smithsonian Science for Global Goals"—a free curriculum program aligned with the UN Sustainable Development Goals (SDGs), which helps students "think globally and act locally."

* **FC-STEM: OSTP Subcommittee** 2016 – present
Washington, DC

- Selected and serve as the Smithsonian representative for the Federal Coordination in Science, Technology, Engineering, and Math (FC-STEM) Education subcommittee, an inter-agency body of executives created to advise and assist the Committee on STEM Education (CoSTEM) and the Director of the White House Office of Science and Technology Policy (OSTP) National Science and Technology Council (NSTC) on developing strategic investments in STEM education across Federal agencies

* **Horizon Research Incorporated, Advisory Board** 2016 - present

- Serve as an advisory to Horizon Research, Inc. and Westat Inc. who are conducting the 2018 National Survey of Science and Mathematics Education (NSSME+), which examines the status of K–12 science, technology, engineering, math, and computer science education in the US. This study is the sixth in a series of surveys dating back to a 1977 study commissioned by the National Science Foundation. The 2018 NSSME+ assesses changes over time and provide current data on essential elements of the STEM education system, data that will inform future education policy and practice. Additional information can be found on the study's website: http://horizon-research.com/NSSME/

* **Pew Research Center, Outside Advisor** 2017 - 2018
Washington, DC

- Served as an outside advisor for a Pew Research Center report that was released on Jan. 9, 2018, which used a national representative survey to understand the issues women face in the STEM workforce; one of the key findings of the report is that while there has been an increased number of women earning degrees and working in the STEM industry, the new study found that women in STEM experience more discrimination at work than women in non-STEM fields. To read the report "Women and Men at Odds Over Workplace Inequity" go to: http://www.pewsocialtrends.org/2018/01/09/stem-acknowledgments/

* **Office of Planning, Research and Evaluation** 2010 - 2012
US Department of Health and Human Services
Advisor/Member, Interagency Working Group on Implementation Science

- Facilitate interaction among federal offices; focus on improving understanding of implementation science across federal agencies; develop technical support materials for researchers, practitioners, and government workers; organize symposia to raise awareness of issues related to implementation.

* **University of Chicago, Physical Sciences Division** 2007-2010
Center for Elementary Mathematics and Science Education (CEMSE)

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***Advisor (*withdrew advisory role Sept 2007 due to conflict of interest)**

- NSF Instructional Materials Development Proposal (Awarded Sept 2006): *Applying Research on Science Materials Implementation: Bringing Measurement of Fidelity of Implementation to Scale*

* **The Keck Center of the National Academies** 2006
Advisor

- STC Books Science Advisory Committee

* **Montgomery County Public Schools** 2005-2006
Advisor

- Elementary Science Curriculum Advisory Committee

* **National Research Council Kellogg Foundation Grant** 2002-2005
Smithsonian Institution, National Science Resources Center
Washington, DC
Course Developer and Advisor

- Serve on the Professional Development Initiative Advisory Board to identify content and pedagogy for graduate level content courses designed for middle school teachers.

* **Montana State University** 2001-2003
National Teachers Enhancement Network (NTEN)
Bozeman, MT
Course Advisor

- Serve on the NTEN Advisory Board and as a liaison between the NSRC and NSF-Funded NTEN-Elementary Project to identify content and pedagogical needs for undergraduate elementary science professional development content courses

***** **Washington State University** 2001-2002
Earth & Space Sciences Department
Middle School Science Systemic Change Partnership
Seattle, WA
Course Advisor

- Assisted in the development of course outline for **UW Geology 499**: **Investigations with Plate Tectonics** based on the sequence for conceptual development in my most recent earth science module for middle schools, *Catastrophic Events*; incorporated use of the module teacher guide and inquiry lessons into content information from UW scientists; suggested methods for blending adult level science content learning and inquiry-based teaching

***** **Mississippi State University, Department of Geosciences** 2001-2002
Educational Consultant

- Responsible for developing educational applications component to Teachers in Geosciences Master of Science by integrating selective investigations from K-8 NSF-developed inquiry-based earth science modules into graduate level geosciences courses

