



UNIVERSITY OF  
SOUTH FLORIDA

Evaluation of CISTL  
Year Six  
October 2008

Prepared by  
Alliance for Applied Research in Education  
and Anthropology  
Department of Anthropology  
University of South Florida

# **Evaluation of CISTL Year Six**

Annual evaluation report prepared for the Center for Inquiry in Science Teaching and Learning,  
August 2007– October 2008

Kathryn M. Borman, Principal Investigator  
Chrystal A.S. Smith, Research Associate  
Reginald Lee, Research Associate  
Bridget Cotner, Research Associate  
University of South Florida

This material is based upon work supported by the National Science Foundation under Award No. ESI-0227619. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or Washington University in St. Louis.

## Table of Contents

Preface.....	iv
Acknowledgments.....	v
Executive Summary .....	vi
1 Introduction .....	1
1.1 Focus of Evaluation Report.....	1
1.2 CISTL Programmatic Goals.....	1
1.3 Brief Overview of CISTL’s Recent History.....	2
1.4 CISTL Evaluation.....	3
1.5 Overview of CISTL Programs .....	3
1.5.1 Doctoral and Post-Doctoral Fellowship Programs in Science Education.....	3
1.5.2 Science Education Doctoral Studies C.A.D.R.E. Model Program .....	4
1.5.3 Teaching Institute and Teacher Resource Center .....	6
1.5.4 After-School Enrichment Program .....	7
1.5.5 Early Elementary Education Program .....	8
1.5.6 ISI Staff Professional Development Project .....	9
1.5.7 St. Louis Regional Database Project.....	10
2 Evaluation Questions.....	13
2.1 Professional Development.....	13
2.2 Collaboration .....	13
2.3 Capacity Building.....	13
3 Methodology .....	14
3.1 Sample .....	14
3.2 Instrumentation.....	17
3.2.1 CISTL Participant Information Form .....	17
3.2.2 Semi-structured Interview Protocol .....	17
3.2.3 CISTL Quarterly Progress Report .....	18
3.3 Procedure.....	19
3.4 Data Analysis .....	19
4 Findings .....	19
4.1 Development of Regional Professional Development with Broad Impact .....	19
4.1.1 Do PD offerings reflect and contain elements of effective PD as cited in research and policy documents?.....	20
4.1.2 Is there evidence of depth of science content in PD offerings as structured by scientists in scientific disciplines including the use of inquiry? .....	22
4.1.3 Are the content and professional development linked to classroom-based practices and standards-based approaches?.....	23
4.1.4 Do the PD offerings model the pedagogical approaches advocated by various providers in the projects for use in the classrooms?.....	23
4.2 Collaboration .....	24
4.2.1 Are organizational structures and decision-making leading to interactions among partners that promote communication, support leadership and lead to shared accomplishments? .....	24
4.2.2 Are organizational structures and decision-making leading feedback to participants that strengthen future decision-making? .....	25

4.2.3	Are all participating groups increasing the quality of their human resource base for science education?.....	25
4.3	Capacity Building.....	26
4.3.1	Are sufficient numbers of graduate students and post-doctoral fellows being recruited into science education and receiving high quality scholarly guidance in their studies to support their capacity to produce excellence in research?.....	26
4.3.2	Are scholars gaining facility in the use of mixed methods and approaches that are likely to have a direct impact on innovative research-practice relationships? .....	27
4.3.3	Is CISTL facilitating access to careers in science education for under-represented populations of students? .....	27
4.3.4	Is there adequate evidence of scholarly products?.....	27
4.3.5	Are products of research reaching local and national audiences meeting scholarly standards? .....	28
4.3.6	Are products of research advancing the understanding of project stakeholders as they enact their role in improving science education in the region? .....	28
5	Recommendations .....	28
5.1	Continue Funding of the C.A.D.R.E. Model Program .....	29
5.2	Publicize St. Louis Regional Database Project .....	29
5.3	Provide support to ISIs and other partners in pursuing grants .....	30
5.4	Produce Scholarly Publications.....	30
	References.....	31
	Appendix A – Instrument Protocols .....	32
	Appendix B – CISTL Publications and Presentations .....	57

## **List of Tables**

Table 1. Overview of CISTL Programs ..... 12  
Table 2. Demographics of CISTL Personnel and Stakeholders Interviewed ..... 16

## **Preface**

The Alliance for Applied Research in Education and Anthropology (AAREA), University of South Florida, Tampa, is the external evaluator of the Center for Inquiry in Science Teaching and Learning's (CISTL) programmatic activities. This evaluation study seeks to determine if CISTL's projects are accomplishing the four goals set forth in its National Science Foundation (NSF) proposal. These four goals are 1) provide research opportunities in science education and learning, 2) rebuild and diversify the human resource base for science, technology, engineering and mathematic (STEM) education, 3) increase the number of K-12 STEM educators with the knowledge to implement standards-based science instruction, and 4) create synergy between research and practice through research based practice and translate results into practical suggestions for science educators. The Year Six evaluation effort began in August 2007. This annual report provides details of AAREA's evaluation activities, findings and recommendations. The Year Six evaluation includes data collected during seven site visits to CISTL and the analysis of relevant CISTL documents such as reports and meeting minutes. During the site visits, individual and focus group interviews were conducted with participants at all levels of involvement in CISTL's programs. Finally, the Year Six report provides both formative and summative feedback on CISTL's programs based on the findings of the AAREA evaluation team.

## **Acknowledgments**

The support and guidance of our colleagues and friends at the Center for Inquiry in Science Teaching and Learning (CISTL), Washington University in St. Louis, University of Missouri-St. Louis, St. Louis Community College, and the partner Informal Science Institutions (ISIs) helped contribute to the success of our evaluation efforts during this year. We would like to thank the Director of CISTL, Dr. William Tate, and his staff members, particularly Jeannette Sanchez and Debra Barco, for their continuous support of our project. Without their assistance with scheduling our visits and data collection activities, sending us documents and reports when requested, and answering our many questions, we would not have been able to conduct the evaluation effectively.

We would also like to extend our gratitude to the participants in our research - the teachers, post-doctoral fellows, doctoral students, liaisons, program managers, administrators, and CISTL partners and collaborators. Their forthrightness and cooperation enriched the data and enabled us to better understand past and current CISTL activities.

In addition to the authors of this evaluation report, the efforts of our colleagues at USF, Cassandra Workman, Tasha-Neisha Wilson and Jaime Davis, have contributed directly to this research. Our heartfelt gratitude is extended to them as well.

## Executive Summary

The Year Six evaluation of the Center for Inquiry in Science Teaching and Learning (CISTL) was conducted from August 2007 through October 2008 by the evaluation team at the Alliance for Applied Research in Education and Anthropology (AAREA) led by Dr. Kathryn M. Borman. This executive summary provides an overview of the programs and activities of CISTL, the sixth year evaluation plan, findings, and recommendations that will contribute to CISTL successfully meeting its goals.

### *Overview of CISTL's Programs and Activities*

In its National Science Foundation (NSF) proposal, CISTL proposed four goals to address through its program of activities. These goals are 1) provide research opportunities in science education and learning, 2) rebuild and diversify the human resource base for STEM education, 3) increase the number of K-12 STEM educators with the knowledge to implement standards-based science instruction, and 4) create synergy between research and practice through research-based practice, and translate these results into practical suggestions for science educators.

To meet its goals, CISTL collaborated with informal science institutions, school districts, universities, and colleges in the St. Louis area. These collaborative efforts resulted in the development of professional development (PD) programs that shared a vision of fostering inquiry and improving the quality of science instruction in the classroom. Additionally, CISTL and its partner institutions engaged in capacity building by training PD providers, post-doctoral fellows, and doctoral students. These science educators were taught the skills and methodologies necessary to produce research that furthers inquiry and standards-based science instruction.

The projects developed and implemented by CISTL and its partners in August 2007 to October 2008 were: 1) the doctoral and post-doctoral fellow programs in science education through Washington University, 2) Science Education Doctoral Studies C.A.D.R.E. Model Program, 3) the Teaching Institute and Teacher Resource Center, 4) the Early Elementary Education Program, 5) ISI Staff Professional Development project, 6) the After-School Enrichment Program, and 7) St. Louis Regional Database Project. The effectiveness of these programs has been evaluated by this external evaluation to determine if CISTL has attained its goals. AAREA's evaluation plan provides formative and summative feedback to CISTL on its project activities.

### *Overview of the Sixth Year Evaluation Plan*

The Year Six evaluation report represents our assessment of three main areas of CISTL's efforts: professional development, collaboration (and research), and capacity building. This evaluation study utilizes primarily qualitative data to examine these three areas. A purposive sampling strategy was used to select individuals who were knowledgeable of and/or had participated in CISTL activities. The data gathered from semi-structured individual and relevant CISTL documents and recordings were coded and analyzed using the qualitative software program, QSR N6 (formerly known as Nu\*DIST).

### *Findings*

The findings presented by this report are constituted of responses to evaluation questions that focus on CISTL's efforts to meet its four goals through professional development, collaboration, and capacity building.

### *Professional Development*

Analyses of the semi-structured individual and focus group interviews of program managers, project team members, and teachers in addition to observations of PD programs revealed that CISTL PD activities:

- 1) reflect and contain elements of effective PD as cited in research and policy documents although teachers would like more mentoring and coaching in the classroom,
- 2) have a depth of science content as structured by scientists including the use of inquiry,
- 3) have science content and PD linked to classroom-based practices and standards-based approaches, and
- 4) model the pedagogical approaches advocated by various providers in the projects for use in the classrooms.

### *Collaboration*

Semi-structured interviews with CISTL personnel and stakeholders along with CISTL documents were analyzed to respond to evaluation questions regarding collaboration. Findings indicate:

- 1) The Leadership Council and project manager meetings have promoted discussion and provided feedback about ongoing research projects and meeting CISTL's goals.
- 2) Improved communication among CISTL, its partners and collaborators.
- 3) Although the decision-making process remains hierarchical, partners and collaborators feel that their advice and opinions are being considered on the project level.
- 4) CISTL's partners and collaborators identify closely with CISTL's accomplishments and are pleased to take credit for their role in the collaboration.

### *Capacity Building*

Analyses of semi-structured interviews and documents collected to respond to evaluation questions about capacity building show that CISTL collaborators and stakeholders:

- 1) Recruited 14 more doctoral students to be trained in science education through the C.A.D.R.E. Model Program beginning January 2009.
- 2) Instructed its personnel and collaborators on the use of mixed method and theoretical approaches to integrate research and practice.
- 3) Promoted ethnic and gender diversity in the C.A.D.R.E. Model Program and its other PD projects.
- 4) Produced a variety of scholarly products including journal articles, presentations and technical reports that have been presented to both national and local audiences. There have also been practitioner publications and presentations at the regional and national level.

*Recommendations*

The recommendations suggested by the current evaluation findings include the need to: 1) continue funding for the C.A.D.R.E. Model Program, 2) publicize the St. Louis Regional Database Project, 3) provide support for ISIs and partners pursuing grant opportunities, 4) ensure that scholarly publications in progress are published in appropriate journals, and 5) dissemination of professional development curriculum units.

# 1 Introduction

Funded by NSF, the Center for Inquiry in Science Teaching and Learning (CISTL) formally began its work on January 1, 2003, in the Department of Education at Washington University in St. Louis. CISTL is engaged in a six year program of research and development aimed at improving teaching and learning in formal and informal science education settings. To accomplish these aims, CISTL has entered into collaborations with several science institutions as well as school districts in the St. Louis metropolitan region.

CISTL currently has formal partnerships with informal science institutions (ISIs) including the Missouri Botanical Garden and Saint Louis Zoo, as well as institutions of higher education (IHE) - Washington University, University of Missouri-St. Louis, and the St. Louis Community College. The Association of Science-Technology Centers (ASTC), Saint Louis Science Center, and Tyson Research Center affiliated with Washington University are former partners.

CISTL has also formed partnerships with five school districts (St. Louis Public Schools, Kirkwood School District, Maplewood-Richmond Heights School District, School District of Riverview Gardens, and the School District of University City). The following section discusses the focus of the Year Six evaluation report.

## ***1.1 Focus of Evaluation Report***

This report provides analysis of major findings of the evaluation undertaken by the University of South Florida during CISTL's sixth year (2007-2008). The data collection methods used during the evaluation effort has included both qualitative and quantitative data in a mixed methods framework. In the Year Six evaluation report, the data sources were semi-structured individual interviews with CISTL personnel and stakeholders as well as participants in CISTL's programs along with observation of program activities and document analysis.

The Year Six evaluation report seeks to provide CISTL project managers, its partners, personnel and other stakeholders with an overview of issues affecting the implementation of programs by examining the complex phenomena that influence CISTL's programs. An additional purpose is to assess change or impact where feasible, for example, how the CISTL project has influenced teacher instructional practices, enhanced research opportunities for science educators, and increased the human resource base. A review CISTL's programmatic goals is presented in the following section.

## ***1.2 CISTL Programmatic Goals***

CISTL has framed four goals that it addresses through its program of activities, all of which dovetail with the National Science Foundation's (NSF's) goals for Centers for Learning and Teaching (CLTs):

Goal 1: CISTL will provide substantive opportunities for research into science learning and teaching by all CISTL participants.

Goal 2: CISTL will rebuild and diversify the human resource base that forms the national infrastructure for STEM education at multiple levels.

Goal 3: CISTL will increase the numbers of K-12 STEM educators who have current science content knowledge and who are prepared to implement standards-based instruction and new assessment strategies in both formal and informal settings.

Goal 4: CISTL will create a synergy between research and practice through research based practice, and the translation of results into practical suggestions for educators.

To meet these goals, CISTL developed the following projects through collaboration with its partners: 1) the doctoral and post-doctoral fellow programs through Washington University, 2) Science Education Doctoral Studies C.A.D.R.E. Model Program, 3) the Teaching Institute and Teacher Resource Center, 4) the Early Elementary Education Program, 5) the ISI Staff Professional Development project, 6) the After-School Enrichment Program, and 7) St. Louis Regional Database Project. A brief overview of CISTL's History is detailed in the next section.

