Picking the Best:

A guide to Finding the Math and Science Programs and Practices that Work for Your Students

Patricia B. Campbell, Ph.D.
Capbell-Kibler Associates

Lois-ellin Datta, Ph.D.
Datta Analysis

www.mckenziegroup.com

For more information or additional copies, contact:

THE MCKENZIE GROUP, INC.
1101 17th Street, N.W.
Suite 1200
Washington, D.C. 20036
(202) 466-1111

Picking the Best:

A guide to Finding the Math and Science Programs and Practices that Work for Your Students

Patricia B. Campbell, Ph.D.
Capbell-Kibler Associates

Lois-ellin Datta, Ph.D.
Datta Analysis

PICKING THE BEST:

A Guide to Finding the Math and Science Programs and Practices that Work for Your Students[1]

TABLE OF CONTENTS:

[1] Thanks to Lesli Hoey, Kathryn Acerbo-Bachmann and Lesley Perlman for their assistance as well as to Arlene Chasek, Pamela Mason, Deborah Mortman and Jo Sanders for their helpful comments.

PICKING THE BEST:

A Guide to Finding the Math and Science Programs and Practices that Work for Your Students

NOT JUST ANOTHER GUIDE: AN INTRODUCTION

What teacher training approach should we use?
Whose science textbook series should we adopt?
What pedagogical theories seem best suited for teaching math and science in our elementary schools?

The questions go on and on. Each year you and your colleagues make many educational decisions related to mathematics and science education. These decisions may range from whole school reform to staff development and evaluation choices to textbook and curriculum adoptions to selections of specific programs. These choices have major implications for what and how mathematics and science are taught in your school or district. Student math and science participation and achievement are based in some part on the choices you make.

In the past, these choices have been made primarily based on cost, recommendations of others and even salesperson's presentations. While anecdotes about the impact of different programs were everywhere, few actual research and evaluation results existed. In fact, for most curriculum and textbook series, the only real data available were publisher's figures on the number of adoptions. There were exceptions: the U.S. Department of Education's National Diffusion Network published lists of programs, such as *Science Programs that Work*, that had validated data on program impact. However, for the most part, you were pretty much on your own.

Things are changing. Organizations such as the American Association of School Administrators (AASA), the American Federation of Teachers (AFT)[2] and the U.S. Department of Education are using expert panels, research studies and reviews of research to identify "best practices," "exemplary or promising programs" and "validated curriculum." State and federal governments are beginning to require that districts adopt programs or other reforms that have been tested and found to have positive effects on students.[3] Yet, each of the organizations have their own procedures and evaluation criteria. Even their definitions of terms like "promising" differ from on organization to the next. So what is a decision-maker to do?

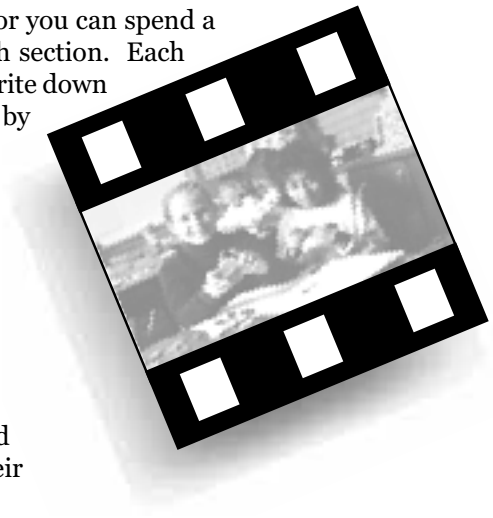
---

[2] Summaries of the AASA and AFT work as well as ways to get copies of the reports, including websites for downloading, can be found in *Additional Resources: Reports.*

[3] Much of the push for impact data has come from the Government Performance and Results Act (GPRA), coupled with the move by private foundations to demand outcome and impact evidence.

This publication seeks to answer that question by providing you and other math and science decision-makers with a step-by-step guide, based on lessons learned from prior research and experience, to selecting math and science programs and practices. It is a synthesis of "lessons learned" in efforts to identify programs and practices that are likely to improve student math and science achievement that can be used to help you develop and implement your own process to "pick the best."

You can use this pamphlet to find quick individual tips or you can spend a little more time and answer the questions posed in each section. Each time you are asked a question, there is space for you to write down your answer. You may want to answer the questions by yourself or with others who are involved in your work. After you have gone through all the sections and answered the questions, you should have the beginning of a plan.



Remember there is no one right way to use this pamphlet. Some people have found it helpful to go through the process more than once, revising their answers to the questions. Others suggest that after an introductory meeting, participants individually respond to a section or two and then meet as a group to share their ideas and brainstorm new ones.

standards translate into practice.

BEGINNING AT THE BEGINNING, OR REFINING YOUR PROBLEM

Sometimes the obvious place to begin is also the best one. Having an answer before you know the question only works well in the TV game show “Jeopardy.” Most likely the first question that you need to ask is: "What's the problem?" The quick answer tends to be "low student achievement in math and/or science." While low achievement may be the problem, it is too general a statement of the problem to help you search for a solution. You may want to make your problem more specific, to look at what may be behind the low achievement. Your real problem may be something simple, such as, the topics and skills covered in your math curriculum don't reflect the topics and skills covered by the tests that you are using, or it may be something much more complex, such as, your teachers have little awareness of national or state standards and how those

[4]

[4] Navarro, M. Susana Navarro and Natalicio, Diana S. (April, 1999) Closing the achievement gap in El Paso: A collaboration for K-16 renewal. Phi Delta Kappan, p. 507-601.

