HAS INQUIRY MADE A DIFFERENCE?
A SYNTHESIS OF RESEARCH ON THE IMPACT OF INQUIRY SCIENCE INSTRUCTION ON STUDENT OUTCOMES

Technical Report 1:
Generating the Synthesis Sample of Studies

The Inquiry Synthesis Project

Center for Science Education

Education Development Center, Inc.

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PROJECT OVERVIEW

With funding from the National Science Foundation (NSF), the Center for Science Education (CSE) at Education Development Center, Inc. (EDC), is conducting a synthesis of research that will answer the question, What is the impact of inquiry science instruction on student outcomes?

This project includes three broad phases. **Phase I—Report Collection**: This phase involved conducting a search for research reports that met the criteria described below. The search was shaped by the objective of "casting a broad net" in order to identify and retrieve all reports that could potentially be part of the synthesis.[1] **Phase II—Coding Process**: Once retrieved, reports entered this phase, which comprised three stages. In stage 1—**inclusion/exclusion**—each report was carefully screened and coded to determine if the inclusion criteria were met. These criteria include the following: the report focused on a science instructional intervention; the report included student outcomes; the outcomes were directly related to the instructional intervention; the report was completed between January 1, 1984, and December 31, 2002; the study was conducted with K–12 students; and the intervention was described with sufficient specificity. Reports that met all of these criteria were included in the synthesis dataset. Details about the development of the codebook used for the inclusion/exclusion coding and the process for establishing interrater agreement will be provided in *Technical Report 3: Operationalizing the Inclusion/Exclusion Coding Process.*

Stage 2 of the coding process, **inquiry instruction description**, involved developing and applying a detailed coding schema to describe the instructional intervention. This descriptive methodology is the subject of *Technical Report 5: Operationalizing the Inquiry Science Instruction Coding Process. Technical Report 2: Conceptualizing Inquiry Science Instruction,* articulates the theoretical underpinnings of the coding protocol used to code inquiry instruction. Stage 3 of coding, **research rigor, context, and study findings**, involved capturing all other relevant information about the methodological integrity of the research, the context of the study, covariates, comparison treatments, and study findings. The third stage of coding will be the subject of future technical reports produced in the next few months.

Each stage of Phase II afforded an opportunity to exclude a report or study due to misalignment with the data requirements of the synthesis. To remain included, reports/studies were required to include the appropriate variables, to provide sufficient information to code the variables of interest, and to present evidence of a minimum threshold for inquiry science instruction. While the search for reports in Phase I was broad to better ensure that all eligible studies would be found, it was understood that a broad search would result in the collection of some number of reports that would not meet the minimum criteria. Thus, this multi-step process was designed to refine and narrow the sample of studies included in this synthesis.

Phase III of the project includes the analysis and dissemination of results.

TECHNICAL REPORT INTRODUCTION

This technical report, *Generating the Synthesis Sample of Studies*, describes Phase I, the process of identifying and retrieving reports that began with the development of the search criteria at the outset of the project (September 2001) and came to a close on December 31, 2002. This technical report describes the initial search criteria, the potential sources of research reports and procedures followed to access them, and collection procedures. The last section provides a summary of the numbers of reports collected and the total number, sources and characteristics of those included in the final report dataset.

SEARCH CRITERIA

Reports of studies eligible for inclusion in Phase I could (1) be quantitative and/or qualitative; (2) be published or unpublished; (3) be foreign or domestic; (4) take place in a range of settings (e.g., classrooms, after-school programs, or science museums); and (5) rest anywhere on the continuum from formal,

[1] There is a purposeful distinction made throughout this technical report between a "report" and a "study." Often authors disseminate multiple reports from a single study. From Phase I through Phase II–stage 1, reports are the primary unit of interest. From Phase II–stage 2 through Phase III, studies (which could be represented by multiple reports) are the primary unit of interest. For a fuller description see "Completing Phase II–stage 1" located prior to the Appendices of this report.

structured, experimental models to non-experimental but purposeful information gathering undertaken by school district administrators and other practitioners. Reports on studies that met the following four criteria were obtained:

- examine one or more aspects of inquiry science teaching;
- assess student outcomes (e.g., science subject matter content knowledge, inquiry content knowledge, science attitudes, attitudes about instruction, school attendance, science course enrollment, science career choice, historical/social perspectives in science, participation in class, motivation, etc.);
- be completed between January 1, 1984, and December 31, 2002; and
- focus on students within the K–12 population.

