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# CENTER FOR ELEMENTARY MATHEMATICS AND SCIENCE EDUCATION

## ACCUMULATING KNOWLEDGE ON SCALING AND SUSTAINING REFORM: A FOUNDATION FOR FUTURE RESEARCH

### TECHNICAL REPORT 1: REPORT IDENTIFICATION FOR THE LITERATURE REVIEW

#### PROJECT OVERVIEW

The Center for Elementary Mathematics and Science Education (CEMSE) in the Physical Sciences Division of the University of Chicago is engaged in a project funded by the National Science Foundation's Research and Evaluation on Engineering and Science Education (REESE) Program. This project, "Accumulating Knowledge on Scaling and Sustaining Reform: A Foundation for Future Research," focuses on three goals:

1. *to provide a foundation for accumulating knowledge about scaling and sustainability of innovations in education with an emphasis on science education;*
2. *to identify knowledge about scaling and sustainability of innovations from other disciplines that can inform researchers', reformers' and policy makers' improvement efforts in education; and*
3. *to establish a forum for cross-discipline collaboration and sharing knowledge on scaling and sustainability of innovations.*

The project has two strands of work: (1) literature review, analysis, and conceptual framework development; and (2) communication and dissemination.

The first strand of work has three iterative phases: Phase 1—Report Collection; Phase 2—Report Coding; and Phase 3—Report Analysis. Phase 1 entailed conducting comprehensive literature reviews on scaling and sustainability of innovations beginning with science education and then expanding to other areas of education and in turn, other fields that have developed knowledge on these topics, including business, marketing, health, and economics. Upon completion of the searches, the CEMSE team began conducting a two-part analysis focused on identifying common themes and findings in the literature and on using a concept development process to identify the similarities and differences in the constructs that underlie the overlapping vocabulary used to describe scaling and sustainability in education and other fields. Building on this analysis, the team is creating a conceptual framework that can support the development of shared language, yet is rich enough to capture the range of ways scaling and sustainability of innovations in education have been described and understood. This conceptual framework with its clear, shared language will thus provide a foundation for accumulation of knowledge.

In Phase 1, the team conducted comprehensive searches for sources that met a set of criteria outlined below. In Phase 2, the team coded the full text of the sources identified during Phase 1. During Phase 3, which was concurrent and iterative with Phase 2 until Phase 2 was completed, the team has been analyzing and compiling the results of the coding to develop a summary of the literature and a conceptual framework for clearly describing scaling and sustainability of reform.

The second strand of work consists of the communication of the ongoing project work (including this technical report) and the creation of a collaborative research environment to share the literature summary and further develop the conceptual framework and other findings.

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## TECHNICAL REPORT INTRODUCTION

This technical report, *Report Identification for the Literature Review*, describes the first phase of Strand One that began with the creation of search terms in February, 2007, and ended on August 31, 2007. This technical report describes the search terms, inclusion criteria, report sources, and collection procedures. A summary is included at the end of this report.

## SEARCH PROCEDURE

*Pilot Search*—The search task began with a pilot effort to test our search procedures and inform our preliminary coding development. We began by using EndNoteX to search the SSCI Web of Science Index. The searches were based on three groups of terms; group 1 including terms that are roughly synonymous with sustainability or scale, group 2 including terms that indicate the object of sustainability, and group 3 naming the field or discipline (see Table 1). Each search was designed to return results that included at least one word from each of the three groups. The search strings were TS = (sustain\* OR diffus\* OR endur\* OR scale\* OR institutionalize) AND TS = (implementation OR program OR capacity OR practice OR policy OR innovation OR curriculum OR knowledge OR organizational change) AND TS = (science edu\* OR math\* edu\*).

Search Term 1	Search Term 2	Search Term 3
Sustain*	Implementation	Science Edu*
Diffus*	Program	Math* Edu*
Endur*	Capacity	
Scale*	Practice	
Institutionalize	Policy	
	Innovation	
	Curriculum	
	Organizational Change	
	Knowledge	

This process returned 554 articles. We reviewed the abstract of every article and downloaded the full text of those articles that seemed relevant to sustainability of innovations. We then reviewed the selected articles in greater depth. Based on this review, we rejected some articles because they were not relevant. We rejected others because, although they used the term sustainability in the abstract, they did not address the issue of sustainability, scale-up, dissemination, or institutionalization in the article.

Once we identified articles that appeared to be useful and relevant, we retrieved articles identified in their references, and put these articles through the process described above. Additionally, we ran searches on Google using the same search terms used in the EndNote search. We then repeated the process by searching the ISI Web of Science Index and the ERIC at EBSCO index. This pilot search process yielded useful information about necessary adjustments to the search process for the full search.

*Full Search*—As a first step in the full search, we finalized the selection of search terms. Building on the pilot process, we identified what we referred to as first-, second- and third-degree terms. First-degree terms are those that capture our primary phenomenon of interest – sustainability – and are essentially synonyms for the concept of sustainability in the many ways it is used. Second-degree terms are those that answer the question, “sustainability of *what*” and include words such as *change* and *program*. Third-degree words describe the context for the sustained change – ranging from

science education to marketing. (See Table 2.) Every search had at least one word from the first-degree list *and* one word from the second- *or* third-degree list.

Table 2.  
*Full Search Process Search Terms*

First-degree	Second-degree	Third-degree
Sustain*	Reform*	Educat*
Scal*	Change	Science Edu*
Diffus*	Innovat*	Math Edu*
Institution*	Program	Business
Adher*	Policy	Marketing
Maintain*	Curricul*	Health
Longevity	Implement*	Economic*
Utiliz*	Capacity	
Dissem*	Progress	
Persist*	Knowledge	
Routinization	Organization*	
Endur*	Organizational Change	

We began the search process by using all combinations of first-, second- and third-degree terms and performing Boolean searches on Google and of the Web of Science SSCI, Library of Congress, and Proquest Dissertation databases using EndNote X. Initial searches with these terms returned too many irrelevant results, and the search process was taking too much time. As a result, we narrowed our searches by subtracting terms that had returned the most irrelevant results. The terms *adher\**, *longevity*, *utiliz\**, *persist\**, and *routinization* were removed from the list of first-degree terms and *curricul\**, *capacity*, *knowledge*, and *organizational change* were removed from the second-degree terms. We felt confident that the relevant items returned from searching for the terms we eliminated would be identified through the use of the remaining search terms. Additionally, we decided to discontinue searching the Library of Congress and only use books that were cited in sources identified earlier in the search process. Finally, we decided to eliminate searches with Google until we had more specific search terms and people to search for, based on the results of earlier searches.

At the end of the full search process, a total of 69,801 sources were identified for abstract review. For a description of the abstract review process, see Technical Report 2. Below is a table that illustrates the number and type of sources identified at the end of the general search process after applying the limitations on the search terms:

Table 3.  
*Sources Identified by Type and Field*

Field	Source Type				
	Total	% of total	Journal	Dissertation/Thesis	All Types
Science Edu*	2,750	3.9%	1,968	782	2,750
Math Edu*	1,238	1.8%	367	871	1,238
Edu	28,555	40.9%	19,806	8,749	28,555
Health	9,197	13.2%	5,353	3,844	9,197
Business	8,255	11.8%	3,352	4,903	8,255
Marketing	2,505	3.6%	1,001	1,504	2,505
Economics	17,301	24.8%	9,126	8,175	17,301
Total	69,801	100%	40,973	28,828	69,801