The math and/or science achievement of your students is not as high as you would like it to be. What are your hunches or best guesses as to what the major contributors to the low achievement are?

Possible Factors Contributing to Lower than Desired Student Achievement

Your hunches are often pretty accurate, but it is always good to check and see if there are data to support them. If your guess is that your math curriculum does not reflect the tests, then you may want to look at the content covered in the tests and systematically compare it to the objectives of your text book series, syllabi or curriculum to see how much of a match there is.

It is also very likely that some students or some schools are scoring much lower than others. Can data that you already collect help you to figure out why? Just knowing that these students are more apt to be poor or minority is not of much help because it doesn't point you towards solutions. You may want to look at the relationship between student achievement and process variables that are often correlated with achievement such as curriculum, pedagogies and even teacher participation in various professional development activities. These are variables that can be changed - variables that you can do something about.

What student, teacher or school data, if any, support your best guesses about the contributing factors to low achievement?

Factor	Supporting Data or Evidence

Now you have some ideas about the factors contributing to the problem of low achievement. An important next step can be to look at what has been done about the problem in the past in your school or district. It may be that these are new problems, and you have never done anything to try to solve them; if so, move right on to the next section. However, in most cases things have been

tried. Some have worked and others have not. Reinventing the wheel is rarely smart. Keeping in mind "what worked and what didn't" as well as any ideas you have about why things worked or didn't can provide you with direction as you search for solutions.

What have you, your school or your district tried in the past to improve math and science achievement that at least to some degree WORKED? Did they work for some students but not for others? Why do you think these things worked?

Successful Strategies that Have Been Employed in the Past
Degree to Which These Strategies Worked
Why These Strategies Worked

What have you, your school or your district tried in the past to improve math and science achievement that DIDN'T WORK? Why do you think these things didn't work?

Strategies that Did Not Work
Why These Strategies Didn't Work

Go back and reread your answers to the previous questions. If you still think that the contributing factors you listed are appropriate and you have some ideas why some things worked better than others did in the past, then it is time to start looking for solutions.

WHAT'S OUT THERE? DETERMINING YOUR RANGE OF SOLUTIONS

While there are many different strategies to use while searching for solutions, they tend to fall into two categories: looking elsewhere and looking at home. While most people start by looking elsewhere, much can be learned from what people around you are doing. Almost every school and district has someone trying out new ideas and better ways of doing things without being in the official spotlight. Finding solutions in your own backyard can help encourage innovation in your school and school system as well as be cost effective.

Looking at home for solutions can be as informal as asking people if they know of anyone within your district who has been trying out a solution to your problem. You can also use more formal strategies such as writing about your search for solutions in district newsletters or presenting at school and district wide faculty and staff meetings.

If you are planning to start your search for solutions within your home district, how will you collect the information?

Possible Data Collection Methods/Avenues

Once you have found out "what's happening" in your district, it is time to search the rest of the world. You may want to match your search strategies to the magnitude of the decisions you are planning to make. For a large decision, such as revamping the district's science and math curriculum, you probably want to invest plenty of time and effort to be sure you haven't missed possible choices. For smaller decisions, you may want to select strategies that are less comprehensive but also less labor-intensive.

Sample Strategies

1. Ask people outside your district.

This is particularly important if you come from a small district or an independent school. Ask for recommendations from people whose schools or districts are doing particularly well.

Recommendations from other teachers, principals and superintendents are probably the most popular and most trusted source of solutions among educators.

You can also ask publishers for recommendations, remembering that textbook publishers have obvious self-interests. However, they also can have a wide, first-hand knowledge of solutions being tried, including some that don't involve textbooks.

2. Check out existing databases of math and science materials.

Some organizations have already done some of the searching for you, including:

- The Annenberg/CPB Math and Science Collection's *Guide To Math & Science Reform*
- The Eisenhower National Clearinghouse's (ENC) Resource Finder, an electronic catalog of math and science curriculum resources with links to Internet materials
- The National Science Teachers' Association's (NSTA) ExplorAsource for Educators which searches through detailed information on over 400 learning products - print, software, and video.

NSTA also has a collection of references, workshop activities, research, analyses, and plans that illustrate different aspects of science literacy and its application to K-12 science education, called Resources for Science Literacy: Professional Development. The *Additional Resources: On Line Science Materials* section has information on how to access these resources and others.

3. Go through the major report summaries of promising programs and practices.

Although not exclusively covering math and science, some recent reports can provide information on school programs and practices that have implications for math and science reform. One of the most useful summaries, *An Educator's Guide to School Reform*, reviews the research on 24 "whole school," "comprehensive," or "school wide" approaches to school reform. Other useful reports include the American Federation of Teachers' *Raising Student Achievement: An Internet Resource Guide for Redesigning Low Performing Schools*, and the U.S. Department of Education's *Tools for Schools: School Reform Models Supported by the National Institute on the Education of At-Risk Students*. *Additional Resources: Reports* has information on how to access these and other reports.

4. Look at the U.S. Department of Education's Expert Panel recommendations.

The U.S. Department of Education is currently sponsoring a series of Expert Panels, including a panel on Mathematics and Science Education, to evaluate educational programs and recommend to the Secretary of Education those programs that should be designated as promising or exemplary. While the results for science are not yet available, the Mathematics and Science Expert Panel has released *Exemplary and Promising Mathematics Programs*. Information on how to get copies of the report can be found in *Additional Resources: Reports*.