SOURCES FOR REPORTS

Electronic Searches

The majority of the reports included in the synthesis were identified through electronic database searches. The searches included a series of systematic queries based on a wide range of search terms that have been used to describe and discuss inquiry science instruction over the two decades covered by the synthesis. A total of 123 terms and combinations across 15 databases were used (see Appendix A of this report for terms). The Web sites that housed the databases include ERIC database (http://www.eric.ed.gov); Dissertation Abstracts Online (http://wwwlib.umi.com/dissertations); ENC Online (http://www.enc.org/); PsycINFO Direct (http://www.psycinfo.com); Campbell Collaboration (http://www.campbellcollaboration.org); The National Teaching and Learning Forum (http://www.ntlf.com); Dialog Online Documentation (http://library.dialog.com); OVID (http://www.ovid.com, http://www.silverplatter.com); Ohio University Libraries (http://www.library.ohiou.edu); IPENET Electronic Directory of Dissertation Abstracts (http://csf.colorado.edu/ipe/phd.html); Dialog DataStar (http://www.datastarweb.com); Association of Science-Technology Centers Incorporated (http://www.astc.org); Museum Learning Collaborative (http://museumlearning.com/default.html); Ingenta (http://www.ingenta.com); Infotrieve (http://www4.infotrieve.com/index.asp). Additionally, general Web searches were conducted using standard search engines, including Google (http://www.google.com); and Yahoo (http://www.yahoo.com).

Calls for Research

In the interest of collecting as many eligible reports as possible, it was vital to inform other professionals of the synthesis study to provide them with the opportunity to contribute research that met the search criteria but did not appear in any of the electronic searches. To reach a wide audience of professionals in science education and other disciplines, the research team placed a "Call for Research" in periodicals (see Appendix B), and on Web sites and electronic mailing lists of professional organizations, including *Education Week*, the *Chronicle of Higher Education*, *NSTA Reports*, the American Educational Research Association, and the Association for the Education of Teachers of Science. Additionally, the call for research was posted on the home page of the Center for Science Education Web site (http://cse.edc.org).

Direct Inquiries to Organizations

The research team assembled a list of 79 organizations with an interest in the field of education and contacted them directly to inform them of the synthesis project, ask them to share this information with appropriate members, and invite submission of reports for possible inclusion. Organizations were contacted by mail and by telephone. If the research team received no response, appropriate follow-up contacts were made. The organizations included corporate and federal funders of education research and their grantees, teachers unions, research and development organizations, and professional and educational organizations. A complete list of those contacted is included in Appendix C; the contact letter is included in Appendix D; and the phone script used for contact calls is included in Appendix E. Detailed records of all communications were maintained and filed.

Reference Lists

To ensure that the identification and retrieval process was thorough, the research team reviewed the reference list of research reports that were obtained. Titles of referenced reports that appeared to be relevant to this synthesis were identified, located abstracts were reviewed, and, if deemed promising, a report was retrieved and added to the inclusion/exclusion coding stage. Though time consuming to identify potentially eligible

reports from their reference information alone, this strategy proved to be effective in locating a great number of studies.

PROCEDURE FOR COLLECTION OF RESEARCH REPORTS

Once the reference information of a potentially eligible report was identified in one of the data sources, we tried to locate an abstract to determine if the report was likely to meet the search criteria. If information in the abstract indicated that the report was likely to be eligible for the synthesis (or if no abstract was available), it was assigned an identification number in the project's "Source table" (located in a project-specific Access database) and bibliographic information was entered. This database table was designed to assist in the report tracking process of Phase I. Reports were retrieved from libraries in the Boston area and libraries throughout the United States via interlibrary loan, from ERIC Document Retrieval Service (EDRS), and from other Web sources, as noted above. In some cases, although the title and/or abstract suggested a report might be eligible for inclusion, once retrieved, a closer review revealed that, in fact, it did not meet the criteria for inclusion; thus, it was abandoned before entering Phase II. Other reports were abandoned because they could not be obtained. A notation of search abandonment for each of these reports was made in the Source table. Books that were not available at libraries were sought using commercial options, such as Amazon (www.amazon.com) and, for used books, Alibris (www.alibris.com).

