A FRAMEWORK FOR MEASURING AND ACCUMULATING KNOWLEDGE ABOUT FIDELITY OF IMPLEMENTATION (FOI) OF SCIENCE INSTRUCTIONAL MATERIALS

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INTRODUCTION

Educators have always been interested in identifying and implementing effective programs. In today’s educational environment, that interest is amplified by the fact that schools and school districts are increasingly expected to select programs with a strong research base (Lynch and O’Donnell, 2005; Mowbray, et al., 2003). In this context, the What Works Clearinghouse and a recent National Research Council panel, have called for more rigorous studies (WWC, 2004a, 2004b; NRC, 2004) to identify effective instructional materials and other programs. Researchers have responded, but regrettably, even as they use more rigorous designs to study interventions and describe and measure their impacts on student outcomes, they overlook the importance of measuring and describing the implementation of the treatment itself (Hall & Loucks, 1977; WWC, 2004a, 2004b; NRC, 2004). Without specific, clear descriptions and measurement of implementation, it is impossible to know whether ill-achieved outcomes are due to an inadequate model of change in a program, or due to poor or incomplete implementation (Fullan, 1983; Lynch & O’Donnell, 2005; Wang et al., 1984; Ruiz-Primo, 2005). Penuel and Means (2004) assert that researchers can use implementation data to “identify competing hypotheses” as well as flawed assumptions in the program design (p. 332).

One of the greatest challenges with regard to measuring fidelity of implementation (FOI) is the fact that there is neither consensus about the definition of FOI nor a single set of tools or strategies for measuring it (Ruiz-Primo, 2005; Dusenbury, et al., 2004). In a typical scenario, as researchers and evaluators set out to measure program effectiveness, they come upon the necessity to develop fidelity measures, and create those measures based on their particular program of interest. The transitive nature of these measures leaves us with a collection of disparate measures and “ad hoc” theories about fidelity of implementation. With no shared basis for measuring and discussing fidelity of implementation, researchers are unable to compare findings across studies of particular interventions, or accumulate knowledge on the measurement of fidelity of implementation itself.

This paper shares the work of a research project that brings a different perspective on measuring fidelity of implementation to the table. Rather than addressing FOI as a secondary element of a larger study, our work focuses on developing measures to determine fidelity of implementation as its primary goal. And, rather than target a single intervention, we are developing a suite of fidelity of implementation data collection tools designed to be used across multiple programs. This paper describes our first step in the process – the development of a conceptual framework for FOI – and the applicability of that framework to the measurement of instructional materials implementation as well as its potential application to other education reform efforts.

FOI CONCEPTUAL FRAMEWORK DEVELOPMENT

The FOI Conceptual Framework is a product of CEMSE’s “Applied Research on Science Materials Implementation: Bringing Measurement of Fidelity of Implementation (FOI) to Scale” project. This National Science Foundation (NSF) supported effort is developing a suite of instruments for measuring FOI of standards-based science and mathematics instructional materials at the K-8 level. Over three years, the project is working in collaboration with the Chicago Public Schools to produce instruments for measuring FOI of five specific curricula (FOSS, STC, Science Companion, SEPUP, and Everyday Mathematics) and a User’s Guide that describes procedures for adapting the instruments for use with other instructional materials. Although the project is focused specifically on reform-based science and mathematics, the framework and its approach of using “critical components” as measurable constructs can transfer to use with instructional materials in other subject areas and with some adaptation, to other kinds of educational interventions.

The Context for the Fidelity Framework

Before focusing on the FOI framework, it is important to understand where the framework resides within a larger “model” of school improvement that focuses on use of instructional materials as a key intervention. Figure 1 below provides a simple illustration of that “model.” This illustration isn’t intended to illustrate the
full complexity of implementation; but rather, to demonstrate the role of FOI in the process. Thus, in this simple scenario, a set of instructional materials is implemented with the expectation that it will lead to desired student outcomes. The extent to which that program leads to those outcomes defines the effectiveness of that program. However, programs are rarely, if ever implemented as intended. Implementation is shaped by various contexts and conditions that reside outside of the materials themselves (e.g. teacher content knowledge, teacher professional development experience, student demographics). Thus, in order to draw truly meaningful conclusions about instructional materials programs’ effectiveness, it is essential to determine the extent and nature of their use – the fidelity of implementation.

