The National
Center for
Improving
Science
Education

DISCLAIMER

A DIVISION OF THE NETWORK, INC.

A Study of
The Teachers' Academy
for Mathematics and Science

by
Belle Brett, Ed.D.
Mary Ann Scheirer, Ph.D.

Principal Investigator: Senta Raizen

Table of Contents

EXECUTIVE SUMMARY

A STUDY OF
THE TEACHERS' ACADEMY
FOR MATHEMATICS AND SCIENCE

by
Belle Brett, Ed.D.
Mary Ann Scheirer, Ph.D.

Principal Investigator: Senta Raizen

National Center for Improving Science Education
The NETWORK, Inc.
300 Brickstone Square, Suite 900
Andover, MA 01810
508-470-1080

September, 1994

EXECUTIVE SUMMARY

A STUDY OF
THE TEACHERS' ACADEMY FOR MATHEMATICS AND SCIENCE

The Teachers' Academy for Mathematics and Science in Chicago (TAMS) is a free-standing institution founded in 1989 by scientists and a variety of other stakeholders, to advance the systemic reform of mathematics and science education in Chicago's public schools. It focuses on the "re-tooling" of its elementary level teachers. The TAMS program, which has been funded in part by the DOE, contributes to strategic goals two through five of the Office of University and Science Education (OUSE).

This evaluation of TAMS by the National Center for Improving Science Education is primarily a qualitative study that summarizes the history and current status of the organization and its programs. Data were obtained through extensive interviews, observations, and document review, using a framework of templates to guide data collection and analyses. Our findings are organized around a series of lessons learned from the first three years of TAMS and conclusions about its current status.

This study was funded by the Department of Energy, Office of University and Science Education. Our findings contribute to the realization of the following OUSE strategic goals:

- STRATEGIC GOAL NUMBER 1: Strengthening and assuring the quality of its educational programs

- STRATEGIC GOAL NUMBER 4: Positioning DOE resources to be a key contributor to systemic education reform

The following summary statements are drawn directly from each chapter of our report.

Chapter II (A): Organizational lessons learned from the first three years of TAMS

Lesson 1: TAMS' mission and goals were visionary statements that were not tied to specific plans for implementing the goals. The lack of realistic planning created continual frustration and confusion, as TAMS moved immediately into attempts for large scale program delivery (p. 17).

Lesson 2: The massive scale of operations attempted during the start of TAMS was unfeasible and led to multiple organizational problems, even though large scale funding was available (p. 18).

Lesson 3: The organization and its specific program activities needed more time for trial delivery within Chicago's schools before attempting to deliver large scale change (p. 20).

Lesson 4: Implementing a systemic program requires substantial time and energy for integrating the components, neither of which was available to TAMS, as well as the support of numerous stakeholders (p. 21).

Lesson 5: The absence of a well functioning evaluation unit within TAMS meant that staff and management could not make data-based decisions and that systematic data were not available for potential and actual funders (p. 21).

Lesson 6: TAMS' complex governance structure provided extensive involvement with stakeholders and communities in Chicago, but led to considerable friction among factions (p. 23).

Lesson 7: The role of federal agencies in relation to TAMS was strongly positive in seeing the potential in TAMS and continuing to prod it toward better management. However, earlier requirements by the agencies for better management planning might have prevented some of its organizational problems (p. 24).

Lesson 8: The roles of federal agencies contributed to major problems for TAMS by providing too much funding too early, but not planning for longer term or stable funding (p. 25).

Lesson 9: Leadership and authority were divided within TAMS, focusing energy away from the central mission of developing and delivering staff development interventions with teachers (p. 26).

Lesson 10: TAMS attracted a number of dedicated and talented people in its first few years, but would have benefitted from a more carefully thought out and systematic staffing plan (p. 27).

Lesson 11: Appropriate internal management systems were neglected at TAMS, but are essential components of smooth operations which should not be neglected during start up (p. 29).

Chapter II (B): Conclusions about TAMS' current organizational status

1. *Overall Status:* A major turn-around has occurred in the organizational management of TAMS since January, 1993, providing a strong foundation for future organizational development and program delivery (p. 31).

2. *Finances*: TAMS' financial instability remains a major problem; its future is uncertain without long term federal financial support (for the next three to five years minimum) (p. 31).

3. *External Relationships*: TAMS' relationships with CPS and other groups in Chicago are improving, but are not yet fully collaborative. Good reasons exist for TAMS to continue to remain independent from the Chicago Public Schools (p. 33).

4. *Leadership*: TAMS' leadership and authority relationships have come together under the strong guidance of the current Executive Director and Chief Operating Officer (p. 34).

5. *Management processes*: TAMS' internal management and communications are improving, but many of these initiatives were new during '93-'94 and have not yet been fully integrated into TAMS' internal systems and prior culture (p. 35).

6. *Staffing*: Staffing has been strengthened since January, 1993, by many senior level and mid level hires. Many excellent staff are now on board, but a key vacancy remains and further work is needed to solidify new job roles (p. 36).

7. *Program Evaluation*: Major weaknesses remain in TAMS' program evaluation plans and products, with an over-emphasis on formative evaluation at the neglect of program delivery documentation and outcome evaluation (p. 37).

8. *Scope of Activities*: Recent formal documents continue to over-promise the future scope of program delivery, toward a greatly expanded number of intensive schools within the near future (p. 38).

Chapter III (A): Conclusions about the intended program model

1. TAMS' overall systemic intervention model is comprehensive and has had the input of a variety of stakeholders (p. 53).

2. TAMS' *intended* instructional model exemplifies "best practice" in science and mathematics education in the elementary classroom (p. 53).

3. TAMS' staff development model takes into consideration the needs of adult learners and allows for frequent and sustained follow-up that addresses transfer of skills and knowledge to the classroom (p. 54).

4. TAMS has shown admirable responsiveness to schools' and teachers' needs as they emerge from TAMS' experiences with them, but over-tinkering may produce an inflexible model (p. 54).

5. *Without thoughtful evaluation*, it will be impossible to say what is effective about each new aspect of the program activities and delivery model, as carried out (p. 54).

6. TAMS' efforts at developing a more comprehensive science staff development program are well placed, but are *not* well enough tested for large scale delivery (p. 55).

7. The "Pyramid of Science" model may be logically correct, but it may not be the most appropriate symbol for a program for elementary schools, which are attempting to be more interdisciplinary in their approach to the sciences (p. 55).

Chapter III (B): Conclusions about TAMS' actual practice

1. By and large, TAMS' key stakeholders agree with and support the conceptual model of the intended program (p. 56).

2. Follow-up with teachers is extensive both in time and material support (p. 56).

3. Program units are in place to carry out most of the conceptual parts for systemic change, but are not yet at the full extent of integration and scope needed to work with large numbers of schools (p. 57).

4. TAMS' professional staff are generally well-qualified, enthusiastic, and dedicated. TAMS' administration gives them a certain amount of freedom to utilize their strengths but does not show much appreciation. The danger is burnout (p. 58).

5. TAMS' instructional quality is generally high, and at times is quite innovative. However, care needs to be taken to ensure continued staff quality and orientation to TAMS as new staff are hired (p. 59).

6. The coherence between mathematics and science teaching and learning is not formally addressed across TAMS' programs, but is treated in an ad hoc manner. Further, integration of mathematics with science is not modelled by TAMS' structure, which has two distinct science and mathematics departments characterized by minimal communication with each other (p. 61).

7. TAMS has made great strides in its programs. However, in trying to be on the cutting edge, TAMS may be undertaking too many projects before it has stabilized its programs, gained more secure funding, and solidified itself as an organization (p. 61).

8. Staffing issues have been addressed creatively in mathematics and elsewhere at TAMS, but continued efforts need to be made to fill key instructional roles to allow for intended growth (p. 62).

9. With a future goal of serving many more schools, TAMS needs to examine program delivery alternatives that capitalize on efficiency while minimally compromising flexibility and effectiveness (p. 63).

Chapter IV: Analyses of quantitative data about TAMS

1. TAMS' database for its numbers of schools and teachers shows an explosive start-up in 1991 and 1992, then a drastic fall off in scope of program delivery in 1992 through 1994. Data entered into TAMS' database do not document large scale teacher development efforts during 1993-94; however, supplementary information from TAMS indicates that substantial staff development work with teachers occurred in 1993-94 that was not entered into the database. (pp. 71-76).

2. Data about TAMS' long-term purpose of improving student achievement show a possible trend for improvement only in Grade Three mathematics among its earlier schools, but a mixed picture overall. (Data were not available for achievement in science.) (pp. 77-80)

3. TAMS has not conceptualized nor collected data to measure its outcomes. While its key systemic focus is on school and teacher development, it has not specified how it will assess the effectiveness of its programs within a comparative design (pp. 82-85).

Chapter V: Recommendations

At the Federal Level

1. Multi-year funding is needed. Federal agencies should expect large scale and systemic change to require several years for development and should award multi-year funding (p. 90).

2. Federal agencies should fund for phased growth, rather than explosive change (p. 90).

3. Monitor past activities, phased accomplishments, and expenditures (p. 90).

4. Federal proposal review should include a substantial weight on organizational factors (p. 90).

5. Federal agencies should expect uneven development, political tensions, and some "false starts" within systemic change projects (p. 90).

For Systemic Staff Development Organizations, in General

1. Involve stakeholders judiciously and provide staff time and resources for working with stakeholders (p. 91).

2. Plan the resources and staff needed for management systems (p. 91).

3. Develop and test programs before attempting large scope delivery (p. 91).

4. Pay close attention to staffing for a diversity of roles (p. 91).

For The Teachers' Academy for Mathematics and Science, Specifically

1. Monitor and evaluate the new science program before large-scale delivery (p. 91).

2. Continue to develop the staffing for the mathematics program (p. 91).

3. Continue to focus on and develop internal coordination and communications. Additional work is needed to avoid "top-down" management (p. 91).

4. Attach staff allocation plans to funding requests, including staff time needed for special projects, working on program development, and internal communications as well as staff time in schools and for instructional preparation and delivery (p. 92).

5. Place strong emphasis on developing and modifying evaluation activities. TAMS' evaluation efforts should include attention to all three evaluation types: a) systematically documenting program delivery and participation by schools and teachers; b) formative studies to obtain feedback about new program components; and c) designing and carrying out data collection for later outcome assessment (p. 92).

6. TAMS' leaders should continually assess the balance they are achieving in their focus among four major aspects: external relationships and stakeholder concerns; internal management and systems development; oversight of program development, and involvement in program delivery (p. 92).

7. Avoid fragmentation of efforts, and focus first on solid program development and delivery for staff development with teachers (p. 92).

This study has examined the Teachers' Academy for Mathematics and Science more than four years after its start-up. TAMS has made great progress in developing a high quality, comprehensive school development program in mathematics and science education. It has had major organizational development problems, but is now restructuring itself for better organizational management. This study has found that TAMS' intended program designs are by and large congruent with national standards and recommended "best practices" for staff development. However, continued intensive work is needed internally to unify these efforts, test out new programs, and continue its expansion to reach the intended scope of schools. As this work occurs, evaluation efforts should focus both on documenting the program delivered and defining and assessing outcomes.

I - OVERVIEW OF THIS STUDY

A. Overview of the Teachers' Academy for Mathematics and Science in Chicago

The Teachers' Academy for Mathematics and Science (TAMS) was the product of major ferment in Chicago surrounding its school reform movement and of federal initiatives in mathematics and science education that were Congressionally stimulated in 1989-90. TAMS' vision for revitalizing science and mathematics education was conceived in 1989 and early 1990 by a group of scientists from the Fermi Lab and Chicago area universities, in collaboration with stakeholders from the Mayor's Office of the City of Chicago, the Chicago Public Schools (both teachers and administrators) and a number of community groups in the Chicago area. TAMS is an independent not-for-profit corporation, governed by a Council of University Presidents and a Board of Trustees. Its major sources of funding have been the federal Department of Energy and the National Science Foundation, as well as the Board of Education of the State of Illinois. The vision of TAMS' founders was to create radical change in Chicago's mathematics and science teaching by reaching all its 15,000 teachers with a "rigorous program of mathematics and science content and teaching methodologies"[1] and to be a prototype for the reform of urban education.

Its stated purpose is to "enable the 'systemic reform' of instruction in science, mathematics, and technology."[2] Currently, the program is open to teachers in public elementary schools in the city of Chicago. Only schools where 75% of teachers agree to participate in the program may sign up for the program, which is approximately three years in duration.

The Academy has three major objectives in relation to science and mathematics education[3]:

- Provide participating schools a comprehensive school development process in mathematics, science, and technology, with the school as the unit of change, teachers as key change agents, and other stakeholders in the school community as agents of support

---

[1] From the Abstract to the "Grecian Urn Document," A Proposal to Enhance Science and Mathematics Teaching and Learning in the Chicago Public Schools," February 28, 1990, developed by a design workshop, January 26-28, 1990, convened by Fermi National Accelerator Laboratory and funded by the U.S. Department of Energy, Office of Energy Research.

[2] TAMS, "Department of Energy Renewal Application," December, 1993, p. 1

[3] Ibid.

- Play a leadership role in policy formulation and leveraging of resources so that systemic reform in mathematics and science education can occur

- Develop networks to facilitate the lifelong learning process of teachers in mathematics and science

To carry out these objectives, the Academy now offers a program with four "strands":

1) *Intensive Teacher Enhancement*, involving a three year program in mathematics, science, and technology, with a "critical mass" of teachers within a school, including direct instruction, follow-up classroom support both during instruction and after, and the identification of those in the schools who might continue to assist others.

2) *A School Improvement Program* that "uses science and mathematics as vehicles to address organizational development issues, build leadership teams and assist schools in strategically planning for their ongoing learning needs, as well as their understanding and alignment to local/State processes to address standards, curriculum frameworks, outcomes and assessment in science and mathematics."[4]

3) *School/Community Partnership Development* to enlist the support for changes in instruction from parents and others and to "increase the general public awareness of people in science, math, and technology."[5]

4) *A Resource Network* whose goals are to provide additional instruction; linkages through electronic media and meetings; information about other appropriate events; model resource centers; and technology as a tool for teaching, learning, and staff development.

In addition, the Academy holds conferences on such topics as assessment and science literacy and will be providing technical assistance to schools being visited by the state.

To date forty-two schools have been involved in the intensive program, although not all with the current program design. Since it started in the summer of 1990, the core "strands" have remained, but not always with the same activities or delivery modes.

TAMS' history and its current programs are intimately related to the processes of the Chicago Public School's attempted educational reform, which established local control of individual schools. Efforts to implement major changes in the ways that schools operate have been highly inter-related with TAMS' organizational history and its program content. Further details about TAMS' organization and programs will be given in Chapters II and III.

---

[4] TAMS, "DOE Progress Report," October, 1993.

[5] Ibid.

The complexity of TAMS' current program intentions and its history as an organization means that no simple summary assessment of its accomplishments is possible.

B. The Evaluation Study

The Purpose of the Evaluation

The Department of Energy (DOE) awarded a grant in September, 1993, to the National Center for Improving Science Education (NCISE) to conduct an assessment of the current status of the Teachers' Academy for Mathematics and Science (TAMS) in Chicago. The key guiding issues for the study, as stated in the NCISE proposal are the following:

1. Is TAMS an effective program for providing teachers with knowledge and skills to reform math and science education? (Is it worth funding?)

2. Is the Chicago Academy a viable model for the nation's schools to emulate?

Amplification of these major questions and subsequent discussions with DOE emphasized understanding TAMS' organizational developments within the city of Chicago as well as the content and operations of its programs.

Study questions

The overall theme of this study is to examine TAMS' programs and organization to ascertain its quality in relation to best practice in teacher development in science and mathematics education and its role as a systemic change initiative. The main questions of the study as set forth in a memo to the Department of Energy in December 1994 are:

1. *What is TAMS' current conceptual framework? How is TAMS presently delivered? How are follow-up and support provided?*

2. *How do content and pedagogy of TAMS' programs compare with current guidelines on "best practice"?*

3. *What quantitative information is available about TAMS' delivery of its programs and potential outcomes for schools?*

4. *How are the processes for implementing TAMS as an organization related to its educational mission?*

5. *What are the overall lessons to be learned from TAMS' developmental history so far?*

Overview of Approach

The evaluation study is largely descriptive, with comparisons to best practices in terms of organization, teacher development, and systemic change in math and science education. Our emphasis is on *what TAMS is doing* rather than what happens when teachers go back to their schools and try to implement what they have learned.

The NCISE evaluation team served as the external evaluators in this study. In addition, TAMS has its own internal evaluation staff and contracts to other consultants, specifically Dr. Robert Stake and his team and Dr. Terry Denny, for particular evaluation tasks. NCISE's plans included drawing on some of the findings of these internal evaluators in its reports as well as asking TAMS to assist with some of the data collection and organization.

Although it is too soon to talk about TAMS as a viable model for replication without further data on its effectiveness, our information and analyses have allowed us to discuss positive and negative aspects of the process of creating a systemic reform initiative in teacher development in science and mathematics.