### ***1.3 Brief Overview of CISTL's Recent History***

Since its establishment in 2003, CISTL has undergone three iterations of its mission and purpose corresponding to the goals and aims of its three successive principal investigators. Leadership changes have inevitably impacted the progress and implementation of CISTL's goals and projects. Initially, CISTL collaborated with ISIs and school districts to design professional development for science teachers according to their expressed needs. While this approach formed strong collaborative relationships among CISTL's partners, the resulting projects did not have a research focus or component and provided post-doctoral fellows and doctoral students with limited research opportunities. In addition, these projects often overlapped with the mission and purpose of the Mathematics and Science Partnerships (MSP) program also housed at Washington University. In 2004, the second CISTL principal investigator emphasized the integration of a research component into CISTL projects in order to train post-doctoral fellows and doctoral students and increase the production of scholarly publications. Additionally, professional development programs were centralized and streamlined to ensure that they were aligned with state curriculum standards prior to implementation in participating school districts.

In 2005, Dr. William Tate was appointed the third principal investigator and director of CISTL. Dr. Tate is the Chair of the Department of Education and Edward Mallinckrodt Distinguished University Professor in Arts and Sciences at Washington University. Dr. Tate leads the CISTL Leadership Council which is comprised of representatives from the majority of partner institutions. The Leadership Council is scheduled to meet every other month to make key decisions about CISTL activities and research projects. Under the direction of Dr. Tate, CISTL has prioritized the design and implementation of researchable projects and the training of post-doctoral fellows and doctoral students through collaborative efforts with the University of Missouri-St. Louis and other partners. Dr. Mark Hogrebe, CISTL's project manager of the St. Louis Regional Database Project, and Debra Barco, CISTL's Project Coordinator, have collaborated with the ISIs and the IHE to develop scopes of work for projects that they would like to implement using CISTL resources which include liaisons, post-doctoral fellows, and doctoral students. These scopes of work are then submitted to Dr. Tate to ensure that the professional development and research components of all projects are appropriately designed for

data analysis and aligned with CISTL's four goals. The AAREA evaluation team and the guiding principles of this evaluation study are introduced in the following section.

#### **1.4 CISTL Evaluation**

This evaluation report provides analysis and feedback on collaborative efforts as well as the effectiveness of ongoing projects in meeting CISTL's goals. In accordance with its NSF proposal, the external evaluation has been an integral component from the initial planning and implementation of CISTL. Annual evaluation reports have been produced by external evaluators since CISTL's establishment. The initial external evaluator, Selinda Research Associates, did not continue in this capacity after 2004. In 2005, the Alliance for Applied Research in Education and Anthropology (AAREA) was selected in a competitive application process as the new external evaluators. Based in the Department of Anthropology, University of South Florida, Tampa, the AAREA evaluation team led by Dr. Kathryn Borman has conducted a mixed method evaluation of CISTL and its projects.

The AAREA evaluation team led by Dr. Kathryn Borman has experience in mixed methods evaluation of reform efforts in education (Borman et al. 2005; Cotner, Herrmann, Borman, Boydston, and LeFloch 2005; Kersaint, Borman, Lee and Boydston 2001). The AAREA evaluation team designed semi-structured interview protocols to interview CISTL project managers, project team members, and participants as well as teachers who participated in CISTL professional development programs during site visits to St. Louis over the course of 4 years. Three focus group interviews were also conducted with CISTL PD participants. Additionally, the AAREA evaluation team observed CISTL program activities and meetings and analyzed CISTL documents, communications, and meeting minutes.

This annual report was guided by the evaluation questions agreed upon by CISTL and the AAREA evaluation team. The questions center on three areas: professional development, collaboration, and capacity building. The evaluation team concentrated on questions related to following on-going CISTL projects: 1) the doctoral and post-doctoral fellow programs, 2) Science Education Doctoral Studies C.A.D.R.E. Model Program, 3) the Teaching Institute and Teacher Resource Center, 4) the Early Elementary Education Program, 5) the ISI Staff Professional Development project, 6) the After-School Enrichment Program, and 7) St. Louis Regional Database Project First, we provide an overview of each CISTL program using data from interviews conducted with project directors and other documentation provided to the evaluation team. Next we address the primary research questions guiding this annual evaluation report by presenting our findings about the major aspects of CISTL's programs. Finally, the AAREA evaluation team make recommendations that will help CISTL's programs more effectively meet their goals.

#### **1.5 Overview of CISTL Programs**

##### **Doctoral and Post-Doctoral Fellowship Programs in Science Education**

The doctoral and post-doctoral programs meet the first two of CISTL's goals which are to provide opportunities for research in science education and to rebuild and diversify the human

resource base that forms the national infrastructure for STEM education at multiple levels. Since 2003, through the Department of Education at Washington University, CISTL has funded and trained seven doctoral students and ten post-doctoral fellows in the area of science education. These doctoral students and post-doctoral fellows have academic backgrounds in physical and social sciences. They have expressed interest in pursuing careers in science education as teachers, academics and science educators at ISIs.

Dr. Tate is the project manager of the doctoral and post-doctoral programs. Under his stewardship, doctoral students and post-doctoral fellows have been encouraged to conduct research on CISTL projects that match their interest and skill sets. Dr. Rowhea Elmesky, a tenure-earning science education professor at Washington University, is also a project director. Dr. Elmesky advises and mentors doctoral students and post-doctoral fellows.

The doctoral students and post-doctoral fellows have participated in mixed-methods seminars and courses that build on their research experiences and broaden their knowledge base by linking theory to practice. The doctoral students and post-doctoral fellows conduct methodologically sound research on the science education projects developed through collaboration between CISTL and its partners. Doctoral students and post-doctoral fellows are also encouraged to publish their research results in scholarly journals and present at professional conferences.

There are currently two doctoral students remaining in this program. One doctoral student is actively involved in the Learning Progression group, which is led by Dr. Elmesky, and is conducting her dissertation research on the science and politics of a community impacted by lead contamination. The other doctoral student is conducting her dissertation research on the ISI Staff PD program.

#### Science Education Doctoral Studies C.A.D.R.E. Model Program

In collaboration with Washington University and University of Missouri-St. Louis, CISTL developed and funded the Science Education Doctoral Studies C.A.D.R.E. Model program in fall 2006. The Cooperative Approach to Doctoral Research in Education (C.A.D.R.E.) Model program meets CISTL's goals to rebuild and diversify the human resource base that forms the national infrastructure for STEM education at multiple levels and to provide opportunities for research in science education. Consequently, the objective of the C.A.D.R.E. Model program is to increase the number of doctoral students conducting research and pursuing careers in the area of science education.

Dr. Tate and Dr. Charles Granger, Department of Biology, University of Missouri-St. Louis, are the co-project managers of the C.A.D.R.E. Model program. Other University of Missouri-St. Louis faculty members administering the C.A.D.R.E. Model program include:

- Dr. Charles Schmitz, Dean of the College of Education
- Dr. Kathleen Haywood, Associate Dean for Graduate Education
- Dr. Harold Harris, Department of Chemistry and Biochemistry
- Dr. Bill Kyle, E. Desmond Lee Family Professor of Science Education
- Dr. Wendy Saul, Allen B. and Helen S. Shopmaker Endowed Professor
- Dr. James Shymansky, E. Desmond Lee Endowed Professor

CISTL and the University of Missouri-St. Louis collaboratively administer the C.A.D.R.E. Model program. A committee comprised of faculty members from Washington University and University of Missouri-St. Louis approve the individuals eligible to participate in the C.A.D.R.E. Model program. The doctoral students receive their degrees from University of Missouri-St. Louis so they are required to meet that institution's admission criteria to be accepted into the C.A.D.R.E. Model program. Doctoral students in the C.A.D.R.E. Model program can enroll in courses offered by University of Missouri-St. Louis and Washington University. They may also select an advisor from either institution. CISTL and its ISI partners will collaborate to provide internship and research opportunities for doctoral students in the C.A.D.R.E. Model program. Doctoral students are also required to participate in CISTL seminars and other professional activities as directed by their faculty advisors.

The establishment of the C.A.D.R.E. Model program was initially communicated to the staff at partner institutions via CISTL's Leadership Council members. CISTL's partners, the ISIs and school districts were a conduit by which local science teachers and educators were informed about the C.A.D.R.E. Model program. Seventy-four persons applied to the C.A.D.R.E. Model program. Forty-six applicants were approved for admission. Twenty funded positions were available. Three of these applicants were offered and accepted full-time CISTL fellowships and stipends; seventeen of the applicants were offered and accepted part-time CISTL fellowships and stipends. Three applicants were self-funded and accepted their invitations. The remaining 22 applicants chose not to enroll. One of the doctoral students dropped out of the C.A.D.R.E. Model program after the first semester. One self-funded doctoral student was accepted in spring 2007. CISTL is currently funding 23 doctoral students at the University of Missouri-St. Louis.

Full-time doctoral students can take up to 23 credit hours every academic year, while part-time doctoral students can take up to 12 credit hours every academic year. Tuition and fees are paid by the C.A.D.R.E. Model program's fellowship stipends. These stipends cover the cost of books, materials and professional travel.

Dr. Granger administers the C.A.D.R.E. Model program on a daily basis. He provides doctoral students with the academic and administration information in person and via email. He also responds to any concerns that doctoral students may express about their participation in the C.A.D.R.E. Model program. Dr. Granger also supervises the weekly seminar course (Seminar 6404) that is a requirement for doctoral students. Science education researchers from academic institutions and ISIs present their areas of specialization to doctoral students during the seminar. As a result of these presentations, doctoral students have initiated contact with researchers whose interests that they share and several of these researchers have agreed to become their advisors.

In the second academic year of the C.A.D.R.E. Model program, two doctoral students who entered the program without graduate degrees earned their Master's Degree in Education. Two of the full time doctoral students will complete their coursework in Spring 2009 and take the required steps to advance to candidacy. A new cohort of 14 doctoral students will be accepted into the C.A.D.R.E. Model program in Spring 2009.

The AAREA evaluation team completed and submitted an interim evaluation summative report on the C.A.D.R.E. Model program to Dr. Granger and Dr. Tate in March 2008.

## Teaching Institute and Teacher Resource Center

In June 2006, CISTL collaborated with the Missouri Botanical Garden Teaching Institute (MBGTI) to provide long-term professional development to K-12 science teachers with the purpose of influencing their classroom practice. This program was designed to meet all CISTL's goals which are to increase the number of kindergarten to twelfth grade educators with the skills to implement standards-based science instruction, rebuild and diversify the human resource base for STEM education, provide research opportunities for CISTL participants, and form synergy between research and practice that provide teachers with practical suggestions.

The Missouri Botanical Garden CISTL team was led by Tracie Cain. Other program members of MBGTI are Lydia Toth, Senior Manager of Education Services; Laura Schaefer, PD instructor; Meg Hoester, Teacher Resource Center (TRC); and Jennifer Hope, Program Evaluator. Deborah Frank, Vice President of Education and Interpretation for the Missouri Botanical Garden, is a member of CISTL's Leadership Council.

During the summer, MBGTI offers the GEMS Leaders and Classroom Inquiry Workshops free of charge to selected K-12 science teachers. The GEMS Leaders Workshop instructs teachers on how to utilize hands-on investigations with easily obtained materials as well as how to adapt the provided curriculum-based math and science GEMS units in the classroom. The Classroom Inquiry Workshop familiarizes teachers with the theories and concepts of inquiry and inquiry techniques to instruct various curriculum based science subjects in the classroom. Eleven to fifteen teachers participated in each workshop. Most of the teachers take these workshops for graduate credit.

Teachers who participate in both MBGTI workshops are recruited to participate in the MBGTI during the academic year. In fall 2007, MBGTI Cadre 2 was comprised of seven teachers (11 teachers were invited to participate). According to the MBGTI progress report, one teacher withdrew because of too many commitments, but the remaining six teachers completed the PD program. Selected teachers from the summer 2008 workshops were issued invitations to participate in Cadre 3.

During the academic year, MBGTI augments the science content and inquiry taught in the summer workshops. Teachers are provided with science content that is curriculum aligned (e.g., seasonal change, adaptation and ecosystems) as well as inquiry process skills (e.g., observing, journaling, questioning and reflecting). Science content is taught to the teachers using inquiry methods that can be used in the classroom. MBGTI meets twice a month, one Wednesday after school and one Saturday. On some Saturdays, MBGTI instructors and teachers would visit ecological sites at Missouri Botanical Garden such as the Shaw Nature Preserve, EarthWays Center, and the Butterfly House. Additionally, the MBGTI purchased classroom materials requested by teachers to assist in the use of inquiry in science instruction.

Although funding for the Teaching Institute program ended in Spring 2008, MBGTI accepted another cohort of science teachers for Fall 2008. There are 11 science teachers, 7 new teachers and 4 returning teachers. MBGTI is offering college credit for which the teachers pay. MBGTI is writing a grant to get funding for Spring 2009.

With CISTL's assistance, the Missouri Botanical Garden is also restructuring the Stupp Teacher Resource Center (STRC) which supports local science teachers by providing them with the resources to successfully incorporate inquiry in classroom instruction. STRC circulates kits that include lesson plans and supplies for hands-on activities on a variety of science topics, models, videos, and CD-ROMs for a fee. TRC also has environmental science and ecology books and other science education materials that teachers can borrow or use on site.

To effectively restructure and streamline the resources that STRC provides to local science teachers, the STRC program team has collected data from its users and other stakeholders. The STRC program team has administered surveys to school district science supervisors and administrators, and other STRCs around the country and conducted focus group interviews with science teachers. The data collected was analyzed and the results used to develop strategies to reorganize the STRC.