CONSULTANT WRITING EXPERIENCE:

* **Discovery Channel School Science Collections,** Bethesda, MD 2000-2001
Bill Smith Studio, New York, NY
Writer

- Responsible for researching and writing the text for the Teachers A-Z Resource Books for the Discovery Channel School Discovery Files; manuscripts authored include *Protists & Fungi* and *Invertebrates*

Dr. Carol O'Donnell

* **Science Weekly, Inc.** 1991-1999
Silver Spring, MD
Developer/Writer

- Freelance writer responsible for researching information and writing full-length issues for educational publication; provided instructional material including spiraling text, activities, labs, background information, and teaching notes; worked directly with the editor and illustrator in selecting topics, proofreading and copyediting revisions, and creating art sheets

* **National Education Corporation** 1994-1995
ICS Learning Systems/Spectrum Design
Author of Windows™ CD-ROM

- Responsible for consulting and providing the text and accompanying graphics for a published interactive educational CD-ROM; wrote the content for interactive projects/lessons; developed individual user assessments

* **McGraw-Hill, Continuing Education Center** 1993-1994
NRI Schools, Washington, DC
Distance Learning Course Developer/Writer

- Contractual author responsible for researching information and developing instructional manuscripts/lessons for distance learning courses used at the post-secondary level; interviewed other experts in the field in order to further develop the text; compiled and created illustrations for the text which included diagrams, photographs, sidebars, schematics, and glossaries.

***** **Addison-Wesley Publishing Co.**, Menlo Park, CA 1990-1991
Book Reviewer

- Freelance textbook reviewer; reviewed proposed full-length manuscripts; proofread and copy edited written text; researched marketability potential; evaluated format, organization, accuracy of information, and grade level appropriateness of books.

PUBLICATIONS (all are listed chronologically)

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Hazelkorn, E. (2015). *Science Education for Responsible Citizenship: Report to the European Commission of the Expert Group on Science Education*. European Union. Available: http://ec.europa.eu/research/swafs/pdf/pub_science_education/KI-NA-26-893-EN-N.pdf

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D'Amico, A., & O'Donnell, C. L. (2016, March). *The Key Role of Educational Leadership in the Changing STEM Landscape*. National Science Teachers Association Web Seminar. Arlington, VA: https://learningcenter.nsta.org/products/symposia_seminars/EMF/bio1.aspx.

O'Donnell, C. L. (2016, March). *The Smithsonian Science Education Center's Leadership and Assistance for Science Education Reform (LASER) Model: Results from a 5-Year Rigorous Experiment*. New York City Community Forum. New York, NY.

DeTroye, D., & O'Donnell, C. L. (2016, January). *STEM Engagement Interagency Working Group: Increase and Sustain Youth and Public Engagement in STEM.* Panel Presentation on CoSTEM. National Science Foundation. Arlington, VA.

O'Donnell, C. L. (2016, January). *Science Education Global Council and STEM.* Gallup: Global Talent Summit: The Futures of Jobs and Education. Washington, DC. https://2016globaltalent.splashthat.com/ https://www.youtube.com/watch?v=djU2zSMtxSg&list=PLzyGLFG67--ViiU7yY26hrRTNm9xY_xZ3&index=5

O'Donnell, C. L. (2015, December). *The Smithsonian Science Education Center: At the Forefront of Scientific Change*. Radio talk show host on WCCO News Radio. Minneapolis, MN. https://embed.radio.com/clip/59878169?ref_url=http://minnesota.cbslocal.com/audio/news-and-views-with-roshini-rajkumar/&ads_ga_page_tracker=UA-17434257-47&rollup_ga_id=UA-2438645-53&r20id=82

O'Donnell, C. L. (2015, December). *Science and Technology Concepts: Alignment to South Carolina Academic Standards and Performance Indicators: World Class Knowledge, World Class Skills.* Keynote for the South Carolina Science Education Association (SCSELA) Annual Meeting. Columbus, SC.