We hope that this study gives DOE a fuller understanding of how it has been spending its money and what has been learned, as well as provide useful data to TAMS in its own development and in its efforts to leverage new resources.

C.   Methods

This section describes the development of the task plan; overall data collection activities, samples, and procedures; and types of analyses.

Development of the Task Plan

The task plan was based on an intensive orientation period to TAMS and its history and programs. This work included a three day site visit to TAMS, interviews with representatives of the three federal funding agencies--DOE, Department of Education, and National Science Foundation (NSF), and review of an extensive set of documents from and about TAMS. The combined interests of our stakeholders posed a challenging task for us as evaluators. Clearly, not all their questions could be answered within the scope of this study, but major themes suggested by their questions were addressed.

The task plan detailed seven modules based on the study questions listed above. These modules guided the activities of the study but were not followed exactly. The modules are as follows:

Module A.   Documenting Program Components and Delivery (Chapter III)

Module B.   Using Quantifiable Data to Assess TAMS' Activities and Accomplishments (Chapter IV)

Module C.   Analyzing Lessons Learned about Organizational Implementation (Chapter II)

Module D.   Documenting Systemic Change (Chapter III)

Module E.   Documenting the Comparison between Best Practice and TAMS' Practices (Chapter III)

Module F.   Comparing TAMS to Other Model Programs--only minimally addressed. (This module was eliminated due to budget cuts in our grant from DOE.)

Module G.   Cost Analysis (Chapter IV)

Data Collection Activities

Site visits to Chicago. Most data were collected through site visits to Chicago. (See Appendix 1A for summary of site visits.) Overall, five site visits to Chicago were made (one in September for orientation and background on TAMS' development, and then monthly from January through April), representing 40 staff days. Site visit activities included--

- 74 interviews with 36 TAMS administrators and staff and one former administrator, 13 Board/Council of University President members, three program designers, five Chicago Public Schools (CPS) staff (not including one board member from CPS), five staff from funding agencies, two evaluation consultants to TAMS, and three other staff and management development consultants to TAMS. In addition, in conjunction with school visits, we interviewed four principals/ assistant principals (see Appendix 1D). (Note: Numbers don't add up because some people were interviewed in pairs and several other TAMS staff members were interviewed more than once.)

- attendance at 13 meetings and conferences (see Appendix 1C for list)

- observations of nine TAMS' sponsored instructional classes

- formal visits to four schools, including informal classroom visits, observations of nine classrooms, two focus groups of teachers, two focus groups of parents, and informal conversations with teachers and children (interviews with school principals are counted under interviews); in addition three schools were visited on a more informal basis. (See Appendix 1D; the three schools visited informally are not included in this list.)

Document analysis. All key documents associated with the founding, progress on, and renewal of TAMS were reviewed, as were documents associated with the specific strands, evaluation reports and records, cost accounting, reports on Chicago reform progress and initiatives, and news releases on TAMS and Chicago. (See Appendix 1E.) Documents were obtained from funders, designers, CPS staff, and primarily from TAMS' staff. Both narrative and quantitative data were collected.

Sample Selection

Interviewees. Most of TAMS professional staff were interviewed, including all the directors/assistant directors/coordinators of the four strands, all mathematics instructional and implementation staff, nine of the 12 science instructional staff, three members of the Resource Center staff, and almost all members of the school improvement staff. Key administrators were interviewed on more than one occasion, including the two chief administrators, who were interviewed at least once in each site visit. In addition, regular, informal update conversations were held with the evaluation staff. (See Appendix 1B.)

Other stakeholders were chosen at the suggestion of the DOE program manager and TAMS' administrators, or by request of the evaluators, to represent key areas of interest.

TAMS classrooms. The evaluators visited a total of nine TAMS classes given by fourteen different TAMS instructors (four classes were co-taught by two or more instructors) to Chicago Public School teachers: four mathematics classes (two K-3 and two 4-8), four science classes (three K-3 and one 4-8), and one Resource Center class. Three of the mathematics instructors were not TAMS employees, but consultants involved with the University of Chicago School Mathematics Curriculum project. Classes fitting the various categories (e.g. Math, K-3) were picked according to schedules of available classes and were visited over two site visits in February and March.

School sites. The evaluators asked TAMS chief administrators, the Lead Faculty member in Science, and the Director of Mathematics to choose one school which had previously been through the science program and one school which had been through the math program. Each was considered to be an exemplary school by TAMS in terms of how well teachers had responded to the TAMS intervention.

In addition, two schools were chosen which were currently involved in the implementation phase, one each for science and mathematics. These schools were chosen because, overall, teachers were responsive to TAMS' presence, and some reasonable changes had been made in instruction because of TAMS. In addition, implementation specialists needed to be present on the day of the visit, so scheduling was a factor in site selection. Thus, the schools were not randomly selected but were chosen to show strong TAMS' program implementation. Classroom visits in both the exemplar and implementation schools were made at the suggestion/request of the principal, implementation specialist, or the teacher.

Two other criteria existed for all four schools: 1) none of the schools selected could be in the internal case study evaluation being conducted under Stake's contract; 2) each needed to represent a different case scenario in terms of socio-economic status (SES) and ethnic makeup. A fifth unscheduled school was visited briefly. Visits took place during the March and April site visits. ˙

Teacher and parent focus groups. Teacher and parent focus groups were set up in two different ways in the two exemplar schools. In the mathematics school, attendance was voluntary and without incentive. Five teachers participated, as did three parents. At the science school, which was much larger, teachers were strongly urged to come and offered a small stipend for doing so. Seventeen teachers were in the focus group for teachers, and ten parents came to the parent group. Parents in both focus groups tended to be somewhat involved in the schools in other ways, such as the Local School Council, classroom volunteering, or employment as teacher aides.

Summary of Data Collection Instruments/Procedures

Template development. The organizational and program modules required development of two special "templates", modeled after other similar templates created by NCISE staff for formative evaluation. (See Appendices 2 and 3.) The templates provide basic criteria for "best practices" based on the research literature and opinions of experts in the field. The development of both templates began with brief literature reviews. The templates then served as frameworks for collecting, organizing, and analyzing the large amount of information from interviews, observations, document reviews, and focus groups.

Because TAMS has specified that it is a "systemic" program, a special template was created combining the appropriate elements from NCISE's staff development and systemic templates. Additional items were added to fit the context. The organizational template was completely original. Both templates were reviewed by several key NCISE staff.

The systemic program template follows the NCISE template pattern: it has one column with the "Effective Practice" data elements, one column for "Intended", and one column for "Actual". The organizational template has a slightly different format. In addition to the "Effective Practice" column, it has one column for "What Happened?" and one for "consequences". More will be said about template use under the "Analyses" section.

Interviews. Open-ended interview protocols were developed for each kind of interviewee and adapted as needed during the interviews. (See Appendix 1F for a sample protocol, used for TAMS instructors and implementation specialists.) Protocols were reviewed by both co-evaluators before use. Interviews were generally conducted in person and lasted from three-quarters of an hour to an hour and half each. Most interviews were taped. Four interviews took place over the phone. Extensive notes were taken in each interview. When more than one interviewer participated, notes were checked and revised by the second interviewer.

TAMS classroom observations. In general, two evaluating staff participated in each observation, except in the case when three classes were being held simultaneously. All but two of the classes took place at the Teachers' Academy. The other two took place in schools and afforded an additional look inside the schools. Except for the Resource Center class, classes were visited for a minimum of two hours, following through a cycle of more than one kind of activity.

A special instrument was designed to summarize instructor and participant behavior and affect as well as classroom activities. The instrument was based on a variety of other classroom observation instruments as well as the staff development template developed by NCISE. It was reviewed by several individuals and modified slightly after the first set of visits. (See Appendix 1G.)

The usual procedure for use was that one person took extensive field notes of dialogue while the other captured activity. During group activities, the evaluators sat in or observed different groups. At breaks, the evaluators informally chatted with the instructors and/or participants. After the session, in cases where more than one person observed, each evaluator filled out the summary part of the observation tool. Then both met and came up with a third version, a consensus.

School observations. A version of the TAMS instructor observational tool was developed for the school classroom and was intended for use only in the two implementation schools. (See Appendix 1H.) This new version allowed observation of both the implementer and the classroom teacher. Because classroom visits were often more informal and briefer, the tool was more difficult to use. Instead, field notes were taken. Class visits lasted anywhere from a few minutes to half an hour. Two evaluators (and three in the case of the exemplary mathematics school) visited each class. In the science implementation school, it was report card pickup day; thus, the normal school schedule was not in progress. Classroom observations in the two exemplar schools were meant just to provide a flavor of the nature of instruction and the environment. In addition, the evaluators had the opportunity to visit a fifth school to hear a recruitment presentation being given by the Lead Science Faculty. The school had participated in an earlier version of the science program.

Teacher/parent focus groups. Focus group protocols were developed for the teacher and the parent focus groups. (See Appendices 1I and 1J respectively.) Focus groups were intended to last about one hour. Three groups lasted approximately this amount of time; the parent group in the mathematics schools lasted one half hour, but was a smaller group in any case. Each focus group had a leader and a recorder. Extensive notes were taken.

TAMS' database of participating schools. At NCISE's instigation and with its assistance, TAMS set up a statistically analyzable database of schools participating in TAMS. This database contains some information about school characteristics, TAMS' programs and dates of participation, and achievement test scores. Most of the needed information elements existed prior to NCISE's visits but had not been entered into an integrated database in a statistically analyzable form.

Summary of Analyses

Analyses of organizational implementation. All relevant data from interviews, observations, and documents were compiled within two time periods (the first three years and current status), using the template components as a framework. These data were then analyzed, compared against the effective practice components, and summarized under the column, "What Happened at TAMS?" for each time period. Interpretations of the findings are offered under the "Consequences" column. (See Appendices 4 and 5 for completed organizational templates.) Chapter II summarizes themes from this analysis that may cut across the various components.

Analyses of the program in a systemic context. Analyses about TAMS' programs and program context were completed in a similar manner. (See Appendix 6 for the completed systemic program template.) Focus was on the most current program. Data reviewed included interviews, observation notes and instruments, and focus group notes as well as a variety of documents on the programs, including data on TIMS© and Math Tools©, the core of the science and mathematics programs respectively. Most of the data on the "intended program" came from document review and interviews; the data for the "actual practice" column came from all sources.

Quantitative data analyses. Information in the database was not complete enough to allow for more than simple descriptive statistics and some comparisons of mathematics gain scores among groups of schools that started TAMS' mathematics program at different time points. Some cost data for TAMS as a whole are also presented, but TAMS has only recently begun to organize its cost data in such a way as to allow for a more detailed breakdown. Finally, we reviewed the evaluation studies undertaken internally by TAMS.

D. Limits of This Study

Some factors have had an impact on the scope and the nature of the findings in this report. Key limitations are: 1) TAMS' still evolving programs; 2) limitations of the evaluation budget; 3) lack of appropriate tools for assessing student learning; 4) reliance on data by others; and 5) lack of comparable data on other programs. These difficulties affect our ability to discuss student outcomes, teacher outcomes, comparisons with other programs, TAMS as an "ideal" model for potential emulation by others, and cost-benefit analyses. Most of the problems are surmountable for future studies, given time and resources.

TAMS Evolving Programs

TAMS is not yet and has never been a stable organization with a fully developed program. Its program components are still undergoing major changes. Thus, a reliable and valid assessment of student learning along with a cost-effectiveness analysis is probably not possible for several years. (Note: cost-benefit analysis requires estimation of the value of benefits, as well as costs.)

Limitations of the Budget

Given the limitations of our evaluation budget, it is not possible for the NCISE team to collect representative short-term or long-term outcome data from teachers. Not withstanding the costs of *administering* instruments to many teachers in many schools, *development* of valid and reliable instruments for a new endeavor is time consuming and costly as are site visits for observations. Following notification of budget cuts from DOE, the initially intended comparisons with other key systemic efforts have been eliminated from this study.

Lack of Agreed Upon Tools for Assessing Student Learning

While stakeholders are in agreement that TAMS' ultimate goals should focus on increased student learning, how to determine whether this learning occurs remains problematic. TAMS has not chosen or developed its intermediate or long term outcome measures. Available achievement test scores (the IGAP) may only partially reflect TAMS' goals.

Reliance on Data from Others

We had hoped to include in this study findings from data collected by TAMS' evaluation staff and its internal consultants, but these were not available in time for this report. These included three case studies of TAMS' schools, interviews with 20 teachers and 20 principals randomly selected from other TAMS schools, and a document review of School Improvement Plans for all participating schools, all to be produced by TAMS' internal evaluation consultant team directed by Robert Stake. In addition, TAMS is analyzing teacher journals, which might provide some additional understanding of the impact of TAMS' efforts on teachers. TAMS' evaluation staff had proposed doing teacher surveys, interviews, and self-assessment checklists on how teachers' participation has contributed to their professional growth as well as interviews with children both before and after their teachers participated in TAMS. These activities have not occurred to date. In addition, TAMS' evaluation unit does not yet have a systematic plan for collecting anything other than formative evaluation data.

Lack of Comparable Data from Other Programs

Although it would be both interesting and useful to compare TAMS to other program models of systemic change in mathematics and science teacher development, such data are very limited at the moment. Systemic initiatives at the state level are just beginning their own evaluation efforts. To our knowledge, TAMS is unique as an individual organization, not affiliated with another institution, doing systemic interventions in mathematics and science staff development. Likewise, good cost comparisons with other programs are also not feasible because the scope and intent of other programs may be very different from TAMS' systemic efforts and because good cost data are unlikely to be available for other programs.

The next three chapters will present the findings of the study, beginning with those related to the organizational implementation in Chapter II, followed by those related to the program itself in Chapter III, and ending with analyses and review of TAMS' internally collected data in Chapter IV. Chapter V provides some overall conclusions and recommendations.
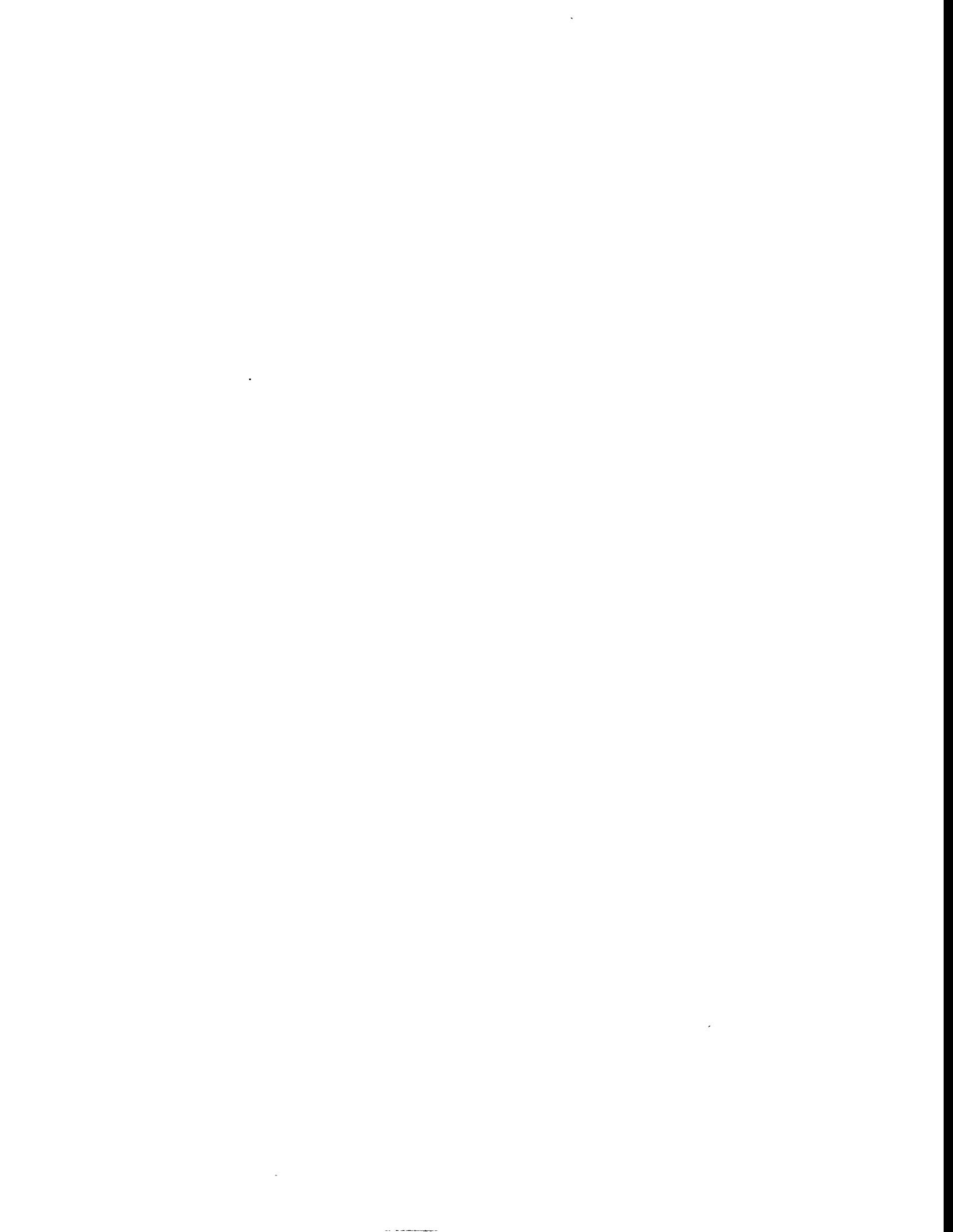
II - TAMS' ORGANIZATIONAL EVOLUTION

In our study of the Teachers' Academy for Mathematics and Science (TAMS), it became apparent early in our orientation that the development of TAMS as an organization played a large role in its capacity to engage teachers in effective professional development activities. Thus, our study undertook to examine what could be learned about TAMS' history and current status as an organization that might be helpful in a broader context with an emphasis on systemic change. New organizations, or new organizational units within a larger organization, are frequently necessary to manage the activities to bring about systemic change. Can TAMS' experience provide guidance for other developing organizations that will ease their evolution from start up to large scale operations? To what extent has the Academy overcome its initial "growing pains" to become a smoothly functioning organization at the present?