After retrieval, appropriate reports entered Phase II–stage 1, and were coded for data about the research questions asked, student outcomes measured, and data sources for these outcomes.

The search for new reports from all sources other than those obtained from reports' reference lists was terminated on December 31, 2002. Reference checking continued to locate new reports until the end of February 2004. At this point, the capture rate[2] for new reports was 5% and the percentage of repetitively identified reports[3] was 34%. To continue checking references with such low success rates was deemed to be too unproductive and inefficient, and so the process was terminated.

LIMITATIONS TO REPORT COLLECTION PROCESS

The report identification and collection strategies outlined above, while providing for a rigorous and thorough search, nevertheless had some unavoidable technical and logistical limitations. For example, even though a report may have been published during the appropriate time period, it may not have appeared in an electronic database during the time of our search. Likewise, an unpublished report may have been submitted to a database during the time of our search but may not have been made available through that database until after our search was completed. Other reports could have been missed due to the database descriptors used to identify them. Keywords are not consistently applied by database service providers so possibly appropriate articles with inconsistent or unexpected keywords could have been inadvertently overlooked. The reference checking process also had limitations since document titles were not necessarily sufficiently descriptive to indicate whether or not a report pertained to the impact of science instruction on students. Thus potentially appropriate reports could have been overlooked. Further, even when a title provided sufficient cause to locate and review an abstract, if the abstract itself did not provide further information confirming that the document was likely to meet the screening criteria, the document was not obtained.

Once a document was deemed appropriate, the process of obtaining that document was not always successful. Many electronic documents were readily available, but in some cases, the excessive cost of obtaining a copy ($\geq$ \$75) resulted in exclusion. The accessibility of non-electronic media was more limited. When not available electronically, reports had to be obtained through libraries that sometimes had incomplete collections or through interlibrary loan requests (especially for theses and dissertations) that did not always prove to be reliable. Similarly, some books were not obtainable due to their out-of-print status. The resulting sample that was generated given these limitations is described below.

[2] Number of new reports found to meet the inclusion criteria (3) divided by the number of reports (58) identified by title in the reference lists of studies currently being coded as possibly suitable for inclusion.
[3] Reports that were found to be relevant *and* had already been identified and retrieved.

INITIAL SYNTHESIS SAMPLE OF REPORTS

In Phase I, through review of the title and the abstract (if available), a total of 1,027 documents were identified as potentially meeting the inclusion criteria. Of these, 207 (20%) were abandoned and did not enter Phase II–stage 1, either because they were not retrievable (88, 9%) or because upon closer inspection, they were deemed not appropriate because they did not meet the inclusion criteria (119, 12%). The 820 (80%) remaining documents, contained 913 reports that were coded for inclusion/exclusion in Phase II–stage 1. Of these reports, 443 (49%) met the inclusion criteria and 470 (51%) were excluded.

Table 1 below illustrates the distribution of reports by research method, year of publication, type of publication, and the grade level(s) of students investigated in the studies.

Table 1: Report Distribution

Report Categories	# of Reports	% of total
	n = 443	
Research Method of Study		
Quantitative	*138*	*31*
Qualitative	*169*	*38*
Mixed	*136*	*31*
Student Outcomes—most frequently reported[a]		
Science content knowledge	*301*	*68*
Inquiry content knowledge	*279*	*63*
Attitudes toward science instruction	*104*	*23*
Attitudes toward science	*97*	*22*
Other[b]	*88*	*20*
Type of Publication		
Unpublished (conference papers, dissertations, masters theses)	*106*	*24*
Published (journal articles, research books, research documents)	*337*	*76*
Grade Level(s) Investigated		
Elementary (K–5)	*93*	*21*
Middle (6–8)	*138*	*31*
High (9–12)	*155*	*35*
Multi-grade (crosses the grade spans above)	*57*	*13*
Study Characteristics		
Location		
Foreign	*99*	*22*
Domestic	*341*	*77*
Foreign and domestic	*2*	*0*
Density		
Rural	*36*	*8*
Suburban	*82*	*19*
Urban	*128*	*29*
Combination	*34*	*8*
Not reported	*163*	*37*
Year of Publication		
1984–1988	*63*	*14*
1989–1993	*109*	*25*
1994–1998	*136*	*31*
1999–2002	*135*	*30*

[a] These categories are not mutually exclusive because a single document may report on more than one student outcome.
[b] Outcomes in the "Other" category include historical/social perspectives, participation, motivation, career choices, self-confidence, attendance, and course enrollment.

