CHAPTER I

Introduction

The National Science Foundation (NSF) has provided funding for systematically developed, research-based curriculum materials beginning in the 1960s. Over the years, there have been changes in the levels of funding for such instructional materials, reflecting changes in public support and educational concern for such endeavors, with the low point following congressional criticism of *Man, A Course of Study* (MACOS), an NSF-funded anthropology-based curriculum. More recently, however, concerns about student achievement in mathematics and science have focused attention on the need for strong curriculum materials (Flanders, 1987; McKnight, Crosswhite, Dossey, Kifer, Swafford, Travers, & Cooney, 1987; O'Day & Smith, 1993) to support "systemic reform."

NSF has responded to these needs by increasing attention to research-based instructional materials. Materials developed through NSF funding have been reviewed by content experts on at least two occasions. Both groups found the materials to be of high quality and meet the demands of the National Council of Teachers of Mathematics (NCTM) and National Science Education Standards (NSES).

Questions remain about the adoption and use of such materials. Some research indicates that teachers and others are more likely to use materials developed locally than those developed by experts (Fullan, Anderson, & Newton, 1986). Other studies show that teachers and school and district decision makers are concerned with the quality of materials, and that, at least for some, quality is judged by some "external" development or validation process (Louis & Rosenblum, 1981; Crandall et al., 1982). Most recently, Slavin has argued that the seeming failure of educational reform is rooted in the lack of clear and well-developed models for classroom instruction (Slavin, 1997). Carefully developed, research-based curriculum materials, such as those sponsored by NSF, could be seen as meeting the need for such models (Schmidt et al., 1996).

Recognizing a lack of information about the adoption and use of NSF-sponsored instructional materials, two divisions within the agency funded a study of the adoption and use of materials developed through the Instructional Materials Development (IMD) program. WestEd and Abt Associates Inc. are carrying out a research study of the quality of a selection of the materials, the development process used, reasons for their adoption, and implementation issues related to teacher use.

The IMD program supports the development of materials and strategies that promote improved science, mathematics, and technology instruction at all levels. The study is designed to answer the following questions:

1. To what extent do instructional materials embody the national standards, including an emphasis on thinking skills and making connections across curriculum topics?

2. To what extent do they reflect what is currently known about good instructional practice?

3. How well have they been marketed?

4. To what extent do adopters and teachers use the materials?

5. What supports do teachers and other school-based professionals need to make the best use of the materials?

6. What is the impact of the materials on classroom practice?

As the report indicates, the study was best able to provide solid answers to the first two questions posed by NSF and was more tentative about the others. The findings about the last four questions lay the groundwork for future NSF-sponsored studies.

The evaluation comprised five phases:

- An expert panel review of the quality of the materials;
- Telephone interviews with developers and marketers;
- Telephone interviews with key school or school district personnel;
- Focus groups with teachers; and
- Observations of classrooms.

Working with IMD staff, WestEd and Abt Associates Inc. selected 30 products, including elementary, middle, and high school science and mathematics; full courses and supplemental curricula that were intended to be used only as part of a course of study; and technology education and use of technology in education. NSF recommended products that not only illustrated the types of products funded, but also represented both fairly new and more "mature" materials. This selection was intended to ensure that the evaluation would identify differences in approaches to development and dissemination under evolving NSF guidelines, as well as issues related to adoption and implementation when products were quite new and when they were well established. In addition, the contractors selected 15 widely used mathematics and science products that did not receive NSF funding. The "non-NSF" products were not reviewed by experts, nor were there interviews with developers. For those products, the study began with adopters.

As is clear, this study was designed to answer questions about the development and use of products in classrooms. However, an equally valuable study could be based on the premise that the purpose of the IMD program is to provide *models* of curricula for a variety of audiences. From that perspective, an evaluation study would focus on how IMD products, taken as a whole, influence mainstream publishers, developers of state and local guidelines for adopting materials, and pre- and inservice educational opportunities. The alternative study of the influence of the products would start from the premise that the value of federal funding for curriculum materials lies in providing the field with "ideal" examples, rather than solely on their use in classrooms. Indeed, we believe that NSF should sponsor a study based on an image of the role of the materials in facilitating a vision of mathematics and science education rooted in conceptions of educational reform.