This chapter addresses the lessons to be learned from TAMS' organizational evolution, from its start up by educational reformers and scientists in 1990 to its current status in the spring of 1994. The chapter has three sections: A) an overview of the major analytic framework used in our work - a template of components needed for building successful new organizations; B) an analysis of TAMS' first three years, until the end of 1992; and C) an assessment of its organizational development since January, 1993. The division of TAMS' organizational history at the end of 1992 represents a major turning point in its history, into a new period of increased viability.   Of course, the stopping point for the examination of TAMS in the spring of 1994 is merely the point at which this study was completed. It does not represent a completion of TAMS' development as an organization, for these processes continue to evolve and change.

It is important for new educational assistance organizations *and* their funders to focus both on the content of their programs and on establishing and maintaining a viable organization to implement the program elements. Too often, the organizational aspects are not planned for when developers' focus is on creating and delivering an exciting new program. Or worse, a smoothly functioning organization is viewed as unnecessary "bureaucracy" and project leaders attempt to avoid thinking about these components entirely. In any project requiring more than a handful of staff members, some organizing processes will be necessary to manage the division of their work among various tasks. The literature about the implementation of new programs is full of examples about well-intended programs sinking into a morass of organizational problems that could have been anticipated.

A. Organizational Template

In order to provide a framework for analysis of TAMS' organizational history, we developed a template of components that are likely to be influential in successful start-ups, drawing from NCISE's experiences with templates in other content areas. In contrast to other templates developed by NCISE, the literature about starting up new

organizations does not yet present a well-agreed on picture of what the "best practices" for building effective new organizations might be. Yet, there is a scattered literature to draw from as well as the much more extensive body of knowledge about organizational behavior, in general. The template introduced below (and presented in full in Appendix 2) contains our consensus on what organizational components ought to be considered by those responsible for a new organization and hypotheses about what is needed to get a new unit off the ground. It is intended to be *suggestive*, rather than *prescriptive*. The primary purpose of our use of the organizational template in this study of TAMS is *not* technical assistance to aid its current developmental status, but summative evaluation to assess how it "arrived at" its present organizational state.

The template provides an introductory checklist of key elements that are likely to affect organizational success. The term "organizational success" refers to its capacity to maintain itself as an organization, to operate reasonably smoothly and efficiently, and to provide a satisfactory working environment for its members. For this organizational analysis, we are *not* referring to the effectiveness of its program activities in addressing its goals. Analytically, it is possible for an organization to be "successful" in maintaining itself as an entity without effectively serving its goals, or an entity may be attempting to deliver very effective program activities while not maintaining itself as an organization. Ideally, the program content delivered will be supported by a successful organization, but in many real world cases there is divergence between these two major strands, especially in non-profit or governmental organizations. This template is intended to aid in the analysis of the organizational components, while other templates developed by NCISE address the program components involved in teacher development or educational system change, for example.

The template is based on the authors' twenty years of organizational analysis, on consultation with the research literature about organizational behavior (see list of references in Appendix 2), and on commentary and feedback from others at NCISE and DOE. This work is intended to be suggestive, as the literature is not definitive about which components are *necessary* for an organization to be developed, and which are merely desirable, but not critical, to achieving a smoothly running new organization.

Particularly in this project assessing TAMS, our purpose is to draw lessons learned from its experience, rather than to criticize it against a set of criteria that were not available in this form in its beginning. However, much of the literature that the template is based on was available at that time; expertise in organizational behavior and development could have been consulted, but was not. We particularly draw from Sarason's analysis of similar organizational start up efforts in *The Creation of Settings and the Future Societies*[1]. In fact, even though it was written nearly twenty years before the founding of The Teachers' Academy, this book describes well many of the dilemmas and conflicts faced by its originators. The kinds of problems that TAMS experienced were not unique.

---

[1] Sarason, S. *The Creation of Settings and Future Societies*. San Francisco: Jossey-Barr, Inc., 1972.

Key Topics in the Template

The complete template of components for building new organizations is shown in Appendix 2. Its major headings are shown below in Exhibit 2-1 to provide an overview of its detailed content. These topics include components reflecting the organization as a whole, components concerning its relations with its external environment, and components describing its internal structure and processes. These should not be viewed as showing a sequence of organizational development because all of them quickly become relevant to daily functioning as soon as an organization is created.

Using the organizational template as an analytic tool might be compared to analysis of the systems of the human body, such as the heart and lungs in the circulatory system, the digestive system, the muscular and skeletal systems, and so forth. The functioning person requires that all these systems operate simultaneously in an integrated manner in order to survive. But the scientist studying anatomy and physiology must study the parts separately and sequentially in order to pull apart the complexity of the complete human being. Similarly, with the use of the organizational template, we break apart analytically the functioning organization in order to examine its processes separately, while knowing that all must work together in an integrated whole.

Exhibit 2-1. Components in Template for Building New Organizations

1. **Mission/Goals of Organizational Unit** - agreed on, clearly articulated, appropriate for clients

2. **Time Table and Scope of Operations** - appropriately scaled for start up and growth

3. **Program Components** - connected to mission, effective, feasible, marketable

4. **Evaluation Plans and Processes** - processes and indicators integrated with program components

5. **Legal Entity Established** - status and governing structure appropriate for mission

6. **Resources and Finances** - congruent with organizational stage, internal and external priorities

7. **Relationships with Environments** - communication links, interchanges maintained

8. **Leadership** - congruent with stage, balanced internal and external focus

9. **Staffing** - roles defined, people hired and well utilized

10. **Administrative Processes** - appropriate operating systems developed and supported

11. **Communications** - formal and informal, vertical and horizontal actively developed

---

Organizational Stages

The components of the template summarize the processes that are influential in organizational development. There are also likely to be a series of phases of growth, although in actual organizations the phases are likely to be intertwined. These stages are briefly: 1) decisions to start up; 2) preparations for start up; 3) getting the organization off the ground; 4) initial program development and delivery; 5) expansion and growth; 6) institutionalization and relatively stability. Each stage may require from several months to a year or more. At any point in these phases, problems may force retrenchment and replanning, or even the collapse and demise of the organization. Literature on the development of organizations provides strong documentation that successful growth is *not* assured, but in fact, is rather unusual[2].

B.   TAMS' First Three Years (1990 - 1992): Lessons Learned

A Brief History of TAMS

The Teachers' Academy for Mathematics and Science grew out of the school reform movement in the city of Chicago and out of simultaneous federal initiatives to improve mathematics and science education. In Chicago, the long efforts of reformers to shake up a moribund bureaucracy in charge of the public schools, coupled with public reports on the sorry status of school conditions, led to state legislation enacted in December, 1988. This Chicago School Reform Act decentralized control of public schools by authorizing Local School Councils to be in charge of each school. It gave extensive authority to the school level for curricular content, recruiting and hiring new teachers, and budgetary decisions[3]. Community members who had pushed for these changes continued to organize new initiatives to support the reform and to implement it within local schools.

In the meantime, pressures had been mounting for federal level initiatives concerning mathematics and science education. These were prompted by a series of reports and international test results indicating that U.S. students were not academically competitive with their counterparts in other countries. In 1989 and 1990, Congress appropriated major new funding for science and mathematics education, with new or expanded educational roles placed in agencies that had not previously focused on pre-college education, and additional funding in others (e.g., the National Science Foundation and Department of Education). For example, DOE's 1990 budget for pre-college education increased dramatically from about $6 million to $21 million which led to needs to identify appropriate ways to use this expanded funding. DOE Secretary Watkins convened a conference at Berkeley of scientists affiliated with its federal labs to generate

---

[2] Sarason, Op. Cit.

[3] Bryk, A. et al. *A View from the Elementary School: The State of Reform in Chicago*. Chicago: Steering Committee on Chicago School Research, 1993.

ideas about how DOE could use its resources in support of science and mathematics education.

Nobel Laureate Leon Lederman from Fermi Lab outside of Chicago attended this Berkeley conference and had already been involved in science and mathematics education at various levels. With his involvement and the financial support of DOE, a group of educational reformers, university and laboratory scientists, and community leaders from Chicago met in January, 1990 to propose a massive intervention effort to enhance teachers' skills in science and mathematics education, beginning with the elementary level. The group wrote a visionary proposal, asking for more than $5 million in funding from DOE for FY 1990. They were awarded about $2 million for the start up of TAMS, in the summer of 1990. It was established as a free-standing organization that would be a national laboratory for big city education, by reaching all 15,000 teachers in Chicago to upgrade their science and mathematics content knowledge and teaching skills. Further funding was awarded in 1990 by NSF, the state of Illinois, and later by the Department of Education.

Exhibit 2-2. Key Dates in TAMS' Early History

1980's	Interest in school reform growing among stakeholders in Chicago
Sept.- Oct, 1987	2-month school strike; parents involved to end strike
November, 1988	Passage of Chicago School Reform Act by state legislature
October, 1989	Local School Council elections
July-Sept, 1989	DOE Sec. Watkins has contacts with Fermi Lab scientists; DOE sponsors Berkeley educational conference
January, 1990	Design Workshop for TAMS; developed "Grecian Urn Document"
April, 1990	Formation of The Chicago Education Federation - parent organization of TAMS
Summer, 1990	TAMS opened in space made available at Illinois Institute of Technology
Oct.'90 to Jan.'91	In-service for Academy (replacement) teachers
January, 1991	First group of participating teachers
Winter, 1991	New Executive Director, Jon Thompson, arrives
Fall, 1992	TAMS begins "sabbatical" to review its programs
December, 1992	Jon Thompson leaves TAMS
January, 1993	New Executive Director, Lourdes Monteagudo, appointed

These separate strands contributing to TAMS' origination continued to dominate its early history. The massive scale attempted from the start of The Academy necessitated a head-long rush into program delivery for hundreds of teachers. At the same time, the vision was for a much larger scale operation, so that all teachers in Chicago could be reached within five years. The origins of TAMS in the Chicago reform movement, its structure as a community-based organization, and the continued political ferment within and about CPS boiled over into TAMS' governance and daily operations. While the Academy quickly began operations and provided programs for more than 1,000 teachers from 30 schools within its first two years of activity, it continued to have major organizational conflicts.

The Department of Energy became more active in oversight of TAMS in Fall, 1991, with a major site visit review, then extensive correspondence to attempt to systematize its operations and financial reporting. When these efforts did not lead to major changes in its leadership, the relationships among its various boards, and its reporting capabilities, DOE strongly encouraged a "sabbatical" in the Fall of 1992, during which no teacher development programs were delivered. Subsequent negotiations led to the resignation of the Executive Director in December, 1992, and the establishment of major conditions for the receipt of continuation funding.

This is the period of TAMS' development analyzed further in this section, drawing from the details provided in the organizational template in Appendix 4. Overall findings about TAMS' first three years are presented as a set of conclusions or "lessons learned" from our analyses of these developments. In essence, we are addressing the questions:

- Why was TAMS' start up so difficult when so much funding was available?

- What factors contributed to the near collapse of TAMS by the end of 1992?

- Can the experiences of TAMS contribute to better planning in the future for similar organizational start ups?

Lesson 1: **TAMS' mission and goals were visionary statements that were not tied to specific plans for implementing the goals.**

Drawing from work on Total Quality Management, recent initiatives to improve the performance of educational and other public organizations have placed considerable emphasis on the need for clear goals and agreement among stakeholders, which is the first set of components in the template. If the mission of a new organization or program is clear and agreement is strong among the relevant stakeholders, then later efforts of various participants are more likely to be congruent with each other. Yet agreement about the mission of a new organization is not *sufficient* for successful start up:

"Consensus about values does not instruct one in how to create settings consistent with these values, and that is why the creation of settings is such an important problem"[4].

The organizing group for TAMS in January, 1990 had agreement on the broad mission for TAMS — to improve the status of science and math education by focusing on the skills and knowledge of teachers. This group was led by scientists from Chicago's universities and federal labs, but also included teachers and administrators from CPS, community leaders, and the educational representative from the Mayor's office. The document they produced (called the Grecian Urn document, after the drawing of an Urn on its cover) laid out a sweeping set of goals. The founders envisioned a very large scale change program, with an extensive listing of potential program ideas to stimulate the sweeping changes. For the first year, they proposed that The Academy would need 40 on-staff instructors to work with the development of 500 teachers attending the Academy for three months each, whose classrooms would be taught by 500 replacement teachers hired by TAMS.

But how to achieve this nearly revolutionary vision was not indicated in the original plans. Nor was there a period of more detailed planning to articulate in detail what was intended. Participants in the early development of TAMS agreed, in retrospect, that the founders did not know what would be needed to achieve their vision. The lack of realistic planning created continual frustration and contention, as the founding stakeholders struggled to articulate the details. As stated by one early Board member, "The scientists who were amateur teachers were trying to get the teachers to become amateur scientists." While the passionate commitment of TAMS' founders has been a strength behind its development, this commitment alone was not sufficient to ensure its success.

Lesson 2: **The massive scale of operations attempted during the start of TAMS was unfeasible and led to multiple organizational problems, even though large scale funding was available.**

As indicated above and detailed more extensively in the organizational template, organizational growth usually requires a series of stages to put in place the multiple pieces needed for smooth functioning, such as an appropriate legal structure; staff with needed background and expertise; management structures for accounting, personnel management, and logistics; and a well tested program with specific components matched to the overall mission. Advice to entrepreneurs starting new businesses is also applicable to organizations like TAMS: "Few would attempt to build a multi-million dollar building without first preparing detailed plans. The same is true for an entrepreneur building a multimillion dollar business"[5].

---

[4] Sarason, Op. Cit.

[5] Welsh, J. and White, J. *The Entrepreneur's Master Planning Guide: How to Launch a Successful Business.* Englewood Cliffs, NJ, 1983.

TAMS' substantial first year funding of over $5 million carried assumptions that the organization would start up in high gear, so that the expected number of teachers would be "trained." Since the funding was promised for only one year, founders believed it was essential to show they could do what they set out to do. The Academy obtained space on the campus of the Illinois Institute of Technology, hired large numbers of "replacement" teachers for an orientation and training program in the Fall of 1990, then began working with nine schools in the Spring of 1991. Although many parts of the program content to be used with teachers were derived from programs already developed within Chicago universities, these programs had not been used within Chicago in such a large scale of operations, nor as an integrated staff development initiative.

Although TAMS did begin to work with rather large numbers of teachers quickly, several consequences of this grand scale start-up can be traced in later events:

- The time was so short for recruiting and selecting the large numbers of staff members needed that many of those hired had inadequate backgrounds and skills, and later had to be fired, which created further difficulty, loss of morale, and lawsuits.

- There was no time for testing the idea of replacing classroom teachers for several days each week; this quickly became unfeasible for the participating schools, particularly when many teachers from each participating school were absent simultaneously and the replacement teachers lacked experience and skills in classroom management.

- There was no time for development of necessary management systems.

- Evaluation was "lost in the shuffle," so data collection did not begin, and there were very little data to provide later feedback on what was happening or even to document programmatic activities for current and potential funders.

- Considerable disagreement arose among TAMS' leaders (Executive Directors and several Boards) over how to create the Academy, focus its program and solve its problems.

- Two years later the Academy nearly collapsed, partly due to the absence of time to solve these problems.

It would have been more realistic for the federal agencies to allocate funding for a three to five year period, but provide only start-up funding of perhaps $500,000 for the first year. This initial time period should have been devoted to key developmental activities such as hiring senior staff who would develop and test the program components more systematically, design job roles and specify skills needed for them, and thoughtfully hire other staff members with appropriate backgrounds. The intended program activities should have been carefully tried with fewer schools, and with less immediate pressure to bring in large numbers of teachers. Further, a phased-in start up period would have facilitated setting up proper long term procedures for accounting, personnel

management, and other organizational systems, and for initiating an evaluation plan tailored to the programmatic activities. (See Lesson 11, for further details on this point.)