Table 2 illustrates the distribution of reports by source.

Table 2: Reports by Source

Source of Report	# of Reports	% of total
Electronic Searches	*193*	*44*
Calls for Research and Inquiries to Organizations	*69*	*16*
Reference Lists	*181*	*41*
Total number of reports included in the sample	**443**	

COMPLETING PHASE II–STAGE 1

The final step of Phase II–stage 1 was a process that entailed differentiating between "documents," "reports," and "studies." It is not uncommon for investigators to produce multiple reports/articles from a single study. However, in conducting a meta-analysis or synthesis, each study should contribute equally to any one analysis. Thus, if investigators of a study produced three different reports that each were identified, that study would have the potential to be weighted more heavily in an analysis than a study with only one report, thus introducing unwanted bias into the synthesis results. Therefore, cleaning of the initial sample of reports was conducted to identify those studies for which more than one research report had been identified. Those reports were consolidated in the process of Phase II–stage 2 coding so that each discrete study had only one record in a newly created database "Study table." Each record in this table includes information on the instructional treatment, research rigor, context, and study findings. Information detailing the study-report reconciliation process can be found in *Technical Report 4*. Below is a summary of the inclusion decisions that shaped the final sample and the resulting reductions in sample size as a result of these exclusions.

SUMMARY OF INCLUSION AND EXCLUSION DECISIONS THAT SHAPED THE FINAL SAMPLE

Studies that Proceeded to Phase II:

- examined one or more aspects of inquiry science teaching;
- assessed student outcomes (e.g., science subject matter content knowledge, inquiry content knowledge, science attitudes, attitudes about instruction, school attendance, science course enrollment, science career choice, historical/social perspectives in science, participation in class, or motivation);
- were completed between January 1, 1984, and December 31, 2002; and
- focused on students within the K–12 population.

Studies that Proceeded to Stage 2:

- were research endeavors that systematically collected data under a single research plan from a designated sample of respondents to answer one or more research questions;
- had at least one research question that was about the effect of a student instructional intervention in science on student outcomes;
- had at least one student instructional intervention in science that was described with sufficient specificity;
- clearly reported student outcomes;
- *were not* basic developmental research studies where the intent of the research was an improved understanding of cognition, of how students learned, and/or of how they processed information; and
- *were not* studies of teacher professional development interventions unless the research included information about the impact of that professional development on classroom instruction and student outcomes.

Studies that Proceeded to Stage 3 Had an Instructional Intervention that Had:

- some type of student engagement with science content as evidenced by: students physically manipulate materials; students watch scientific phenomena; students watch a demonstration of scientific phenomena; students watch a demonstration that is NOT of scientific phenomena but is of scientific processes or the use of scientific apparatus or data collection aids; or students use secondary sources about science content;

- some or a lot of emphasis was present in one of the inquiry domain elements (student active thinking, student responsibility for learning, student motivation);
- science as inquiry, physical science, life science, earth/space science or general science were covered in the instruction; and
- *were not* longitudinal studies.

Studies Included for Final Analysis:
- had sufficient information to clearly determine the presence or absence of at least three (a majority) of the five components of instruction;
- had student understanding or retention of science facts, concepts, or principles and theories in physical science, life science or earth/space science was a dependent variable for the study;
- had explicit instruction in either physical, life, and/or earth/space science (not just general science);
- had one instructional treatment that could be distinguished from others as exhibiting more inquiry instruction based on our coding protocols (i.e., a treatment of interest);
- *were not* descriptive investigations;
- *were not* conducted in museum contexts; and
- *were not* case studies of individual students.

Table 3: Sample Reductions at Each Phase of Coding

Project Phase	**Number at Beginning of Phase**			**Number Remaining at End of Phase**		
	Documents	**Reports**	**Studies**	**Documents**	**Reports**	**Studies**
Phase I: Document Collection	1027			820	913	
Phase II: Stage 1, Inclusion		913			443*	
Stage 2, Instruction			364			282
Stage 3, Rigor			282			138

*described in detail in Tables 1 and 2 above.