5. Search the Web.

At this point there is much information available on the web that can help you find programs and practices. Through the National Science Foundation (NSF) (http://www.nsf.gov), you can download information on grants that have been funded, including curriculum and other materials that have been developed under NSF funding and information on contacts for further information. Similar information also is available from the U.S. Department of Education although it is not on-line. However, the Department's website (http://www.ed.gov) has a variety of resources including information on projects and products, research studies and reports.

The more directions in which you search for solutions, the more solutions you will find; however, there are tradeoffs in terms of time and money. You need to decide how intensively you want to search for solutions.

What first steps will you take to search for solutions? Once you have finished your search for solutions, jot down the list of possible strategies and programs that may serve as solutions for each of the problems you have identified.

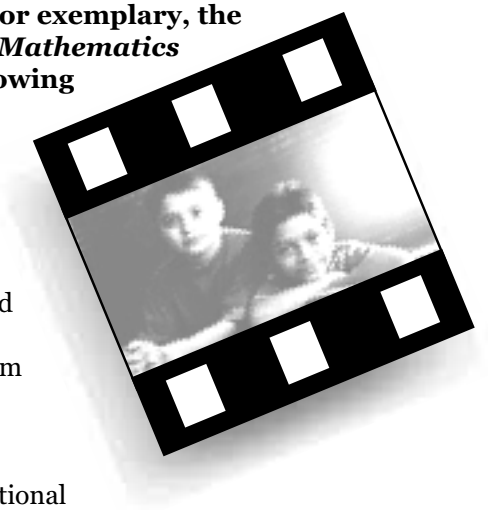
Possible Solutions	
Problem	Strategy/Program
I.	A.
	B.
	C.
II.	A.
	B.
	C.

MAKING CHOICES

LEARNING FROM WHAT HAS GONE BEFORE

Now you have a good sense of both your problem as well as a range of possible solutions. To begin to narrow that range, it helps to make some decisions about the criteria you want to use to make judgments. As you would expect, others have already "been there, done that" and have much advice to ffer. Not surprisingly different groups use different criteria in their decision-making. The following three examples may give you some ideas of criteria you want to use in your decision-making.

I. To determine if math programs are promising or exemplary, the *U.S. Department of Education's Expert Panel on Mathematics and Science Education* evaluates them in the following areas[5]:



Quality of Program:

- Are the goals challenging, clear and appropriate?
- Is the content accurate, appropriate and aligned with its learning goals?
- Is the instructional design appropriate, engaging and motivational?
- Is the assessment appropriate and designed to inform student learning and teacher decisionmaking?

Usefulness to Others

- Can the program be implemented in multiple educational settings?

Educational Significance

- Do the learning goals reflect the vision promoted in mathematics education national standards?
- Does it address individual and societal needs?

If programs satisfy the criteria under the preceding categories,then they undergo evaluation against a fourth category:

Evidence of Effectiveness and Success

- Does it make a measurable difference in student learning?

---

[5] U.S. Department of Education. (1999). *Guidelines and Materials for Submitting Mathematics Programs For Review*. Washington, DC: Author.

II. The Educational Research Service's An Educator's Guide to Schoolwide Reform uses two categories for making judgments:

Evidence of Positive Effects on Student Achievement

- Based on research and evaluation studies, reforms are rated on a five-point scale from "strong" evidence of positive effects to "no research."

Support the Developers Provide Schools

- Reforms are rated on a four-point scale from "strong implementation support in which developers provide a range of services," to "weak support where developers provide only initial training."

III. The Education Development Center's publication *Choosing a Standards Based Mathematics Curriculum* suggests the following categories for selection criteria and provides a series of possible questions to ask when making judgments about programs:

Mathematics Content:

- What mathematics content [in this program] is particularly well developed?
- Are there important mathematical ideas students will not have a chance to develop adequately?
- How does the curriculum encourage the development of technical skills?
- How does this curriculum connect with other curricula?

Pedagogy:

- What instructional approaches does the curriculum use?
- How does the curriculum make mathematical concepts and skills accessible to students with different learning styles, backgrounds and intellectual strengths?
- How does the curriculum help students learn to ask mathematically important questions, make conjectures, advance convincing arguments and develop proofs?

Assessment:

- How does the program help teachers assess student learning for purposes of instruction?
- What kinds of assessment opportunities does the curriculum offer for purposes of accountability?
- What opportunities exist for students' self assessment?

These are just a few of the criteria available that have particular relevance for math and science reform. There are, of course, many others. Listings in Additional Resources: On-Line Materials and Additional Resources: Reports include the criteria they used for selecting materials.

These different sets of criteria have been worked out, often literally over years of discussion and debate by good, experienced people. At this point, however, there are no data to indicate which set of criteria for judging programs is better or more effective than others. So if some criteria don't seem all that relevant in your circumstances, leave them out.

Which criteria do you want to use in your decision-making? Among the criteria listed categories, which, if any, do you want to use in your decision-making?

Critera for Selecting Programs/Strategies

DEVELOPING YOUR OWN CRITERIA

Most likely there are categories and criteria that are important to you and your district that aren't included in the existing lists. If this is the case, you may want to develop some criteria of your own. Remember it is a lot easier to work with criteria that are simple, quantifiable and objective. "At least a 90% match with national math standards" is a workable criterion. For example, "shows innovative approaches" isn't a particularly workable criterion because it doesn't include a definition of"innovative approaches." One person's concept of an innovative approach may be “old hat” to someone else and totally crazy to a third person.

As you develop your own categories and criteria, there are some things you may want to keep in mind including:

Cost

You need to know about how much you have to spend on your solution, be it teacher training, curriculum and/or revamping the K-12 science program. If a possible solution costs much more than what you have to spend, then it isn't for you.