Where there is existing data, some of these factors (e.g. demographics and teacher experience) can be accounted for through research design and analysis strategies. Others need to be addressed through collection of new data. An in-depth study of the contexts and conditions that affect FOI is beyond the scope of our current project, but where possible, the FOI instruments target data collection on some of these factors while still keeping a primary focus on FOI itself.

The First Step: Defining FOI

The first step in framework development was arriving at a definition of FOI. Commonly, FOI is defined operationally, by measuring the extent to which particular identified important characteristics of a specific program are present when the program is implemented. While this may be practical when studying the effectiveness of a single program, it defines FOI in a limited, operational way that leads to FOI findings that are only applicable to that particular program.

Our goal, on the other hand, was to create a framework for defining and measuring elements of FOI that would be common to multiple programs but still could be customized to particular program features. With instruments based in such a framework, researchers can use the same (or very similar) set of measures with all groups in a single study and thus, more clearly differentiate treatments. Also, by identifying aspects of FOI that are shared across programs, the instruments can contribute to the accumulation of knowledge of FOI across studies. Thus, we needed a broader definition of FOI that would support this goal.

While there isn’t agreement in the field about how to describe or define FOI at any level of detail, there is a general consensus about what it is. We chose to word that general definition as follows: The extent to which an enacted program is consistent with the intended program model. While this definition closely resembles others’ work (Bodzin et al., 2003; Lewis & Seibold, 1993; Ruiz-Primo, 2005) chose the words “enacted” and “intended program model” quite deliberately because they lent themselves to a wide range of educational interventions and thus allowed for a broad starting point for developing a conceptual framework that could support research across multiple programs.

Building on Previous Work

With a clearly stated general definition of FOI, a next step was to operationalize that definition into a framework of measurable constructs. As a first step in framework development, we performed an extensive theoretical review of fidelity of implementation, covering a range of fields, with a focus on health and education. In that review we uncovered several commonalities.
Dimensions of Fidelity Approach: First, many authors built on or adapted a study by Dane and Schneider (1998). This study was one of the first to identify measurable aspects of, or “dimensions” of fidelity. In years before Dane and Schneider, early conceptualizations of FOI drew important attention to the study of program use, but characterized implementation in broad terms. Hall and Loucks (1977), for example, focused on “levels of use,” and Fullan & Pompfret (1977) characterized FOI by suggesting that there are five aspects of implementation in practice: changes in materials, structure, behavior, knowledge, and value internalization. Since then, researchers, particularly those working in health such as Dane & Schneider, have developed more refined approaches for characterizing and assessing FOI that account for the fact that it is complex and multidimensional (Fullan, 1983; Gersten et al., 1981; Wang et al., 1984).

In Dane and Schneider’s 1998 review of studies on prevention programs, they found that most of the studies did not measure “program integrity” at all. Among those that did however, they identified some common aspects of integrity, namely, adherence, exposure, quality of delivery, responsiveness, and program differentiation. They recommended that all five of these dimensions be measured in order to gain a better understanding of program integrity. Furthermore, they suggested that adopting standardized definitions of these aspects would help promote comparisons across studies. Over the last ten years, others used this five-dimension approach to look at programs in the areas of drug abuse prevention and education (Domitrovich & Greenberg, 2000; Dusenbury, Brannigan, Falco, & Hansen, 2003; Lynch & O’Donnell, 2005; Ruiz-Primo, 2005; Songer & Gotwals, 2005). Of particular note is a 2000 study by Domitrovich and Greenberg. They reviewed implementation studies of prevention programs and found that most studies measured adherence or dosage, while only 21% looked at more than one dimension, and no studies measured more than two dimensions (Domitrovich & Greenberg, 2000).

At the outset of framework development, we decided to begin as others had, with the Dane and Schneider (1998) study. We explored the relationships between the dimensions – adherence, exposure, quality of delivery, participant responsiveness, and program differentiation – as well as their possible definitions. Ultimately, we decided that while our framework needed to account for these dimensions, they were too incommensurate to be a foundation for the clear specific approach to measuring FOI we were seeking to develop. Rather, we built on other common themes in the literature that are explained below.

