

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

The evaluation of the IMD program focused on questions related to the development, marketing, adoption, implementation, and impact of the materials supported by the program. The lenses through which we looked put the materials at the center of reform of mathematics, science, and technology education. As such, the study may have slighted alternative perspectives and the role of other NSF programs in reform. Indeed, we found that many sites with the strongest implementations were found in states that had participated in Statewide Systemic Initiative efforts.

Our findings, in brief, were that the materials were of high quality, but that marketing, adoption, and implementation were problematic. As a result, there was deviation between intention and actuality at every link in the chain between development and impact. Products were marketed by small publishers who had limited resources for aggressive dissemination, so they were unable to increase the market for reform-oriented materials through their efforts. Further, adoption process frequently involved single teachers so widespread use in a district was rare. Teachers became aware of the materials through their participation in pilot or field tests or by seeing them at subject-matter conferences. Although such teachers were able to use school and district funds to purchase the materials, in general, they were unable to influence other teachers to use them. Also, implementation encountered problems due to lack of sustained professional development; and impact was more limited than it could be. On the other hand, most products overcame the hurdles at each juncture and were successfully implemented in at least a few settings. The lessons from these successes and failures can guide future NSF programming.

This concluding chapter begins by summarizing the answers to the questions posed by the study, and then moves to recommendations for NSF action. The recommendations place the IMD program within a portfolio of activities NSF can support, whether directly through materials development or through other mechanisms.

Answers to the Evaluation Questions

The study was framed by six 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?

The first two questions address issues over which NSF exerts direct influence by creating appropriate guidelines for funding, including reviewers who understand the intent of the program, and funding projects that hold promise of embracing the standards and reform-oriented pedagogy. The other questions are about the downstream issues, and the IMD program itself is more limited in the actions it can take about these matters, at least at the time of funding. In addition, the findings of the study related to these questions are more suggestive than definitive.

Each question will be answered in turn.

The Quality of the Materials

Both members of the Expert Panel and teachers who use the materials rate them highly. They believe that the materials embody the national standards. However, the quality of the materials is not sufficient to lead to widespread use. First, many teachers and parents do not embrace the reforms inherent in the products, and even in adopting districts, may resist their use or change their nature during implementation. For example, we conducted focus groups with teachers who “reorganized” the curriculum to make it more like what they were used to, ignoring the developers’ intent. Second, state and local standards and tests are not always congruent with the national mathematics and science standards, and teacher success is judged by how well their students perform according to state and local expectations. Nonetheless, the IMD program goal of creating high quality materials has been realized.

Instructional Practice

IMD-supported materials are highly rated as supporting what is currently known about good instructional practice. Both the Expert Panel and teachers who are using the materials agree that the materials embrace reform-oriented pedagogy. Teachers reported that they encouraged student inquiry, problem solving, and making connections across curriculum topics as they used the materials.

However, despite the positive ratings related to instructional practice, the materials faced barriers in implementation. For example, users of IMD products reported that parents were concerned that student homework (if it existed) was not what they expected. Some teachers then “supplemented” the materials with drill and practice homework sheets. In other instances, comprehensive materials were used as supplementary, and reform-oriented pedagogy became marginalized in the classrooms.

However, the materials themselves are appropriate models that reflect current thinking about instruction.

Marketing

The first stumbling blocks to program success appear at the link between developers and marketers. When the relationship is positive, the two share a vision and work closely to market the materials, but both developers and publishers frequently cited misunderstandings or differences in perspectives. Further, both report being hampered by what they believe is a limited market for reform-oriented materials. As a result, major publishers are unlikely to publish the materials, and the smaller, reform-oriented publishers have fewer resources to use for marketing.

The marketing problem arises because of the limited market for the materials, but is exacerbated by the fact that the most effective marketing tool is professional development. Professional development helps sell products in two different ways. First, developers, marketers, and adopters

agree that seeing the materials in a workshop setting is more likely to stimulate sales than any other approach. One person drew the analogy of the difference between reading a menu and eating a meal and other methods of dissemination and actual experience with the product. Second, and equally important, adopters cited the availability of professional development as an important factor in their decision to adopt. In the “ideal case” cited above, the key advocate said, “Service sold it,” referencing both workshops and ongoing support to teachers.

Professional development is expensive, and publishers believe that their role is to provide support at the front end of use. They argue that others are responsible for ensuring that teachers have adequate knowledge of the content and are able to use a variety of instructional approaches. If teachers came to classrooms with strong preparation in content and pedagogy from their preservice education, there might be less need for the depth of professional development required by the materials. The professional development issue is exacerbated by the fact that most IMD publishers are small and do not have the resources for significant amounts of front-end support, nor should they be placed in a position that requires them to do more than help teachers use particular materials.

We found that marketing is most successful when it reaches those who are already interested in reform and acquainted with current instructional approaches. For this reason, teachers who were involved in pilot and field tests frequently became a major source of sales of the materials.

Use of the Materials

There was considerable slippage between marketing, adoption, and use of the materials. When the process worked well, teachers and community members were invested in the success of the product and used it as well as they could. Adoption processes that engendered such investment varied, depending on the setting. For example, some districts built support through adoption committees, but there were fewer of these than anticipated. In other sites, an individual teacher began using the product and her/his enthusiasm (and the enthusiasm of students) spread its use. Whatever the process, if it yielded understanding of and support for the approaches taken by the materials, successful use followed.