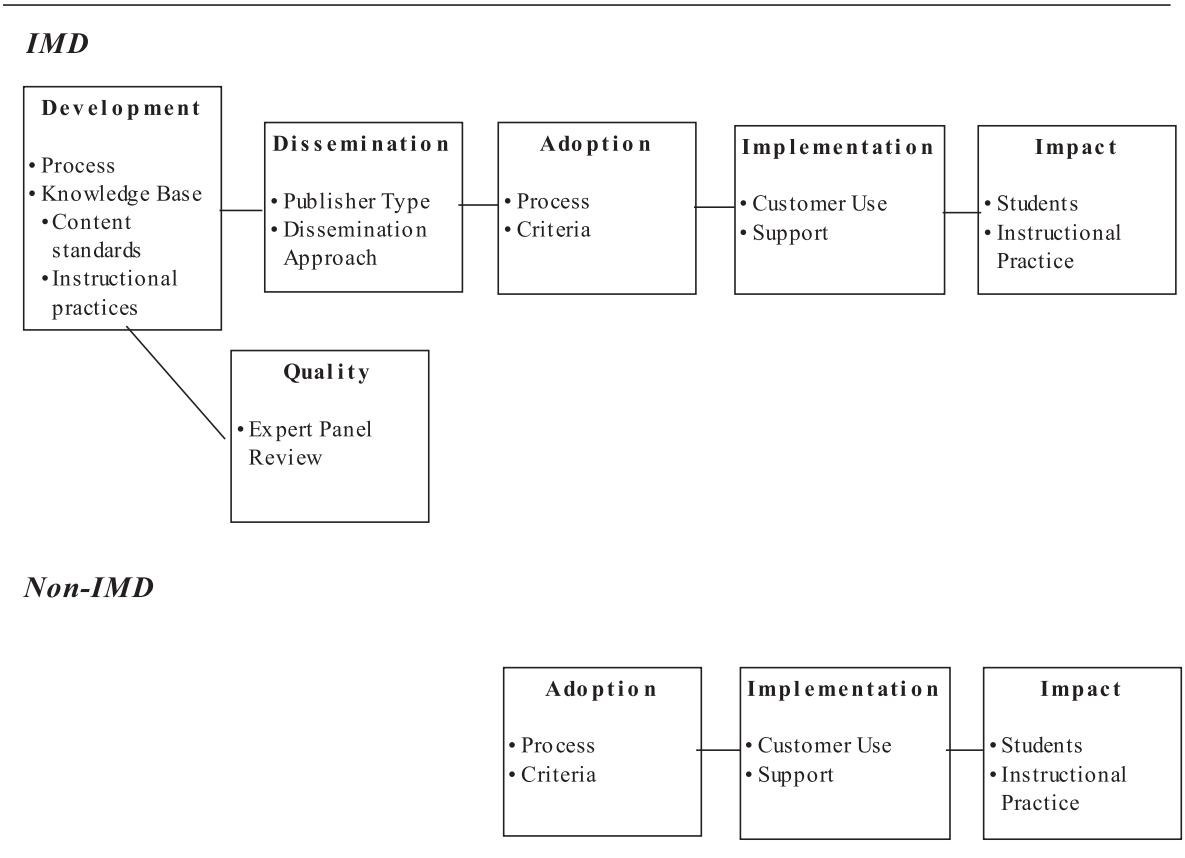
Whatever the merit of a study of product development as an instrument for presenting ideals to the field, it was *not* the question posed by NSF for this study. Rather, NSF was interested in actual use of products, including an analysis of the barriers and facilitators of such use.

Evaluation Methods

The IMD program evaluation was a mixed methods study, based on a design for gathering information at each step in a chain from product development to classroom use. It combined an expert panel review of curriculum materials, telephone interviews, focus groups, and classroom observations. In addition, the expert panel served as interpreters of the meaning of the study. This section will begin with a description of the overall design of the study and then move to a discussion of each method used, the data collected through its use, the evaluation questions answered, and the rationale for the choice of method.