The Givens: Issues of Constraint

Within your school or district, things like average class size and how classes and teachers are scheduled are unlikely to change. These existing constraints should be considered when you are selecting solutions. If a program requires block scheduling and you have 50-minute periods, then this scheduling program is not going to work well in your school. Similarly, if a teacher training program requires a five-day block of time and your teacher professional development time is a half-day weekly, there will be problems. Team teaching, cross-age classes, pullout programs, even the length of the school day are all variables that may influence your choice of solutions.

Other Things

There are things that are very important to your school or district that have not been mentioned but that should be included in your criteria for evaluating solutions. If your students are predominately bilingual, you may want a criterion to be the availability of materials in languages other than English. If "parent involvement" is important to your district, you may want any program you chose to include effective ways to involve parents. Other possible issues of importance to your school or district may be: a focus on "hands-on learning," applications related to "multiple intelligences," or ways to ensure that students with physical disabilities are able to do the science activities. Whatever these criteria are, they are important and should be included in your criteria for making decisions about solutions.

What, if any, particular constraints or opportunities do you need to consider in your decision-making?

Special Constraints and Opportunities

What additional criteria will you be using in making decisions?

Additional Decision-Making Criteria

At some point you will most likely be making a choice among several programs. Often making the choice can be easier, and more justifiable, if you make a summary chart, such as the one below which compares the different programs in terms of the degree to which they meet each of your criterion.

Evaluation Criteria

Possible Solutions	**Program I**	**Program II**	**Program III**
Solution A	Partially Met	Not Met	Fully Met
Solution B	Fully Met	Partially Met	Fully Met
Solution C	Fully Met	Not Met	Fully Met

Evaluating Possible Solutions			
Criteria:	Solution I	Solution II	Solution III

EVIDENCE, EVIDENCE, EVIDENCE

EVIDENCE OF WHAT: WHAT ARE YOU LOOKING FOR?

As you assess possible solutions for impact on student achievement, there are several dimensions of achievement in which there may be affected, including:

- changes in knowledge and skills
- factual knowledge
- new types of knowledge
- more rapid acquisition of knowledge
- application of knowledge
- acquisition of skills
- application of skills.

You may also want to look for evidence of changes in areas that are indirectly related to student achievement such as:

- teacher attitude and behavior
- student attitudes and behavior
- instructional practices and procedures.

If you do look for changes in the areas of attitudes and practices, you may also want to look for some indication that changes in these areas will contribute to student achievement in the future.[6]

[6] Ralph, John and Dwyer, Christine M. (November, 1988). Making the Case: Evidence of Program Effectiveness in Schools and Classrooms. Washington, DC: U.S. Department of Education; Office of Educational Research and Improvement.

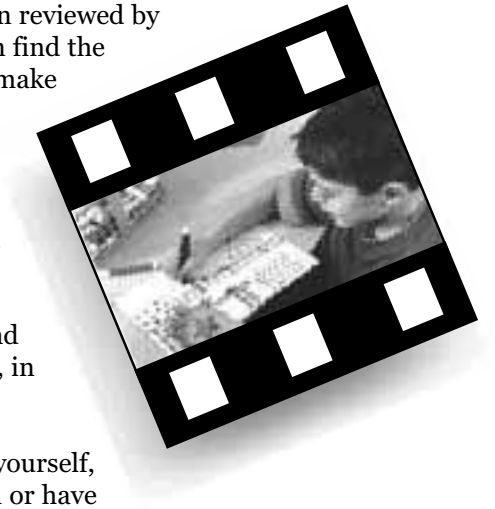
In what areas are you looking for evidence?

Possible Solution	Area of Evidence Needed
I.	A.
	B.
	C.
II.	A.
	B.
	C.
III.	A.
	B.
	C.

WHOSE JUDGEMENTS?

If there is evidence of effectiveness of a proposed solution you need to decide if you are going to accept others people's judgments or if you will review the research and evaluation data yourself not an easy task.

Before you decide if you are going to accept the judgments of others, you may want to check if recommended programs or practices have been reviewed by panels of evaluators *and* educators. Evaluators can often find the holes and flaws in research and evaluation data that can make evidence invalid, while practitioners can assess the quality and "doability" of innovations most effectively. The Expert Panel on Mathematics and Science Education, for example, uses content area experts and practitioners to do the initial reviews and then has expert evaluators review the evaluation and research studies submitted by programs. Reports such as *An Educators' Guide to Schoolwide Reform* review all of the research and evaluation studies available for a reform but only include, in their guide, studies they deemed of high quality.



If you plan to review the research and evaluation results yourself, you should have a background in research and evaluation or have someone with such a background working with you.

Probably the easiest way to get research and evaluation data about a possible solution to math and science reform is to contact the developer/publisher and ask for it. Often evaluation studies have not been published and are not available in research literature.

It is important to look at the date that the research and evaluation was done and if the studies were done over the reform as it currently exists. Programs and other solutions go through many iterations correcting problems and weaknesses. As John Anderson, president of New American Schools warns:

> In the same way a software developer has successive versions of the same product, schoolwide models can change to enhance what they offer. Judging them today based on research that is several years old may be a shortsighted as judging Windows NT on the crashes of Windows 2.0.[7]

Unfortunately, there is not a great deal of evidence on program effectiveness available for many efforts. While we all want to pick solutions for which there is a great deal of data that indicates the solution works well for students like ours in settings like ours, this kind of evidence is rarely available. Out of the 24 major whole school reforms reviewed in *An Educator's Guide to Schoolwide Reform*, only three were rated as having "strong evidence" of positive effects on student achievement." A full third were rated as having no research at all!