With federal funding spread out over three to five years, there would have been much less pressure for immediate results, and less time needed from TAMS' administrators for preparing re-applications. Further, federal agencies should have coordinated better among themselves so that too much funding would not be awarded too early and conflicting expectations could be avoided. Federal monitoring could have been based on the quality of the start up activities, the staffing, and the extent of coordinated plans being developed and tested, rather than on a "body count" of number of teachers trained each year. For programs with a large scale, systemic programmatic vision, the slogan "make haste slowly" is likely to achieve better results than a headlong rush to action.

Lesson 3:   TAMS' specific program activities needed more time for trial delivery within Chicago's schools before attempting to deliver large scale change.

TAMS was able to start up so quickly because it could draw from mathematics and science educational programs that had been developed and tested over several years within Chicago area universities. The Math Tools©' strategies and approaches were part of the School Mathematics Project at the University of Chicago, which was intensively developing both elementary curricular materials and pedagogical techniques for classroom use. TAMS' major science program has been Teaching Integrated Science and Mathematics (TIMS©), a set of science experiments for elementary schools developed at the University of Illinois - Chicago. TIMS©' experiments develop students' data collecting and graphing skills while focusing on physical science concepts. TAMS' work with both TIMS© and Math Tools© was supported by faculty in the universities that had developed them, and several key TAMS staff came from these programs. A third package, Integrated Science and Mathematics Teaching (ISMT©), was used for two years, then dropped because it did not focus well on the consensus of reform recommendations being developed in elementary science education.

Having these programs and their supporting staff available enabled TAMS to begin working with teachers quickly. But other aspects of the original program model had not been tested in practice, particularly the idea of providing "replacement" teachers while the classroom teachers spent two days every other week at TAMS. The original concept of TAMS' founders had been to hire master teachers who could handle the classrooms and become co-teachers in enhancing the mathematics and science instruction. In actuality, many of those hired in the rush to get started were new graduates or even lacked the credentials for teaching. The replacement concept was found to be unworkable during the first several years, as teachers and schools opposed the extensive time away from their classrooms, and CPS and the teacher union objected to having uncertified people teaching. Further, TAMS' reputation and credibility were shaken by the inadequate work of some replacement teachers who were not themselves exemplifying the methods that TAMS was advocating.

TAMS needed a period to test its program concepts and ideas before proceeding to full scale delivery. The individual pieces had been developed and tested, but not the concept of working with an entire school with integrated strategies. Further, such testing would have fostered the development of program evaluation methods to assess the effectiveness of the program components as a total package. Such step-by-step program development probably could have helped to avoid much of the organizational turmoil which followed, and would have provided a more solid basis for subsequent expansion.

Lesson 4: **Implementing a systemic program requires substantial time and energy for integrating the components, as well as the support of numerous stakeholders.**

The intentions of the founders of TAMS were to provide program components that would support and sustain teachers' development, as well as direct instruction with teachers. The Grecian Urn Document included as suggested components of TAMS' program the following topics: teacher enhancement, follow-up in classrooms, resource center, networking, undergraduate teacher preparation, and research in teaching and learning. Work with teachers was to focus on the school as the locus of change, including working with principals and Local School Councils. While the words "systemic change" were not yet in the vocabulary of the Grecian Urn Document, many of the ideas underlying TAMS were similar to these systemic concepts.

Many of these components were partially implemented during the first three years. But developing them simultaneously took enormous time and energy of staff, and much negotiation among the numerous TAMS' stakeholders who were represented on the Board of Trustees. Simply having stakeholders represented in developing a program does not mean that they agree on the details of what should be done, or its priorities. Disagreements were substantial, and tended to become translated into political maneuvering among the advocacy groups on TAMS' Board. While this might have become a constructive experience in reaching consensus from initial discord, TAMS' staff skills did not focus on achieving such consensus, and no resources or time had been provided for it. Further, the rush to deliver to large numbers of teachers meant that little time was available for the staff working on various components to meet with each other internally to coordinate their work and their perspectives on staff development.

Lesson 5: **The absence of a well functioning evaluation unit within TAMS meant that staff and management could not make data-based decisions and that systematic data were not available for potential and actual funders.**

Again, the text of the Grecian Urn Document shows clear intentions to include program evaluation, but provides no concrete plans for how it would be carried out. Given the time schedule that TAMS promised its funders, there was little time for program developers to consult prior literature or contact other programs to explore best options for setting up TAMS. These potential uses of prior evaluation might have suggested strategies for better structuring of TAMS' programs in its beginning years, and for

rational approaches to its organizational growth, thus helping to avoid the later political turmoil.

In 1991, TAMS submitted a proposal to the Department of Education's FIRST program for a large-scale evaluation of TAMS, which was awarded about $800,000 for evaluation over a three year period. This action confirms TAMS' good intentions to do systematic evaluation, and its capability to win funding within a competitive review process. But no evaluation staff were hired until mid-1992 to implement this grant. Use of this funding appears to have supported implementation specialists in classrooms. While these staff members might have been able both to collect classroom-level data and to provide support for teachers, there was no training, instruments, or guidance for them as data collectors and the data-collection function was not implemented.

Evaluation efforts during the remainder of 1992 also foundered. The person hired as Associate Director of Evaluation in 1992 had a background in testing and pupil evaluation at the school district level, as well as course work in program evaluation. Using a goal-oriented approach to evaluation (only one out of several possible approaches in this profession), he focused heavily on trying to develop an evaluation plan to measure TAMS' vaguely worded goals and objectives, which were also being substantially modified during this period. The plan that resulted suggested many different types of potential measures related to each goal but was not focused on specific data collection activities. Evaluation efforts also became controversial among stakeholders on the Board of Trustees, which prevented some actions from being implemented.

Alternative approaches that might have been more useful would have focused on several of the following:

- Starting up a database about the schools and/or teachers participating in TAMS, to build data over time about which TAMS components each teacher was receiving, other professional development activities that teachers participated in outside of TAMS, their self assessments about their teaching, their ratings of TAMS' offerings, and, perhaps the achievement scores of their students. Data aggregation and analysis from such a growing data file could have provided specific documentation for funders, a summarization of the extent of their teachers' professional development activities, and ways to connect participation data with information about outcomes for teachers and schools.

- Providing guidance and an observational instrument for implementation specialists working with teachers to collect data about the on-going processes.

- Doing intensive observations and case studies of several schools undergoing change, to document in detail the starting points of teachers, the interventions and approaches used by TAMS' staff, and the experiences of teachers engaged in change.

- Compiling and analyzing data available from CPS about TAMS' schools, in comparison with several other schools not participating in TAMS.

Of course, by late 1992, TAMS' problems had precipitated the need for the "sabbatical" for fundamental re-thinking, so there were few on-going activities to be evaluated.

Lesson 6: **TAMS' complex governance structure provided extensive involvement with stakeholders and communities in Chicago, but led to considerable friction among factions.**

TAMS was created as a free-standing non-profit organization, under the legal oversight of a Council of (university) Presidents and guided by a large Board of Trustees. The Council of Presidents is the official corporate body heading The Teachers' Academy, composed of the Presidents (or their representatives) from 10 Chicago area universities. It appoints members of the Board of Trustees, which provided the voice for the multiple stakeholder groups involved with TAMS, including a senior administrator from CPS. The Board included more than 30 members at some time points. An Executive Committee guided operations more closely, but this had as many as three co-chairs at some points. With all these governing bodies, TAMS' administrators had to spend extensive time in reporting and support functions. Further, particularly in these early years, the Board members who were stakeholders also represented diverse advocacy groups who became quite contentious about TAMS and its programs. Stakeholder-based involvement in management can easily become chaotic if it is not carefully managed.

A key issue at the beginning was how to maintain The Academy as a separate organization from the official administration of the Chicago Public Schools, but able to work closely with individual schools and teachers. The reform movement for public schools in Chicago had been generated by strong objections to the apparently arbitrary actions of the central administration, with substantial distrust of its financial administration and its processes for allocating resources to schools. Many of those interviewed expressed strong feelings about the rigidity of CPS bureaucracy even in mid-1994, or simply pronounced it "corrupt." Several of TAMS' stakeholders had spent years in the school reform movement fighting this bureaucracy. They were determined to keep TAMS free of control from CPS.

For several of the founders, helping schools to constructively use the school-based management opened up by the reforms was a major motivating factor. Strong staff development for teachers in mathematics and science was seen as intertwined with a school becoming a supportive environment for the professional work of its teachers. Although the federal funding was for mathematics and science staff development, for many on the Board of Trustees, school reform was paramount. They could not compromise TAMS or its schools' growing independence by too close an affiliation with CPS.

From an organizational management perspective, TAMS' focus on independence within a separate organization meant that it had to do all the work of creating a new

organization at the same time that it was doing massive program development and delivery. Apparently, the founders did not want to affiliate with any single existing organization, such as one of the Chicago universities, because they feared that such an association might deter other organizations from participating fully in The Academy. In consequence, TAMS was not affiliated with another organization to learn from or participate in its organizational management systems, for example, for financial management, personnel selection, or human resources benefits and procedures.

The complexity of TAMS' involvement in local political issues created dilemmas at the federal level. Federal managers believed that TAMS should work in a collaborative fashion with the school district it was serving, and wanted to avoid political controversies that might stem from funding a "rival" to the official public schools. Such dilemmas were recognized as early as 1972 in Sarason's analysis of new settings:

> "The chances of success for the new setting are considered high [by the founders] precisely because it is outside the influence of existing bureaucratic organizations which would dilute, or subvert, or abort the superior ideas or values" underlying the new organization[6].

Sarason analyzed several case study examples from the 1960's and noted that, frequently, other organizations or funding officials want to refer the new idea or control back to the same bureaucratic organizations that had achieved little in the past. Close collaboration with a rival organization, even if it is the "official" one, is not likely to be productive for either side. As stated by one perceptive CPS administrative, TAMS should not be too close to CPS because "they're not ready for us, nor us for them."

Lesson 7:   Federal agencies had strongly positive roles in TAMS by seeing its potential for contributing to educational change and continuing to prod it toward better management. However, earlier requirements by the agencies for better management planning might have prevented some of its organizational problems.

It is unclear whether TAMS would have started up without federal funding, at least in anything resembling its current form. The federal agencies were able to see the national need for major new initiatives in big city education in science and mathematics. They were able to support the idea of a free-standing Teachers' Academy even though it had not been tried before. Further, federal project managers, particularly from the Department of Energy continued to "ask the hard questions" to stimulate the Academy's leadership toward better management. It is likely that the federal oversight contributed substantially to the eventual turn-around and new beginning with TAMS.

While this greater involvement of DOE in the oversight of TAMS is unusual for federal agencies, it may become more necessary in the future. Given the complexity of the

---

[6] Sarason, Op. Cit., p. 33.

problems that are being addressed by "systemic change" programs, the progress toward solutions will not be straightforward. Federal funders might have stimulated TAMS to a better start up by requiring evidence that its management needs were addressed up front, such as by requiring appropriate financial management systems and detailed activity and staffing plans. As happened with TAMS, federal managers may need to stay involved in order to observe whether organizational processes are making progress, to suggest alternative strategies when problems arise, and to avoid any long term waste of scarce federal resources if the attempted change is drastically off course.

Lesson 8:   The federal agencies contributed to major problems for TAMS by providing too much funding too early, but not planning for longer term or stable funding.

The scale of initial funding of TAMS and its short term nature created major problems for the new organization. As discussed previously, the massive initial funding put pressure on TAMS to justify its funding by reaching large numbers of teachers, but this scale contributed to its organizational chaos. The fact that federal commitments have been mostly one year at a time has had a number of consequences:

- From the first year, there has been a constant struggle to secure the next year's funding in order to keep operations going and to meet the payroll. This consumed enormous amounts of executive time and contributed to a continual atmosphere of crisis.

- It was and still is very difficult to attract high quality senior staff members when the future funding is so uncertain. Appropriate potential staff members in other locations do not want to uproot their families and their professional careers to transfer to an organization with very unstable prospects. The big city tensions and politics create initial disincentives for well-qualified senior staff who have appropriate programmatic backgrounds, without adding the pressures of constantly applying for new funding and of job insecurity.

- Those in rival organizations, such as CPS, can hope that the competitive presence of an "upstart" organization like TAMS will soon go away, due to lack of renewal funding. The ambitious vision of a new organization like TAMS, promising to create major changes in education, is an implicit criticism of those in the older bureaucracy. As one CPS administrator stated, "If it was as easy to do as TAMS' leaders promise, we would have done it years ago!" In the thinking of some outsiders, CPS will still be there after TAMS goes away.

- One-year at a time funding tends to foster expectations within the policy arena of agency heads and Congress that substantial achievements toward systemic change will occur within a year. Each year's new funding is intended to document major progress toward the objective of better science and mathematics education. When this does not occur, policy makers may become frustrated with their investment, and wonder whether they have committed their funds unwisely.

Federal agencies have tended to use a grant-award model for providing funding for large scale change projects such as TAMS. While derived from generally productive experience in funding basic research, this model may be less appropriate for funding and oversight of large educational change projects. The funding for basic research usually is awarded to universities or other research institutes that already have an infrastructure established for managing the projects. Further, the senior staff usually have tenure, or at least long term appointments, so that ending a particular project does not mean the demise of the organization. In contrast, an educational change organization such as TAMS does not have the management structure already established, does not offer tenure or job security, nor does it have multiple overlapping projects, each with separate funding. The cooperative agreement model is probably more appropriate for an organization such as TAMS, so that managers from the funding agencies remain in close contact with the project to assure its productive development, but continuity of funding can be expected by project managers.

Lesson 9: **Leadership and authority were divided within TAMS, focusing energy away from the central mission of producing and delivering staff development interventions with teachers.**

The literature on organizational change, for both educational and other organizations, emphasizes the crucially important role of leadership in bringing about change. Those that have the "great visions" for how things could be different tend to become leaders and entrepreneurs. Managerial leadership is needed for integrating the parts of an infrastructure, for recognizing and hiring other staff with appropriate backgrounds, for coordinating the specialized skills of diverse staff members, for using data and other feedback to productively change programmatic course when needed, and for choosing among various courses of action when the likely outcomes of each direction are uncertain. The diversity of roles and skills needed for strong leadership means that few single individuals possess all the qualities desired. Yet if leadership is split among several individuals, authority is also divided, which may engender conflicts and indecision. The organizational template developed for this project calls for a single person with overall final authority, but a single person may not be necessary if a collaboration of skills can be obtained.

Within TAMS' first three years, leadership and authority were structurally divided, with the charismatic Leon Lederman as a key founder and Chairman of the Board of Trustees, a succession of three Executive Directors within the first year, and active intervention from other founders and stakeholders on the Board. The first Executive Director attempted to implement the great vision by quickly hiring nearly 100 "replacement" teachers, many of whom did not have the teaching skills or background in science and math needed for this program. Subsequent Executive Directors then had to contend with the problems of attempting to utilize these under-qualified staff, and with the loss of credibility created by their work, which frequently did not exemplify best practices in mathematics and science teaching. In the meantime, Lederman was publicizing the vision of TAMS' nationally and seeking even more financial support.

Members of the Board of Trustees, who represent the diverse ethnic groups competing in Chicago and within CPS, also actively intervened to support their views and interests within TAMS. Since many were powerful individuals and/or group representatives, their attempted interventions could not be ignored, but frequently these held up or prevented actions proposed by the Executive Director. TAMS' leadership also became embroiled in intergroup politics, which then became centered on the personality and style of the third Executive Director. This white male came to the job from outside Chicago with strong credentials in both science education and the management of new educational organizations. But several early Board members stated that they had not been consulted in his selection and may have resented him as an outsider to begin with. Further, many of those interviewed stated that he did not have good skills in working with diverse cultural groups and personalities and that he could not understand and deal with the political situation in which he was enmeshed. Even with the sabbatical in program activities in the Fall of 1992, TAMS was unable to re-start itself under this leadership, and the third Executive Director left TAMS in December.

The change in leadership did precipitate a turn-around in TAMS' evolution, but it is not clear that the prior problems were the "fault" of the Executive Director. As this analysis has shown, the structure of the situation that was created with the establishment of TAMS created a likely "no win" job for whoever held the position at the time. Yet, in our interviews with many of TAMS' stakeholders, respondents tended to see the personality of the Executive Director as the primary source of problems that were fundamentally structural in nature. Although with a different personality, the Executive Director might have gained more collaborative help from the multiple stakeholders, the problems in leadership were not the only problem facing TAMS. While leadership is an important ingredient in the successful evolution of new organizations, policy makers should not focus *only* on the personal skills of those in leadership positions.

Lesson 10:   **For its staffing needs, TAMS attracted a number of dedicated and talented people in its first few years, but would have benefitted from a more carefully thought out and systematic staffing plan.**

The important contributions of fully qualified staff members is a well-recognized principle of organizational management. In fact, one of the stimulants for the current emphasis on science and mathematics education is that the skills needed in the future work force will be lacking and that strong interventions for improvement are needed now. Yet to say that staffing is important is much easier than for a new organization to do all the implementing actions needed to carry out "good staffing." These include:

- Identifying the tasks that will be needed some months in the future, to carry out a program whose specifics may still be undergoing development.