Conceptual Structure and Process Approach: Some of the works we reviewed demonstrated a dichotomy of types of fidelity that could be best characterized as “structure vs. process.” In “Fidelity Criteria: Development, Measurement, and Validation,” Mowbray, et al. (2003) discuss “fidelity criteria” (what we call critical components) and organize them into two groups. The first group focuses on structure (“framework for service delivery”) and the second group focuses on process (“the ways in which services are delivered”). Mowbray, et al. weren’t the first to organize program elements this way. In 1984, Wang, et al. studied the Adaptive Learning Environments Model and identified two types of “critical program dimensions.” In their work, the structural elements are described as “those that relate to the provision of adaptive instruction” and the process elements are described as “those that relate to supporting effective implementation of adaptive instruction.” Although Mowbray, et al.’s work wasn’t focused on instructional materials, the structure/process approach was an appropriate fit for the instructional materials context. Thus, as we continued to conceptualize our framework, we chose an approach aligned with theirs and combined it with the third commonality we discovered – the identification of what we came to call the “critical components” of the programs.

Framework Development and Critical Component Identification

Over the last several years, educators have built the foundational work in health to measure FOI of educational programs with a level of specificity that allows the identification of program components that are more and less critical for achieving desired outcomes (Bond et al., 2000; Ruiz-Primo, 2005). Given our overall goal to create a foundation for measuring and analyzing FOI of instructional materials at a level of specificity that would provide useful information on relationships between the materials, the instruction, and student
outcomes we explored and ultimately adopted an approach to FOI that was informed by critical component measurement.

Having identified our general approach, we engaged in a process of instructional materials review that focused on identifying program critical components and placing them into framework categories. Framework development and critical component identification informed one another through an iterative process. As we proceeded with our framework development, we tested its utility through conversations with program developers, other researchers and through exploring its application to a range of instructional materials.

**Defining Critical Components:** If we return to our conceptual definition of FOI – *the extent to which the enacted program is consistent with the intended program model* – we can operationalize it using the idea of critical components by restating it as: *the extent to which the critical components of an intended program are present when that program is enacted.* The FOI Conceptual Framework provides a structure for describing and organizing these critical components so that researchers can rigorously analyze their relationships to one another and to student outcomes. Critical components, more explicitly defined, are the elements of a program model that are essential to its implementation. In other words, they are the variables one must measure in order to determine a program’s FOI, and in turn, its efficacy. Likewise, they are the variables one must identify and measure in order to engage in studies that rigorously compare programs and their relative effectiveness (as part of a process we refer to as “differentiation,” described below).

In the case of instructional materials, the “intended program model” comprises the developers’ collective beliefs about how to physically and pedagogically design instructional materials that will lead to desired outcomes. This is not to suggest that developers always explicitly define their program models, or that developers of the same program necessarily share an understanding of the program model. Indeed, we have seen that this is, in fact, not the case. Still, as they create a program, developers implicitly and explicitly embed their beliefs about effective instructional materials and instruction in it. Together, these beliefs comprise the intended program model. Critical components then, are the operationalizations of developers’ beliefs; they are the measurable elements of the intended program model and thus the primary focus of FOI measurement. Working with this understanding of critical components, CEMSE identified a working set of critical components of the reform-based mathematics and science instructional materials (the process of identifying those critical components and a description of what those critical components are is described in another paper).

**FOI Conceptual Framework Overview**

Throughout the framework development process, we were guided by our goal to enable rigorous and systematic measurement and analysis of FOI by providing useful measurement categories in a sound organizational structure. Working with the general “structure” and “process” approach, after several iterations, we defined two broad organizational categories: 1) Structural Critical Components and 2) Instructional Critical Components. While aligning with Mowbray, et al. (2003) and later work by Lastica and O’Donnell, (2007) we elaborated on the concepts of “structure” and “process” by identifying specific sub-categories (i.e. procedural, educative, pedagogical, and student engagement).
Figure 2. Basic FOI Framework

Figure 2 shows the FOI Conceptual Framework and the two large categories of critical components—structural critical components and instructional critical components. Then, each of these larger categories is divided into two sub-categories that are described below.

**Structural Critical Components:**
Structural critical components reflect the developers’ decisions about the design and organization of the physical materials and fall into two types: 1) Procedural and 2) Educative.

1) **Structural-Procedural Critical Components**
These critical components communicate what the teacher needs to do in the classroom. While one might suggest that all parts of instructional materials “tell” a teacher what to do, this category of critical components is focused on the organizing structural elements of the written program including the basic steps of specified lessons.