Over the sixth year of this evaluation, STRC has been undergoing reorganization, and an inventory of its materials and other holdings is in process. In order to improve services to its users, STRC created an electronic catalogue of all holdings, updated the MBTI teacher contact list, clarified its fee structure, and created informational materials about the Missouri Botanical Garden's education programs. STRC is pursuing funding to execute other recommendations to improve STRC's services. These recommendations include providing staff specifically for STRC, establishing regular hours on weekday evenings and weekends, making classroom kits available free of charge, promoting STRC's resources through Web sites, listservs, and newsletters, and creating a variety of formats to effectively train teachers to use STRC's resources.

#### After-School Enrichment Program

In partnership with St. Louis Community College, CISTL developed a science mentoring program for students from grades 9 to 12 at a high school in St. Louis Public Schools. This program was designed to meet all of CISTL's goals which are to increase the number of kindergarten to twelfth grade educators with the skills to implement standard-base science instruction, rebuild and diversify the human resource base for STEM education, provide research opportunities for CISTL participants, and form synergy between research and practice that provide teachers with practical suggestions.

Timitra L. Robinson, CISTL liaison for St. Louis Community College, was the project manager of the After-School Enrichment program. The After-School Enrichment program team members included Mike Holmes, manager of Harrison Education Center Outreach, St. Louis Community College, and the principal of the high school. In summer 2005, Dr. Mark McDaniel and Dr. Lynn McDaniel, Department of Psychology, Washington University, assisted in the implementation of this project. During summer and fall 2005, CISTL post-doctoral fellows, Dr. Andrew Grillo-Hill and Dr. Andrea Gay and doctoral students, Jill McNew and Ji Shen, participated in the research component of this project.

The After-School Enrichment program works with inner city students to improve their benchmark and MAP scores as well as their science grades and achievement by providing the prerequisite skills needed to excel in science such as mathematics and literacy. The After-School

Enrichment program seeks to enrich science knowledge by ensuring that students understand the basic concepts of science as taught in their classes according to the state standards. Program administrators review student science test scores and achievement data at six week intervals to determine the areas where students need more assistance. One additional objective of the After-School Enrichment program is to provide teachers and educators with professional development.

The CISTL facilitator engages students who the teachers identify as needing special attention in enrichment activities during science class time. These activities involve assisting the teacher or engaging the students directly in science activities. Several of the students participating in the After-School Enrichment program attend tutoring enrichment sessions once a week. During the tutoring enrichment sessions, mentors spend two hours reviewing basic concepts of science that students were taught in class using a hands-on approach and preparing students to take tests. Some of these students are also members of the CISTL White Coat Society, an after-school science club that meets for two hours on Tuesdays.

With the assistance of personnel from CISTL's partners, including the Saint Louis Science Center and University of Missouri-St. Louis, students who participate in the CISTL White Coat Society engaged in activities, field trips and workshops that reinforced the science concepts reviewed during class. Approximately the same 25 students participated in the after-school program and the science club. Student attendance, parent contact, curriculum, activities, and the participation of ISIs and other agencies were documented.

The research component of the After-School Enrichment program studied the effect that linking professional development and classroom lessons to after-school activities has on science achievement of students in an urban high school. Science achievement will be determined by examining participating students' benchmark assessments, MAP scores, and semester and quarterly grade reports. Additionally, pre- and post-surveys are administered to students to determine if their participation in the enrichment sessions and the science club have increased their interest in science. CISTL funding for the After-School Enrichment program ended in May 2008.

#### Early Elementary Education Program

After conducting a literature review and pilot study in 2005, the Saint Louis Zoo and CISTL formally began the Early Elementary Program (EEP) in February 2006. The EEP involves the implementation of the Japanese Lesson Study model (LS) as an intervention to improve teacher practice in science focusing on grades K-2. This program was designed to meet all CISTL's goals which are to increase the number of kindergarten to twelfth grade educators with the skills to implement standard-base science instruction, rebuild and diversify the human resource base for STEM education, provide research opportunities for CISTL participants, and form synergy between research and practice that provide teachers with practical suggestions.

The LS model involves creating learning communities to support teachers and to provide a platform for their development as teacher leaders. A total of ten teachers in four schools in St. Louis Public Schools matriculated the project. Beginning November 2006 and ending May 2008, the teachers were divided into 5 teams that met on a regular basis. Participating teachers and CISTL personnel developed eight science units to facilitate the utilization of inquiry and

instruction as well as the understanding of science process skills in accordance with district science curriculum standards and the Missouri Grade-Level Expectations (GLEs). The EEP team also designed and/or purchased the resources and materials for these lesson study and research units and provided supplemental science content to support six class field trips. On 10 occasions, the EEP team assisted teachers by team-teaching inquiry lessons. In August 2007, the EEP team and teachers had one all-day and two half-day workshops to share their lesson units and study inquiry methods used in these units. Also, the initial findings of the LS were presented to the teachers.

The EEP team was led by Martha Galganski, CISTL liaison from Washington University in St. Louis. The project team included: Dr. Tommie Turner, CISTL research specialist and lead researcher; Lisa Kelly, CISTL doctoral student researcher; Sharon Kassing, Saint Louis Zoo's CISTL liaison; Kevin Koenig, Saint Louis Zoo educator; Yeonha Sim, CISTL doctoral student researcher; and James Jordan, Saint Louis Zoo's Curator of Education.

The research component of the EEP determines if the implementation of the LS model has resulted in any measurable change in teacher practice, if teachers perceive any change in their practice, and if there has been any student improvement in science knowledge and process skills in response to these changes in teacher practice. After some initial reservations, teachers agreed to be videotaped pre-LS classes, LS classes, debriefings and re-teaching class sessions. An observation protocol and questionnaire were designed and administered to teacher participants. The observation protocol measured changes in teacher practice as related to science instructional content and process skills in the classroom. The questionnaire measured teachers' perception of their practice and the collaborative professional development experience. The pre-LS class and LS class videotapes along with the questionnaires, field notes and meeting transcripts were coded and analyzed by researchers. During November 2007 the EEP team presented papers on: (1) teacher beliefs and practices related to the science LS program at the School Science and Mathematics Association annual conference and (2) the collaboration between informal science educators and elementary teachers at the Michigan North Central Association (NCA) fall conference.

On May 31, 2008, EEP instructors conducted a final LS workshop with participating teachers. In the workshop, teachers were given copies of the LS units so they could discuss them, build upon each other's work, and share them with other teachers at their schools. The EEP team sent recognition and informational documents to EEP teacher participants. The EEP team is in the process of revising articles for submission to scholarly journals. The EEP team also plans to disseminate research instruments and the eight science units on the CISTL Web site. They will contact the teachers who have expressed interest in LS as well as school district science coordinators and inform them that the documents are accessible on the CISTL Web site. Information about conferences and other related lesson study data or events will also be available on the Web site. CISTL funding for the EEP ended in August 2008.

#### ISI Staff Professional Development Project

The Saint Louis Zoo also designed and implemented a CISTL funded ISI Staff Professional Development (ISI Staff PD) project for its education staff. This program meets CISTL's goals to provide opportunities for research in science education and to rebuild and diversify the human

resource base that forms the national infrastructure for STEM education at multiple levels. The Saint Louis Zoo's education staff had been challenged by its director to implement a new approach that connects its visitors, particularly children, to animals and their habitats called "affective transformation." Affective transformation is a concept that seeks to enable people to make emotional connections to wildlife and nature that ultimately result in nature-friendly behaviors that are consistent with zoo conservation efforts. The ISI Staff PD project incorporated the concept of "affective transformation" into its PD activities for Zoo's education staff.

The ISI Staff PD project is led by Sharon Kassing, Saint Louis Zoo's CISTL liaison. The project team includes: Louise Bradshaw, Saint Louis Zoo's Director of Education; Lisa Kelly, CISTL doctoral student researcher; Dr. Phyllis Balcerzak, Director of PD, Washington University, Science Outreach; Mike Dawson, Saint Louis Zoo's Naturalist Instructor; Dr. Christine Klein, PD Consultant; and James Jordan, Saint Louis Zoo's Curator of Education.

Twenty-one full-time and part-time employees are currently participating in the ISI Staff PD project. These employees include not only instructional staff, but also registrars and administrative support staff. In total, there were 21 group and 10 individual action research projects conducted by participants. Two action research projects were presented at the Regional Meeting of the Association of Zoos and Aquariums, March 2008, Birmingham, AL. Michael Dawson, a Zoo staff member who is also on the project team, presented his action research project, "Animal Handling Training Consistency: A Process for the Development of a Consistent Animal Handling Practice." In September 2008, ISI Staff PD project team members, Ms. Kassing, Ms. Kelly, and Ms. Bradshaw presented a paper titled, "Emotional Connections between People and Animals: Affective Transformation in Practice" at the 2008 Association of Zoos and Aquariums (AZA) Annual Conference, Milwaukee, Wisconsin.

The ISI Staff PD project is unique and has introduced the idea of providing PD activities to science educators at zoos and aquariums. Consequently, the presentations at national and regional meetings for AZA have stirred interest in designing and implementing PD projects. Using the ISI Staff PD project as a model, the Shedd Aquarium in Chicago developed a similar PD project and was awarded a \$138,000 grant by the Institute of Museum and Library Services (IMLS) to implement the project. The ISI project team has also been approached by the Monterey Bay Aquarium, California, to assist in the development of a PD project for its education staff.

ISI Staff PD project team members are currently writing papers to submit to practitioner and scholarly journals. They also intend to disseminate project documents on the Saint Louis Zoo Web site. Funding for the ISI Staff PD project will end December 2008.

#### St. Louis Regional Database Project

The St. Louis Regional Database Project analyzes and interprets science attainment data for students in St. Louis elementary, middle and high schools using local, state and national resources. The St. Louis Regional Database Project provides CISTL and its partners with an overview of the status of student achievement levels and science education in the St. Louis region as well as other regions of Missouri. The St. Louis Regional Database Study meets goal 4

of CISTL which is the formation of synergy between research and practice through research based on practice and the translation of these results into practical suggestions for educators.

Dr. Mark Hogrebe, CISTL's research statistician, is the project manager of the St. Louis Regional Database Project. Dr. Li Zou, CISTL's data manager and analyst, creates geodatabases and analyzes education and community data, primarily using GIS to map the St. Louis region as well as the other areas in Missouri.

The St. Louis Regional Database Project analyzes education and community data that originate from a variety of sources including National Center for Education Statistics (NCES) and the U.S. Census. There are plans to expand the St. Louis Regional Database Project's to include public health variables. The St. Louis Regional Database Project disseminates its data analysis of science attainment data to ISI partners, science educators, school district officials, community leaders and education policy makers as well as the general public in order to assist in planning and policy-making decisions and raise awareness of the current deficiencies in science education. Additionally, the St. Louis Regional Database Project works with the ISI partners to develop research and evaluation designs and strategies for CISTL projects which are incorporated into their scopes of work.

The St. Louis Regional Database Project has created an interactive database comprised of achievement and demographic data on the students, teachers and school district in the St. Louis region. The science achievement data was obtained from the Missouri Department of Elementary and Secondary Education (DESE) databases through the University of Missouri-Columbia. Other education and demographic data was gathered from the National Center for Education Statistics (NCES) and the U.S. Census Bureau. The database integrates these data so that the variables can be downloaded by users to be used for research as well as Geographical Information Systems (GIS) mapping of science achievement in the St. Louis region.

The St. Louis Regional Database Project Web site (<http://gis.wustl.edu/CISTL/>) is hosted on Washington University's GIS server which is accessible to the general public. Washington University's Network Technologies Services and GIS initiative provided the technical support and resources (hardware and software) necessary to get the database functioning effectively on the Internet. The St. Louis Regional Database Project's technical briefs are available on the CISTL Web site (<http://cistl.wustl.edu/>).

Drs. Hogrebe, Kyei-Blankson and Zou authored the article, "Examining Regional Scientific Attainment and School-Teacher Resources using GIS" which was published in *Education and Urban Society*, July 2008. The article, "Geography of Opportunity: Poverty, Place, and Educational Outcomes," was authored by Dr. Tate and published in *Educational Researcher*, October 2008.

Dr. Hogrebe have presented data analysis and methodology on the use of GIS in education research at two sessions at the American Educational Research Association (AERA) Annual Meeting in March 2008. At this conference, he also offered a professional development session in which they trained other education researchers in the use of GIS methodology.

*Summary of Overview of CISTL Programs*

Table 1 summarizes CISTL’s project activities which involve science educators from diverse backgrounds and experiences throughout the St. Louis region.

**Table 1. Overview of CISTL Programs**

<b>CISTL Program</b>	<b>Partner Institution</b>	<b>Program Manager</b>	<b>No. of Participants*</b>
Doctoral and Post-Doctoral Programs in Science Education	Washington University	Dr. William F. Tate	7 Doctoral Students 10 Post-Doctoral Fellows
Science Education Doctoral Studies C.A.D.R.E. Model Program	University of Missouri-St. Louis	Dr. Charles Granger & Dr. William F. Tate	24 Doctoral Students
Teaching Institute & Teacher Resource Center	Missouri Botanical Garden	Tracie Cain	20 K-12 Teachers
After-School Enrichment Program	St. Louis Community College	Timitra L. Robinson	25 9 <sup>th</sup> & 10 <sup>th</sup> Grade Students
Early Elementary Program	Saint Louis Zoo	Martha Galganski	10 K-2 Teachers
ISI Staff Professional Development	Saint Louis Zoo	Sharon Kassing	22 Education Division Employees
St. Louis Regional Database Project	Washington University	Dr. Mark Hoglebe	7 Science Educators at the ISIs, Doctoral Students & Post-Doctoral Fellows

\* These are the number of participants since AAREA became CISTL’s external evaluators.