- Assigning the tasks to job roles for *persons* to be hired; for example, should different specialists each do a different kind of task, or should generalists do multiple tasks?

- Assessing what background and skills are needed for the tasks and job roles identified. Sometimes these have been codified into a profession, such as accounting (but what *kind* of accountant will be needed?). Other job roles are new, such as "classroom implementation specialist," and little precedent exists to know what education, skills, and background will be most likely to produce good staff members in these new roles.

- Finding and hiring persons with the skills and experience needed. If a specialized area is expanding rapidly, such as elementary science and mathematics staff development, will persons with appropriate skills be available in sufficient quantity?

- Creating a structure of incentives for good candidates to join this organization. Will strong potential candidates want to join this organization? Can a problematic location or other types of disincentives be overcome?

- Creating a human resources management system to hire people, keep personnel records, devise the payroll structure, and manage a competitive benefits package.

- Creating an organizational structure that provides appropriate reporting relationships, good communication among those working on closely related tasks, and an organizational culture that fosters collaboration among various staff members.

The complexity of successful staffing is one of the reasons why it is so difficult to create large new organizations in a hurry, especially in an organization using human resources to develop other human resources, such as the Teachers' Academy.

One of the strong points of TAMS, from its first three years is that it has attracted a number of very dedicated and talented individuals. These persons were attracted by the importance of TAMS' mission of educational transformation in a large city. Many had the backgrounds and skills to translate this vision into the daily activities needed for the teacher development programs. Perhaps because of the confusion and overload at the top of TAMS organizational structure, senior program staff had the freedom and the necessity to develop its program components.

But problems of staffing TAMS have been pervasive from the beginning. Several of these problems have already been mentioned: the hiring of numerous professional staff before their job roles were defined; hiring some staff members with questionable skills or for political reasons; the need to fire many people when it became clear that their skills were not adequate for the jobs needed; and the difficulty of attracting appropriate senior staff when long term financing was so shaky. TAMS' early years were filled with searches for appropriate senior staff members, including a Director of Operations and a Director of Science. The Academy has never had a Director of Science Instruction, so the development of its science offerings has been piecemeal. Mathematics instruction has had stronger content-based leadership and outside support from the University of Chicago, but the authority to manage this program component was not clearly assigned

until recently. The leadership problems at the Executive level inhibited good communications from developing among the separate units of TAMS, so each group of staff tended to develop their own programs without an integrated, systemic focus. Many of the intended components were only implemented partially, due to a lack of staff and priorities.

All of the detailed requirements listed above for staffing a new program posed problems for TAMS. It was, and is, working in substantially "uncharted territory" in its mission of large scale, school-based staff development. This means that precedents for many of the job roles needed are not well defined, and the specific skills and background needed for new roles such as "staff development instructor" and "implementation specialist" have to be defined while they are in process. This openness provides the opportunity for many staff members to creatively invent their own jobs. But it also makes likely that some individuals will not have the skills or personality needed, and that obtaining consistency in program delivery will be a problem. Further, in a headlong rush to get the organization and its programs up and running, hiring mistakes can create long-term weaknesses in key components, as happened at TAMS in both financial management and program evaluation.

Lesson 11: **Appropriate internal management systems were neglected in TAMS, but are essential to smooth operations and should not be neglected during start up.**

Many people are bored by the details of running large organizations and feel that "bureaucracy" should be done away with. Particularly those with the vision to focus on major changes in existing systems often do not want to be bothered with the details of system operations. Further, in the United States, many policy level and political leaders receive their professional education in the field of law, which focuses on the rights, responsibilities and conflicts among *individuals,* but has not historically focused on the management and operations of organizational systems. This may lead to a relative neglect of organizational systems at the policy level. But no large scale organization can function without specialized systems to obtain and manage its finances, to hire and manage human resources, to obtain and manage its physical facilities and equipment, and to purchase and distribute needed daily supplies.

TAMS tended to set up these support functions in an ad hoc way, probably because it had no time to develop them systematically. For example, TAMS' financial accounting system was reported to be "a complete mess" by early 1993, and neither internal managers not external funders could obtain adequate records of how funds had been expended. One contributing factor to the inadequate accounting was that its financial systems had been developed using a guide manual for Illinois school districts, rather than a system appropriate for a "soft money" organization with multiple funders and accounts. It would have been more appropriate for TAMS to use accounting systems and software developed for non-profit or research organizations that have many, unstable sources of funding and many different types of needed records. Since TAMS was not affiliated closely with a larger organization, such as a university, it may have lacked appropriate

guidance in setting up its managerial systems. These weaknesses later resulted in severe problems, as TAMS was unable to provide good answers to appropriate questions about its expenditures.

Conclusions

These lessons summarize major strengths and weaknesses, particularly the latter, from TAMS' first three years. Major recommendations drawn from these lessons, and their interrelationships with other aspects of TAMS, appear in Chapter V. As will be seen in the next section analyzing TAMS' more recent history, many of these factors continued to be influential. The major weaknesses that had to be corrected consumed substantial amounts of time from TAMS' leadership over its next year. For other organizations and funders embarking on systemic change efforts, heeding these lessons can minimize similar problems and may help to increase the pace and success of future systemic change initiatives.

C. TAMS' Organizational Status Since January, 1993: Major Themes

Stimulated by the concerns of its federal funders and its governing boards, The Teachers' Academy initiated a new period in its history by hiring a new Executive Director in early 1993. Many changes have occurred and continue to occur since that time, especially in staffing, in organizational administration, in integration of its program components, and in improving relationships with its governing bodies and the environment in Chicago. This section presents major themes that summarize our analysis of this period. Our orientation in this report is particularly toward policy makers at the federal level, which provided the funding for this study. Further details of our analysis are presented in the template for this period, presented in Appendix 5. It is important for readers to keep in mind that these analyses are very much about an organization in progress, not one at a final or "steady state" of development. This material was written simply at a time point when a report was due, rather than reflecting any final conclusions about TAMS' evolution as an organization.

These findings are based on our extensive interviews, observations of TAMS' activities, and reviews of TAMS' documents produced during this period, as detailed in Chapter I. Several formal documents were used as indicators of TAMS' administrators current aspirations and intentions, particularly the Strategic Plan prepared in November, 1993 - January, 1994 (the version we used is dated January, 1994) and the proposal for new funding submitted to National Science Foundation in April, 1994. Our projections in the template for this period concerning the "likely consequences" of the current status for each part of the template reflect our analytical hypotheses about potential future events, rather than data-based conclusions. The themes developed here cut across several of the components in the template, in order to draw out major conclusions about TAMS' current organizational status, especially those which are of interest at the federal level.

Theme 1: *Overall Status:* **A major turn-around has occurred in many aspects of TAMS since January, 1993, providing a strong foundation for future organizational development and program delivery.**

The change in TAMS' leadership was the catalyst for many other changes within TAMS. Further staffing changes resulted in the hiring of a new Chief Operating Officer, a new Chief Financial Officer, and the creation of the School Improvement Unit. TAMS released staff members who could not be accommodated under TAMS' financing or were not viewed as productively contributing to TAMS' overall programs. Relationships with TAMS' governing bodies have improved, and the structure of these groups has been modified to focus more clearly on functional guidance and oversight. The Academy has continued its focus on stimulating dialogue among the many stakeholders for improved mathematics and science education within Chicago and the nation, while improving its own relationships with its key stakeholders in the administration of Chicago public schools.

A number of developments have strengthened TAMS' internal operations. A period of intense self assessment led to a written Strategic Plan, which consolidates the presentation of TAMS' overall mission, its supporting strategies, and an overview of action steps needed. With the support of business-oriented staff from Motorola University, TAMS is using modern quality-oriented management techniques to improve internal communications and to focus on a "customer" orientation. Internal management is developing with revisions of the financial accounting system, and with periodic reviews of the budgets and expenditures of each unit. Program components continue to undergo development, to align them with each other and with the mission statement, to coordinate better the program in each intensive school, and to expand and deepen the intensive work of the Science Unit.

These changes provide a good basis for the Academy to continue its development, but it has not yet fully overcome all the problems engendered by the prior chaotic period. As will be indicated in the themes below, TAMS' current organizational status might be characterized as about "two-thirds" full - it is somewhat more than "half full, half empty", but has not completely coalesced into a well functioning organization. At least a year of intensive effort was required to overhaul the poorly functioning structures and to begin to create a new organizational culture that is responsive to its clients and its staff. Further, as described more fully below in Chapter III, many of TAMS' program components are still being developed and tested; the revised three and a half year program has yet to be delivered and evaluated as a whole. *Thus, TAMS should not be considered a fully developed program model that is ready for emulation in other locations.*

Theme 2: *Finances:* **TAMS' financial instability remains a major problem; its future is uncertain without long term federal financial support (for the next three to five years minimum).**

The Academy's program concept is one of using TAMS' staff intensively to bring about fundamental change in teachers' methods for science and mathematics teaching in their

classrooms. This long term, systemic change requires a large scale investment of resources in each school. As of the Spring of 1994, TAMS has initiated many feelers and proposals for the large scale funding its program model requires, but there is no assurance that any of them will be successful. (Of course, those interviewed were aware that our study is sponsored by the Department of Energy; many interviewees hoped to convince the federal sources to continue supporting TAMS.) TAMS has applied for a new grant for $12 million over three years from NSF's Teacher Enhancement and Development program, and a re-application to the Department of Energy is forthcoming. Its current grant from the Department of Education expires at the end of this fiscal year. A brief review of some of the current non-federal funding initiatives follows:

- **The state of Illinois** - TAMS' supporters have submitted a special bill to the state legislature (one of a number of special education bills often submitted) requesting an annual appropriation of $ 6.2 million, to provide unrestricted support for TAMS. In the views of those interviewed, the chances for passage of this legislation may be better this year than in other years, but depend on the intricacies of the politics involved. The state's Center for Scientific Literacy has also supported TAMS with grants of up to $1 million in recent years, but has a rather limited total budget for supporting similar projects across the state.

- **Chicago Community Colleges (CCC)** - Negotiations are proceeding between TAMS and CCC for TAMS to establish linkage with the community colleges, which may be able to provide support in line with CCC's mission to educate and retrain the work force. TAMS may be able to utilize CCC space for its programs with teachers. However, in order for TAMS to receive line-item funding in CCC's budget, this affiliation will require changes in the legislation governing City Colleges to include the re-training of teachers. Those interviewed emphasized that this potential relationship should be viewed as an addition to, not a replacement for federal funding.

- **Chicago Public Schools** - Since TAMS' origination and start up emphasized its independence from the CPS administration, TAMS is very reluctant to seek substantial funding from the central CPS, fearing that this would increase CPS' control over its activities. Further, with the financial crisis continuing in CPS, it is unclear that it could or would support TAMS with direct financial contributions. Individual schools might be able to increase their payments for TAMS' services to them, but their unrestricted funds are unlikely to be large enough to cover the full costs of TAMS. Further, having to pay substantially for TAMS would reduce their incentive to participate in this long-term, intensive program, which requires extensive extra effort from all school staff members.

- **Private industry or foundations** - These sources were not discussed as extensively as the above but appear unlikely to provide the long term funding that TAMS needs. Several of those interviewed stated that businesses may provide some start-up funding or in-kind support for organizations such as TAMS, but believe that the taxes they pay should provide the long term financing for such organizations. Similarly, there is substantial competition for the limited amounts

of foundation funding available, and foundation officers prefer to fund larger numbers of small scale projects.

In short, there does not realistically appear to be assured funding sources to replace the federal grants to TAMS that would continue its operations over the next several years even at its current scope of program delivery. This is one of the great dilemmas of attempts toward systemic change in education, as in other national problem areas. Such interventions require five to ten years of large scale support, at a minimum, in order even to assess whether the attempted interventions will be effective, let alone to deliver such interventions on a continually expanding scale. But many federal agencies' budgets and program strategies are revised annually in line with Congressional and political priorities. Therefore, commitments of federal funding for long term developments are not attempted, contributing to the financial instability of organizations such as TAMS. Some large scale, long term community intervention projects have been successfully carried out in the health promotion arena (e.g., the Stanford, Minnesota, and Pawtucket Heart Health Projects, and the COMMIT and ASSIST cancer prevention trials), with funding from research organizations such as the National Institutes of Health. But similar financial support for long term, systemic change efforts in science and mathematics education has not been forthcoming.

Theme 3: *External Relationships:* TAMS' relationships with CPS and other groups in Chicago are improving, but are not yet fully collaborative. Good reasons exist for TAMS to continue to remain independent from CPS.

As indicated above in the analysis of TAMS' earlier history, TAMS' relationship with its major stakeholder and competitor, the CPS administration, has been at an arms' distance. At the same time, TAMS is intimately involved in staff development in many individual public schools. Recent changes in the administration of CPS, with a new Superintendent and a new Deputy Superintendent for Academic Support, have brought renewed vows from both CPS and TAMS to work more cooperatively. The CPS representative on TAMS' Board has changed, bringing a fresh view about TAMS. TAMS' and CPS' staff have met several times to attempt to resolve long-standing financial issues to work more collaboratively on the plan for the Chicago Systemic Initiative and to exchange ideas and views about TAMS' programs. While it appears that neither has fully overcome the prior tensions, differences in cultures, and lack of trust, both groups now proclaim their intentions to work together: "They're our friends now!"

Much of the current joint effort centers around the plans for the Chicago Systemic Initiative, CPS' proposal to NSF for multi-year funding under NSF's Urban Systemic Initiative in mathematics and science education. TAMS and CPS are in communication about these plans, although CPS is doing the planning for the CSI without extensive input from TAMS. CPS has developed the initiative by convening separate meetings with diverse potential collaborators, such as the museums and zoos, the universities, and business representatives. As TAMS does not fall within these major groups, it was not included in these meetings. In CPS' current plans, The Teachers' Academy is one of a

number of opportunities for staff development that could be elected by schools participating in the CSI. Given the current decentralized administration of Chicago schools, CPS is emphasizing each school's need to plan its own development within the CSI, rather than designing a centrally mandated change program. However, CPS is conducting a needs assessment survey of all its schools during the spring of 1994, and has promised that TAMS can have access to these data.

It is likely that TAMS' and CPS' assumptions about systemic change also differ somewhat, in ways that are consistent with the inherent differences between the two organizations. As detailed in Chapter III, TAMS' definitions of "systemic change" focus on the individual school, with intensive efforts focused on each of the schools it can accommodate with available resources. The perspective of CPS administrators is oriented toward all the schools in the school district, with the school district as a whole as the "system" to be changed. Therefore, CPS is primarily looking for ways to change many or all schools within the CSI umbrella initiative, and the intensive TAMS approach would be only one of a number of potential approaches. Thus, neither effort can be fully subsumed by the other: the CSI is based on CPS' perceived need for a broader inclusion of schools, while TAMS is committed to its intensive school-focused staff development model. Before being applied on a Chicago-wide scope, TAMS' program concepts need to be fully implemented and evaluated within its school-focused context.

Other reasons — particularly the continued turbulence within CPS' central administration and finances — remain for TAMS to continue to be independent of CPS. CPS central administration has been buffeted by the changeover in Superintendents in mid-1993 (for a total of four changes in Superintendents since TAMS started), a financial crisis causing late opening of schools in the Fall of 1993, a controversial Superintendent's initiative to create "three tiers" of schools based primarily on their achievement test scores, and both city and state efforts to foster systematic planning and accountability in schools. Within individual schools, the substantial power of Local School Councils has required principals to be responsive to local parents, but has also brought local inter-ethnic politics into schools. The turbulence is likely to contribute to the high rate of turnover among principals: TAMS reports that about 2/3 of Chicago's principals have changed since 1989. TAMS' staff report that teachers were substantially demoralized in the fall semester of 1993, which decreased teachers' motivation to undertake the self assessment and hard work to implement radically new teaching methods and content in science and mathematics.

Theme 4: *Leadership*: **TAMS' leadership and authority relationships have come together under the strong guidance of the current Executive Director and Chief Operating Officer.**

The stakeholders and staff interviewed for this study were uniformly positive about the current leadership team of TAMS. The Executive Director has a long history of involvement with Chicago's schools and their politics. She was a teacher, a principal, a member of the founding group of TAMS, and the Deputy Mayor for Education, before becoming Executive Director of TAMS in January, 1993. She is a person of strong

commitment to the need for intensive staff development for revitalizing education, with a passionate zeal for communicating her ideas. The Chief Operating Officer also has extensive background in education, particularly with the educational programs of the state of Illinois and is a very strong manager of TAMS' organizational systems and staff. Together, these two individuals complement each other to bring a strong leadership team to TAMS, with both charismatic vision for guiding the organization's overall course and managerial skills to coordinate its people and programs.