2) **Structural-Educative Critical Components**
These critical components communicate what the teacher needs to know. They acknowledge the complexity of instruction as well as the likelihood that teachers may not necessarily have the wide range of expertise needed to teach the program as intended. Structural-educative critical components can range from general commentary on instructional strategies such as “cooperative learning” to subject matter content summaries.

**Instructional Critical Components:**
Instructional critical components reflect the developers’ decisions about the intended instructional transactions that take place in the classroom. These decisions include expectations about both the teacher’s and the students’ role in the instructional process.

1) **Instructional-Pedagogical Critical Components**
These critical components reflect the developers’ intentions about the general instructional strategies the teacher will use and the teacher’s interactions with students in the classroom. They are not tied to specific sections of a lesson, but can occur any time during the enacted instruction.

2) **Instructional-Student Engagement Critical Components**
The student engagement critical components reflect expectations about the students’ participation in the instructional process including their interactions with the content as well as with the teacher and one another. Like the pedagogical critical components, these critical components (with a few exceptions) are not tied to specific section(s) of the lesson or teacher’s guide.
Due to the complexity of instructional materials development (and the development of other interventions), program critical components may cross the boundaries of these categories. In the case of this particular project, each has been defined so that, to the extent possible, they are exclusive of one another.

The FOI Framework and Program Differentiation

If researchers are interested in understanding the implementation of a particular program, they can use the FOI instruments to collect data on that single program’s critical components. Then, when moving from studies of single programs to comparison studies, the FOI instruments can provide researchers with a systematic, clear and specific way to distinguish one treatment from another through a process we refer to as “program differentiation.” Differentiation is the identification of critical components that are shared (if any) among, or are unique to each of the programs’ intended models. After identifying the shared and unique critical components, researchers can collect data on the extent to which they are actually enacted in each of the study’s groups. Then they can make decisions about how different each of the enacted programs actually is before comparing the programs’ outcomes.

In the case of our current work, the process of differentiation called for the addition of another group of critical component categories to the framework that we called “categories of differentiation” (see Figure 3). Because our project focused on reform based mathematics and science instructional materials programs, categories of differentiation include: “Common to Reform-based Mathematics and Science Programs”; “Common to Science Programs”; “Common to Mathematics Programs”; and “Program Specific.” Thus, for the five programs of the CEMSE project, each critical component was identified with a “Category of Critical Components” (the horizontal cells) and a “Category of Differentiation” (the vertical cells). For more information on the differentiation process and examples of the critical components that reside in each cell, please refer to the critical component paper presented in this session.

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<th>Categories of Differentiation</th>
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<td>Categories of Critical Components</td>
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Figure 3. The FOI Conceptual Framework with Categories of Differentiation
ALIGNING THE FOI FRAMEWORK WITH PREVIOUS WORK

Now that we have explained the CEMSE FOI framework, we can take a closer look at how it is aligned with earlier approaches to describing FOI. The discussion below references Figure 4. Our framework categories are in bold type while others’ are numbered and italicized.

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<th>CATEGORIES OF DIFFERENTIATION</th>
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<td>CATEGORIES OF CRITICAL COMPONENTS</td>
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<td>Common to Mathematics and Science Programs</td>
<td>Procedural (2. Exposure, Dosage)</td>
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<td>Common to Science Programs</td>
<td>Educative (3. Quality)</td>
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<td>Common to Mathematics Programs</td>
<td>Pedagogical (4. Responsiveness, Participation)</td>
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<tr>
<td>Program Specific</td>
<td>Student Engagement</td>
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Figure 4. The CEMSE FOI framework aligned with others’ work

1. **Adherence**: Dane and Schneider (1998) identified adherence as the first of their five dimensions of FOI. Others, however, defined adherence as the extent to which enacted activities and methods are consistent with the intended or written program. (Dusenbury et al., 2003; Lynch & O'Donnell, 2005; Ruiz-Primo, 2005). As we considered these points of view, we saw that our overall definition of FOI – the extent to which the enacted program is consistent with the intended program model – was consistent with the idea of adherence. Therefore, our perspective on Dane & Schneider’s first dimension is that it is not a dimension of FOI at all. Rather, it is a broad term that is consistent with the overall definition of FOI.