ADDITIONAL INFORMATION

For more information on this or other CSE research projects or to view additional technical reports, visit http://cse.edc.org/work/research/

Inquiry Project Staff
Daphne D. Minner, Ph.D., Principal Investigator (dminner@edc.org)
Abigail Jurist Levy, Ph.D., co-Principal Investigator
Jeanne Rose Century, Ed.D., co-Principal Investigator (August 2001-July 2005)
Erica S. Jablonski and Erica T. Fields, Research Associates

Appendix A

ELECTRONIC SEARCH TERMS

1. action research & inquiry science
2. action research & inquiry science & outcomes or achievement or performance or assessment
3. action research & hands-on science
4. action research & hands-on science & outcomes or achievement or performance or assessment
5. authentic assessment & science
6. constructivist science
7. constructivist science teaching
8. constructivist science teaching & student outcomes
9. constructivist science teaching & student achievement
10. constructivist science teaching & student performance
11. constructivist science teaching & student assessment
12. constructivist science instruction
13. constructivist science & student outcomes
14. constructivist science & student achievement
15. constructivist science & student performance
16. constructivist science & student assessment
17. constructivist teaching
18. constructivist science teaching
19. constructivism
20. constructivism & science
21. constructivism & science teaching & student outcomes
22. constructivism & science teaching & student achievement
23. constructivism & science teaching & student performance
24. constructivism & science teaching & student assessment
25. constructivism & student outcomes
26. constructivism & student achievement
27. constructivism & student performance
28. constructivism & student assessment
29. creative teaching & science
30. discovery learning & science
31. discovery learning & science & student outcomes
32. discovery learning & science & student achievement
33. discovery learning & science & student performance
34. discovery learning & science & student assessment
35. discovery science
36. ecology & student outcomes
37. ecology & student performance
38. ecology & student assessment
39. ecology & student achievement
40. educational change & science
41. environmental education & student outcomes
42. environmental education & student performance
43. environmental education & student achievement
44. environmental education & student assessment
45. experiential learning & science
46. experiential science
47. experiential science teaching
48. experiential science teaching & student outcomes
49. experiential science teaching & student achievement
50. experiential science teaching & student performance
51. experiential science teaching & student assessment
52. experiential science instruction
53. experiential science & student outcomes
54. experiential science & student achievement
55. experiential science & student performance
56. experiential science & student assessment
57. hands-on science

58. hands-on science & outcomes or achievement or performance or assessment
59. hands-on science teaching
60. hands-on science teaching & student outcomes
61. hands-on science teaching & student achievement
62. hands-on science teaching & student performance
63. hands-on science teaching & student assessment
64. hands-on science instruction
65. hands-on science & student outcomes
66. hands-on science & student achievement
67. hands-on science & student performance
68. hands-on science & student assessment
69. inquiry & science
70. inquiry science
71. inquiry science teaching
72. inquiry science teaching & student outcomes
73. inquiry science teaching & student achievement
74. inquiry science teaching & student performance
75. inquiry science teaching & student assessment
76. inquiry science instruction
77. inquiry science & student outcomes
78. inquiry science & student achievement
79. inquiry science & student performance
80. inquiry science & student assessment
81. instructional innovation & science
82. minds-on science
83. minds-on science & student outcomes
84. minds-on science & student achievement
85. minds-on science & student performance
86. minds-on science & student assessment
87. research & experiential science
88. research & experiential science & outcomes or achievement or performance or assessment
89. research & science instruction
90. research & science instruction & outcomes or achievement or performance or assessment
91. research & hands-on science
92. research & hands-on science & outcomes or achievement or performance or assessment
93. research & inquiry science
94. research & inquiry science & outcomes or achievement or performance or assessment
95. science education & performance-based assessment
96. science instruction
97. science instruction & student outcomes
98. science instruction & student achievement
99. science instruction & student performance
100. science instruction & student assessment
101. science teaching
102. science teaching & student outcomes
103. science teaching & student achievement
104. science teaching & student performance
105. science teaching & student assessment
106. student-centered instruction & science
107. student-centered instruction
108. student-centered instruction & student outcomes
109. student-centered instruction & student achievement
110. student-centered instruction & student performance
111. student-centered instruction & student assessment
112. student-centered curriculum & science
113. student-centered curriculum & science
114. student-centered science
115. student outcomes
116. student achievement
117. student performance