This strong leadership team has won the confidence of TAMS' governing boards, so that the Boards' involvement in day to day management is no longer considered necessary. TAMS' founders are now content to let its management take charge and for its programs to prove themselves within the classrooms with teachers. The governance has also been streamlined, with more detailed oversight placed in an Executive Committee and four working committees and the large Board of Trustees assuming an advisory function. A number of external stakeholders have also returned to supportive relationships with TAMS, including extensive support from Motorola University, and a revitalized Council of University Presidents. The newly proposed linking with Chicago City Colleges shows another creative initiative. But a number of stakeholders expressed interests in stronger evidence that TAMS' programs are working for teachers and children, so some of this support is tied to desires for stronger accountability within TAMS.

Theme 5: *Management processes:* **TAMS' internal management and communications are improving, but many of these initiatives were new during 1993-1994 and have not yet been fully integrated into TAMS' internal systems and prior culture.**

During the past year many new processes have been started at TAMS to improve its internal functioning and communications. Intensive and lengthy meetings to develop a major Strategic Plan brought together staff from all of TAMS' units, as well as some external stakeholders, to compare the diverse perspectives among staff members and to achieve a common vision of where TAMS is headed. This effort is continued via the operation of a Learning Leadership Team, which meets at least monthly to continue working on strengthening internal communications.

Coordination of various staff members' work with each school has been strengthened by the development of School Assessment Team meetings, in which all the staff working with a particular school (i.e., from the Math Unit, the Science Unit, the Resource Center, the parent coordinators, and the School Improvement Unit) come together about once per month to assess its current status and devise action plans for next steps likely to meet its needs. These meetings also facilitate the use of feedback data from each school to keep track of its changes and to tailor future TAMS' efforts to its status. Further, extensive staff development for the Science Unit led by BSCS also involved staff from other units and helped to bring about communication among TAMS' staff members.

Substantial work has also been devoted to improving TAMS' formal management systems, particularly its financial management. A new Chief Financial Officer in mid-1993 brought the expertise to begin creating a modern financial accounting system, with

emphasis on program-specific budgeting and expenditure accounting. In turn, this information about finances is being used and discussed in periodic review meetings of budgets, expenditures, other plans, and unit problems in meetings between each unit head and TAMS' leadership. Such meetings help to keep program delivery on track with expectations and expenditures, but require an extent of internal accountability that was not always present in TAMS' past.

Nevertheless, substantial problems in internal communications remained during the spring of 1994. Many staff members stated that they do not know what other units do, and very few coordinated program efforts among TAMS' units were present. Staff still felt the presence of a "top down" management style, and often did not feel that their views were listened to before major decisions were made. Full staff meetings were not frequently held to keep everyone updated on the latest developments concerning TAMS' changing status and programs. These communication links will need to develop over time, as all staff become more experienced in using the new mechanisms set up within the past few months. Such emphasis would contribute to a better balance in the attention of TAMS' leadership between internal program development and external relationships.

Continued work is needed to solidify the management of each unit, so that unit managers are able to plan for the composition of their units and the activities of their staff members. With better planning (which may depend on more assured finances), more open collaboration is likely to grow between top administrators and unit managers. Further, efforts are needed for some unit managers to work on developing the instructional skills of their staff members. Unit leaders need to work together collaboratively for program integration, even if it takes time away from instruction with teachers.

Theme 6: *Staffing:* **Staffing has been strengthened since January, 1993, with many excellent staff on board, but a key vacancy remains and further work is needed to solidify new job roles.**

Substantial attention has gone into proper staffing during this period, by releasing inadequate staff members, delegating authority to unit managers to hire their staff, and hiring new staff members when resources allowed. Many well-qualified and dedicated staff members are now present and are creatively using their skills to further TAMS' mission. Our interviews documented that a highly motivated group of staff members exists with a tremendous reservoir of background experience.

A number of new job roles are being developed by their incumbents, such as "implementation specialist" and "school improvement specialist." The fact that such roles have few precedents means that staff have to feel their way as they go. Time for self-assessment, group discussions among people doing the same role in different schools, and feedback from more experienced staff is much needed in this type of situation. This role assessment goes on informally when there is time, and is beginning to be formally included in TAMS' management. However, new staff in 1993-1994 received little

orientation to TAMS' structure of program activities, or to their own job role. As they work in classrooms with teachers, they may or may not be carrying out TAMS' underlying approach. Perhaps a period of "internship" is needed for new staff members to work closely with older staff within the teacher development units to fully grasp TAMS' underlying strategies. Some staff members also mentioned desires for more support through TAMS for continuing their own professional education toward advanced degrees.

A key vacancy remains in the position of Director of Science. The Lead Faculty member in the Science Unit has done a good job of coordinating its efforts, particularly from his school experience in using TIMS⊕. But he does not have educational credentials in science or science education from which to speak for TAMS to a national audience. Yet a Director of Science is needed to have the authority to speak for and to manage this unit, both internally and externally. TAMS has recruited and interviewed several candidates for this position within the past year, but a hiring agreement could not be reached. TAMS' requirements are quite rigorous, and they have had few strong candidates who are willing to come to the turbulent Chicago environment. The absence of long-term financial support for TAMS is also a major disincentive for a well-qualified candidate who is already established elsewhere. In mathematics, vacancies remain for implementation specialists, and the instructional staff is too small to handle the new 4-8 curriculum.

Formal documents, such as proposals for the expansion of TAMS' scope, have not included detailed plans for what types of staff members and how many would be needed for expansion. As shown by the previous section on TAMS' past history, expansion of TAMS' staff-intensive program delivery should include careful attention to staffing, if it is to be successful. Before expansion is undertaken, staffing plans should include details of what job roles are needed in what numbers, what background experience and skills are needed, how these new staff will be recruited and selected, how they will be oriented to TAMS' philosophies and pedagogical methods, and whether there is space for their offices and work. Strong staff members are the basic ingredient of TAMS' work with teachers and schools.

Theme 7: *Program Evaluation:* **Major weaknesses remain in TAMS' program evaluation plans and products.**

The evaluation unit at TAMS was started up in 1992 in the midst of its major organizational turmoil and has not kept pace with the major changes within TAMS. The results of TAMS' internal program evaluations are examined more fully in Chapter IV. An Evaluation Plan was written and revised several times during 1992 and early 1993, attempting to attach multiple types of measurements to TAMS' evolving goal statements. TAMS indicates that a panel of external advisers reviewed the plan and offered comments. The plan seems to be more a statement of aspirations than of intended data collection, for it does not prioritize among potential data collections to specify those activities that will actually be done within the resources available.

The evaluative focus thus far has been nearly exclusively on formative and qualitative evaluation projects, with little continuity of data collection from one year to the next, and no attempts to document TAMS' program delivery or outcomes as a whole. A number of positive vignettes have been produced from teacher surveys, TIMS®-specific testing, and focus groups. So far, these interesting and suggestive pilot results have not been followed up over a longer term, and most remain dependent on the self-reports of teachers. In addition, evaluation data reports have been weak in their presentation of methodological information that permits their methods and the validity of their results to be assessed by other evaluators. (See Chapter IV for more detail on TAMS' program evaluation.)

A major weakness of TAMS' evaluation is that no plans have been put in place for summative assessment of TAMS' outcomes for teachers (or students), so that outcome analyses will be available several years from now. Such outcome evaluation requires a design that would permit inferences about TAMS' effectiveness. TAMS has not initiated data collection for any such design, such as collecting pre-TAMS data from or about teachers' classroom practices, selecting other similar schools to provide comparison data, or developing a time series design for analysis of student data. Further, until stimulated to collect and compile data about its participating schools by this NCISE project, TAMS' evaluation unit did not have a central data system in place simply to document over time what programs are in fact delivered within each school. Data from those units that have ongoing data collection, such as the Resource Center, are not integrated into a TAMS-wide analyzable database.

TAMS' evaluation efforts have not been well integrated into the work of other units. Many staff mentioned that they would welcome help with collecting and using systematic evaluation for their units, but the evaluation unit has not been able to provide this help. Some current joint efforts are underway to develop a tool for assessing a school's readiness to become one of TAMS' intensive schools; this work was still in progress at the time of our last site visit in April, 1994. TAMS' Strategic Plan of early 1994 includes clear intentions to use systematic data feedback to improve its programs. Yet, its major goal statements are mostly phrased toward long-term outcomes (the year 2000), and few of its strategies and action plans are easily measurable. The translation of the statements in the Strategic Plan into plans for data collection would take major work in itself; further major resources would be needed to collect data to assess progress toward the goals and strategies in the Plan.

Theme 8:   *Scope of Activities*: **Recent formal documents continue to over-promise the future scope of program delivery, toward a greatly expanded number of intensive schools within the near future.**

Recent planning documents have continued TAMS' practice of over-optimistic projections for the scope of its activities. For example, Goal 3 of TAMS' Strategic Plan is that:

"By the year 2000, TAMS will have initiated a systemic change process in mathematics and science education within 300 elementary schools in Chicago."

To meet this goal would require that TAMS work with 50 new schools each year for the six years between now and 2000. Given that TAMS' program model is now for three and a half years of intensive work with each school, implementing this goal would quickly require that TAMS have the capacity to work intensively with about 150 schools at one time. Since it has thus far worked intensively with about 42 schools total over the prior three years, it is unrealistic for TAMS to expect to implement its model in 50 new schools each year without major expansion.

Similarly, TAMS' proposal to NSF (of April 1994) discusses the scope of the project in terms of numbers of teachers, rather than new schools, but proposes to bring in 700 new teachers in 1994-95, then more than 1000 for each of the 1996 and 1997 school years, for a total of about 2700 teachers in TAMS' programs by 1997-98. At an average of about 20 teachers per school per program (its prior average), this would translate into working with about 35 to 50 new schools each year. Yet surprisingly, the budget proposed to NSF is a flat $4 million per year, with no increased budget for the second or third year with each school, or even to allow for inflation.[7] It does not appear that this proposal reflects a realistic budgeting and planning for the staffing requirements for this expanded number of teachers.

Another issue affecting expansion is whether TAMS will be able to recruit this large number of new schools each year. Quite appropriately, TAMS is emphasizing that the staff of new schools should voluntarily decide that they want to participate in this intensive developmental effort. TAMS had a major recruitment meeting this spring and is planning other efforts to familiarize teachers with its programs. The results of these efforts were still ambiguous at the time of our last data collection in terms of the number of new schools that will elect to join TAMS in 1994-95. With the current situation and low morale in many schools, their teachers may still not be ready to make the commitment for TAMS' intensive program. Their willingness to commit to TAMS may also be affected by the absence of strong evaluation results documenting that this effort makes a difference for children. The feasibility of recruiting large numbers of new schools is a key issue that is only partially under TAMS' control.

Our analyses of TAMS' organizational development in this Chapter and of its program model in the next Chapter indicate that major developments are underway within TAMS, but that substantial work remains to build its science program, to integrate the program components, and to consolidate the organizational changes that have taken place. TAMS' capability to solidify these changes is likely to be severely jeopardized, if it also attempts to substantially expand its program delivery within the next year. Yet the two major planning documents promise such expansion, without any detailed planning for

---

[7] TAMS indicates that it expects to obtain funding for the second and third year of a school's participation from local sources, but such large scale local funding has not been forthcoming in the past. We received no firm predictions within stakeholder interviews that such funding is likely to be available in the future.

what would be involved, nor any discussion of its feasibility. Making unrealistic promises to funders puts extreme pressure on staff members, and creates later frustration for both staff and funders about unrealized expectations. It would be preferable for TAMS to plan realistically for the numbers of schools it can work with, and for a steady but realistic expansion of its work each year, for example in the range of 20% to 30% increase in staffing.

Conclusions

Analyses using the templates in Appendices 4 and 5 have provided the framework for a systematic assessment of TAMS' current organizational status. The cross-cutting themes discussed above indicate that TAMS has made substantial progress internally. A strong leadership is in place, the damage to external relationships is being mended, and an integrated program model is being developed. TAMS now needs a phase of operating stability at its current substantial scale, but not rapid expansion. A key need is for evaluative data systems to capture what it is doing and to put in place at least one appropriate design for assessing TAMS' results over several years. With several years of continued development and intensive work with schools, TAMS *might become* a national model for the revitalization of urban schools in mathematics and science instruction. But organizational expansion takes time, and a too rapid expansion of its still developing programs and systems could plunge The Teachers' Academy into another period of confusion and crisis.

III - THE PROGRAM OF THE TEACHERS' ACADEMY FOR MATHEMATICS AND SCIENCE

The previous chapter described organizational growth and effectiveness, both past and present. It alluded broadly to the raison d'etre of the organization--"to create and facilitate a continuous improvement process that ensures excellence in teaching and learning mathematics and science"[1].

The purpose of this chapter is to examine in much greater detail the content of TAMS' overall program, which is made up of several program components. This chapter has seven sections:

A) factors influencing TAMS' intended program model;
B) an overview of the template to be used for analysis;
C) a brief description of the program components and activities;
D) comparing the intended program model to "best practice";
E) comparing TAMS' actual practice with the intended program and "best practices";
F) a review and analysis of data gathered in TAMS's schools; and
G) a summary.

The focus of this chapter will be on TAMS' *current* program designs and delivery, rather than any earlier program models.

A. Factors Influencing TAMS' Intended Program Model

Early in our study, it became apparent that two key concepts--staff development and systemic reform--were at the heart of what TAMS' overall program was about. In addition, TAMS' conceptual program model was influenced heavily by the context in which it is set--Chicago's school reform movement. Each of these contributes to another important theme in the program design: change takes time. In this section, we will briefly discuss each of these four themes as they pertain to TAMS' intended program.

Staff Development

TAMS' program content is not intended to be a "teacher training" model that provides a standard or core curriculum to large numbers of teachers. Rather, its aim is long term development of teachers, often called professional development. The distinction is not a minor one. The teacher training model typically provides short term interventions, often in a workshop format, designed to give teachers "how-to's" that might be immediately translatable into the classroom.

---

[1] TAMS, *Strategic Plan*, 1994, p. 6.

In contrast to this more "cook book" approach, teacher development implies a longer term, integrated set of activities that enhance the teachers' knowledge and pedagogical bases in a subject or subjects. Using this deeper understanding, the teacher must make his/her own decisions about how to apply the new knowledge and techniques in his/her own classroom instruction. Good staff development should provide the opportunity for thinking about these issues, but does not give the answers. Some aspects of "retooling" teachers (TAMS' vocabulary to describe its mission) are more technical, for example, exposure to models or methods for cooperative learning or portfolio assessment.[2]

The goal of staff development is to produce better teachers, not teachers who may be more able in a specific technique or curriculum. Professional development aims to create more permanent shifts in the ways teachers understand and act on their knowledge. The assumption, of course, is that better teachers will provide better learning environments for their students, who will, in turn, learn more.

What does the programmatic side of good professional development look like? Little outlines several key ingredients:

- "meaningful intellectual, social, and emotional engagement with ideas, with materials, and with colleagues both in and out of teaching"[3];

- consideration of the experiences of the teachers and the contexts of teaching diverse populations;

- support for informed dissent;

- placement of classroom practice in the context of school practice and school culture; and

- preparation of teachers to use inquiry methods.

Given these levels of complexity, assessing the effectiveness of professional development programs poses numerous challenges. A reachable evaluation goal for this study was to see whether TAMS' professional development program is providing a quality intervention which matches up to generally agreed upon standards of "best practice." If we follow the hypotheses that 1) better teachers foster better learning in students and 2) certain "ingredients" are important in the staff development program to promote better teaching, then we must first ascertain to what extent the program exemplifies these ingredients.

---

[2] Little, J. *Teachers' Professional Development in a Climate of Educational Reform*. New York: National Council for Restructured Education, Schools, and Teaching, 1993.

[3] Ibid., p. 10.

Systemic Reform

"Systemic" reform is the paradigm for education in the 1990's. The assumption that underlies this paradigm as it relates to mathematics and science education is that "effective changes in the teaching and learning of mathematics and science (i.e. changes that result in students more capable of flexible thinking and problem solving in these disciplines) require integrated and coordinated changes among various interacting components at several levels of the educational system."[4] The reform itself involves the "adoption of ambitious student learning goals and the alignment with these goals of instructional materials and practices, assessment strategies, and the preparation and ongoing professional development of teachers".[5]

The level of systems referred to varies among different writers and policy makers. In the broadest sense, this kind of reform pertains to the educational system of the United States as a whole. The development of national standards in the various subject area disciplines is one example of this larger system. More commonly, the system focus is the state, which sets broad goals and policies for the districts in its purview. The smaller subsystems of the state include the districts and within the districts, the schools themselves. In any case, the nature of reform involves collaboration among the various stakeholders of a system in creating the appropriate avenues for change to occur. Change is a result of both "top down" and "bottom up" initiatives. It is adaptive to local circumstances.

Although TAMS as an organization is interested in influencing policy on a larger scale, its focus is on the *school as the system of change*, and the teachers as the change agents. In a highly decentralized district, such as Chicago, the schools have great responsibility for themselves as systems in need of reform. The school operates within the larger systems, following district and state guidelines and policies (as they affect certification of staff, curriculum standards, testing, finances and other resources, facilities, and calendars, among others). The teachers are the core of a decentralized school, but they, in turn, need to be responsive to the concerns, direction, and resources of the community, the Local School Council (in the case of Chicago), and the principal, as well as the needs of their students.