2. **Exposure and Dosage**: Exposure is defined by Dane & Schneider as “an index that may include any of the following: (a) the number of sessions implemented; (b) the length of each session; or (c) the frequency with which program techniques were implemented” (Dane and Schneider 1998). Dusenbury, et al. refer to this as “dose” but define it similarly, as “the amount of program content received by participants” (Dusenbury, Brannigan et al. 2003). We distinguish dosage and exposure by asserting that dosage addresses the question: “how much time is spent?” and exposure addresses the question: “in what way that time was spent?” Both of these related but subtly different aspects of fidelity fit within our Structural-Procedural critical component category.

3. **Quality**: Dane and Schneider define their third dimension, quality of delivery, as “a measure of qualitative aspects of program delivery that are not directly related to the implementation of prescribed content, such as implementer enthusiasm, leader preparedness, global estimates of session effectiveness, and leader attitudes toward program” (Dane and Schneider 1998). Conversely, Dusenbury describes it as “ratings of provider effectiveness which assess the extent to which a provider approaches a theoretical ideal in terms of delivery of program content” (Dusenbury, et al. 2003). Our approach to quality comes close to Dusenbury’s in that
quality of instruction is not defined by an outside standard. Rather, it is defined by the developers’ “theoretical ideal” that is embedded in the intended program.

4. Participant Responsiveness. Dane & Schneider describe participant responsiveness as “a measure of participant response to program sessions, which may include indicators such as levels of participation and enthusiasm” (Dane and Schneider 1998). Others refer to this as the extent of participant/student participation or engagement (Dusenbury et al., 2003; Lynch & O'Donnell, 2005; Ruiz-Primo, 2005). This dimension of FOI recognizes that some critical components essential for implementation reside not with the teacher, but with the students. In other words, it is not sufficient to determine that a teacher enacted activities targeting types of student participation; students must in fact engage in those intended activities. Thus, Dane and Schneider’s “student responsiveness” and what others refer to as student participation, is captured in our critical component category of “instructional-student engagement.”

5. Differentiation: Dane and Schneider define their dimension of “differentiation” as “a manipulation check that is performed to safeguard against the diffusion of treatments, that is, to ensure that the subjects in each experimental condition receive only planned intervention” (Dane and Schneider 1998). Others refer to differentiation as features of a program that distinguish one program from another (Dusenbury et al., 2003; Lynch & O'Donnell, 2005; Ruiz-Primo, 2005). As explained above, we and others (Ruiz-Primo, 2005) came to understand that differentiation is not a dimension of fidelity per se, but rather is an analytic process by which a researcher determines the degree to which the critical components that distinguish one program from another are present or absent. Thus, it is a process that one undergoes before, during, or after measurement of implementation to determine the extent to which programs share or don’t share particular critical components.

6. Alignment with more Recent Frameworks that use a Structure/Process Approach: Lynch and O'Donnell's (2005) study of implementation included the creation of a framework for measuring fidelity that combined Mowbray’s structure and process approach with Dane and Schneider’s five dimensions of fidelity. In their merging of the two, they place adherence, exposure, and differentiation under “structure” and quality under “process.” They also add a third category of “self-perceived effects of participants” and place responsiveness therein (Lynch and O'Donnell 2005). Their framework is consistent with the structure and process approach but adds clarity with the juxtaposition of Dane & Schneider’s five dimensions. As explained earlier, our framework also uses a structure-process approach combined with other categories.

LOOKING AHEAD TO USING THE FRAMEWORK

Implementation Types, Typologies, and Student Outcomes: While there is little current agreement about how to define and measure FOI, there is consensus in the field that, generally speaking, teachers never implement a program exactly as written. Therefore, rather than building instruments that focus on measuring the extent of FOI, the instruments grounded in our framework describe the nature of that implementation and can be used to determine relationships between types of FOI and student outcomes. Specifically, we expect that data collected using the suite of instruments will result in particular patterns, or “types” of FOI that comprise particular groups of critical components. Earlier work has explored this idea (Hall & Hord, 1987; Huntley, 2005; Neale et al, 1990; Ross et al, 2003). Hall and Hord identify what they refer to as “Innovation Configurations” with each configuration comprising combinations of critical components enacted in particular degrees (1987). Our framework lends itself to an innovation-configuration like approach that capitalizes on its categorical organization and clear, specific descriptions of critical components.