118. student assessment
119. teaching methods & science
120. wildlife & student outcomes
121. wildlife & student performance
122. wildlife & student achievement
123. wildlife & student assessment

Appendix B

CALL FOR RESEARCH
on the
IMPACT OF INQUIRY-BASED SCIENCE ON STUDENT OUTCOMES

The Center for Science Education (CSE) at Education Development Center, Inc. (EDC), has been funded by the National Science Foundation to conduct a synthesis of research on the impact of inquiry science teaching on student outcomes. We are seeking quantitative and qualitative studies, published and unpublished, foreign and domestic, and those that span a continuum from formal, structured, experimental models to informal but purposeful information gathering undertaken by school district administrators and other practitioners.

We invite submissions that meet all the following criteria:

- Studies examine an aspect of inquiry science teaching alone or in comparison to another instructional strategy (can examine inquiry in a range of settings, such as classrooms, after-school programs, or science museums);
- Student outcomes (such as test scores, attitudes, course enrollment, career choices) are assessed;
- Studies were conducted in or after 1984; and
- Studies focus on ages/grade K–12.

Please note that we are not accepting review articles or articles that focus only on methodological issues.

Please submit papers to Dr. Daphne D. Minner, Center for Science Education, Education Development Center, Inc., Newton, MA 02458-1060. If you have questions, you may reach Dr. Minner at (617) 618-2461 (dminner@edc.org). When submitting your paper, please indicate that you saw this call in/or _____.
This material is based upon work supported by the National Science Foundation under Grant No. 0101766.

Appendix C

Research and Development Organizations

1. ABT Associates
2. American Association for the Advancement of Science
3. Annenberg Institute for School Reform
4. Biological Sciences Curriculum Study
5. Center for Research on Evaluation, Standards, and Student Testing
6. Consortium for Policy Research in Education
7. Education Commission of the States
8. The Exploratorium Center for Inquiry
9. Horizon Research, Inc.
10. Inverness Research Associates
11. MCREL
12. National Academy of Sciences/National Research Council
13. National Clearinghouse for Comprehensive School Reform
14. NCREL
15. National Science Resource Center
16. New American Schools
17. Public Education Network
18. Research for Better Schools
19. SERVE
20. SRI International
21. TERC
22. WESTED

Professional Organizations

1. American Association of Colleges for Teacher Education
2. American Association of School Administrators
3. American Chemical Society
4. American Educational Research Association
5. American Physical Society
6. Association for the Education of Teachers of Science
7. Association for Supervision and Curriculum Development
8. Association of Science-Technology Centers
9. Council of Chief State School Officers
10. Council of State Science Supervisors
11. National Association of Elementary School Principals
12. National Association for Research in Science Teaching
13. National Council for Accreditation of Teacher Education
14. National Science Teachers Association
15. National Staff Development Council
16. New England Educational Research Organization
17. Northeastern Educational Research Association

Corporate and Federal Funders and Grantees

1. Hewlett Packard
2. Merck Institute for Science Education
3. Toshiba America Foundation
4. NEC Foundation of America
5. The Spencer Foundation
6. Office of Educational Research and Improvement
7. United States Department of Education
8. NSF Local Systemic Initiative Program

Unions

1. American Federation of Teachers
2. National Education Association

Educational Organizations

1. Activities Integrating Math and Science Education Foundation
2. American Enterprise Institute
3. The Board on Testing and Assessment
4. Center for Research on Education, Diversity, and Excellence
5. Center for Research on the Education of Students Placed At-Risk
6. Center for Research on Learning, Center for Science Education
7. Center for the Study of Teaching and Policy
8. Community-Campus Partnership
9. Council for Basic Education
10. Curriculum Research and Development Group
11. Educational Testing Services
12. FermiLab's Education Center
13. Girls, Inc.
14. Illinois Loop
15. The Invention Factory
16. Kelliher and Associates
17. Laboratory for Student Success, Educational Leadership
18. Learning Research and Development Center
19. The National Board for Professional Teaching Standards
20. National Center for Educational Statistics
21. National Center Improving Student Learning and Achievement in Mathematics and Science
22. National Center for Research on Teaching and Learning
23. National Institute on Early Childhood Development and Education
24. National Partnership for Excellence and Accountability in Teaching
25. The Network for Leadership, Inquiry, and Systemic Thinking
26. The Philadelphia Education Fund
27. QEM Network
28. Science and Math Outreach Company
29. Success Lab
30. Teachers Academy for Math and Science