The IMD program evaluation was designed to answer questions related to the development, dissemination, and use of NSF-supported materials. The questions reflect concerns at each stage of development and use, starting with issues related to the quality of the materials and ending with their application in classrooms. The design was intended to inform NSF and others about the relationship of the development process to quality, and how both quality and approaches to marketing affect adoption and use. Further, the design provided contrasting information about marketing, adoption, and use through our identification of widely used non-NSF products and how they were disseminated, adopted, and used. Figure 2 shows the evaluation framework.

Figure 2
Evaluation framework



Each approach to data collection was designed to answer questions about a specific stage in the chain from development to use. This approach is in contrast to some multimethod studies in which multiple sources of data are used to answer one question. Table 1 presents the evaluation question, data sources, and methods.

Table 1
Evaluation question, data source, and method

Evaluation Question	Data Source	Method
To what extent do instructional materials embody content standards and current knowledge of effective instructional practice?	Expert panel review (IMD) Developers (IMD)	Structured written review Telephone interview
How well have materials been marketed?	Marketers (IMD)	Telephone interview
To what extent are users of IMD and non-IMD materials satisfied with them?	Decision makers Classroom teachers	Telephone interview Focus group
What supports do teachers and other school-based professionals need to make the best use of the materials?	Classroom teachers	Focus group
What impact do the materials have on classroom practice?	Classroom teachers	Observations

Development

Information about the extent to which the materials embody national content standards, including an emphasis on thinking skills and making connections across curriculum topics, comes from two sources. First, the Expert Panel reviewed the products, using a structured format that directs attention at key quality concerns. Content and pedagogical experts brought to bear their knowledge and judge the output of the program. Their ratings (and subsequent discussions) provide indicators of project and program effectiveness.

The members of the Expert Panel (see Appendix 1) were identified by NSF and included scientists and mathematicians; science, mathematics, and technology educators; a former publisher; school and district administrators; and classroom teachers. WestEd and Abt Associates Inc. adapted an instrument for evaluating the quality of the materials that was previously developed by Inverness Research under contract to NSF for a study of year-long courses in middle school science (see Appendix 2). The adaptation was designed so the instrument would be applicable to the broader range of materials included in this study.

The Expert Panel met to explore its role in the study and develop shared understanding of the instrument used to evaluate the materials. The meeting included an opportunity to rate some products not included in the study and come to agreement on the meaning of each element in the rating form. Then, two members of the panel with relevant background rated each product. The group met again to resolve differences in the ratings and share their views on the quality of the materials.

Second, interviews, lasting from 45 minutes to over an hour, with key members of the product development teams of the projects identified by NSF included questions related to the intellectual underpinnings of the product, including bodies of scientific, cognitive science, and pedagogical knowledge used to inform their work. The developer interviews also included questions about the development process, including formative and summative evaluation efforts. The interviews not only reconstructed the development process, but they also provided developers with an opportunity to reflect on their experience and how they might approach the task in the future. During the interviews, we also asked developers to share supporting documentation from their project, including evaluations, field-test results, annual reports, and dissemination materials. As a result, the study made extensive use of already existing information.

Dissemination

High-quality materials must be appropriately disseminated to ensure their impact on teachers and students. Consequently, the evaluation included a focus on marketing and dissemination.

We gathered information about dissemination through telephone interviews with publishers and distribution houses that package and disseminate kits and other materials for IMD developers. The non-IMD products were identified through a review of adoption lists in states that have such a process, because we believed that materials included on the list would have widespread use. Our original intention was to conduct similar interviews with the publishers of non-IMD developed materials, but those publishers refused to participate in the study in any way. Consequently, the final report does not include their perspective on marketing. As a result, we cannot compare and contrast the marketing approaches of IMD and non-IMD publishers.

Interviews with publishers were the method of choice for two reasons. First, they allowed us to probe for the reasons that particular marketing decisions were made. Second, given the reluctance of commercial vendors to release information related to sales, telephone interviews seemed less threatening than written questionnaires or surveys, or even in-person interviews. Telephone interviews are also cost effective.

Adoption

Cost effectiveness was the major reason for using telephone interviews of adopters, the customers for the products. Although the original design called for a random selection of adopters from lists provided by publishers, the publishers would not share that information. (Nor would they share information about the numbers of adoptions.) As a compromise, we asked for names of "some" adopters, allowing the publisher to select those to include, but pressing for variation in type of setting and students served. From these lists, we selected schools and districts throughout the nation, representing rural, urban, and suburban settings. This approach is less desirable than randomly sampling adopters because it is likely that the names we receive represent "good adoptions"—districts that participate in publisher- and developer-sponsored staff development, purchase related materials, and provide feedback to the marketer.