## 2 Evaluation Questions

The evaluation questions agreed upon by CISTL and the AAREA evaluation team sought to determine whether or not CISTL's research projects and collaborative effects have successfully met the goals and objectives laid out in its original NSF proposal. The evaluation questions focus on three major areas: development of a regional professional development curriculum with broad impact; collaboration with institutional partners; and capacity building in science education. In this annual report, the AAREA evaluation will address the following questions:

### 2.1 *Professional Development*

- Do professional development (PD) offerings reflect and contain elements of effective PD as cited in research and policy documents?
- Is there evidence of depth of science content as structured by scientists in scientific disciplines including the use of inquiry?
- Are the content and professional development linked to classroom-based practices and standards-based approaches?
- Do the PD offerings model the pedagogical approaches advocated by various providers in the projects for use in the classrooms?

### 2.2 *Collaboration*

- Are organizational structures and decision-making leading to interactions among partners that promote communication, support leadership and lead to shared accomplishments?
- Are organizational structures and decision-making lending feedback to participants that strengthen future decision-making?
- Are all participating groups increasing the quality of their human resource base for science education?

### 2.3 *Capacity Building*

- Are sufficient numbers of post-doctoral fellows and doctoral students being recruited into science education and receiving high quality scholarly guidance in their studies to support their capacity to produce excellence in research?

- Are scholars gaining facility in the use of mixed methods and approaches that are likely to have a direct impact on innovative research-practice relationships?
- Is CISTL facilitating access to careers in science education for under-represented populations of students?
- Is there adequate evidence of scholarly products?
- Are the products of research reaching local and national audiences and meeting scholarly standards?
- Are products of research advancing the understanding of project stakeholders as they enact their role in improving science education in the region?

### 3 Methodology

The Year Six evaluation study of CISTL and its program was conducted using primarily qualitative methodology to collect data. Qualitative methodology is now widely accepted in the area of education evaluation research (NSF, 2002). Fetterman (1988) described the paradigm shift that led to widespread use of qualitative methodology in education evaluation as “a quiet storm.”

The primary ethnographic methods used in education evaluation are open-ended or semi-structured interviews, focus group interviews, case studies, and participant observation (Camino, 2004; Borman *et al.*, 2007; LeCompte and Preissle, 2003). Semi-structured interviews were conducted with CISTL personnel, ISI and school district partners, and other stakeholders, as well as doctoral students and teachers participating in CISTL programs. CISTL PD activities were observed by members of the AAREA evaluation team. Relevant documentation including scopes of work, quarterly progress reports, curriculum materials, email communication and meeting minutes were gathered and analyzed by the AAREA evaluation team.

#### 3.1 Sample

The AAREA evaluation team used a purposive sampling strategy to select participants for this study. All participants have been involved in CISTL and were able to provide insight to varying degrees about how effectively CISTL’s programs have been meeting its goals. Participants were identified through conversations with CISTL personnel. All study participants signed an informed consent form which described the evaluation study in detail. They were guaranteed that any information they shared with the AAREA team would be confidential. Study participants were provided the evaluators’ contact information in the event that they had any further questions. All interviews were audio-recorded and participants were assigned identifiers to ensure confidentiality.

In total, 47 semi-structured interviews were conducted by the evaluation team during 2 site visits to CISTL for the Year Six evaluation report. Twenty semi-structured interviews were conducted with CISTL personnel, program managers, doctoral students, project team members, and collaborators. The collaborators include members of the Leadership Council, administrators, liaisons, and representatives from the ISIs, school districts, University of Missouri-St. Louis, and St. Louis Community College.

Several of the collaborators, program managers and project team members were also members of the Leadership Council, so they were also interviewed in that capacity. Four of the collaborators were also doctoral students in the C.A.D.R.E. Model program, so they were interviewed about their experiences in that CISTL project. In addition, semi-structured interviews were conducted with 2 administrators in the C.A.D.R.E. Model program. Ten semi-structured interviews were conducted with teachers participating in the After-School Enrichment program and the MBGTI. In addition, AAREA evaluation team members observed two days of the After-School Enrichment program classes. Table 2 summarizes the demographics of the individuals interviewed for this evaluation study.

**Table 2. Demographics of CISTL Personnel and Stakeholders Interviewed**

CISTL	No. of Interviewees	Ethnicity	Gender
Science Education Doctoral Studies C.A.D.R.E. Model Program	2 Program Team Members	1 White American	F
		1 White American	M
	4 Doctoral Students	1 White American	F
		1 Black/African American	F
Teaching Institute & Teacher Resource Center	2 Program Team Members	2 White Americans	F
	7 Teachers	3 White Americans	F
		2 Black/African Americans	F
		2 White American	M
After-School Enrichment Program	1 Program Team Member	1 Black/African American	F
	3 Teachers	1 Black/African American	F
		1 White American	M
		1 White American	F
Early Elementary Program	4 Program Team Members	Black/African American	F
		3 White Americans	F
ISI Staff Professional Development	4 Program Team Members	2 White Americans	M
		2 White Americans	F
St. Louis Regional Database Project	2 Program Team Members	1 Asian & Pacific American	F
		1 White Americans	M
Learning Progression	2 Program Team Members	2 White Americans	F
CISTL Leadership Council	4 Members	1 Black/African American	M
		3 White Americans	F
CISTL Personnel	2 Staff	1 Hispanic	F
		1 White American	F

### **3.2 Instrumentation**

The instruments used to collect data for this evaluation study were the CISTL participant information form, semi-structured interview protocol, and the CISTL quarterly progress reports. Each instrument is described below in turn. The instruments are included in this report as Appendix A.

#### **CISTL Participant Information Form**

All participants interviewed for the Year Six evaluation report were asked to complete the CISTL participant information form. The CISTL participant information form collected data on the participant's demographic information including age, ethnicity, gender, educational background as well as employment history.

#### **Semi-structured Interview Protocol**

Semi-structured interview protocols were designed to ascertain interviewees' awareness and perceptions about CISTL's goals and projects. Seven different semi-structured interview protocols were designed for the CISTL director, program managers, project team members, CISTL PD teachers, Leadership Council members, C.A.D.R.E. Model doctoral students, and C.A.D.R.E. Model administrators.

#### *CISTL Director*

This interview protocol asked the CISTL director about his responsibilities and primary CISTL decision maker. He was also asked about the role of the Leadership Council as well as its strengths and weaknesses. Questions were also included to gain his perspective on CISTL's projects and how they are aligned with CISTL's goals, and the issues of communication among collaborators and partners.

#### *CISTL Leadership Council Members*

This interview protocol asked how the interviewee became a member of the Leadership Council, responsibilities, and its strengths and weaknesses. Questions were also asked about the Leadership Council's decision-making process and how information was communicated about CISTL's projects and organizational issues. They were also asked about their involvement in CISTL's projects and how they are aligned with CISTL's goals.

#### *CISTL Program Managers & Project Team Members*

CISTL program managers and project team members were asked about the current status of project activities, any changes that had occurred with the project and their responsibilities as well as how project outcomes were determined by the project team. They were also asked for an update on dissemination activities, plans for future publications and their involvement in the CISTL Writer's Group. They were then asked to reflect on their projects' strengths and weaknesses and how it meets CISTL's goals as well as CISTL's decision-making process and communication issues.

#### *C.A.D.R.E. Model Administrators*

The interview protocol for the C.A.D.R.E. Model administrators asked about the current status of the program and any changes that had occurred. They were also asked about the strengths and weaknesses of the C.A.D.R.E. program and the future of the program on CISTL's funding ends.

They were also asked how University of Missouri-St. Louis and Washington University's partnership will go forward

#### *C.A.D.R.E. Model Doctoral Students*

The interview protocol for the C.A.D.R.E. Model doctoral students asked about their career goals, how participating in the C.A.D.R.E. Model program will help them meet these goals, their impressions of the program, their knowledge about CISTL, the obstacles that would prevent them from completing the program, the other forms of support that the program could provide, the strengths and weaknesses of the program, and how they would improve the program.

#### *CISTL Personnel*

CISTL Personnel were asked about their responsibilities, their involvement in CISTL's projects and how they are aligned with CISTL's goals as well as how information about CISTL is communicated to them and CISTL collaborators.

#### *CISTL PD Teachers*

The interview protocol for CISTL PD teachers asked about their experiences with CISTL PD, if their participation affected their teaching of science in the classroom, if there were any school policies encouraging or limiting their classroom practice and how CISTL could further assist them in improving their science instruction.

All interview protocols, excluding the CISTL teacher interview protocol, concluded with questions about:

- Impact of CISTL on the interviewee's career goals.
- Impact of CISTL on science education in the St. Louis region.
- How CISTL has promoted or increased the involvement underrepresented groups such as ethnic minorities and women in science education.
- CISTL's strengths and weaknesses.
- How to improve communication in the collaboration.
- Ways that collaborations and partnerships formed through CISTL will continue after it has officially ended.
- Plans to continue collaborating with the institutions and individuals that you have met through CISTL.

#### *CISTL Quarterly Progress Report*

The CISTL quarterly progress report form was developed by the AAREA evaluation team for the CISTL program managers to complete with updated information on their project activities, members and participants. The data collected in these progress reports were used to track changes that occurred in CISTL programs between site visits, to identify the CISTL personnel

and participants who should be interviewed and the program activities that should be observed by the AAREA evaluation team.

### **3.3 Procedure**

The AAREA evaluation team made two site visits to CISTL to collect data for the Year Six report. The visits occurred in the spring and fall 2008. During these visits, semi-structured interviews and observations were conducted by the AAREA evaluation team. Relevant documents such as curriculum materials, draft publications, and other program documents were also collected by the AAREA evaluation team.

- In March 2008, the AAREA evaluation team interviewed teachers and doctoral students participating in CISTL PD programs as well as program managers and team members. Additionally, the AAREA evaluation team observed the 2 days of the After-School Enrichment program activities at a St. Louis Public Schools high school.
- In Fall 2008, the AAREA evaluation team interviewed CISTL project manager, team members, partners, doctoral students, and members of the Leadership Council.
- Two weeks after returning from St. Louis, the AAREA evaluation team conducted a telephone interview with a CISTL program manager who had not been available during the site visits.

### **3.4 Data Analysis**

Qualitative methods were used to analyze the data collected for this evaluation study. The semi-structured and focus group interviews were transcribed and coded by three members of the AAREA evaluation team (there was 75 percent coding agreement) using themes that emerged from the evaluation questions, preliminary review of transcripts, and reviewing documentation such as the annual reports and meeting minutes. The interview transcripts were entered into QSR N6 (formerly known as Nu\*DIST) for analysis. The field notes of observations, scopes of work, quarterly progress reports, curriculum materials, email communication and meeting minutes collected by the AAREA evaluation team were analyzed to identify themes that could further elucidate the evaluation questions.

## **4 Findings**

Each evaluation question is addressed in this section of the evaluation report. The responses to the evaluation questions are supported by analysis from the data collected by the AAREA evaluation team during Year Six.

### **4.1 Development of Regional Professional Development with Broad Impact**

To investigate the evaluation questions about CISTL PD activities, the researchers analyzed: (a) semi-structured interviews with CISTL PD teachers; (b) semi-structured interviews with CISTL

PD program managers and project team members; (c) observations of CISTL PD activities; and (d) CISTL PD curriculum materials. CISTL's primary PD programs for K-12 science teachers are the MBGTI and EEP.

Do PD offerings reflect and contain elements of effective PD as cited in research and policy documents?

CISTL PD activities reflect and contain elements of effective PD as recommended by the research literature on science PD for K-12 science instruction. According to the National Research Council (1996), successful PD encourages professional growth and provides teachers with opportunities to work with educators specializing in their fields and reflect on classroom practices as they encounter students with diverse backgrounds, interests, and abilities in science. Teachers participating in professional development should not only increase or reaffirm their science knowledge, but they should engage in research on teaching and learning with an emphasis on inquiry which "requires that students combine processes and scientific knowledge as they use scientific reasoning and critical thinking to develop their understanding of science" (p.105).

The National Science Education Standards (National Research Council, 1996) states that effective professional development programs for teachers of science should be implemented according to four main standards:

1. Learning necessary science content utilizing perspectives and methods of inquiry.
2. Integration of scientific knowledge, learning, pedagogy, and student needs as well as the application of scientific knowledge in the classroom.
3. Development of understanding and ability for lifelong learning by encouraging reflection and providing feedback and mentoring to improve practice.
4. Professional development programs must be coherent with clear goals and visions for science learning, teaching and teacher growth and program components must be integrated.

The semi-structured interviews conducted with CISTL PD program managers, program team members and teachers, along with a review of CISTL PD curriculum materials, indicated that the PD activities contained most of the elements of effective science PD. The MBGTI and EEP provided teachers with instruction on science content knowledge, methods of inquiry, developing assessments, reviewing student work, reflection through journaling, follow up on previous PD activities, and met their goals for professional growth.

The main criticism of CISTL PD activities identified in the Year Four and Five evaluation reports was that "these projects do not provide adequate coaching or mentoring in the classroom." In Year Five, the EEP addressed this criticism by assisting and observing teachers in science instruction in the classroom and providing them with feedback. In Year Six, the AAREA evaluation team found that the MBGTI had also taken steps to provide teachers with mentorship and feedback on their science instruction.

With their consent, MBGTI instructors observed teachers in their classrooms three times over the year. MBGTI instructors designed an observation form which was used to evaluate the use of inquiry in the classroom. Teachers' use of inquiry in their science instruction was scored on the observation form which was then given to the teachers. The teachers' reactions to receiving the observation form suggested to MBGTI instructors that they were intimidated by their scores. MBGTI instructors became concerned that the teachers' focus on their scores would divert from the goal of the process which was to encourage teachers to critically reflect on their science instruction. As a result, MBGTI instructors revised the observation form so as to give teachers credit for having a well run classroom in addition to the use of inquiry. Now instead of giving teachers scores, the MBGTI instructors give teachers a reflection form which emphasizes three areas in which teachers did well and two areas that they need to improve their use of inquiry.