At the school level in Chicago, systemic change for mathematics and science has several facets:

- developing curricula that meet national, state, and local standards, including the Illinois goals that center on the needs of all children

- identifying, using and creating (if necessary) instructional methods, materials, and assessments that are aligned with these standards and goals

---

[4] Shields, P.; Zucker, A.; and Hawkins, E. *Identifying Indicators for NSF's Statewide Systemic Initiatives (SSI) Program.* Menlo Park, CA: SRI International, 1993, p. 2.

[5] Ibid.

- improving classroom teaching so that the intended curricula, instructional methods, materials, and assessments are fully implemented

- establishing community support for and understanding of the need for new science and mathematics teaching

- creating an infrastructure that supports change: time for planning; access to necessary resources, including materials and staff development opportunities; and appropriate scheduling for classes

Many of these changes require major shifts in the way schooling has occurred in this country.

Although TAMS did not initially define itself as a "systemic" change initiative, perhaps because the word was not in vogue in 1989, the realization of its mission relied on creating new structures and ways of thinking to support change in education, not just within the classroom but more broadly. More recently, it has focused on the alignment of these structures and ways of thinking with each other. TAMS' stakeholders now speak of it as a systemic initiative.

Professional development becomes even more complex when set within the context of a systemic reform agenda. Judith Little describes five different kinds of reforms that need to be addressed by professional development: 1) subject matter teaching (standards, curriculum, pedagogy); 2) the nature, extent, and uses of student assessment; 3) problems of equity among a diverse student population; 4) the social organization of schooling; and 5) the professionalization of teaching. TAMS' central mission involves all of these to varying degrees.[6]

Evaluating systemic initiatives is an even more complex process than evaluating staff development programs. Evaluators are only just starting to struggle with developing frameworks and indicators to describe and measure both the change process and its intermediate goals. Once again, if change is to occur because of TAMS' interventions, we must first recognize to what extent the systemic intervention is occurring and what the quality of that intervention is.

School Reform in Chicago

TAMS' staff tell us that "systemic staff development" has never really existed within the Chicago Public Schools. Although teacher training activities, such as workshops, have been provided, these are not integrated into a program to create long-term, ongoing change.

Now under school-based management in Chicago, staff development becomes the responsibility of the individual school community. Schools may choose to focus their staff

---

[6] Little, Op. Cit.

development efforts with a unifying goal or theme. Some schools have organized themselves around mathematics and science and are recognized by the city as special mathematics and science schools. Others may become involved in a wide variety of programs and projects that might be exciting but often dissipate teachers' energies and create skepticism about the worth of the newest "fads" in education. Dubbed "Christmas tree" schools by some, these may not be the best clients for intensive staff development programs, such as that offered by TAMS. In addition, schools now face the somewhat burdensome task of having to put together their own curriculum in all subject areas. Because of the strong role of the Local School Councils, schools vary widely in the kinds of support they receive locally for change efforts. Some are embroiled in local politics.

Further, the continued turmoil in the Chicago school system and in some individual schools inhibits comprehensive staff development. As recently as Fall, 1993, budget shortfalls caused the system to close down until the court ordered it to re-open. These kinds of incidents contribute to lower teacher morale and make it difficult for some to participate in programs such as TAMS, which requires long term commitment.

Until recently, the "readiness" for change in mathematics and science has not been a primary concern for TAMS in its recruitment of schools. Consequently, its previous "intensive" schools represent a whole range along this continuum of change. A school's ability to change may be less a result of the good or poor quality of TAMS' instructional program than the myriad of other issues in its "system". TAMS now plans to address these readiness issues as part of the whole systemic model, and its success in doing so might be a part of future assessments.

Change Takes Time

Even for program components that are more stabilized (in this case TAMS' mathematics program), change in both teacher and student outcomes is likely to occur over time. With teachers especially, change may occur at different rates because of individual differences as well as the characteristics of the schools in which they teach. Teachers need to 1) internalize and own new content knowledge and instructional techniques, 2) practice new learning on a small scale, 3) choose, adapt, and/or construct appropriate curricula that meet local, state, and national standards, 4) create appropriate learning environments, 5) acquire and develop new materials, and 6) be afforded the time, opportunity and resources to do these things. For teachers with poor backgrounds in mathematics and science and accompanying anxiety about these fields, the road to travel will be that much further. School conditions and culture and the other demands of schools and teaching may conspire against smooth change, despite teachers' mental readiness to shift.

Even under ideal conditions, students will take longer to be influenced by these changes. Older children have habits from previous years' of schooling to overcome. In this urban school setting, some children shift schools frequently, thus necessitating catch-up between

schools where change may not yet have occurred to schools where it is more embraced.[7]

All the change literature is adamant on one theme: change takes time. Those interested in seeing quick results will be disappointed if test scores do not respond immediately. *A better use of resources is to set up the methods for examining both intermediate and long term change, and then concentrate on making sure that the program is being delivered as intended.* That is the aim of this study.

B. Program Template

This section briefly describes a template that compares with "best practices" the intentions and realities of a staff development program within a systemic context (see Appendix 3). As mentioned in the first chapter, the idea of using the template as a formative evaluation tool was developed by the National Center for Improving Science Education. Given the contexts for our study as outlined above, we believed that a thorough examination of the program against a framework of effective practices criteria would be the most important contribution we could make at this point in TAMS' history. The standard NCISE template format—components of effective practice, intended program, and actual program—was appropriate for our task. In this way, we could address several questions with one instrument.

- What is effective practice for this type of program?

- What is TAMS' intended program?

- How are its programs carried out?

- To what extent does the *intended* program model reflect "best practice?"

- To what extent does the program *as carried out* reflect "best practice?"

- To what extent *is* the program's model carried out?

- Where are the gaps? What can be improved?[8]

Key Topics

Because systemic reform is such a new concept for evaluation, this template should be considered a work in progress. The completed template is shown in Appendix 6, and is

---

[7] Data for TAMS' schools are ambiguous about student mobility – See Chapter IV for more detail on this subject.

[8] Adapted from "Anatomy of a Template" in NCISE, *Profiling Teacher Development Programs*. Andover, MA: National Center for Improving Science Education, The NETWORK, Inc., 1993.

---

the basis for the findings presented in this chapter. Its major headings are shown in Exhibit 3-1.

Exhibit 3-1. Components in the Template for Staff Development Programs in a Systemic Context

1. **Vision of the Program**--developed through collaboration and consensus

2. **Program Design and Delivery**-- addresses the alignment of many elements; sustained over time; focused on the school rather than the individual

3. **Attention to Equity**--fairness in gender, race and ethnicity in recruitment, practices, content, and resources

4. **Vision of the Classroom**--hands-on learning, real world content

5. **Teacher Development Program Activities**-- designed for adult learners; transferable to classroom

6. **Follow-up and Support for Teachers**--long term commitment, with variety of activities

7. **Teacher Leadership Responsibility**--teacher input and teacher leadership supported

8. **Building the Capacity of the School as a System**--attention to an integrated infrastructure to allow for change, community support, and opportunities for networking

9. **Program Evaluation**--both formative and summative

10. **Public Support**--strategies to influence policy makers

---

C. TAMS' Intended Program Model

The Vision and the Collaboration

As discussed in the organizational chapter, the original planning group that resulted in the creation of The Teachers' Academy was diverse, including university presidents, professors, scientists, Chicago Public Schools representatives, city government officials, and other stakeholders in the Chicago community. As TAMS has developed, the governance structure has stabilized. However, the Board of Trustees and key Executive Committees, which now set overall policy, still represent a diversity of interests with the Chicago school community. During the latter part of 1993, a core group from TAMS, with the help of Motorola, developed a strategic plan, with opportunity for input from the whole organization. The plan asserts TAMS' intent to work in partnership with school communities, seek feedback from customers and suppliers, and allow staff to

contribute to the development of TAMS' programs and services. Thus, TAMS sees itself as a collaboration with its many stakeholders, including its own staff.

Comprehensive School Development: An Overview

As has been discussed previously, TAMS sees its overall purpose as enabling systemic reform of instruction in science, mathematics and technology. This systemic change addresses the alignment of curriculum, instruction, materials, and in-school assessment strategies with each other and with school infrastructure, community support, and local, state and national standards.

TAMS' comprehensive school development program is the centerpiece of its mission. Using the school as the unit of change, this process seeks to "engage" teachers and other community stakeholders "in the strategic rethinking, revitalizing, and restructuring of their instructional program in mathematics, science, and technology." School development is addressed through four parallel strands, each roughly representing one of the four units of TAMS:

- intensive staff development in mathematics, science, and technology (Mathematics and Science Departments);

- organizational and technical assistance (School Improvement Unit--SIU);

- school community partnership development (School/Community Partnership, part of the SIU); and

- networks and follow-up support (the Resource Center).

In addition, TAMS plays a leadership role in policy formulation and leveraging of resources. Each of these will be discussed further.

Comprehensive School Development: Intensive Staff Development.

The core of the comprehensive school development program is staff development in mathematics, science and technology. Guidelines for TAMS' staff development are laid out in a July 1993 document, approved by the Program Committee of the Executive Board, and entitled, Teachers' Academy Mathematics and Science Program Policy Guidelines. TAMS seeks to integrate experts' feedback, current research, "best practices," and standards into all aspects of its model.

Key themes. TAMS' overall intended program for staff development emphasizes: 1) development of different kinds of skills and knowledge; 2) practices that encourage learning among adults; 3) in-class activities that help to foster the skills and increase knowledge; 4) classroom support and follow-up to help develop and sustain growth in these areas.

The activities and philosophy of TAMS' intended program are built around a vision of the classroom that sees the teacher as the *facilitator* of learning. In this vision, the teacher believes that all human beings can and will learn; uses a hands-on, minds-on instructional approach that relates to real world problems and applications; promotes depth of study rather than breadth; provides access to a broad range of learning resources both in and out of the school; and uses a variety of assessment practices. The above emphases and vision are outlined more fully in the "Intended Program" section of the completed systemic program template (Appendix 6).

Program delivery. The intensive program is now designed as a three and a half year program. The school is the unit of delivery for change, and teachers are the "change agents." Currently, recruitment is by school, and 75% of teachers must agree to participate before that school is accepted in TAMS' intensive program. Teachers in intensive schools are expected to actively participate, and the schools are asked to commit to change by providing the necessary support. Schools are expected to set aside $25 per student per subject area pursued through TAMS (science and mathematics) as a budget allocation for materials. In addition, there is a sliding scale of fees payable to TAMS, but actual payment has been held up by CPS financial procedures. In return for the school's financial commitment, the science program at TAMS will provide an additional $500 for materials per individual teacher if that teacher attends at least 85% of the instructional sessions.

In the future, TAMS expects to engage schools in a readiness assessment to see if they are open to the kinds of changes that TAMS' program is designed to create in schools. One half year is designated for this activity. The School Improvement Unit (to be discussed next) will work with schools that are not quite ready.

Staff development is organized into two very distinct programs departments: mathematics and science. Each program is now offered to teachers at a K-3 level and a 4-8 level. The current model for both the mathematics and science programs calls for a year and a half each, with mathematics being offered first. Schools must agree to the whole package-- mathematics and science at all grade levels. The complete program includes computer technology training (as an add-on to the mathematics program, offered through the Resource Center).

The scheduling aspect of the program has undergone great shifts since the inception of TAMS. At first, teachers participated in TAMS' mathematics or science program on a "pull-out" basis two days in a week, every other week. TAMS trained its own substitutes, called Academy Coordinating Teachers, who took over teachers' classes during these times. This approach was disruptive to teachers and children and was abandoned within TAMS' early period in favor of more flexible and slightly less intensive models.

Although the program policy guidelines note that options will be made available for establishing schedules other than during school time, the mathematics and science programs take slightly different official approaches to scheduling. At the K-3 level, mathematics is a "pull-out" one day every other week for eight sessions, with substitutes provided. The 4-8 program calls for one day per month plus a Saturday, or after school

sessions bi-weekly. All mathematics programs have been held at TAMS (and most recently have moved to a larger location at the University of Chicago) and combine several schools. Classes are typically about 25-30 teachers, with a pair of instructors. Instructional time for the 4-8 level teachers is somewhat greater than for K-3, and is spread out over one year. K-3 instruction is over a summer and one semester.

The science program is offered either on site at the school or at TAMS, and on a pull-out basis or an after-school or Saturday mode. Instructional time is the same for both levels, and includes 40 hours in the summer in addition to 60 hours spread out over 10 months during the school year. Average class size is much smaller than in mathematics (often around ten teachers or even less) except when instructors decide to double up, as several have.

In-school follow-up is also handled differently by the science and mathematics departments. The instructor in the science program is also the immediate "implementer" in the school and is at the school approximately three days a week during the intensive instructional stage (approximately three hours per month per teacher), offering additional workshops and in-class modeling, co-teaching, coaching, and assistance. In the follow-up semester after instruction, school time is reduced to six hours per month total. Documentation does not indicate the expected teacher case load for instructors, but science teachers reported being responsible for about 10 teachers each on average.

In the mathematics program, instructors and implementers are different people. Time allowed for in-school follow-up during the instructional phase is considerably less for the K-3 group than for the 4-8 group. The instructor makes these visits during the instructional period, followed by the implementation specialist in the follow-up period.

Program content.

   Mathematics. The mathematics program at both levels is intended to provide "in-depth and expansive treatment of content, pedagogy, and curricular issues relevant to systemic change in support of more effective mathematics instruction."[9] The program is based on the University of Chicago School Mathematics Project's (UCSMP) Teacher Development Programs and follows the emphases for staff development outlined in the beginning of this section.[10] A key goal of TAMS' mathematics program is to give teachers a better understanding of mathematics in general. Topics include, but are not limited to, number theory, geometry, measurement, statistics, calculator usage, and problem solving applications. Instruction is carried out through hands-on experiences, frequently using cooperative learning modes, presentation, discussion, and individual exercises and strives to teach both content and process. Although the program is not a curriculum, it includes activities that can be taken back to the classroom, such as the

---

[9] TAMS, "Comprehensive School Development Process," Section 8.

[10] The UCSMP Math Tools for Teachers (K-3) was developed during the mid-1980's and has been adopted by more than 100 school districts nationwide. Chicago served as a pilot site. Recently, materials were created for teachers and specialists in Grades 4-6.

work with manipulatives and "finger math." For examle, in one instructional session we observed teachers engaged in cooperative, hands-on activities to solve problems on such topics as graphing, base-10 counting and operations, geometrical shapes, and volume. Earlier in this session, these teachers enthusiastically shared how they had applied previous learnings from TAMS in their own classrooms. They discussed and devised solutions for pedagogical issues they encountered. Connections between material presented and classroom practice were continually made by both instructors and teachers. In addition, regular time was set aside for teachers to plan their own mathematics curricula (expected under school-based management in Chicago) both within and across grade levels, using national, state, and local standards and frameworks.[11]

Science. The science program currently also covers topics related to children's learning, instructional practices, curriculum standards, and assessment and aids teachers in developing curricula. The science department program has been through more changes than that of the mathematics department for several reasons: lack of clear national standards, lack of appropriate, already developed staff development programs in science, complexity created by the many disciplines in science, and lack of a science director throughout TAMS' history. Initially, the ISMT® program, along with a number of other kit-driven programs, was offered by what eventually became the Resource Center. From the beginning, however, TAMS has always had a program centered around the TIMS® (Teaching Integrated Mathematics and Science) curriculum. This program is an integrated mathematics and science set of activity units with specific recommended experiments, designed for children at the elementary level. It was not originally designed as a staff development program, but has been the main content piece of the science program up until this point. It is a physics based program which focuses on teaching the scientific process by introducing a few key variables from science and mathematics: length, area, volume, mass, and density. As with the mathematics program, instruction uses a variety of modes, especially hands-on, since the "labs," which can be used with children, are all set up as experiments. After carrying out the experiment as a four part process, the student is then directed to answer a series of questions about the experiment which use hypothesizing, comparison, and inferential skills.

For some time, TAMS has been seeking a way of incorporating a stronger content focus into its science program. Through its own intensive and ongoing staff development relationship with BSCS (Biological Sciences Curriculum Study), it is now in the process of revising its science teacher development program. The new program will be centered more around themes in science, such as cause and effect, time and scale. These themes will allow for an in-depth interdisciplinary examination of key science concepts, rather than textbook coverage of many. The new program was neither developed nor operationalized at the time of this report.

---

[11] See Appendix 6, "A Template for Mathematics and Science Staff Development Programs in a Systemic Context," sections 2, 4, and 5, especially for a more detailed description of TAMS' intended and actual mathematics and science programs in relation to "best practice."

Comprehensive School Development: Organizational and Technical Assistance.