---

[7] Anderson, John. (June 2, 1999). Commentary: Is it working yet? Education Week, p. 30.

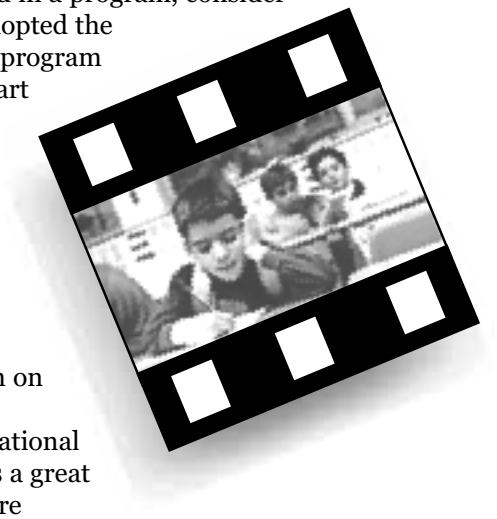
Are you planning to evaluate evidence of the effectiveness of different solutions?
_____Yes _____No. If yes, how are you planning to evaluate that evidence?

Possible Solution	Ways to Evaluate Effectiveness
I.	A. B. C.
II.	A. B. C.
III.	A. B. C.

If you find little or no evidence of effectiveness for the solutions in which you are interested, there other things that you can do. First you can contact program developers/publishers and ask them for information about the number and types of schools and districts that have adopted a particular program as well as the number and types of schools and districts who, several years later, are still using it. You can then look and see whether a particular solution has been implemented by schools and districts like yours and whether they are still using it.

You can also go a step further and ask for the names of schools like yours who are using the program. Contact principals or curriculum directors and ask them about the program - are they satisfied with it? is it working in their district? have they collected any data on the impact of the program on student achievement? Also consider contacting some schools who are no longer using the program and asking why they stopped.

If, after gathering this information, you are still interested in a program, consider making site visits to some schools like yours who have adopted the program and are still using it. That way, you can see the program in action and talk to the teachers and students who are part of it.



Along with collecting information from those using programs in which you have an interest, you can also look at the program and its components. Is there any theory behind the program? Do developers explain why the program was designed the way it was? Do they provide any information about why different program components were selected? Or do they have any research on the effectiveness of different program components or strategies? If not, using sources such as the Third International Mathematics and Science Study (TIMSS), which provides a great deal of information on math and science strategies that are correlated with higher achievement, you can check to see if programs include strategies that have been found to be effective[8].

Finally, you can collect your own data on the effectiveness of a particular program or other solution. Of course, to do this, you must first implement the program. Since what works in one setting does not necessarily work in another, it is always a good idea to collect your own impact data. If you are not a researcher or evaluator, others in your district can help you set up a process to collect and analyze data on program impact.

[8] More information about TIMSS and it's results can be found at www.nces.gov.

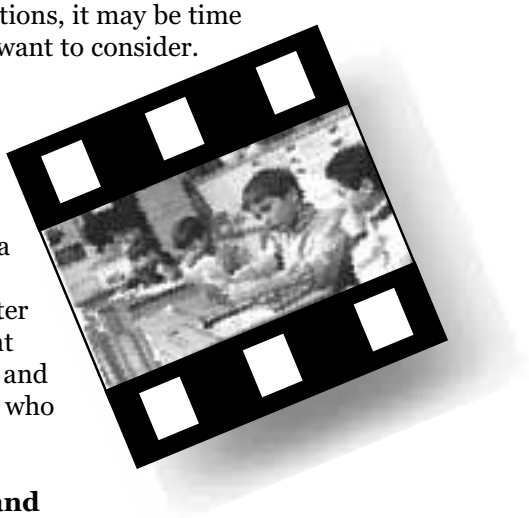
If there is little evidence of effectiveness of different solutions in which you have any interest, what will you do?

Possible Solution	Steps to Take in the Absence of Evidence of Effectiveness
I.	A.
	B.
	C.

Whatever you chose to do about evidence of effectiveness, consider using your power as a consumer to push publishers and program developers to collect and make available impact data on their products. This will only happen if enough decision makers say "we will not purchase products and/or services that have not been shown to have a positive impact."

FROM SELECTING A SOLUTION TO SOLVING THE PROBLEM

Now that you are close to selecting a solution or solutions, it may be time for a reality check. There are several areas you may want to consider.



TIME

You have selected the approach. You have the initial funds. You have the timeline for implementation, and it all seems to fit. However, if you are like most educators, you are working within a complex system, governed by complex rules for procurements, staff time and more. Funds arrive later than expected. Paperwork is lost. The unions, parent groups and others who you thought were "on board" and supportive of the solution turn out not to be. People who should have showed up for training, didn't.

Knowing that there will always be problems and things will always take longer than expected, do you think you will have enough time scheduled to implement this solution? _____Yes _____No. If no, what can you do to give yourself some more time?

Strategies for More Time

Money and Resources

Teachers, principals, parents, students, curriculum specialists and superintendents are being bombarded with things that add to or change their workloads and responsibilities.

Your solution has a much better chance of success if both time and resources have been budgeted and if you do everything in your power to just say "no" to other ideas, other initiatives, other funds until *this* solution has had a fair chance.

Do you think you will have enough money and people resources available to implement this solution? _____Yes _____No If no, what can you do to get some more resources?