The adopters of non-IMD products were identified by asking the IMD adopters to identify nearby schools or districts that used more mainstream products. Although we attempted to select adopters in areas with demographics similar to those in the IMD group, we were not always able to do so.

The interviews yielded information about the process and criteria used for adoption. Further, adopters reported on their use of the materials. Adopters of both IMD and non-IMD products were interviewed so we could see if there are particular processes and criteria associated with the selection of IMD products. Further, differences in use and impact may emerge.

Classroom Use

We elected to conduct focus groups of classroom teachers to gather information about their use of the materials. Focus groups are an efficient method to gather information on specific topics defined by the evaluator. The evaluator can direct the group in a manner that encourages interaction and reveals much about how consumers use the materials. The focus groups explored both strengths and weaknesses in the materials through the eyes of the users, as well as encouraged discussion of how teachers were (or should be) supported through workshops and other

professional development opportunities. Further, teachers were asked to reflect on how the use of the materials affected their classroom practice and student learning.

We were not always able to form focus groups, particularly for supplementary products. In those cases, we conducted telephone interviews with users.

Finally, classroom observations, using an instrument that reflects content standards in mathematics and science and knowledge of effective instructional practice, enabled us to contrast classroom practice and student response to IMD and non-IMD materials (see Appendix 3). WestEd and Abt Associates Inc. staff members conducted the observations. Only classrooms using full-course products were observed because the logistics of scheduling observations of supplementary materials in a variety of settings across the nation was an overwhelming prospect. Such materials are frequently used on an *ad hoc* basis, and teachers cannot predict when they will be drawing upon them.

Summary

The study employed a variety of methods to examine issues at each step from development to use. The design assumes that the purpose for developing materials is for them to be used in classrooms, although it does not assume that IMD materials should dominate the market. In fact, our approach will enhance NSF's understanding of the circumstances under which IMD-supported materials lead to high customer use, as well as affect classroom practice. Such understanding may be just as useful for the design of dissemination and professional development programs as for materials development programs.

From an evaluation methodology perspective, the study extends the use of multiple method approaches to evaluation. Most earlier multimethod evaluations are either integrative or sequential (Caracelli & Greene, 1997). Integrative studies use a variety of methods to illuminate a complex phenomenon by employing such devices as consolidated coding, concept mapping, or nesting qualitative methods in an experimental study. Sequential multimethod evaluations typically use qualitative methods to gather information that helps in the design of quantitative instruments, which are then used to confirm or extend findings. This study, however, uses various methods in a sequential fashion in order to build an integrated picture of the development, dissemination, and use of instructional materials.

Limitations of the Evaluation

As with most evaluations, the implementation of the design faced some realities that limit the strength of the findings. The major limitation of this study has been alluded to above—and that is publishers' (both of IMD and non-IMD products) refusal to share information with us. As a result, the evaluation cannot report on market penetration. It also cannot include an analysis of similarities and differences between approaches to marketing by the publishers of the two different types of products.

Publishers of IMD materials were willing to speak with us about the issues they faced in marketing the products, and they also provided names of some adopters. Their lists enabled us to select adoption sites that varied in demographic qualities, including urban, rural, and suburban districts. However, we are cautious in generalizing the findings about adoption and use because the sites in which we conducted interviews, focus groups, and classroom observations were sampled from what is likely a biased list.

Organization of the Report

The final report of the IMD study is organized around the questions originally posed. It begins with an analysis of the IMD products that are included in the study, starting with the assessment of their quality by the Expert Panel, as well as descriptive information about them. The report then moves to a focus on the development process, followed by a discussion of marketing and dissemination. We then turn to adoption, including an analysis of approaches to adoption that seem most likely to affect implementation. Implementation itself is the focus of the section that follows, and, along with providing information across products, the section looks at issues that facilitated or impeded successful implementation.
The concluding section summarizes the findings, and provides recommendations to NSF that are intended to enhance the impact of the IMD program.