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O'Donnell, C. L. (2015, September). *Balancing the STEM Equation*. Invited table host. Washington Post. https://www.washingtonpost.com/blogs/post-live/wp/2015/08/07/how-do-we-balance-the-stem-equation-join-educators-students-and-policymakers-sept-10/

O'Donnell, C. L. (2015, Feb). *Redefining Teacher Quality to Support Student Learning*. 2015 National Title I Conference Invited Talk. Salt Lake City, UT. https://www.titlei.org/sched/2015-National-Title-I-Conference/presenter/carol-odonnell

Chism, M. et. al (2014, Nov). *U.S. Department of Education Office of State Support Accountability: Federal Update*. AAFEPA Annual Conference Alabama Education: A Step In The Right Direction. Point Clear, Alabama. http://www.aafepa.org/printables/2014-conference-office-of-state-support-accountability.pdf

O'Donnell, C. L. (2010, July). *Inquiry-based science education programs: Summary of research findings*. Invited talk given at the National K-8 Science Education Strategic Planning Institute. National Science Resources Center. Washington, DC.

O'Donnell, C. L. (2008, July). *Inquiry-based science education programs: Summary of research findings*. Invited talk given at the National K-8 Science Education Strategic Planning Institute: Meeting the Challenge of Science Education in a High-Stakes Environment. Sponsored by the National Science Resources Center. Alexandria, VA.

O'Donnell, C. L. (2007, November). *Research on the effectiveness of inquiry-based science programs*. Invited talk for the Building Awareness of Science Education (BASE) Center: National Leadership Development Symposium. Sponsored by the National Science Resources Center of the National Academies and the Smithsonian Institution. National Academies Keck Center, Washington, DC.

O'Donnell, C. L. (2007, September). *Review and discussion of studies documenting impact on student learning: A summary of the evidence on the impact of research-based science education programs on student achievement*. Invited talk for "Changing the Course of K-16 Science Education: Translating Policies and Research into Effective Programs for School Districts and States." Sponsored by the Council of Chief State School Officers, James B. Hunt, Jr., Institute for Educational Leadership and Policy, and the National Science Resources Center of the National Academies and the Smithsonian Institution. Washington, DC.

O'Donnell, C. L. (2007, July). *A review of curriculum effectiveness studies in science education*. Keynote address given at the National Strategic Planning Institute of the National Science Resources Center. Washington, DC.

O'Donnell, C. L. (2007, June). *Making the case for exemplary, effective, and equitable science curriculum materials*. Keynote address given at the Washington State Leadership and Assistance for Science Education Reform (LASER) Institute. Bellingham, WA.

O'Donnell, C. L. (2007, March). *Research on exemplary, effective, and equitable curriculum materials*. Keynote address given at the New York State Department of Education Enhancing Collaborative Leadership for Improved Performance in Science Education (ECLIPSE) Curriculum Showcase, Albany, NY. Video presentation and ppt available: http://www.emsc.nysed.gov/ciai/mst/NYEclipse/ScienceCurrShowcase.html

O'Donnell, C. L. (2007, February). Fidelity of implementation to K-12 curriculum interventions in efficacy and effectiveness studies. Invited talk for the panel: *Measuring implementation: For what purpose? What happened in both the control and treatment groups? Matching fidelity of treatment to a developer's design? What to do in the future, linking implementation to outcomes?* Regional Educational Laboratory (REL) Directors' Meeting. U. S. Department of Education, National Center for Education Evaluation, Institute of Education Sciences, Washington, DC.

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Lynch, S., & O'Donnell, C. L. (2006, November). *Evolving conceptualization and measurement of fidelity of implementation in scale-up of highly rated curriculum units.* Invited talk given at the U. S. Department of Education, National Center for Education Evaluation, Institute of Education Sciences, Washington, DC.

O'Donnell, C. (2006, October). *Research on inquiry-based programs.* Keynote address given at the 2006 National Symposium on Science Education for Business Leaders: Changing the Course of Science Education: A Symposium for Key Stakeholders in America's Future. Washington, DC: Keck Center of the National Academies.