In their interviews, the teachers discussed how much they valued the observation of their science instruction and the feedback provided by the MBGTI instructors. Some teachers admitted to being wary about the scores on their observation form. However, all the teachers believed that the observation and feedback were extremely useful and that they could use them to improve their use of inquiry in their science instruction. Discussing the MBGTI classroom observation form and feedback, one 4<sup>th</sup> grade teacher stated:

Well the first one was wonderful and the second one I haven't heard the feedback yet and the last one it was a lower score than I expected but after reading through it I could see some of the things, like the closing, we didn't have a closing to the activity because it was going to continue to the next day so you know I got zero on that because she didn't see it. So it wasn't that I didn't do it; she just didn't see it because it would happen the next day. And then with that feedback I would take it and internalize it and then for my future lesson with that particular activity then I would learn from the feedback that was given to me to improve the next time I teach the lesson.

Another MBGTI science teacher stated:

Well, first of all it's good to be observed...Where she [the MBGTI instructor] had concerns I've gone back and worked with the kids to make sure they do understand the concept. I've tried to in future lessons incorporate the feedback to make sure that it was being implemented.

When asked what more MBGTI could do support her, the same science teacher stated:

I would even have more observations. Those observations are so helpful and maybe having one project, one unit where you're working with somebody on that unit, providing them the outline and then having it challenged. Have you thought about this? How are you going to handle this? Just having start to finish relationship with somebody from CISTL for one unit and then having more observations and getting more feedback on the teaching.

The AAREA evaluation team has concluded that CISTL PD activities reflect and contain elements of effective PD as cited in research and policy documents.

Is there evidence of depth of science content in PD offerings as structured by scientists in scientific disciplines including the use of inquiry?

CISTL PD activities provided teachers and science educators with a depth of science content, including the use of inquiry as structured by scientists in scientific disciplines. The MBGTI and EEP instructed teachers using science content and inquiry techniques developed by scientists at ISIs. They also showed teachers how the science content and inquiry techniques could be modified for their students' grade levels. The MBGTI based their PD activities on the modification of science content and inquiry PD designed by the Institute for Inquiry at the Exploratorium in San Francisco and the Great Explorations in Math and Science (GEMS) from the Lawrence Hall of Science, at the University of California – Berkeley.

The MBGTI and EEP also provided teachers with materials for the hands-on activities that accompanied inquiry in the classroom. The K-12 teachers participating in the MBGTI's summer GEMS Leaders workshop were given GEMS guides which provide in-depth science content on a variety of topics taught in their classrooms. The GEMS guides improved the teachers' science knowledge and were a valuable classroom resource.

All the teachers participating in the MBGTI who were interviewed in Year Six stated that CISTL PD activities provided science content and encouraged use of inquiry to teach science in the classroom. A 3<sup>rd</sup> grade teacher participating in the MBTI stated:

Actually I think it's been very informative. I've learned a lot. I'm not the strongest science person in the world so I took it to strengthen my own knowledge base but I've learned a lot of activities and just the correspondence with other teachers from different districts and learning you know different strategies from them just helps you grow and become you know a more well-rounded person so that when I come into the classroom that I feel like I'm giving my kids the best and that's what they need.

Several teachers said that the methods of inquiry that they learned were more valuable than the science content provided by the CISTL PD activities. One science teacher in the MBGTI stated:

It wasn't until I did this week of inquiry with Missouri Botanical Garden that I really felt like I truly understood what inquiry was about and how to really facilitate that in my classroom.

Recalling a science lesson that he had modified to use inquiry, a 4<sup>th</sup> grade teacher stated:

One activity that really stands out in my head that my kids absolutely enjoyed, I teach two fourth grade science classes and instead of reading about decomposition I actually brought in pieces of rotting logs and each group had their own rotting log and for an entire hour all they did was explored this rotting log, tearing it apart and finding things. And every time they found a bug you would think that they found gold because I mean they were just screaming and hollering and it was just so amazing to me to see that one hundred percent change in my kids' excitement in science.

Teachers also stated that the CISTL PD materials such as the GEMS guides (MBGTI) and the LS units (EEP) were useful in their science instruction when they were teaching required topics, such as natural selection using bird beak adaptation LS units in their classes. They also appreciate the resources that MBGTI provided for use in inquiry in the classroom.

The AAREA evaluation team has concluded that there is ample evidence of depth of science content and inquiry in CISTL's PD offerings as structured by scientists in scientific disciplines.

Are the content and professional development linked to classroom-based practices and standards-based approaches?

The science content and CISTL PD activities were aligned with classroom-based practices and standards-based approaches. The scopes of work of the MBGTI and EEP show that these PD activities in specific science topics areas were designed to be aligned with the Missouri Grade Level Expectations (GLEs) and school district curriculum requirements.

Teachers stated that the CISTL PD activities were aligned with classroom-based practices and standards-based approaches which allowed the science content and methods of inquiry to be used in the classroom on a regular basis. Teachers were able to share CISTL PD activities with colleagues at their schools because the science content was linked to the GLEs and their district and state standards.

Most of the teachers felt that because CISTL PD activities are aligned with classroom-based practices and standards-based approaches it was easier to incorporate them in their classrooms. While their schools and district administrators were supportive using inquiry in science instruction, several teachers stated that there were time constraints due to limited time allotted to science instruction and the demands of Missouri Assessment Program (MAP) testing. Yet all the teachers believed that CISTL PD activities were beneficial for science instruction because they were aligned with classroom-based practices and standards-based approaches. One science teacher stated:

I'm trying to follow the state curriculum so I can't get through everything because we, this year we decided to give more minutes to math because our period's only thirty-seven minutes long which is substantially shorter than what public schools would have or regular private schools would have so for math. They gave them an additional period which came from my time for science so I only see the kids four times a week for thirty-seven minutes each so I get as much in as I can.

The AAREA evaluation team has concluded that CISTL's PD offerings are linked to classroom-based practices and standards-based approaches.

Do the PD offerings model the pedagogical approaches advocated by various providers in the projects for use in the classrooms?

A study of CISTL PD activities showed that MBGTI and EEP implement pedagogical approaches such as inquiry, process skills, and lesson building for teaching science. The CISTL

facilitators of these PD projects use hands-on activities and encourage teachers to identify investigable questions in a group setting. The AAREA evaluation team observed the CISTL facilitators in MBGTI using inquiry to instruct science teachers in science content, methods of inquiry and science process skills. The symbiotic relationship of animals in nature, investigating the ice balloon and making a top were taught by the CISTL facilitators in the MBGTI using inquiry. The CISTL facilitators gave teachers copies of these materials and encouraged them to replicate these methods of inquiry in their classrooms.

Teachers stated in their interviews that they utilized these pedagogical approaches in their classrooms. After participating in the MBGTI, one 3<sup>th</sup> grade teacher stated:

Just the whole, I learned a lot about inquiry. I got rid of a lot of misconceptions about inquiry thinking that you just let the kids go and you just let ‘em learn what they want to learn and I realize from taking an inquiry class that you structure it a certain way so that the kids do have their own involvement but that you’re still kind of guiding them along the way. So it was nice to take the class and to understand that but then also to be able to come in and sort of experiment with it. I mean it is a lot of work that goes into it but I think the teachers giving us some examples, giving us some guidance, showing us some different strategies and different ways to teach different concepts, that’s always wonderful for me.

Another 5<sup>th</sup> grade teacher participating in the MBGTI stated:

I mean throughout every single lesson that they give I bring back something you know from it. So there’s not one particular pinpointed idea. I mean every single class I bring back something to my class or to my colleagues. I can’t tell you just one thing; there’s been so many.

By modeling the pedagogical approaches that they advocate for use in the classroom, CISTL PD activities have successfully encouraged teachers to use inquiry, science process skills, and lesson building in their science instruction.

#### **4.2 Collaboration**

To respond to the evaluation questions about collaboration, the researchers analyzed: (a) semi-structured interviews with CISTL program managers and project team members, collaborators from partner institutions, and members of the Leadership Council; (b) email communications on the CISTL listserv; (c) recordings of CISTL Leadership Council and program manager meetings; (d) relevant CISTL documents such as annual reports and meeting minutes; and (e) ISIs and other CISTL partner Web sites.

Are organizational structures and decision-making leading to interactions among partners that promote communication, support leadership and lead to shared accomplishments?

CISTL’s organizational structures and decision-making have led to increased interactions among partners that promote communication and support leadership which results in shared accomplishments. The Leadership Council led by Dr. Tate is the primary organizational structure

that makes decisions for CISTL. The program manager meetings are a CISTL organizational structure that allows CISTL partners to interact and communicate about their projects.

Communication among CISTL and its partners had improved significantly since the initial round of interviews. Initially, members of the Leadership Council and program managers complained that communication was infrequent and lacked depth. Over the year, they are more satisfied that they are informed about CISTL's project activities through the CISTL listserv, in part. However, as CISTL has completed projects there have been fewer meetings that have led to a sense of dissociation as program managers and project team members focus on analyzing their results and producing publications.

Interviews with members of the Leadership Council and program managers show that they identify closely with CISTL's accomplishments and are pleased to take credit for their role in the collaboration. While members of the Leadership Council and program managers feel that more CISTL's projects could have contributed more to the community if CISTL had gotten off to a smoother start, they are pleased with its achievements in science education in the St. Louis region.

Are organizational structures and decision-making leading feedback to participants that strengthen future decision-making?

Interviews conducted for the Year Six evaluation show that members of the Leadership Council and program managers continue to view the decision-making process as hierarchical. However, several CISTL collaborators stated that they feel that their advice and opinions were being considered on the project level.

Are all participating groups increasing the quality of their human resource base for science education?

CISTL partners and collaborators are involved in a variety of PD programs that increase the quality of the human resource base in science education:

- The Science Outreach program, Department of Biology, provides Washington University's resources to K-12 teachers, students, and families in the St. Louis region. Science Outreach's goal is to improve math and science instruction through inquiry and the use of hands-on activities in PD provided to K-12 teachers in the St. Louis region.
- The Saint Louis Zoo provides teachers and science educators with professional development workshops aligned with the Missouri standards in a variety of zoological subjects as well as instruction on science and conservation education.
- The Saint Louis Zoo also offers science teachers summer workshops that can be used to earn graduate credits, teacher lesson plans on a variety of zoological topics that can be downloaded for free, and a program that describes the free educational resources that can be used in the classroom as well as a free evening science lecture series.

- The Missouri Botanical Garden offers professional development in science for teachers as well as instructional materials for the classroom. Teachers stated that they had access to professional development as well as the materials that the Missouri Botanical Garden provided for science instruction.
- The Math-Science Partnership (MSP) program at Washington University, St. Louis provides extensive professional development to mathematics and science teachers throughout the St. Louis region. CISTL's school district partners and teachers interviewed spoke positively about the role that MSP has played in improving science instruction.

The goal of these PD programs is to improve the human resource base in science education in St. Louis, thereby increasing the number of quality science educators and graduate students choosing to pursue STEM careers.

### **4.3 Capacity Building**

To analyze these evaluation questions about capacity building, evaluators undertook: (a) semi-structured interviews with CISTL program managers, project team members, and collaborators from partner institutions; (b) semi-structured interviews with doctoral students and administrators in the C.A.D.R.E. Model program; (c) a review of publications, presentations, and Web sites, and (d) a review of relevant CISTL documents such as annual reports and meeting minutes.

Are sufficient numbers of graduate students and post-doctoral fellows being recruited into science education and receiving high quality scholarly guidance in their studies to support their capacity to produce excellence in research?

CISTL has recruited and trained sufficient numbers of doctoral students and post-doctoral fellows in science education. Currently, 23 doctoral students in the C.A.D.R.E. Model program and two doctoral students through Washington University are receiving high quality scholarly guidance in their courses and research to support their capacity to produce excellence in research.

Interviews with 22 doctoral students in the C.A.D.R.E. Model program confirm that they receive high quality guidance from Dr. Charles Granger who administers the program on a daily basis as well as from advisors who they have selected to supervise their dissertation research. The AAREA evaluation team conducted a summative evaluation of the C.A.D.R.E. Model program which is attached to this Year Six report.

CISTL has also trained 17 doctoral students and post-doctoral fellows in the Department of Education at Washington University. Currently, two doctoral students, conducting research in science education, receive scholarly guidance from Dr. Tate and Dr. Elmesky. Dr. Elmesky advises and mentors doctoral students. One post-doctoral fellow who finished the program continues at CISTL as a Research Specialist on the EEP project team.

Are scholars gaining facility in the use of mixed methods and approaches that are likely to have a direct impact on innovative research-practice relationships?

CISTL researchers are gaining facility in the use of mixed methods and approaches that are likely to have a direct impact on innovative research-practice relationships through the Learning Progression, an off shoot of the “Learning Sciences Practicum in Math/Science Technology” seminar taught by Dr. Rowhea Elmesky in Fall 2005 and Spring 2006. This course provided participants with methodological and theoretical frameworks that can be used to conduct research and implementation of science education programs. The CISTL researchers involved in the Learning Progression include science educators at Washington University and the ISIs and CISTL doctoral students and post-doctoral fellows. By participating in the Learning Progression, these CISTL personnel and partners are engaging in multidiscipline discourse in order to conduct research in science teaching and learning.

Is CISTL facilitating access to careers in science education for under-represented populations of students?

CISTL has facilitated access to careers in science education for under-represented populations. CISTL collaborators and stakeholders were very aware of the need to provide opportunities in STEM careers and PD activities to these traditionally underserved populations. Consequently, these groups were specifically targeted to participate in CISTL projects activities.

An analysis of the demographic information of the 23 doctoral students in the C.A.D.R.E. Model program show that they are diverse as to their ethnicity and gender: thirteen students (57 percent) are white American females, four students (17 percent) are white American males, three students (13 percent) are black/African American females, two students (9 percent) are black/African American males, and one student (4 percent) is a Latino/Hispanic American female.

Additionally, CISTL projects serve its partner school district schools that have diverse and often underserved student populations. For example, the recently completed After-School Enrichment program provided tutoring and mentoring to inner city 9<sup>th</sup> and 10<sup>th</sup> students in biology and chemistry.

Is there adequate evidence of scholarly products?

