
CENTER FOR ELEMENTARY MATHEMATICS AND SCIENCE EDUCATION

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

TECHNICAL REPORT 4: REPORT GENERATION AND ANALYSIS

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 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 process is outlined in Technical Report 1. In Phase 2, the team coded the abstracts of the sources identified in Phase 1 to determine their suitability for full coding. That is described in Technical Report 2. Then, they coded the full text of the sources that were identified for inclusion. That is described in Technical Report 3. During Phase 3, which was concurrent and iterative with Phase 2 until Phase 2 was completed, the team has been compiling and analyzing the results of the coding to develop a summary of the literature and a conceptual framework for clearly describing scaling and sustainability of reform. Part of that process, report generation and analysis, is described in this technical report.

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.

TECHNICAL REPORT INTRODUCTION

This technical report, *Report Generation and Review*, describes the beginning part of Phase 3, in which the coding results were compiled and analyzed. This technical report describes the process for report generation, matrix coding report creation, and report review and analysis.

REPORT GENERATION

As the coding process neared completion, the team began the analysis process. Using the report function in NVivo, the team created “reports” on various nodes. A “report” is a compilation of all of the text from all sources coded with a particular node. In reports, text excerpts are organized by author and then reference number (some sources have multiple excerpts, or “references” for a single node). Reports vary in length from only a few pages to up to thirty or more, depending on the node.

ORDER OF REPORTS

During the coding process, the team selected reports to review based on questions about nodes that arose during meeting discussions. These reports would not be complete until the coding process came to an end, but these initial report reviews yielded emerging ideas about the factors that affect sustainability and their relationships to one another. Once all sources had been coded, the team decided on a specific order for report review, starting with the concepts and definitions and then moving on to the factors. As the team proceeded, new categories of nodes emerged that provided additional structure to the order of the report review process.

MATRIX REPORTS

In addition to generating reports on single nodes, the team also generated reports consisting of more than one node that yielded only text that had been coded with all of the selected nodes. These are referred to as matrix reports. By reviewing text that only appeared when coded with both of two seemingly related nodes, team members were able to test their assumptions about how various concepts were related. Many of the matrix coding reports involved processes, concepts and/or definitions. For example, the team generated a report coded with the node “definition of sustainability” and “Concept A” (“lasting of it characterized by the capacity to evolve and adapt”) or “Concept B” (“lasting of it characterized by similitude to the original it”). This allowed the team to see how many sources associated the definition of “sustainability” with the concept the team referred to as “Concept A” and likewise for “Concept B.”

REPORT ANALYSIS

All team members read each report and then met together during regularly scheduled meetings to discuss the main ideas emerging from the reports and highlight particular references that supported those ideas. These discussions led to more refined understandings of the nodes, revision of node definitions, addition of nodes, and over time the articulation of relationships between the nodes and ways to categorize them.

The report generation and review process grew into an iterative process with thought memos. Upon discussing reports, team members documented their thinking about particular nodes and then used those documents as the focus for discussion in future meetings.

SUSTAINABILITY CONCEPTUAL FRAMEWORK CONSTRUCTION

Prior to coding, the team participated in a phone call with Beth Rodgers (one of the project advisors). Through conversations with Rodgers as well as reading her book titled *Concept Development in Nursing: Foundations, Techniques, and Applications* the team was better able to plan for how the nodes could be used to create a conceptual framework. Rodgers suggests creating model cases for concepts of interest. In our case, these model cases would be the “operational definitions” for each node.

Concurrent with reviewing the reports and revising the Nodebook, the team began the creation of a conceptual framework for organizing the emerging ideas. Rodgers touts a “low-tech” method using butcher paper and note cards. The team decided to use “sticky notes” and began to organize the different concepts on a wall, shifting them with each revision of our thinking about the relationships each node had with another and their sensible groupings.

As each node was discussed and each report reviewed, the team again revisited the node definition and refined it as necessary. The team also reviewed examples of the nodes that had been identified in the reports for accuracy and then discussed the relationships between those nodes and other nodes. This process led to questions about other not-yet-reviewed nodes and thus provided an order in which to review subsequent reports. Throughout the process, the sticky note associated with each node was moved on the wall as appropriate to newly identified relationships and categories. The nodes and categories are described in more detail in another report.

SHIFTING ANALYSIS TO THE WIKI

Halfway through the report coding process, the team decided to move to an online wiki format for report analysis. The use of the wiki would not only make meetings more productive (because some content could be reviewed by all team members before meeting in person), but it would provide readers of the wiki access to the ongoing development of ideas and provide them with opportunities to inform the team’s continuing thinking. On the wiki, each node has its own page with a space for assertions and another for comments. As team members read the reports, they identify assertions that are supported in the literature as well as more general comments related to the node and place them in the wiki. Other team members then are able to use the wiki to respond to the assertions and comments. After team members initially post their findings and ideas on the wiki, the whole team comes together to review the content of each node and discuss any outstanding issues or questions.