For example, one type of FOI (type “A”) may include the presence of many structural-procedural and instructional-student engagement critical components but only a few structural-educative components and even fewer instructional-pedagogical critical components. Another type (type “B”) may include many instructional-pedagogical critical components and very few other components. Knowing this, we can explore
the extent to which teachers or schools that have FOI type “A” demonstrate student outcomes greater or less than teachers or schools that have FOI type “B.” Instead of answering questions about whether implementation leads to desired student outcomes, these tools will help identify and understand the typologies of implementation that lead to desired student outcomes. Furthermore, identifying the most effective FOI typologies can inform developers, school leaders, and researchers about the particular critical components of instructional materials that seem most closely tied to desired outcomes they seek so that they can shape professional development, future materials development, and studies on those particular aspects of the programs.

Informing program development. FOI types can also be used for a more basic purpose. They can inform the work of program developers by helping them specifically identify the structural program components that teachers do and do not use. For example, developers can learn whether teachers use particular portions of a lesson and then use that information to further highlight, improve, or remove those portions. Or, developers can learn the extent to which teachers use the educative critical components of the program and which of those components, if any, the teachers benefit from the most.

Looking at program structures that lead to desired instructional practices. Because the framework is divided into structural and instructional sections, it facilitates the work of researchers interested in exploring relationships between the presence of particular program structures and the instructional practices aligned with the developers’ intentions. For example, if teachers are teaching with masterful questioning (instructional critical component), researchers can look to see if there is a relationship between that questioning and high presence of the particular structural critical components that are associated with questioning. This will further help developers determine which structures of their materials are leading to the desired practices and should remain in their instructional materials which should be removed, and where there is a need for revision.

Acceptable adaptation. In addition to informing immediate questions about the merits of particular program components, FOI types can also inform work on other long-standing issues in studies of program efficacy. Many researchers and practitioners have concerned themselves with the question of how much adaptation is acceptable when implementing a program (Blakely, et al 1987, Hall and Loucks, 1980). Those who take a fidelity perspective contend that implementation should occur as intended by developers, whereas the adaptation perspective allows for changes to occur to fit specific contexts. Knowing which implementation typologies lead to desired student outcomes can inform researchers who seek to understand the extent to which programs can, or should, be flexible when scaled up (Fullan & Pomfret, 1977; Emshoff et al., 1987; Lipsey & Cordray in Penuel & Means, 2004; Songer & Gotwals 2005).

Factors that affect implementation. Finally, implementation research often focuses on factors that affect fidelity. Recurring themes include a lack of time, lack of program specifications, lack of support, and attitudes/beliefs about the program being implemented (Bay, 1999; Bodilly & Keltner, 1998; Bodzin et al., 2003; Buston, Wight, Hart, & Scott, 2002; Fagan, 1996; Flocks et al., 2001; Heaney, 1995; McDonel et al., 1997; Wafa & Yasin, 1998). While these may not be telling in regards to strengthening the findings of program outcomes, these kinds of studies offer a great deal with regard to identifying strategies to support and improve implementation. The FOI types can contribute to a more specific and systematic analyses of relationships between these factors, implementation, and student outcomes.
BROADENING OUR WORK AND THE FUTURE

At the end of the FOI project, CEMSE will produce a suite of instruments for measuring FOI of each of the five reform-based mathematics and science instructional materials programs. In addition to the instruments themselves, the project will create a User’s Guide that will include a range of information on instrument use and adaptation. First, it will explain in detail the instrument development process and findings of the pilot and field tests. Second, it will explain steps that researchers can take for creating instruments for other reform-based mathematics and science instructional materials programs, by adapting the existing instruments as necessary. Finally, the guide will include suggestions for the use of each instrument alone or in combination with others and clearly identify the strengths and limitations of each instrument configuration with regard to information about an overall understanding of FOI.

While these products will contribute significantly to supporting rigorous mathematics and science instructional materials studies, the FOI framework and instrument development process can inform FOI measurement for instructional materials in other disciplines as well as other types of educational interventions. Our steps, including the explicit articulation of the program model through identification of the model’s critical components, organization of those critical components into the FOI conceptual framework, and instrument development (or revision of CEMSE’s instruments) based on the critical components create a sound starting point for FOI data collection in other studies. Through the articulation and categorization of program critical components, the framework is a basis for instrument development that will open up the “black box” of FOI and provide a deeper understanding of the program components and characteristics that are most closely tied to the desired student outcomes. In the short term, we hope that this process and its associated instruments will become increasingly refined through their use in studies of other interventions. In the long term, we hope to work with others to further understanding of FOI, our ability to accumulate knowledge about its measurement, and ultimately our ability to identify educational interventions that will bring high achievement to our schools.
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