There is evidence that CISTL has produced scholarly products as a result of their research projects. These products of research have been presented on both a local and national level. In addition, three CISTL projects are in the process of writing and submitting articles for publication in scholarly and practitioner journals.

The St. Louis Regional Database Project produced the article, “Examining Regional Scientific Attainment and School-Teacher Resources using GIS” which was published in *Education and Urban Society*, July 2008. This article was authored by Drs. Hoglebe, Kyei-Blankson and Zou. The article, “Geography of Opportunity: Poverty, Place, and Educational Outcomes,” was authored by Dr. Tate and published in *Educational Researcher*, October 2008.

Dr. Hoglebe have presented data analysis and methodology on the use of GIS in education research at two sessions at the American Educational Research Association (AERA) Annual Meeting in March 2008. At this conference, he also offered a professional development session in which they trained other education researchers in the use of GIS methodology.

In November 2008, the AAREA Evaluation team displayed a poster on the CISTL evaluation study at American Evaluation Association annual conference, Denver, CO. The updated list of CISTL's scholarly products and presentations are displayed in Appendix B.

Are products of research reaching local and national audiences meeting scholarly standards?

CISTL's products of research which include journal publications, presentations, and technical reports do meet scholarly standards. Some of these products are targeted at practitioner as well as scholarly audiences. These products are well written and clearly presented to both local and national audiences. The St. Louis Regional Database Project has played an important role in determining that CISTL's projects have research and evaluation designs that produce valid results. The Writer's Group meets to provide authors with guidance and feedback on articles in progress, ensuring that they meet scholarly standards. Dr. Elmesky keeps track of appropriate scholarly journals where articles would likely be accepted for publication

Are products of research advancing the understanding of project stakeholders as they enact their role in improving science education in the region?

CISTL's partners and collaborators have used research to guide the design of their project activities and objectives. The research component of CISTL projects has advanced the understanding of project stakeholders of the strategies and techniques required to achieve effective science education. For example, the MGBTI, EEP, and ISI Staff PD project managers and team members have conducted extensive literature reviews in their areas of science education and this has advanced their understanding of their research activities. Additionally, the science education data analyses conducted by the St. Louis Regional Database Project have played in an important role in designing CISTL projects as well as the dissertation research of doctoral students. CISTL projects has produced a number of scholarly products, technical reports and curriculum units which have led collaborators to gain a better understanding of science education from a theoretical as well as practice perspective as they pursue their goal of improving science education in the St. Louis region.

## 5 Recommendations

Data analysis from AAREA's evaluation effort (August 2007 to October 2008) shows that CISTL's collaboration has had a positive impact on science education in the St. Louis region. Overall, CISTL collaborators, stakeholders and participants speak positively of CISTL and its project activities. ISI collaborators and several teachers stated that they appreciated the challenge of conducting scientific research for the first time. School district partners and teachers appreciated CISTL's PD activities and the resources that were made available to them through

the ISIs and CISTL projects. However, they argued that CISTL would have had a wider impact on science education if initial professional development activities which included the Science Saturday and Summer Workshops had not been discontinued in favor of more narrowly focused research projects. Other stakeholders believed that they have been able to meet their career goals through their involvement in CISTL. They also believed that the relationships that they had established through CISTL would lead to future collaborations and grant funded opportunities in the future. This networking has been a valuable aspect of CISTL's collaboration efforts. Indeed, the AAREA evaluation team identified several individuals whose participation in CISTL's project activities had led to professional and academic advancement in the area of science education.

CISTL, along with its partners as well as other stakeholders in the St. Louis science education community, collaborated to create projects that not only met CISTL's goals, but also built upon their interests and strengths as science educators and researchers. There were tensions between academicians and informal science educators regarding their approach to implementing projects. However, these tensions were resolved successfully through discussion and compromise which resulted in the design and implementation of effective projects.

CISTL's projects were well designed with clear objectives. Each project had a research and evaluation component which led to the effective implementation of project activities. The projects also promoted and encouraged the participation of traditionally underrepresented groups such as minorities, women and low income students. The projects are in the process of producing publications in scholarly and relevant practitioner journals.

The AAREA evaluation team's recommendations going forward are as follow:

### ***5.1 Continue Funding for the C.A.D.R.E. Model Program***

It is imperative that the current and upcoming cohorts of the C.A.D.R.E. Model program continue to be funded so that they can complete their degrees in a timely manner. Most of the doctoral students work full-time and would be challenged to fund their degrees on their own. These individuals are enthusiastic about improving science education in the St. Louis region. With their doctoral degrees, they can become leaders in science education at their schools and institutions. The C.A.D.R.E. Model program provides a systemic means to build human capacity in science education in the St. Louis region.

### ***5.2 Publicize St. Louis Regional Database Project***

There is a need to publicize the St. Louis Database Project. The St. Louis Regional Database Project is impressive and it is a valuable research tool to researchers or anyone else interested in learning about student achievement in the St. Louis region. Some suggestions include making presentations and demonstrations at local science education groups, school district meeting, teacher organizations as well as other academic institutions. Also, several of the doctoral students in the C.A.D.R.E. Model program are in the process of developing their dissertation topic and should be reminded about the value of the St. Louis Regional Database Project. One suggestion is to ask Dr. Hoglebe to create an electronic presentation that can be distributed via email by Dr. Granger to doctoral students.

### **5.3 *Provide support to ISIs and other partners in pursuing grants***

CISTL should provide support to partners that would like to apply for grants to continue their projects and create new projects. Many of these projects are invaluable to improving science education and building the human resource base in STEM careers. For example, the Missouri Botanical Gardens is seeking funding to continue the MBGTI. CISTL can assist in the areas of project design and grant writing. Through this support, CISTL builds upon the collaboration in a meaningful way that strengthens Washington University's relationship with the ISIs.

### **5.4 *Produce Scholarly Publications***

It is critical that CISTL produce scholarly publications in peer-reviewed journals as well as practitioner journals. Several projects have been completed, so CISTL must ensure that project managers and team members are analyzing data and writing publishable articles. CISTL should designate one individual to supervise the publication process and weekly contact should be kept with the authors so to ensure that articles are progressing in a timely manner. A simple Excel spreadsheet with the project's name, article topic, authors' names, potential journal, and status of article can be created to keep track of publications. The spreadsheet should be distributed on the CISTL listserv so that all collaborators can be aware of the importance of the publication process. The Writer's Group should continue to meet on a regular basis to provide support and feedback to authors. Meetings notes of the Writer's Group should be taken and distributed over the CISTL listserv as well. These notes are helpful to other authors who may be unable to attend the meeting.

### **5.5 *Dissemination of Professional Development Curriculum Units***

CISTL should also develop strategies to systematically disseminate curriculum units developed by CISTL PD projects to school districts and researchers interested in replicating these PD models throughout the St. Louis region as well as nationally. These standards-based units, particularly those produced by MBGTI and EEP, would be especially useful for science teachers in local school districts.

## References

- Borman, K.M., Kersaint, G., Cotner, B., Lee R., Boydston, T., Uekawa, K., Kromrey, J.D., Katzenmeyer, W., Baber Y.M., & Barber J. (2005). *Meaningful urban education reform: confronting the learning crisis in mathematics and science*. New York: State University of New York Press.
- Borman, K.M., Clarke, C., Cotner, B., & Lee, R. (2006). *Cross-case analysis*. In J. Geen, G. Camilli, & P. Elmore (Eds.), *Complementary methods for research in education* (pp. 123-139). Washington, D.C., American Educational Research Association.
- Camino, L.A. (2004). What Can Anthropologists Offer Ethnographic Program Evaluation? *National Association for the Practice of Anthropology Bulletin 17(1)*, 41-57.
- Cotner, B., Herrmann, S., Borman, K. M., Boydston, T., & LeFloch, K. C. (2005, April). *A deeper look at implementation: School-level stakeholders' perceptions of Comprehensive School Reform*. Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada.
- Fetterman, D.M. (1988). Qualitative Approaches to Evaluating Education. *Educational Researcher, 17(8)*, 17-23.
- Kersaint, G., Borman K.M., Lee R., and Bodyston T.L. (2001). *Balancing the contradictions between accountability and systemic reform*. *Journal of School Leadership*, 11, 217-240.
- LeCompte, M.D. & Preissle, J. (2003). *Ethnography and Qualitative Design in Education Research*. San Diego, Academic Press.
- National Research Council (1996). *National Science Education Standards*. Washington, D.C.: National Academy Press.
- National Science Foundation (2002). *The 2002 User-Friendly Handbook for Project Evaluations*. Division of Research, Evaluation and Communication National Science Foundation.

## **Appendix A – Instrument Protocols**



**7. Current Employment:** \_\_\_\_\_

**8. Position Title:** \_\_\_\_\_

**9. When did you start your current position? (Month/Year):** \_\_\_\_\_

**10. What are your primary responsibilities?**

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

d. \_\_\_\_\_

**11. Previous positions (here or at other institutions):**

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

d. \_\_\_\_\_



*CISTL Director Interview  
2008*

## **CISTL Project Director Interview**

### **Background**

First, I would like to ask you questions about your role as the leader of the CISTL Leadership Council.

1. Describe your responsibilities as the Director of CISTL.
2. Describe your role as the leader of the Leadership Council.
3. In what ways has the Leadership Council made decisions about CISTL and its activities?
4. How is information about CISTL communicated to Leadership Council members? [Probe specifically about how info is communicated during periods between meetings?]
5. Describe how the Leadership Council has been kept informed about the activities of CISTL's projects as well as other organizational issues.
6. In what ways have CISTL's projects been aligned with its overall goals? [Probe for examples]
7. What have been strengths of the Leadership Council? [Probe for examples]
8. What were the weaknesses of the Leadership Council? [Probe for examples, specifically ask if they meet frequently enough]
9. Describe the ways that you are involved in CISTL projects. If yes, in what capacity?

### **Impact of CISTL**

Now I would like to ask you questions about CISTL's impact on the St. Louis science education.

10. In what ways has your participation in CISTL impacted you? [Probe about how participating in CISTL has furthered career goals]
11. In what ways has CISTL impacted science education in St. Louis? [Probe for examples of positive things that CISTL has done]
12. How has CISTL promoted or increased the involvement underrepresented groups such as ethnic minorities and women in science education? [Probe for examples]
13. What are some of the strengths of CISTL? [Probe for examples]

14. What are some of the weaknesses of CISTL? [Probe for examples and ask what could have been done to turn the weakness around]

15. In a collaboration like CISTL what would be the best way to improve communication between collaborators and partners? [Probe for specific examples]

16. Describe the ways that you think that the collaborations and partnership formed through CISTL will continue after it has officially ended? [Probe for specific examples]

17. Describe your plans to continue collaborating with the institutions and individuals that you have met through CISTL? [Probe for specific examples]

18. Please share with me any other thoughts that you have about your experience with CISTL.

*Thank you for taking the time to talk with me today.*



*Leadership Council Interview  
2008*

## **CISTL Leadership Council Interview**

### **Background**

First, I would like to ask you questions about your role as a member of the CISTL Leadership Council.

1. How did you become a member of the Leadership Council? When did you join the Leadership Council?
2. Describe your responsibilities as a member of the Leadership Council.
3. In what ways has the Leadership Council made decisions about CISTL and its activities?
4. How is information about CISTL communicated to Leadership Council members? [Probe specifically about how info is communicated during periods between meetings?]
5. Describe how the Leadership Council has been kept informed about the activities of CISTL's projects as well as other organizational issues.
6. In what ways have CISTL's projects been aligned with its overall goals? [Probe for examples]
7. What have been strengths of the Leadership Council? [Probe for examples]
8. What were the weaknesses of the Leadership Council? [Probe for examples, specifically ask if they meet frequently enough]
9. Describe the ways that you are involved in CISTL projects. If yes, in what capacity?

### **Impact of CISTL**

Now I would like to ask you questions about CISTL's impact on the St. Louis science education.

10. In what ways has your participation in CISTL impacted you? [Probe about how participating in CISTL has furthered career goals]
11. In what ways has CISTL impacted science education in St. Louis? [Probe for examples of positive things that CISTL has done]
12. How has CISTL promoted or increased the involvement underrepresented groups such as ethnic minorities and women in science education? [Probe for examples]
13. What are some of the strengths of CISTL? [Probe for examples]

14. What are some of the weaknesses of CISTL? [Probe for examples and ask what could have been done to turn the weakness around]

15. In a collaboration like CISTL what would be the best way to improve communication between collaborators and partners? [Probe for specific examples]

16. Describe the ways that you think that the collaborations and partnership formed through CISTL will continue after it has officially ended? [Probe for specific examples]

17. Describe your plans to continue collaborating with the institutions and individuals that you have met through CISTL? [Probe for specific examples]

18. Please share with me any other thoughts that you have about your experience with CISTL.

*Thank you for taking the time to talk with me today.*



*CISTL Personnel Interview  
2008*

## **CISTL Personnel Interview**

### **Background**

First, I would like to ask you questions about your role in CISTL.

1. Describe your responsibilities as a member of CISTL.
2. How are decisions made about CISTL and its activities?
3. How is information about CISTL communicated to you? [Probe for specifics]
4. Describe the ways that you are involved in CISTL projects. If yes, in what capacity?
5. Describe how you have been kept informed about the activities of CISTL's various projects.

### **Impact of CISTL**

Now I would like to ask you questions about CISTL's impact on the St. Louis science education.

6. In what ways has your participation in CISTL impacted you? [Probe about how participating in CISTL has furthered career goals]
7. In what ways has CISTL impacted science education in St. Louis? [Probe for examples of positive things that CISTL has done]
8. How has CISTL promoted or increased the involvement underrepresented groups such as ethnic minorities and women in science education? [Probe for examples]
9. What are some of the strengths of CISTL? [Probe for examples]
10. What are some of the weaknesses of CISTL? [Probe for examples and ask what could have been done to turn the weakness around]
11. In a collaboration like CISTL what would be the best way to improve communication between collaborators and partners? [Probe for specific examples]
12. Describe the ways that you think that the collaborations and partnership formed through CISTL will continue after it has officially ended? [Probe for specific examples]
13. Describe your plans to continue collaborating with the institutions and individuals that you have met through CISTL? [Probe for specific examples]
14. Please share with me any other thoughts that you have about your experience with CISTL.