Strategies for More Resources - Fiscal and Human

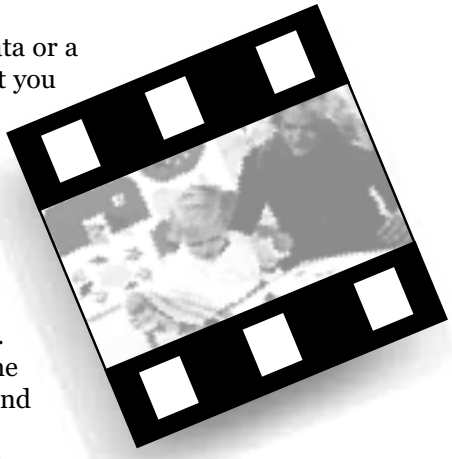
Moving to Scale

Implementation seems to go more smoothly on a larger scale - whatever the scale is - when the approach has been piloted on a smaller scale. If the solution is at the classroom level, consider trying it out with one or two classes for six months or a year first. If the innovation is at the school level, try it out with a few classrooms, or if the change is at the system level, try it out with one or two schools first.

Is piloting a possibility? _____Yes _____No If yes, where do you think you could pilot your solution?

Possible Pilot Locations/Configurations

Data



Whether you have found the perfect solution with perfect data or a reasonable solution with very little data, as you implement it you should consider collecting your own data on student impact. Since one solution rarely fits all, your data collection efforts should also allow you to look at the impact of the solution on different groups of students in different settings. A curriculum that works well in a class of 18 may not in a class of 27. A particular instructional strategy may work well for elementary teachers with a strong science background but not for the "average" teacher. Collecting data over different settings can help you determine within your school or district what does, or does not, work and for whom. This is true whether the approach is staff development, new curricula, different scheduling or learning incentives.

The data you collect should reflect the data that helped you define the problem and suggested the solution. That is, you should look at student achievement. Too often, innovations and change are justified by one set of data while success is measured by a different set of data. If the solutions were selected in the hope that they would raise student science achievement or increase the number of students in upper-level math courses, then that is the impact data that should be collected. It is fine to determine the degree to which the solution was implemented, the number of participants, and even participant satisfaction, but that is not enough.

Can you collect data on the impact of your solution on student achievement? _____Yes _____No. If yes, how will you collect that data?

Steps to Collect Data on the Impact of the Proposed Solution on Student Achievement

FLEXIBILITY

Sometimes, change can be linear - step 1, step 2, step 3 to the finish. More often, change is non-linear, even chaotic, involving things neither predicted nor predictable by current theories. Identifying decision points where your options could include stopping, modifying or going forward can help you deal with potential confusion as can roughing out alternate scenarios. If the solutions you chose have flexibility, you could have additional options. For example, you could pick a curriculum which may not be the very best by your criteria but is easy to modify and could permit a relatively easy transition to other options if the first doesn't work.

Can you change the "solution" if it isn't working? _____Yes _____No. If yes, what changes can you make?

Possible Ways to Refine/Alter the Solution

If you cannot answer yes to all, or even most, of the preceding questions, the solution you have chosen may not be the best one for you.

IT'S YOUR TURN

Congratulations! You have answered the hard questions and collected a lot of useful information about your problem and possible solutions including:

- different ways of searching for solutions
- criteria for making judgments about the quality of solutions
- issues related to evidence

It's time to decide what you are going to do now and what you are going to do later. Remember the more specific you are now in describing what you want to do, the easier it will be to do it.

The authors would much appreciate receiving your comments and suggestions for additional resources. Please e-mail them to Dr. Campbell at campbell@campbell-kibler.com or www.campbell-kibler.com or to Dr. Datta at 74434.1122@compuserve.com.

ADDITIONAL RESOURCES: REPORTS

American Association for the Advancement of Science, Project 2061. (1999). ***Middle Grades Mathematics Textbooks: A Benchmarks-Based Evaluation.*** Washington, D.C.: Author.

This publication is the first in a series of evaluations of widely used mathematics and science textbooks. Textbooks in this report were evaluated on how likely they would help students achieve the six key learning goals from Benchmarks for Science Literacy, consistent with the standards developed by the National Council of Teachers of Mathematics. Included are evaluations of 13 text book series, based on a set of 24 instructional criteria developed by Project 2061. Also included are areas where supplemental materials or staff development may be needed to use textbooks more effectively. The report can be downloaded from the Web at http:// project2061.aaas.org.

Print copies and along with a companion CD-ROM containing a searchable collection of evaluation data are available. Orders can be made through:

Project 2061
AAAS
1200 New York Avenue NW
Washington, DC 20005
1800222-7809
project2061@aaas.org.

American Association of School Administrators (AASA), (1999). ***An Educator's Guide to School Reform.***

This 1999 guide reviews research on 24 of the most widely available "whole school," "comprehensive," or "school wide" reform approaches. Models are rated based on reviews of available studies. A one-page table provides comparative information on the evidence of positive effects on student achievement, (from "strong" evidence to a "no research" rating), the year each approach was introduced to schools, the number of schools using the approaches, the amount of support developers provide schools as they adopt the approaches, and first-year adoption costs. More detailed profiles of each program explain the ratings on student achievement, key features of the program, and information about its developer. The guide can be downloaded from: www.aasa.org/Reform/overview.htm

American Federation of Teachers' (1999). ***Raising Student Achievement: An Internet Resource Guide for Redesigning Low Performing Schools.***

Six programs are described in this publication, each of which has been identified as a promising program for raising student achievement, especially in low-performing schools. Included in the report are descriptions of each model program, the necessary materials, tools, and training for effective implementation of the program. Featured programs were chosen on the basis of evidence showing:

- High standards. The program helps all students acquire the skills and/or knowledge they need to successfully perform to high academic standards.
- Effectiveness. The program has proven to be effective in raising the academic levels of at-risk students in low-performing schools, based on independent evaluations.
- Replicability. The program has been effectively implemented in multiple sites beyond the original pilot school(s).
- Support structures. Professional development, materials, and ongoing implementation support are available for the program, either through the program's developer, independent contractors, or dissemination networks established by schools already in the program.