O'Donnell, C. (2006, October). *Research studies about inquiry-based science programs.* Invited keynote given at the Pennsylvania Science: It's Elementary, K-6 Science Education Strategic Planning Institute. King of Prussia, PA: ASSET, Inc.

O'Donnell, C. (2006, August). *Making the case for science education reform: Research studies about inquiry-based science programs.* Invited keynote given at the Pennsylvania Science: It's Elementary, K-6 Science Education Strategic Planning Institute. Pittsburgh, PA: ASSET, Inc.

O'Donnell, C. (2006, July). *Making the case for science education reform: Research studies about inquiry-based science programs.* Invited keynote given at the 2006 National Strategic Planning Institute. Washington, DC: National Science Resources Center.

O'Donnell, C. (2006, May). *An inquiry-based approach to science teaching: What is it? Does it work?* National Association of Geoscience Teachers' Distinguished Lecture Series. Invited lecture given at the School of Education, Monroe College, Rochester, NY. Available: http://www.nagt.org/files/nagt/programs/speakerflyer0607.v5.pdf

O'Donnell, C. (2006, February). *Designing and using models to teach earth and space science*. National Association of Geoscience Teachers' Distinguished Lecture Series. Invited lecture given at the Geology Department, Western Washington University, Bellingham, WA.

O'Donnell, C. (2005, September). S*cience education reform: Examining research studies about inquiry-based science programs.* Keynote address given at the 2005 National Symposium on Science Education for Business Leaders: Developing Your Next Generation of Scientists and Engineers. Washington, DC: National Academy of Sciences.

O'Donnell, C. (2005, July). *Making the Case for Science Education Reform: Research studies about inquiry-based science programs:* Invited keynote given at the National Strategic Planning Institute, Washington, DC. Available: http://www.laserscienceevents.si.edu/SPI/SPI_program.html

O'Donnell, C. (2005, June). *Research studies about inquiry-based science programs: Making the Case Part I*. Invited keynote given at the Washington State Science Education Strategic Planning Institute, Everett, WA.

O'Donnell, C. (2005, March). *Examining research-based teaching methods at the undergraduate level*. National Association of Geoscience Teachers' Distinguished Lecture Series. Invited lecture given at the Department of Geosciences, Western Michigan University, Kalamazoo, MI. Available: http://www.nagt.org/nagt/programs/dsp0506.html

O'Donnell, C. (2005, February). *Fidelity of implementation in scaling up highly rated curriculum units for diverse student populations.* Invited talk given at the American Geological Institute / National Science Foundation, Instructional Materials Development Conference, Washington, DC. Available: http://www.agiweb.org/education/nsf2005/speakers.html

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O'Donnell, C. (2004, December). *Examining the effects of research-based instructional materials on learning and teaching: Assessing curricula that support NCLB*. Keynote address given at the National Science Education Planning Symposium, Georgia Tech University, Global Learning Center, Atlanta, GA.

O'Donnell, C. (2004, November). *Examining the effects of research based instructional materials on learning and teaching: Assessing curricula that support NCLB.* Keynote address (Featured Speaker: Assessment) given at the Regional Meeting of the National Science Teachers Association, Seattle, WA.

O'Donnell, C., Lynch, S., Szesze, M., & Merchlinsky, S. (2004, September). *Fidelity of implementation in scaling up highly rated curriculum units for diverse student populations.* Invited talk given at the Interagency Educational Research Initiative (IERI) Principals' Investigators Annual Meeting sponsored by NORC/University of Chicago. National Science Foundation, Washington, DC.

O'Donnell, C. (2004, July). *Making the case for science education reform: Research studies about inquiry-based science programs.* Invited keynote given at the Southwestern Pennsylvania Tri-State Strategic Planning Institute, Pittsburgh, PA.