*Thank you for taking the time to talk with me today.*



*Project Manager Interview  
2008*

## **CISTL Project Manager Interview**

### **Background**

First, I would like to learn about your project activities since we last spoke.

1. What project activities are currently ongoing?
2. Describe what changes (e.g. research questions, site, or methodology) have occurred in the final year of this project.
  - a. If yes, please explain why the change occurred.
  - b. Have you revised the scope of work to reflect these changes? If not, where are these changes documented? If yes, would you mind sharing these documents with me?
3. In what ways have your current position and responsibilities for this project changed?
4. What dissemination activities have occurred since we last visited? Would you mind sharing these documents with me?
5. Describe your plans for future publications.
6. What is your involvement in the CISTL Writer's group?
7. Describe how project outcomes were determined. [Probe: were any mechanisms in place to evaluate this project? Were pre-tests conducted? Ask for copies of results.]
8. How has did this project's activities align with CISTL's goals? [Probe for examples]
9. What are the strengths of the project? [Probe for examples]
10. What are the weaknesses of the project? What would you do differently if you were starting the project now? [Probe for examples]
11. Describe the ways that you are involved in other CISTL projects. If yes, in what capacity?
12. Describe how you have been kept informed about the activities of CISTL's projects. [Probe for specifics]
13. How are decisions made about CISTL and its overall activities? [Probe for specifics]
14. How is information about CISTL communicated to you? [Probe for examples]

## **Impact of CISTL**

Now I would like to ask you questions about CISTL's impact on the St. Louis science education.

15. In what ways has your participation in CISTL impacted you? [Probe about how participating in CISTL has furthered career goals]

16. In what ways has CISTL impacted science education in St. Louis? [Probe for examples of positive things that CISTL has done]

17. How has CISTL promoted or increased the involvement underrepresented groups such as ethnic minorities and women in science education? [Probe for examples]

18. What are some of the strengths of CISTL? [Probe for examples]

19. What are some of the weaknesses of CISTL? [Probe for examples and ask what could have been done to turn the weakness around]

20. In a collaboration like CISTL what would be the best way to improve communication between collaborators and partners? [Probe for specific examples]

21. Describe the ways that you think that the collaborations and partnership formed through CISTL will continue after it has officially ended? [Probe for specific examples]

22. Describe your plans to continue collaborating with the institutions and individuals that you have met through CISTL? [Probe for specific examples]

23. Please share with me any other thoughts that you have about your experience with CISTL.

*Thank you for taking the time to talk with me today.*



*Project Team Interview  
2008*

## **CISTL Project Team Interview**

### **Background**

First, I would like to learn about your project activities since we last spoke.

1. What project activities are currently ongoing?
2. Describe what changes (e.g. research questions, site, or methodology) have occurred in the final year of this project. If yes, please explain why the change occurred.
3. In what ways have your current position and responsibilities for this project changed?
4. What has been your role in the production of scholarly documents and other publications as well as conference presentations?
5. Describe your plans for involvement in future publications.
6. What is your involvement in the CISTL Writer's group?
7. How has did this project's activities align with CISTL's goals? [Probe for examples]
8. What are the strengths of the project? [Probe for examples]
9. What were the weaknesses of the project? What would you do differently if you were starting the project now? [Probe for examples]
10. Describe the ways that you are involved in other CISTL projects? If yes, in what capacity?
11. Describe how you have been kept informed about the activities of CISTL's various projects. [Probe for specifics]
12. How are decisions made about CISTL and its overall activities? [Probe for specifics]
13. How is information about CISTL communicated to you? [Probe for examples]

### **Impact of CISTL**

Now I would like to ask you questions about CISTL's impact on the St. Louis science education.

14. In what ways has your participation in CISTL impacted you? [Probe about how participating in CISTL has furthered career goals]

15. In what ways has CISTL impacted science education in St. Louis? [Probe for examples of positive things that CISTL has done]
16. How has CISTL promoted or increased the involvement underrepresented groups such as ethnic minorities and women in science education? [Probe for examples]
17. What are some of the strengths of CISTL? [Probe for examples]
18. What are some of the weaknesses of CISTL? [Probe for examples and ask what could have been done to turn the weakness around]
19. In a collaboration like CISTL what would be the best way to improve communication between collaborators and partners? [Probe for specific examples]
20. Describe the ways that you think that the collaborations and partnership formed through CISTL will continue after it has officially ended? [Probe for specific examples]
21. Describe your plans to continue collaborating with the institutions and individuals that you have met through CISTL? [Probe for specific examples]
22. Please share with me any other thoughts that you have about your experience with CISTL.

*Thank you for taking the time to talk with me today.*



*Doctoral Student Interview  
2008*

## **CISTL Doctoral Interview**

### **Background**

First, I would like to learn about your project activities as a doctoral student.

1. Describe how your dissertation topic is related to this project. When do you expect to complete your doctoral program?
2. What project activities are you currently involved in?
3. Describe what changes (e.g. research questions, site, or methodology) have occurred in the final year of this project. If yes, please explain why the change occurred.
4. What has been your role in the production of scholarly documents and other publications as well as conference presentations?
5. Describe your plans for involvement in future publications.
6. What is your involvement in the CISTL Writer's group?
7. How has did this project's activities align with CISTL's goals? [Probe for examples]
8. What are the strengths of the project? [Probe for examples]
9. What were the weaknesses of the project? What would you do differently if you were starting the project now? [Probe for examples]
10. Describe the ways that you are involved in other CISTL projects? If yes, in what capacity?
11. Describe how you have been kept informed about the activities of CISTL's various projects. [Probe for specifics]
12. How are decisions made about CISTL and its overall activities? [Probe for specifics]
13. How is information about CISTL communicated to you? [Probe for examples]

### **Impact of CISTL**

Now I would like to ask you questions about CISTL's impact on the St. Louis science education.

14. In what ways has your participation in CISTL impacted you? [Probe about how participating in CISTL has furthered doctoral degree and career goals]

15. In what ways has CISTL impacted science education in St. Louis? [Probe for examples of positive things that CISTL has done]
16. How has CISTL promoted or increased the involvement underrepresented groups such as ethnic minorities and women in science education? [Probe for examples]
17. What are some of the strengths of CISTL? [Probe for examples]
18. What are some of the weaknesses of CISTL? [Probe for examples and ask what could have been done to turn the weakness around]
19. In a collaboration like CISTL what would be the best way to improve communication between collaborators and partners? [Probe for specific examples]
20. Describe the ways that you think that the collaborations and partnership formed through CISTL will continue after it has officially ended? [Probe for specific examples]
21. Describe your plans to continue collaborating with the institutions and individuals that you have met through CISTL? [Probe for specific examples]
22. Please share with me any other thoughts that you have about your experience with CISTL.

*Thank you for taking the time to talk with me today.*



*C.A.D.R.E. Administrator Interview  
2008*

## **C.A.D.R.E. Administrator Interview**

### **Background**

First, I would like to ask you questions about your role as an administrator of the C.A.D.R.E. program.

1. What activities are currently ongoing with the C.A.D.R.E.? [Probe for descriptions of the new C.A.D.R.E.]
2. Describe what changes (e.g. admission, funding, course work) have occurred in the final year of CISTL's funding of the C.A.D.R.E. program.
3. In what ways have your current position and responsibilities for the C.A.D.R.E. program changed?
4. Describe your plans for future publications on the C.A.D.R.E. program
5. How has the C.A.D.R.E. program been aligned with CISTL's goals? [Probe for examples]
6. What are the strengths of the C.A.D.R.E. program? [Probe for examples]
7. What are the weaknesses of the C.A.D.R.E. program? What would you do differently if you were starting the project now? [Probe for examples]
8. What impact will the ending CISTL's funding of the C.A.D.R.E. program have on the doctoral students? [Probe for info on graduation timetable]
9. What impact will the ending CISTL's funding of the C.A.D.R.E. program have on its continuation/future? [Probe for specifics]
10. Describe any financial or other support that WashU and UMSL will provide to C.A.D.R.E. students once CISTL's funding ends.
11. After CISTL's funding of the C.A.D.R.E. program ends, describe how UMSL's partnership with WashU will go forward.
12. Describe how the C.A.D.R.E. program has impacted science education in St. Louis. [Probe for examples, any negatives?]
13. Describe the ways that you are involved in other CISTL projects. If yes, in what capacity?

## **Impact of CISTL**

Now I would like to ask you questions about CISTL's impact on the St. Louis science education.

14. In what ways has your participation in CISTL impacted you? [Probe about how participating in CISTL has furthered career goals]

15. In what ways has CISTL impacted science education in St. Louis? [Probe for examples of positive things that CISTL has done]

16. How has CISTL promoted or increased the involvement underrepresented groups such as ethnic minorities and women in science education? [Probe for examples]

17. What are some of the strengths of CISTL? [Probe for examples]

18. What are some of the weaknesses of CISTL? [Probe for examples and ask what could have been done to turn the weakness around]

19. In a collaboration like CISTL what would be the best way to improve communication between collaborators and partners? [Probe for specific examples]

20. Describe the ways that you think that the collaborations and partnership formed through CISTL will continue after it has officially ended? [Probe for specific examples]

21. Describe your plans to continue collaborating with the institutions and individuals that you have met through CISTL? [Probe for specific examples]

22. Please share with me any other thoughts that you have about your experience with CISTL.

*Thank you for taking the time to talk with me today.*



*Teacher Interview*  
*2008*

### **CISTL Teacher Interview**

1. What grade(s) and science subjects do you teach?
2. As you know, your district has been involved in an NSF-supported Center for Inquiry in Science Teaching and Learning (CISTL). To what extent have you participated in CISTL's activities since becoming involved in the project (e.g., number of hour/days)?

PROBE for both summer and academic year activities.

3. How do you feel about the professional development provided by CISTL?
4. Looking back, how has CISTL affected you and your teaching?  
PROBE for examples of changes, especially science inquiry
5. **If teacher reports changes:**
  - a. Are there any policies or practices in your school or district that you believe will help you to maintain or even expand the changes you have made in your teaching as a result of being involved with CISTL?
  - b. Are there any school and district policies or practices that you believe will limit your ability to sustain the changes you have made in your teaching?

**If teacher reports *no* changes:**

- c. What factors have limited the impact of the CISTL on you or your teaching?
  - d. Are there particular school or district policies or practices that have hindered your efforts to implement the kind of instruction advocated by the CISTL?
6. Are there any characteristics of the CISTL that have been particularly helpful to you?  
PROBE for examples
  7. What else could CISTL have provided, to support your efforts toward improving your science instruction?

**For teachers who have participated in leadership development:**

8. To what extent have you grown as a leader of science reform in your school or district since becoming involved in CISTL?  
PROBE for specific examples of growth.
9. Do you have any other comments you would like to share?

## Appendix B – CISTL Publications and Presentations

Please add the following:

Tate, W. F. (2008). Putting the “Urban” in mathematics education scholarship. *Journal of Urban Mathematics Education*.

Tate, W. F. (2008). The political economy of teacher quality in school mathematics: African American males, opportunity structures, politics, and method. *American Behavioral Sciences*.

Tate, W. F. (2008, April). The Geography of Opportunity: Poverty, Place, and Educational Outcomes. Presidential Lecture, Annual Meeting of the American Educational Research Association.

Tate, W. F., & Rousseau, C. (2007). Engineering change: Research, policy, and practice. In F. K. Lester (Ed.), *Second Handbook of Research on Mathematics Teaching and Learning*. Charlotte, NC: Information Age Publishing.

Tate, W. F. (2008, April). *Science and Metropolitan America: Research and Civic Responsibility*, University of Illinois, Bureau of Educational Research 2007-2008 Seminar Series, Urbana, Illinois.

Tate, W. F. (2008, April). *The Political Arithmetic of Metropolitan Education: Moving Beyond Uncertainty in Mathematics, Engineering, Technology, and Science (METS) Leadership*. Invited Keynote Lecture, National Council of Supervisors of Mathematics Annual Conference, Salt Lake City, Utah, 2008.

Tate, W. F. (2007, June). *Supporting the Advancement of Science Education with Geospatial Mapping*, 13<sup>th</sup> Annual Coalition for National Science Funding Exhibition, Rayburn House Office Building, Washington, DC.

Tate, W. F. (2007, November). *The Metropolitan Challenge in Science Education*, Invited Speaker, Annual Meeting of the Consortium of Social Science Associations, Washington DC.

Tate, W. F. (2007, October). *Knowledge Workers and the Need for Opportunity Expansion Regimes in Urban America*, Invited Keynote Lecture, National Education Association [Research Division], Washington, DC, 2007.

Tate, W. F. (2007, November). The Political Arithmetic of Opportunity in Science. Invited Keynote Lecture, Benjamin Banneker Association National Forum, Georgia State University, Atlanta, Georgia, 2007.

Tate, W. F. (2007, August). *Educational Opportunity in an Emerging Biotechnology Region*. Invited Keynote Lecture, University of Memphis, Urban Education Initiative, Memphis, Tennessee.

Tate, W. F. (2006, January). *Partnership, Civic Capacity, and Systemic Change in Science*. Invited Lecturer, Dean's Lecture Series, University of North Carolina, Chapel Hill, North Carolina, 2006.