Along with descriptions of these model programs, there are discussions on how a school can identify its strengths and weaknesses, find solutions among programs that have been replicated successfully in similar situations, and develop a fair and effective process in selecting programs. The guide can be downloaded from:

www.aft.org/edissues/rsa/guide/promising.htm

American Youth Policy Forum's ***Some Things That Do Make A Difference for Youth*** (1997) ***and More Things That Do Make A Difference for Youth*** (1999).

Among the variety of publications available from the American Youth Policy Forum are two publications, *Some Things That Do Make A Difference for Youth and More Things That Do Make A Difference for Youth*. The reports provide summaries of in and out of school programs in math and science and other areas found to be effective. Each summary includes an overview, a brief description of the population served, evidence of effectiveness, key components, contributing factors, study methodology, geographic areas and contact information. The reports are available from:

American Youth Policy Forum
1836 Jefferson Place, NW
Washington, DC 20036

Education Development Center, K-12 Mathematics Curriculum Center. (1998). ***Choosing a Standards Based Mathematics Curriculum***. Newton, MA: Author.

This guide focuses on the 13 programs supported by the National Science Foundation-funded K-12 Mathematics Center and implemented in diverse districts across the country involved in standards-based curricula. It offers a big-picture, comprehensive view of selection and implementation, discussing the range of issues that a district may confront, decisions that need to be made, strategies to choose from, and tips others have used. Much of the guide also focuses on the more detailed logistics involved in reform. As part of choosing a program, it mentions forming a selection committee, assessing resources and needs, and deciding on criteria and guidelines for

evaluating different programs. These criteria, along with sample selection questions that are included, cover the following categories: mathematical content, approaches to teaching, approaches to learning, and presentation and organization of curriculum materials. Issues involved in realistically and effectively implementing a program are also covered, including supporting teachers,building community support and collecting data. More information on this and other resources available can be obtained from:

Ki McClennan
K-12 Mathematics Curriculum Center
Education Development Center, Inc.
55 Chapel St.
Newton, MA 02458-1060
1-800-332-2429
mcc@edc.org

Educational Research Service. (1998). ***Comprehensive Models for School Improvement: Finding the Right Match and Making It Work***. Arlington, VA: Author.

This publication provides profiles of 17 comprehensive programs available and discusses what type of reform is most appropriate for a school. It provides a wealth of useful components for evaluating and choosing a program, lessons learned in successful implementation, and essential elements for a self-designed program. It attempts to answer key questions such as:

- Why is comprehensive school reform now receiving increased attention from many education policy makers and practitioners? What potential benefits does it offer?
- If we decide to implement comprehensive school improvement, how can we choose the best model for our school or district?
- What models are available to choose from? How can we find out more about these models?
- Is it better to choose an existing model, or to develop a program within the school or school district?
- If we decide to implement a comprehensive school improvement model, how can we create the conditions for success?

Orders can be made through:

The Information Source for School Decisions
2000 Clarendon Boulevard
Arlington, VA 22201
1-800-791-9308
www.ers.org

Northwest Regional Educational Laboratory. (1998). ***The Catalog Of School Reform Models: First Edition.*** Portland, OR: Author.

Developed to support schools, school districts, states, and others as they work under the Obey-Porter Comprehensive School Reform Demonstration program passed by the U.S. Congress in 1997, this catalog provides information on over 40 whole-school reform and skill- and content-based models. Each description includes costs, implementation plans, target populations, and research references. In order to be included, programs must have shown evidence of the model's effectiveness in improving student achievement and in improving student performance on other variables such as attendance or behavior. The catalog can be downloaded from the Web:

www.nwrel.org/scpd/natspec/catalog/
or ordered from:
Northwest Regional Educational Laboratory
School Improvement Program: National Specialty in School Change
101 SW Main, Suite 500, Portland, OR 97204
Telephone (503) 275-9500

Becker, Henry Jay (1999). **Teaching, Learning, and Computing-1998**. Irvine, CA: University of California: Irvine

The first two reports - Internet Use by Teachers and The Presence of Computers in American Schools in a series of reports based on a national survey of teachers' use of computer technology, their pedagogies, and their school context are now available. The study included schools and teachers from a national probability sample and also included purposive samples of schools and teachers because of their participation in major school reform programs or their unusually high amounts of computer technologies available. Along with the reports a free on-line newsletter is available. More information on how to subscribe to the newsletter or order the reports can be found at:

Teaching, Learning, and Computing-1998
www.crito.uci.edu/tlc/html/tlc_home.html

Stringfield, Sam; Millsap, Mary Ann; Herman, Rebecca; Yoder, Nancy; Brigham, Nancy; Nesselrodt, Pamela; Schaffer, Eugene; Karweit, Nancy; Levin, Marjorie; and Stevens, Robert. (1997). ***Urban and Suburban/Rural Special Strategies for Educating Disadvantaged Children***. Washington, DC: U. S. Department of Education.