O'Donnell, C. (2004, January). *Examining the effects of research-based curriculum materials on learning and teaching: Selecting curricula that support NCLB.* Invited keynote given at the Washington State Leadership and Assistance for Science Education Reform Curriculum Showcase, Spokane, WA. Available: http://www.wsta.net/html/modules.php?name=News&file=article&sid=58

O'Donnell, C. (2004, January). *Examining the effects of highly rated science curriculum units on diverse middle school student populations.* Invited presentation given at the 11th Annual Office of Superintendent of Public Instruction Statewide Education Reform Conference, Spokane, WA. Available: http://www.k12.wa.us/conferences/Janconf2004/Materials.aspx

O'Donnell, C. (2003, July). *Pedagogical content knowledge: Implications for professional development.* Invited talk given at the National Science Resources Center Professional Development Initiative, Smithsonian Institution, Washington, DC.

O'Donnell, C. (2002, November). *Examining the elements and effectiveness of research-based instructional materials.* Keynote address given at the Washington State Leadership and Assistance for Science Education Reform Curriculum Showcase, Vancouver, WA.

O'Donnell, C. & MacGregor, I. (2000, August). *Catastrophic Events: A hands-on pre-college earth science program for the 21st century.* Invited keynote address for the Geological Education General Symposium of the 31st International Geological Congress, Rio de Janeiro, Brazil.

O'Donnell, C. (1999, January). *Using inquiry to implement a standards-based earth science program.* Keynote address given at the Geological Society of Washington, Cosmos Club, Washington, DC.

O'Donnell, C. (1998, December). *Forum on K-12 Curriculum Development at the National Science Resources Center*. Department of Mineral Sciences Invited Lecture Series, Smithsonian Institution, Washington, DC.

PROFESSIONAL DEVELOPMENT WORKSHOPS & OTHER PROFESSIONAL PRESENTATIONS:

O'Donnell, C. (2006, June). *Food Chemistry, Motion and Design.* Workshop given for the DC Children and Youth Investment Trust Corporation DC Summer Youth Programs, Washington, DC.

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O'Donnell, C. (2006, January). *Catastrophic Events*. Three-day workshop given for the Center for Science Literacy, Oklahoma State University, Stillwater, OK.

O'Donnell, C. (2005, June). *Soils*. Workshop given for the DC Children and Youth Investment Trust Corporation DC Summer Youth Programs, Washington, DC.

O'Donnell, C. (2003, June). *Project 2061 Instructional Analysis: Implications for the SCALE-uP Grant*. Presentation given at the Middle School Professional Development Institute. Montgomery County Public Schools, MD.

O'Donnell, C. & Hansen-Grafton, B. (2005, April). *Reducing the achievement gap: Examining the effects of highly rated science curriculum units on diverse middle school student populations*. NARST presentation given at the National Science Teachers Association National Conference. Dallas, TX.

O'Donnell, C., Hansen-Grafton, B., & Merchlinsky, S. (2005, March). *Lessons learned in closing the gap*. Presentation given at the National Science Teachers Association National Conference. Dallas, TX.

O'Donnell, C. (2002, October). *Teaching and Learning Middle School Science Using Curriculum as a Vehicle*. Presentation given at the National LASER Middle School Science Implementation Conference: Curriculum Immersion. Keystone, Colorado.

O'Donnell, C. (2002, January). *STC/MS Physical Science and Technology Curriculum Strand*. American Physical Society, Lead-Scientist Institute, University of Maryland, Washington, DC.

O'Donnell, C., (2001, August). *Catastrophic Events Short Course*. Clemson University, Clemson, SC.

O'Donnell, C. (2001, July). *Catastrophic Events*. LASER K-8 Science Education Planning Institute, Washington, DC.

O'Donnell, C. (2001, April). *Catastrophic Events Overview*. National Science Teachers Association Regional Convention, St. Louis, MO.

O'Donnell, C. (2001, February). *Earth in Space five-day field-test course*. Smithsonian Institution, Washington, DC.

O'Donnell, C. (2000, December). *Catastrophic Events: We're not in Kansas anymore.* National Science Teachers Association Regional Convention, Phoenix, AZ.

O'Donnell, C. (2000, July). *STC/MS professional development short course*. Carolina Biological Supply Company, Burlington, NC.