Appendix D
SEARCH LETTER

[Date]

[Inside Address]

Dear _____,

My colleagues and I recently received a research grant from the National Science Foundation to do a synthesis of research studies that look at the impact of inquiry-based science instructional strategies. We are interested in both quantitative and qualitative studies conducted since 1984. In an effort to address the issue of bias in our selection of studies, we are making a strong effort to locate unpublished work, which is why we are currently contacting you. We would greatly appreciate any references to or copies of unpublished (or published) work that you have done or are aware of that meet the general selection criteria listed below:

1. Student outcomes are assessed (learning outcomes, attitudes, course enrollment, career choices).
2. The study was conducted after 1984.
3. Study focused on K–12 classrooms with a normal student population (e.g., not predominantly special education) and science instruction is done by the usual classroom teacher.
4. Specific science instructional approaches used in the study are described.

Please note that we are not interested in review articles or articles that focus primarily on methodological issues, but rather in work that discusses research findings.

We would greatly appreciate any information that you may have regarding studies that meet our criteria. Please contact us via e-mail at dminner@edc.org or telephone at 617-618-2461 to share any information you have (and to let us know an e-mail and/or phone number for you so that we can follow up).

We greatly appreciate your assistance in our endeavor to summarize the findings of the effectiveness of different kinds of science instruction on student outcomes. We believe this study will make a significant contribution to the field for not only researchers, but more importantly, practitioners. Thank you in advance for your help.

Sincerely,

Daphne D. Minner, Ph.D.
Senior Research Associate

Appendix E

PHONE CALL SCRIPT FOR FINDING STUDIES FROM ORGANIZATIONS

Hello, my name is _____ and I am calling from the Center for Science Education at Education Development Center, Inc. *(If appropriate,* _____ suggested I call because) We received a grant from the National Science Foundation to conduct a synthesis of research on the impact of inquiry science on student outcomes, and we are in the process of locating studies to include. We/I am hoping that you could help us locate papers. If you have a few minutes, I would like to describe our project and see if *(name of organization)* could help us with our search.

If this isn't a convenient time, find out when you should call back. If you can continue:

These are our criteria for selecting studies to include:

1. Studies examine an aspect of inquiry science teaching alone or in comparison to another instructional strategy.
2. Student outcomes are assessed (learning outcomes, attitudes, course enrollment, career choices).
3. Studies were conducted after 1984.
4. Studies focus on ages/grades K–12.
5. Studies could have been conducted in the U.S. or internationally.
6. Studies can examine inquiry instruction in a range of settings, such as classrooms, after-school programs, or science museum education programs.
7. Studies should NOT be review articles or articles that focus primarily on methodological issues.

We are hoping that you might help us find articles in two ways:
First, could you direct us to studies that *(name of organization)* has been involved with or knows about?

Get information on specific studies:

- *Name of study*
- *When it was conducted*
- *Research question or topic, if possible*
- *Contact person*
- *Contact information*

Second, would it be possible to send out an announcement of our study and our call for papers to your membership so that we could extend our search as broadly as possible? We wondered about possibilities such as posting an announcement on your Web site, including an announcement to members of your listserv, or any other venue you would recommend.

Get information on specific method of contact:

- *Venue; listserv, website, newsletter, etc.*
- *About how many people will see the announcement (say, "That's great!" or some such positive response)*
- *Materials we need to submit - length*
- *Deadlines: our interest is ASAP*
- *Name of person we should send this information to*
- *That person's contact information*

Thank you very much for all of your help. We will follow up with your suggestions and look forward to talking with *(name of person they referred us to for a study)* about the study, and to getting our announcement on your *(listserv, Web site, newsletter, etc.).*