A U.S. Department of Education study, the *Urban and Suburban/Rural Special Strategies for Educating Disadvantaged Children* final report details the results of a three year case study of 10 different strategies identified as promising, covering 25 programs and 20 replication sites, all of which had Chapter 1 programs or were eligible to participate. The *Special Strategies* studies were formed in 1990 to: 1) describe promising alternatives to traditional Chapter 1 practices, 2) compare the characteristics of promising alternatives to more traditional practices and 3) assess the replicability of programs that appear most successful.

Along with results of the study for each program and a summary of the common findings, the *Special Strategies* final report details program characteristics (including the goals and philosophy, components of the program, staff development, degree of parent involvement, initial requirements before implementation, and comparison of different sites using the program) as well as curriculum, instruction, and implementation issues of each program.

Copies can be obtained by writing:
Planning and Evaluation Service
U.S. Department of Education
600 Independence Ave. SW
Washington, DC 20202

U.S. Department of Education, Office of Educational Research and Improvement. (1999). ***Tools for Schools: School Reform Models Supported by the National Institute on the Education of At-Risk Students***. Washington, DC: Author.

This publication covers 27 research-based school reform models that have been or are currently being supported by the Office of Educational Research and Improvement, National Institute on the Education of At-Risk Students, and the U.S. Department of Education. Three levels of reform models are covered:

- comprehensive school reform that focus on changing the organizational climate of the schoolbut also extend to influence changes in classroom instruction
- classroom or curricular redesign which are focused on changing classroom management, instruction or curriculum
- inservice professional development whose primary focus is to strengthen the knowledge and skills of teachers and other staff working in schools serving large numbers of students at risk of educational failure.

Descriptions of each model cover the history and creation of the model, components of the model and how it works, costs, steps, timelines, and technical assistance necessary for implementation, evaluation and research evidence demonstrating improvement in educational outcomes of at-risk students, research the model is founded on, sites using the model and how to get more information.

More information can be obtained from:

The National Institute on the Education of At-Risk Students
U.S. Department of Education
555 New Jersey Avenue, NW
Washington, D.C. 20208-5521
1-202-219-2239
www.ed.gov/offices/OERI/At-Risk/

ADDITIONAL RESOURCES: ON-LINE MATERIALS

Annenberg/CPB Math and Science Collection

Guide To Math & Science Reform, sponsored by the Annenberg/CPB Math and Science Collection, is a periodically updated searchable data base of over 1000 entries that describe projects, resources and organizations dedicated to significantly improving K-12 mathematics and science education in America." It can be used on-line from The Annenberg/CPB Project's website:
ww.learner.org/theguide/
or purchased from:
The Annenberg/CPB Math and Science Collection
PO Box 2345
South Burlington, VT 050407-2345
800 965-7373.

Education Commission of the States

Promising practices in education policy, is a component of the Education Commission of the States information Clearinghouse. A database of 24 comprehensive reform models, it includes policies, programs and practices that show evidence of success in realizing their stated goals based on the most recent research. Each description includes information on program components, evidence of effectiveness, professional development and support, implementation, costs, policy issues and questions, and resources. It can be used on-line from the Commission's website:http://www.ecs.org (click on Information Clearinghouse). More information can be obtained from:
Education Commission of the States
707 17th St., #2700
Denver, CO 80202-3427
303-299-3600
FAX: 303-296-8332
ecs@ecs.org

Eisenhower National Clearinghouse for Mathematics and Science Education

The Eisenhower National Clearinghouse (ENC) provides a collection of mathematics and science resources available to educators through their website www.enc.org. ENC Online provides access to the ENC Resource Finder, an electronic catalog of math and science curriculum resources, and links to many other Internet materials. ENC also has developed a CD: ROM Making Schools that Work for Every Child to serve as a resource for those concerned about educational equity related to K-12 math and science education.

As part of ENC Online, *The Guidebook of Federal Resources for K-12 Mathematics and Science* is available at www.enc.org/guidebook/ The Guidebook is intended to improve awareness of the federal government's extensive commitment to mathematics and science education focusing on

elementary and secondary levels. Programs described include those that assist students who will go to college or technical school as well as programs intended to improve general mathematics and science literacy.
The ENC resources are available from:

The Eisenhower National Clearinghouse for Mathematics and Science Education
1929 Kenny Road
Columbus, OH 43210-1079
800 621-5785
614 292-2066
www.enc.org/order/

ENC has also established a web site, Teacher Change: Improving K-12 Mathematics www.change.enc.org designed for those working with teachers to improve K-12 mathematics teaching and learning. The web site offers professional development workshop activities, full text journal articles about teacher change, teacher narratives, an overview of school change and reports and publications from the Third International Mathematics and Science Study (TIMSS). The professional development activities, created by the Math and Science Consortium at the North Central Regional Educational Laboratory (NCREL), provide facilitator notes, handouts, and PowerPoint presentations.

National Science Teachers Association

The National Science Teachers Associations (NSTA) provides several different searchable resources. ExplorAsource for Educators searches through detailed information on over 400 learning products print, software, and video selects, lists, and displays detailed information about the products that match specified learning topics.

NSTA also provides to assist teachers planning their own professional growth, individuals and higher education institutions involved in planning preservice and inservice education, and school districts designing staff development programs a collection of references, workshop activities, research, analyses, and plans that illustrate many aspects of science literacy and its application to K-12 science education, called Resources for Science Literacy: Professional Development. A CD-ROM of developmental tools and strategies is also included. The materials can be ordered from:

National Science Teachers Association
1840 Wilson Boulevard
Arlington VA 22201-3000 USA
703 243-7100
www.nsta.org