Marsland, D., Milne, H., O'Donnell, C., Smith, K. L., Toler, D. (2000, April). *Launching the STC/MS Program: Catastrophic Events*. National Science Teachers' Association National Conference, Orlando, FL.

Higdon, R. & O'Donnell, C. (2000, January). *Overview of the Science and Technology Concepts for Middle Schools Curriculum*. LASER K-8 Science Education Strategic Planning Institute, Greenville, SC.

O'Donnell, C. (1999, April). *Preparing Teachers to Implement a Standards-based Inquiry Science Program* National Science Teachers' Association National Conference, Boston, MA.

O'Donnell, C. (1999, October). *Catastrophic Events: A Standards-based Earth Science Program*. Middle Level Earth Science Instructional Materials Showcase. Carnegie Science Center, Pittsburgh, PA.

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O'Donnell, C. (1999, July). *Using Inquiry to Implement a Standards-based Earth Science Program.* Invited presentation given at the Virginia Collaborative for Excellence in the Preparation of Teachers (VCEPT). Mary Washington College, Fredericksburg, VA.

O'Donnell, C. (1999, June). *Science and Technology Concepts for Middle Schools: Catastrophic Events.* Southwestern Pennsylvania LASER K-8 Science Education Strategic Planning Institute. Hidden Valley, PA .

O'Donnell, C. (1999, June). *Science and Technology Concepts for Middle Schools Overview*. Washington State LASER K-8 Science Education Strategic Planning Institute. Seattle, WA.

O'Donnell, C. (1999, April). *STC/MS Meets the Standards*. National Science Teachers' Association National Conference, Boston, MA.

O'Donnell. C. (1999, April). *Teaching Ecosystems in the Middle School Classroom.* ScienceWorks! Teacher and Instructional Services, Minneapolis Public Schools, Minneapolis, MN.

O'Donnell, C. (1998, October). *Catastrophic Events Field-Test Course.* National Science Resources Center Professional Development Institute, Washington, DC.

O'Donnell, C. (1997, April). *Technology Isn't Just Computers! Using Technological Design in the Science Classroom*. National Science Teachers' Association National Conference, St. Louis, MO.

O'Donnell, (1997, July). *Incorporating Educational Technology into the STC Curriculum.* National Science Resources Center, presented to members of the Royal Swedish Academy.

O'Donnell, C. (1996, April). *Land and Water*. National Science Teachers' Association National and Regional Conferences, Phoenix, AZ.

O'Donnell, C. & Binder, W. (1995, December). *Standards, Curriculum, and Students: Experiments for Policymakers*. National Association of State Boards of Education, Pennsylvania.

O'Donnell, C. & Price S. (1995, November). *Assessment Strategies.* National Academy of Sciences, Washington, DC.

PRODUCT INVENTIONS (Distributed exclusively by Carolina Biological Supply Company www.carolina.com)**:**

* **Air Mass and Convection Tube™**
  - demonstrates how air is heated or cooled locally by surface features and how air moves when it loses or gains heat energy; demonstrates the concept of fronts which form along the boundary of two air mass systems of different temperature, humidity, and pressure conditions; models convection cells in the air

* **Lateral Fault Laboratory™**
  - fault model; students manipulate force applied along transform faults and relate resultant motion to quakes

* **Moving Plates Model™**
  - conveyor belt demonstrates opposing convection cells along spreading plates, ridge formation, and uprising "magma" and cooling "basalt;" students manipulate ridge-push and slab-pull mechanisms

* **Model Magma™**
  - colloidal substance which serves as a model of molten rock; when heated and kneaded, it demonstrates the effects of temperature and pressure on fluidity; when used with soil it demonstrates the effects of rising magma

* **Ash Tube ™**

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- self-contained centrifuge tube containing ash and water; used to examine the settling rates and magnetic properties of ash and apply these observations to the effect of ash fall on air, water, human health, and property

* **Sun-Earth-Moon System Board™**
- two-sided molded plastic board used to investigate movement of shadows, seasons, lunar phases, and eclipses

* **Orbital Motion Model™**
- model used to investigate the motion of planets around stars; includes simulation of "Wobble Method"