We found that barriers to implementation were the mirror image of the facilitators. For example, technology could support use if it were available but was a barrier if the product relied too heavily on the existence of large numbers of computers. However, if materials that use technology are not available, there will be little reason for schools and districts to invest in computers.

Perhaps the most important barrier to use lay in the fact that teachers sometimes resisted use or used the materials in ways that conflicted with the developers’ intention when they lacked the skills and knowledge related to content and instructional practice. Such resistance and misuse arose less in sites in which there was strong support for appropriate implementation.

Required Support

As indicated throughout this report, sustained professional development is a necessary accompaniment to successful implementation of IMD products. The materials themselves require teachers to change their conceptions of mathematics, science, and technology as academic content areas, moving from an emphasis on passive knowledge of facts and algorithms to active construction of knowledge. In addition, the materials embody instructional approaches that focus on the student as problem solver and thinker. These changes place great demands on teachers, and professional development is an essential tool for their learning how best to use the materials.

The sustained professional development associated with successful implementation had a number of components. First, teachers were introduced to the materials through some kind of hands-on workshop. Second, extended institutes or workshops, most often held during the summer, gave teachers an opportunity to practice using the materials in instruction. Third, someone—either a developer, publisher representative, or teacher who was more experienced in the program—was available to provide support during the school year. And, finally, in the best circumstances, the developer received feedback and changed or supplemented the materials to meet teachers' needs.

In addition to formal professional development, successful implementers often had an advocate or champion. The champion was able to arrange events with parents so they were supportive of the curriculum change. Further, he/she solved logistical problems by such actions as developing a centralized location for laboratory materials or manipulatives and a system for their use that facilitated teacher access to the materials. Having a champion meant that the teachers using the materials believed they would get help, which increased their enthusiasm for the products.

Impact

When materials were well implemented, they had positive impacts on classrooms, as reported by teachers. For example, elementary school teachers reported increased knowledge of science, and, to a lesser extent, of mathematics as a result of using the materials. Elementary, middle, and high school teachers said that the materials helped them use more student-centered, problem solving instructional approaches. And teachers at every level reported increased student enthusiasm for science, mathematics, and technology.

Only sites implementing mathematics curricula had data related to student achievement, typically from state or district tests. The designs did not include comparison groups so attribution is problematic. However, those that had information about student learning indicated positive outcomes.

Recommendations

The recommendations arising from the evaluation of the IMD program fall into two broad categories. The first focuses specifically on actions IMD program staff can take that will improve product development and dissemination. The second group of recommendations concerns issues outside the direct influence of the IMD program, and focuses on creating the climate and support for reform that we found essential to successful implementation and positive impact.

IMD Program Recommendations

- IMD program guidelines should emphasize the importance of including teachers on development teams.
- IMD program staff should acknowledge the importance of individual teachers as adopters of IMD products and seek ways to increase their opportunities to influence other teachers, through support for networks and school- and district-reform efforts that build on teacher knowledge, skills, and interest.
- IMD program guidelines should increase the stress on evaluation as a component of the development process, and should also emphasize the importance of

collecting data related to student learning of mathematics, science, and technology on tests not directly connected with the materials, but appropriate to them, such as the NAEP or TIMMS.

- IMD program staff should offer assistance to developers through such avenues sessions at Principal Investigator meetings and other venues as they begin to work with publishers and develop relationships with agents who work with publishers.
- IMD program staff and grant recipients should strengthen connections with other NSF and federal programs to increase opportunities to connect with professional networks and create awareness of the products. Such avenues as the NSF Implementation Centers and the various systemic change projects, the Eisenhower Regional Consortia, and the Eisenhower National Clearinghouse are potentially useful to dissemination.
- NSF should sponsor a study that proceeds from an alternative vision for the IMD program—that the purpose of the program is to demonstrate what types of materials are possible and influence professional practice, preservice education, and publishers through the example the materials present.

Supporting Reform More Broadly

- NSF should stimulate a public dialogue about reform of mathematics, science, and technology education and the role of materials in efforts to improve education.
- NSF should provide support to professional networks, including the Presidential awardees, in order to increase their effectiveness in stimulating attention to reform of mathematics, science, and technology education.
- NSF should work with professional associations outside the science and mathematics community to build support for reform. Such organizations as the American Association of School Administrators (AASA), the Association for Supervision and Curriculum Development (ASCD), and the American School Boards Association (ASBA) offer opportunities to work with a broad array of educators and policymakers to create the environment that will support the use of the materials.
- NSF should increase attention to support structures and approaches that provide sustained professional development related to reform-oriented curricula and pedagogy. Such professional development should include in-depth workshops and institutes and on-site support to teachers.
- NSF should increase attention to the role of materials in preservice education. Teachers play a major role in choosing instructional materials, and most current preservice courses do not include work on processes and

criteria to use in making such choices. In addition, preservice teachers who are familiar with reform-oriented materials are likely to be supportive of their use when they begin their teaching careers.