## CISTL Publications and Presentations

Products from 2008	Citation
<b>Journal articles</b>	
	Hogrebe, M., Kyei-Blankson, L., & Zou, L. (2008, July) Examining regional scientific attainment and school-teacher resources using GIS. <i>Education and Urban Society</i> .
	Tate, William F. (October 2008) Geography of Opportunity: Poverty, Place, and Educational Outcomes. <i>Educational Researcher</i> .
<b>Conference papers</b>	
	Michael Dawson (2008, March) <i>Animal Handling Training Consistency: A Process for the Development of a Consistent Animal Handling Practice</i> . Presented at the meeting of the Regional Meeting of the Association of Zoos and Aquariums.
	Kassing, Sharon, Kelly, Lisa and Bradshaw, Louise (September 2008) <i>Emotional Connections between People and Animals: Affective Transformation in Practice</i> . Paper presented at the 2008 Association of Zoos and Aquariums Annual Conference, Milwaukee, Wisconsin.
<b>Posters</b>	
	Cotner, Bridget, Smith, Chrystal A.S., & Borman, Kathryn M. (2007, November) <i>Building Capacity in Science: Evaluation of a Science Inquiry Center</i> . Poster displayed at the 2008 American Evaluation Association annual conference, Denver, Colorado.
Products from 2007	Citation
<b>Conference papers</b>	
	Hogrebe, M. C., Kyei-Blankson, L., & Zou, L. (2007, June) <i>Geospatial perspectives of school, teacher, and student variables: Focus on recently de-accredited St. Louis City School District</i> . Presented at the GIS ESRI national conference, San Diego, CA.
	Gay, A. (2007, August) <i>Chemistry content transfer from professional development to the K-8 classroom: Teachers' motivations and adaptations</i> . Paper presented at the 234th national meeting and exposition of the American

Chemical Society (ACS).

Gay, A. (2007, April)

*Pedagogical contexts in chemistry content professional development to facilitate persistence in teacher learning.* Presentation at NARST annual conference, New Orleans, Louisiana.

Balcerzak, P., Bouchard, L., & Iverson, J. (2007, April)

*Learning progression on DNA and protein synthesis: A tool for analysis and effecting change in science curricula.* Presentation at NARST annual conference, New Orleans, Louisiana.

Berkes, E., & Hogrebe, M. C. (2007, April)

*Undergraduate laboratory research, persistence in science, and the effect of self-efficacy beliefs: A quantitative study.* Presentation at the American Educational Research Association national conference, Chicago, IL.

Hogrebe, M. C., & Kyei-Blankson, L. (2007, April)

*Educational quality in regions that are divided: Proficiency by state lines.* Presentation at the American Educational Research Association annual conference, Chicago, IL.

Balcerzak, P., Hogrebe, M., Iverson, J., Kelly, L., & McNew, J. (2007, March)

*PDI WUSO pathway session: leadership as collaboration—strategies toward the establishment of learning communities.* Presentation at the National Science Teachers Association national conference, St. Louis, MO.

Balcerzak, P., Bouchard, L., Gay, A., Hogrebe, M., Iverson, J., & McNew, J. (2007, January)

*Design of a k-12 learning progression in sub-cellular processes: implications for educators and policy-makers.* Presentation at the Association for Science Teacher Education national conference, Clearwater Beach, FL.

Borman, Kathryn M., Smith, Chrystal A.S., Cotner, Bridget, & Lee, Reginald S. (2007, January)

*Evaluation of a National Science Foundation Center for Learning and Teaching: A Mixed Methods Approach.* Presentation at the Association for Science Teacher Education national conference Clearwater, FL.

## Posters

Borman, Kathryn M., Smith, Chrystal A.S., Cotner, Bridget, & Lee, Reginald S. (2007, March)

*Using Anthropological Approaches to Evaluate a National Science Foundation Center for Learning and Teaching.* Poster displayed at the 2007 Society for Applied Anthropology Annual Conference, Tampa, FL.

Products from 2006	Citation
<b>Journal articles</b>	<p>Astor-Jack, T., Balcerzak, P., Klein, C., &amp; McCallie, E. (in press). Professional development provider views: A comparison between university and informal science educators. <i>Science Education</i>.</p> <p>Astor-Jack, T., Balcerzak, P., &amp; McCallie, E. (in press). Professional development and the historical tradition of informal science institutions: Views of four providers. <i>Canadian Journal of Science, Mathematics and Technology Education</i>.</p> <p>Seiler, G. &amp; Elmesky, R. (in press). The role of communal practices in the generation of capital and emotional energy among African American students in science classrooms. <i>Teachers College Record</i>.</p> <p>Shen, J., Gibbons, P.C., Wieggers, J.F., &amp; McMahon, A. (2005, submitted). Using research based assessment tools in professional development – electricity &amp; magnetism</p> <p>Tate, W.F. &amp; Malancharuvil-Berkes, E. (2006). A contract for excellence in scientific education: May I have your signature please? <i>Journal of Teacher Education</i>, 57(X), 1-8.</p> <p>Tate, W. &amp; Zurawsky, C. (2006) Do the math: cognitive demand makes a difference. <i>AERA Research Points; Essential Information for Education Policy</i> (Vol 4, Issue 2). <a href="http://www.aera.net/publications/?id=314">http://www.aera.net/publications/?id=314</a></p>
<b>Book chapters</b>	<p>Elmesky, R. (in press). Poverty and science teaching and learning. In Tobin, K. <i>Science education encyclopedia</i>.</p> <p>Elmesky, R. (in press). Students as researchers: Creating new identities. In Tobin, K. <i>Science education encyclopedia</i>.</p> <p>Sawyer, R.K. (Ed.). (in press). <i>Cambridge handbook of the learning sciences</i>. New York: Cambridge University Press.</p> <p>Sawyer, R.K. (in press). Preface. In Sawyer, R.K. (Ed.), <i>Cambridge handbook of the learning sciences</i>. New York, Cambridge University Press.</p>

Sawyer, R.K. (in press). The schools of the future. In Sawyer, R.K. (Ed.), *Cambridge handbook of the learning sciences*. New York, Cambridge University Press.

### Conference papers

Hogrebe, M. C., Kyei-Blankson, L., & Zou, L. (2006, August) *Using GIS to examine regional science and mathematics attainment*. Presented at the GIS ESRI national conference, San Diego, CA.

Shen, J. (2006, April). *Understanding balance: Tool or model?* Paper presented at the meeting of the National Association for Research in Science Teaching, San Francisco, CA.

### Posters

Hogrebe, M. C., Kyei-Blankson, L., & Zou, L. (2006, November) *Using GIS in educational research*. Presented at the Washington University GIS User Conference, St. Louis, MO. Poster Recognition Award.

Barco, D. & Tate, W. (2006, February). *CISTL: Center for inquiry in science teaching and learning*. Poster session presented at the annual CLT PI meeting, Washington, DC.

Gay, A. (2006, February). *Investigating the effects of pedagogical contextualization of science content in K-8 professional development*. Poster session presented at Washington University's Post-doc Symposium, St. Louis, Missouri.

Iverson, J. (2006, February). *Communication styles and methods for centers for learning and teaching*. Poster session presented at the annual CLT PI meeting, Washington, DC.

Kyei-Blankson, L. & Hogrebe, M. (2006, February). *Science attainment in St. Louis area school districts*. Poster session presented at the annual CLT PI meeting, Washington, DC.

Shen, J. (2006, February). *Teaching strategies and conceptual change of science teachers of K-8*. Poster session presented at the annual CLT PI meeting, Washington, DC.

Turner, T.Y., Astor-Jack, T., Galganski, M., Corse, J., Mulvihill, T., Seger, L., & Jordan, J. (2006, February). *The achievement gap and cognitive development in early elementary science*. Poster presented at the American Association for the Advancement of Science annual

conference, St. Louis, Missouri.

**Press releases,  
Tech briefs,  
Magazine articles,  
Other reports**

Hogrebe, M.C., Kyei-Blankson, L., & Zou, L. (December 31, 2006). *Science attainment by content strands in St. Louis area school districts: Technical Report*. St. Louis, MO: Washington University, Center for Inquiry in Science Teaching and Learning.

Hogrebe, M.C., & Kyei-Blankson, L. (December 31, 2006). *Science attainment in St. Louis area school districts 2006 Update: Tech Brief No. 3*. St. Louis, MO: Washington University, Center for Inquiry in Science Teaching and Learning.

Hogrebe, M.C., Kyei-Blankson, L. (2006). *Mathematics attainment in St. Louis Area School Districts: Critical knowledge for advanced science learning*. (Tech Brief No. 2). St. Louis: Washington University in St. Louis, Department of Education & Center for Inquiry in Science Teaching and Learning.

Hogrebe, M.C., Kyei-Blankson, L. (2006). *Science attainment in St. Louis area school districts*. (Tech Brief No. 1). St. Louis: Washington University in St. Louis, Department of Education & Center for Inquiry in Science Teaching and Learning.

**Products from  
2005**

**Citation**

**Journal articles**

Elmesky, R. (2005). "I am science and the world is mine": Embodied practices as resources for empowerment. *School Science and Mathematics*, 105(7), 335-342.

Elmesky, R. (2005) Rethinking Qualitative research: Research participants as central researchers and enacting ethical practices as habitus. *Forum: Qualitative Social Research*. 6(3), <http://www.qualitative-research.net/fqs-texte/3-05/05-3-36-e.htm>

**Book chapters**

Seiler, G. & Elmesky, R. (2005). The who, what, where and how of our urban ethnographic research. In Tobin, K., Elmesky, R. & Seiler, G. *Improving urban science education: New roles for teachers, students and researchers*. NY: Rowman and Littlefield.

Tate, W.F. (2005). *Brown*, political economy, and the scientific education of African Americans. In R. E. Floden (Ed.), *Review of Research in Education*. Washington, DC: American Educational Research Association.

### Books

Rowe, S. (2005). Discourse in activity and activity as discourse. In R. Rogers (Ed.), *Collection: An introduction to critical discourse analysis* (pp. 79-96). New York: Lawrence Erlbaum.

Tate, W. F., & Rousseau, C. (in press). Engineering change: Research, policy, and practice. Handbook for research in mathematics education.

### Books (cont'd)

Tobin, K., Elmesky, R. & Seiler, G. (2005). *Improving urban science education: New roles for teachers, students and researchers*. NY: Rowman and Littlefield.

### Conference papers

Astor-Jack, T., Balcerzak, P., & McCallie, E. (2005, April). *Professional development provider views: A comparison between institutions of higher education & informal science institutions*. Paper presented at the annual meeting of the National Association of Research on Science Teaching, Dallas, TX.

Astor-Jack, T., Turner, T.Y., & Galganski, M. (2005, April). *Developing non-written tests of science process skills for kindergartners*. Paper presented at the meeting of the National Association for Research in Science Teaching, San Francisco, CA.

Astor-Jack, T., & McCallie, E. (2005, August). *The historical tradition of informal science institutions & professional development*. Paper presented at the Bay Area Institute, San Francisco, CA.

Balcerzak, P., & Gay, A. (2005, February). *Professional development: A regional continuum for teachers*. Symposium conducted at the Association for the Educational of Teachers of Science International Conference (AETS), Colorado Springs, CO.

Coulter, R. (2005, July). *Using geodata for school reform*. Paper presented at the annual Environmental Systems Research Institute conference, San Diego, CA.

Gay, A. (2005, April). *Using the DEOI Method: Student responses to a process-based laboratory notebook and report writing methodology in organic chemistry*. Paper presented at the annual meeting of the

National Association for Research in Science Teaching (NARST),  
Dallas, TX.

Kelly, L. (2005, May). *Middle-and high-school students' science research internships: A review of the research*. Annual Spring Forum, Department of Education, Washington University, St. Louis, MO.

### Conference papers (cont'd)

Shen, J., Gibbons, P.C., Wiegers, J.F., & McMahon, A. (2005, April). *A framework of a professional development program for K-8 science teachers*. Proceedings of the 2005 Annual Conference of National Association for Research in Science Teaching.

Shen, J. (2005, April). *Conceptual change of K-8 science teachers in Force and Motion*. Paper presented at the Missouri Academy of Science, Jefferson City, MO.

Shen, J. (2005, May). *Conceptual change of K-8 science teachers in buoyancy*. Annual Spring Forum, Department of Education, Washington University, St. Louis, MO.

Shen, J. (2005, August). *Conceptual change of K-8 science teachers in buoyancy*. Paper presented at the annual meeting of the American Association of Physics Teachers, Salt Lake City, UT.

### Posters

Gay, A., Shen, J., Maloney, A., Balcerzak, P., & Confrey, J. (2005, January). CISTL professional development bundles: Investigating impact on teacher conceptual development. Poster session presented at the Association for the Education of Teachers of Science International Conference (AETS), Colorado Springs, CO.

Gay, A., Shen, J., Maloney, A., Balcerzak, P., & Confrey, J. (2005, February). CISTL professional development bundles: Content course design and teacher conceptual development. Poster session presented at the fourth Annual Centers for Learning and Teaching Principal Investigator (CLT-PI) meeting, Washington, DC.

McNew, J. (2005, February). Investigating teacher retention. Poster session presented at the Fourth Annual Centers for Learning and Teaching Principle Investigator (CLT-PI) Meeting, Washington, DC.

McNew, J. (2005, May). Investigating teacher retention. Annual Spring Forum, Department of Education, Washington University, St. Louis, MO.

### Posters

Turner, T. (2005, February). The achievement gap and cognitive development in early elementary science education. Poster session presented at the Fourth annual Centers for Learning and Teaching Principle Investigator (CLT-PI) Meeting, Washington, DC.

### Press releases, Tech briefs, Magazine articles, Other reports

Klein, C. (2005). Structure of professional development: A regional analysis. *CISTL white paper*.

Fadigan, K., & Beane, D. (2005, August). *St. Louis science center's youth exploring science (YES) teen/CISTL program, 2003-2004*. A report submitted as part of the NSF/CISTL sub-award agreement with the Association of Science-Technology Centers.

### Products from 2004

### Citation

### Conference papers

Astor-Jack, T. (2004, October). *Professional development provider views: How do universities and informal science institutions differ?* Paper presented at a Research Seminar, University of Missouri, St. Louis, MO.

### Products from 2003

### Citation

### Journal articles

Rowe, S. (2003). Visitors and voices: A dialogic approach to learning in science museums. *Journal of Museum Education*. 28(2), 3-7.