This strand, offered primarily through the School Improvement Unit (SIU), examines the infrastructure and internal support mechanisms that allow integrated change to occur within the schools. The SIU is also charged with the responsibility for determining readiness of new TAMS schools; working with the leadership of its intensive schools by facilitating principal support and developing leadership teams; providing support to schools involved in the state visitation process and technical assistance workshops to others; serving as a bridge to school improvement initiatives at the local, state, and national levels; and coordinating TAMS' services. In addition, it oversees the School/Community Partnership, which will be discussed next.

To serve these ends, the SIU is charged with facilitating regular meetings of principals from intensive schools; coordinating the School Assessment Team meetings at TAMS, which bring together representatives from the different TAMS' units to discuss each intensive school's progress and problems in relation to TAMS' program; providing consultation to schools on the state's review process; and organizing conferences on key topics, such as assessment.

Comprehensive School Development: School/Community Partnerships

The School/Community Partnership division of the SIU focuses on building support with the larger community, especially the parents. The goals of this group are to create better public understanding of science and mathematics and to promote parental involvement with and support of the school's instructional program. These goals are met through the identification of parent facilitators who serve as the links between TAMS and the schools and work with other parents, through the Local School Councils, developing a parental/family involvement piece and offering opportunities for increasing appreciation of math and science.

Comprehensive School Development: Networks and Follow-up Support.

Primarily through the Resource Center, TAMS has stated it will provide opportunities for electronic networking among professionals in mathematics and science education; regular idea exchange and support among TAMS' intensive schools; additional training both for intensive school participants and others; resource centers that provide ideas; and partnerships with museums, universities, science labs, and libraries. Currently, the Resource Center provides each intensive school with a computer for its use while it is associated with TAMS. The school appoints a Liaison to be the primary link with TAMS, both through the computer connection and through monthly meetings held at TAMS with Liaisons from other schools.

Future plans call for the use of technology for distance learning and interactive technology to reach broader audiences.

Leadership Role in Policy Formulation/Leveraging of Resources.

TAMS wants to support change by advancing the relevant policy issues at all levels of government and promoting the belief that urban students can learn and make contributions to society. It plans to achieve the first goal by identifying both key audiences for the message and key partners to amass support, targeting relevant issues, and working with those most affected by the policies to understand their impact. To achieve the second, it proposes to translate key research and TAMS' beliefs to the public, educating the media, becoming an active voice in public conversations, and creating mechanisms for schools to share their successes.

D. Comparing the Intended Program Model to Best Practice

There is no doubt that TAMS' intended program is an ambitious one, but how does it measure up to what we understand to be most effective practice, particularly given its systemic context? In this section, we present a few key themes, offering both areas of strength and areas with a mixed picture of strength and concern.

Areas of Strength

1. **TAMS' overall systemic intervention model is comprehensive and has had the input of a variety of stakeholders.**

TAMS' four stranded intervention model currently addresses the key ingredients in making reform in mathematics and science a reality in the schools. It provides an ongoing, extensive teacher enhancement program, with long-term follow-up; access to materials and resources, including human resources, through networking; provisions for creating community support and increasing community knowledge of mathematics and science education; and assistance with building the capacity of the school for change. Assessment of student learning is addressed both through the teacher enhancement program and through special programs for school-wide change sponsored by the School Improvement Unit. In addition, the model as it stands today is not the creation of one or even a few people, but rather a diversity of people from all parts of the educational and scientific community—both "clients" and "suppliers." Although the basic framework has been in place for some time (the four strands), the details of how each strand is to be carried out reflect adaptation in response to new needs and experiences.

2. **TAMS' intended instructional model exemplifies "best practice" in science and mathematics education in the elementary classroom.**

The many developers of TAMS have clearly done their homework in being aware of "best practice" in science and mathematics education. Their descriptions of their programs are frequently peppered with references to works on effective practice. The program begins with the philosophy that all children can learn. Its vision of the classroom addresses teaching for conceptual understanding of key principles of mathematics and science; a hands-on, minds-on instructional approach; depth rather than

breadth of study; balance between science and mathematics content and process in classroom instruction; use of real world problems, and exposure to different kinds of assessment. The model includes not only references to these specific practices, but it also addresses the alignment of curriculum, instruction, and assessment with each other and with local, state, and national standards.

3. **TAMS' staff development model takes into consideration the needs of adult learners and allows for frequent and sustained follow-up that addresses transfer of skills and knowledge to the classroom.**

TAMS program developers were clearly abreast of the effective staff development literature as well. The program models are strong in their focus on appropriate practical, relevant activities and attitudes, including opportunities for teachers to experience different modes of instruction; to develop new skills as well as a core of content about mathematics, science, and children's learning; both to cooperate and collaborate in their learnings and applications; to reflect on new knowledge; and to try it out, with guidance, in their own classrooms. Follow-up is both interpersonal and material. In the long-term, teachers can stay linked to each other and to TAMS through an electronic network, and through meetings of key representatives from their schools.

Mixed Pictures

4. **TAMS has shown admirable responsiveness to needs as they emerge from experience, but over-tinkering may produce an inflexible model.**

The delivery model, especially, has been changed in many ways in TAMS' brief history. Although many changes have been for the better, the model may be in danger of becoming too inflexible and, thus, may not meet the needs of the teachers whom it was intended to serve. For example, the new model calls for a three and half-year commitment, with participation in readiness, mathematics and science. Not all schools may need this level of intervention, and some may be dissuaded from participating in TAMS because of this requirement. The Mathematics Department has begun to consider some alternative levels of programming, which may help to address the potential problem of inflexibility.

5. **Without thoughtful evaluation, it will be impossible to say what is effective about each new aspect of the program activities and delivery model.**

For program delivery, TAMS has relied somewhat heavily on client satisfaction (teachers and administrators) in making changes. Although client satisfaction is important for TAMS' success, these data should be bolstered by data from other sources. At the moment the organization can only note whether these changes have been accepted, not whether they produce the intended results. Furthermore, the various adjustments are often not in place long enough to judge their effectiveness. TAMS needs to plan for more systematic evaluation of new or altered elements to its programs as well as keep abreast of other good delivery models.

6. In science, TAMS' efforts at developing a more comprehensive staff development program are well placed, but are not yet well enough tested for large scale delivery.

The TIMS® program, while a well-tested and well-respected integrated math and science program, is very weak in content for science and is not really a full staff development program. Science has not had the developed national standards that mathematics has had for several years. Lack of national standards and no existing staff development program equivalent to the UCMSP Teacher Development program make the task of developing one that much more challenging. Nevertheless a sincere and carefully crafted effort has been underway, with the assistance of BSCS. A major difficulty is that the staff who must develop the program continue to perform their other time-consuming activities. In addition, by necessity, the new program will need to be able to "fly" right away, as its first audience is a "real" one. The pressure is enormous to produce something worthwhile in a short time span for large scale delivery. Despite the able and motivating leadership of the Lead Faculty member, these staff would have benefitted from ongoing leadership from someone with expertise in both science education and staff development. Thus, it is doubly important that good formative evaluation be in place from its introduction, with plans for assessing what teachers have gained from the program.

7. The "Pyramid of Science" model may be logically correct, but it may not be the most appropriate symbol for a program for elementary schools, which are attempting to be more interdisciplinary in their approach to the sciences.

The pyramid of science, which serves as TAMS' official logo is one of the main philosophical tenets of some of its founders from the scientific realm, especially Leon Lederman. The pyramid model states that mathematics forms the foundation of all the sciences. Upon this foundation rests physics, followed by chemistry which uses physics, and biology, which is based on the building blocks of the other scientific disciplines. From this understanding comes the argument for rearranging the sequence of science courses, usually taught at the high school level, so that physics is taught first in the sequence.

Aside from the fact that the "Pyramid of Science" may be sound from a logical standpoint, its place in the TAMS' lexicon is somewhat controversial. At the elementary school level, the goal is to break down the division between the science disciplines and focus on themes which cut across disciplines. A theme may encompass aspects of physics, chemistry, and biology. The elementary curriculum is moving towards integration not away from it. Hierarchy is antithetical to this goal. TAMS' physics based curriculum, while a good introduction to scientific process, will no longer be the main focus of its science program. In all fairness, TAMS' new science program appears to incorporate the goal on integrating the sciences by emphasizing some of these cross-cutting themes, such as "systems" and "diversity."

TAMS has chosen to offer its mathematics program first in the sequence of staff development. This order makes sense beyond the place of mathematics as the foundation for other sciences. According to TAMS' staff and others, elementary staff are more "ready" to learn mathematics; they are more comfortable with it and teach it every day.

This perception is born out for elementary teachers in general.[12] Science is often considered an "add-on", and many elementary teachers are ill-prepared to teach it. Starting with the more comfortable, common, and familiar makes sense, but not *because* mathematics is the base of advanced sciences.

In addition, young children exhibit a natural curiosity to the world around them, including the technological world, which integrates science disciplines. Schools would probably be well advised to take advantage of that curiosity. TAMS may choose not to subscribe to a model of science teaching that includes the man-made world. However, as an organization working primarily with elementary schools TAMS might want to consider using the pyramid model only as a pictorial symbol of the importance of mathematics and all the sciences, including physics, which has not been taught traditionally in the lower grades. For its particular audiences, it might be less confusing to downplay the notion of the hierarchical nature of science illustrated by the pyramid, especially in light of TAMS' own new science program. This hierarchical notion is more appropriate for those teaching at levels at which the science disciplines begin to be separated from each other.

E.   Comparing TAMS' Actual Practice with the Intended Program and "Best Practices"

In this section, we will examine how the actual practice compares to both "best practice" and the intended program model. As in section D, we will offer our assessment of strengths and mixed pictures of strength and areas for concern in regards to TAMS' actual practices.

Areas of Strength

1. By and large, TAMS' key stakeholders agree with and support the conceptual model of the intended program.

After a somewhat rocky beginning, with sometimes competing factions, stakeholders consider the basic TAMS model of systemic change to be sound. Most of the professional staff were especially enthusiastic about its potential, given the right conditions. Only a couple feel that not as much energy should go into areas that support change but might not be considered staff development per se. After a turnover in the Board slot for the Chicago Public Schools, even the CPS has come around to the point where it sees that TAMS might be a valuable player in reform, without necessarily being under the wing of the CPS. This development is promising because CPS does control some of the staff development purse strings. (See Chapter II for a more detailed assessment of the relationship between TAMS and its stakeholders.)

---

[12] Weiss, I. *Report of the 1985-86 National Survey of Science and Mathematics Education.* Washington, D.C.: National Science Foundation, 1987.

2. Follow-up with teachers is extensive both in time and material support.

Teachers were vocal in their praise of the kinds of assistance they received back at their schools. (See next section for more details.) Teachers particularly liked the materials given to them by TAMS so they could try out new activities in their classes. TAMS' staff discussed their methods of working with teachers--to move their teachers towards independence. All offer additional on site workshops as well as in class assistance, as provided for by the model. Schedules for implementation are sometimes disrupted by TAMS events or by school events, such as testing and report card pickups.

The liaison teachers from each school are supposed to link in with TAMS electronically and reprint information on upcoming events. They can also communicate with each other. Other teachers may use the system as well. In a seven month period between March 1993 and November 1993, 44 teachers from almost as many schools logged onto the computer at least once, with some schools clocking as much as several hours in a given month. They are also supposed to attend monthly meetings at TAMS, and more than half do so each month.

Discovery Centers have been set up in six schools, to allow children a chance to work with science after school.

Mixed Pictures

3. Program units are in place, carrying out most of the conceptual parts for systemic change, but not yet at the full extent of integration and scope needed to work with large number of schools.

The four strands of the comprehensive school development model are now operational in varying degrees.

The delivery model of the teacher enhancement/staff development program operates somewhat as intended. As indicated, the science program is in flux at the moment and will not begin to use its new curriculum until the next cycle. However, TAMS' instructors have built in time for teachers to plan collaboratively with each other and are introducing them to alternative assessment modes.

The School Improvement Unit is the newest, having just hired its key staff during Fall, 1993. Each of its five members (in addition to the School/Community Partnership team) is in charge of eight to nine schools, with the responsibility for maintaining a liaison with the school, assessing its needs and progress, and chairing School Assessment Team meetings about that school. In addition, each SIU member has responsibility for one or more overall areas of school development, such as school recruitment and intake, readiness, principal support, and student assessment. The work of this unit has produced such activities as a three day workshop on authentic assessment for teams from intensive schools; a science literacy conference attended by around 300, focusing on state standards (as part of the program, the conference had some high visibility players in science and science education talking together); a functioning principal's group, meeting

quarterly on topics of interest to its constituents (these meetings appear to have been favorably received); and identified sites and facilitated the set-up of Discovery Centers in six schools. This coming summer, the SIU will be sponsoring a school restructuring institute for its schools and a summer science camp.

The School/Community Partnership branch of the SIU has finally been able to operate as a unit this year, with fewer diverting responsibilities. Previously, the two staff members were acting as the "odd jobs" people for TAMS, filling in where needed in school liaison work and the intake process. Able to concentrate their energies, they held a three week long summer Family Math and Science workshops for parents and children in Summer, 1993. As of Spring 1994, five schools were actively participating in the parent facilitator meetings, sending two facilitators each. Two of these facilitators had in turn organized parents within their own schools. To date, the scope of activity is still small to reach the large number of parents associated with the intensive schools but is headed in a positive direction.

The Resource Center keeps good records to show its activities in the form of a monthly report. In the past academic year, it has developed a more coherent package of teacher workshop offerings in science at different grade levels, coordinated two geometry based series for mathematics, and offered one-shot programs on using computer technology for instruction and classroom management. It recently published a handsome listing of upcoming workshops in mathematics and science professional development in the Chicago area, including its own. It assisted six intensive schools in setting up their own resource centers. The school liaison meetings appear to be well attended; schools are using the computer linkup although amount of usage appears to be varied and type of usage is unknown.

4. **TAMS's professional staff are generally well-qualified, enthusiastic, and dedicated. TAMS' administration gives them a certain amount of freedom to utilize their strengths but does not show much appreciation. The danger is burnout.**

TAMS has made some hiring errors in the past. Budget cutbacks and changes in administration allowed for some shifts in personnel. The results are a stronger core of staff in both science and math. The science staff is characterized by longevity in the institution; several have held a variety of roles, thus giving them the "big picture" of TAMS as an institution. Many were in the original pool of replacement teachers. Two have worked for the TIMS® program as trainers at the University of Illinois.

The three main instructors for math have this same longevity; the four implementation specialists are all new but have been carefully chosen for their backgrounds in mathematics education.

Of the seven professionals in school improvement, four are relatively new, and three, including the two school/community staff have been at TAMS for several years. Each comes with a special area of expertise, developed through experience, encompassing school labor unions, multi-cultural education, and school administration. The two school/community representatives have had years' of experience in parent advocacy.

Most of the staff take their own staff development seriously--they take courses regularly or are in degree programs. They are committed to the mission of the organization; the long-term staff will testify that it is this belief (and their comradeship) that has kept them at TAMS through turbulent times. Science staff have put in long hours in the BSCS workshops and in revision of their science program in addition to their instructional and implementation work for schools. All staff seem to have far more to do than their schedules will allow, and yet many seem to take on more responsibilities, sometimes self-created tasks. The danger for the organization is that these staff will burn out, especially if they are not appreciated by the organization or if they feel that their efforts do not make a difference in schools. TAMS' administration has some control over the former. For example, policies for the staff's own professional development do not appear to follow "best practice" with respect to involving staff in designing plans that would be personally useful, with whatever resources are available. This aspect of the working conditions was the most frequently mentioned as one in which staff would appreciate some improvement. They would like to have TAMS support them in attending professional conferences of their choice, even when not presenting; to be able to take courses and receive some reimbursal; or to be given release time for other important professional responsibilities from which TAMS stands to gain.

5. TAMS's instructional quality is generally high, and at times is quite innovative. However, care needs to be taken to ensure continued staff quality and orientation to TAMS as new staff are hired.

TAMS' instructional sessions in mathematics and science are its "meat and potatoes" (the follow-up in schools is the vegetables). The observed TAMS' classes were well-paced and offered a variety of modes of instruction including hands-on activities, individual and class exercises, presentation, and discussion. Most students observed were actively engaged most of the time, even though participation in classroom discussions was not even. Given both the conditions under which some teachers worked and the time frames of some classes (after school or weekends), both instructors and participants are to be commended. One class we observed was held in a huge auditorium with a loud gym class right next door; the class was interrupted by paging, period bells, and a fire bell. The class had to be moved to the library at short notice. Yet the teachers managed to keep their concentration.

Many questions by TAMS instructors addressed higher order skills rather than regurgitation of information and facts. Some TAMS instructors were especially helpful in getting teachers to make connections between the material and classroom practice. Not only did instructors discuss how activities may be adaptable to the classroom, but participants were encouraged to share the ways they had recently used or adapted certain ideas introduced in class. Participants were especially enthusiastic during these sharing times. Many activities were set up to allow cooperative learning, and instructors provided information about how to set up good cooperative grouping arrangements.

Here are a few examples of effective teaching:

- A teacher in a primary science group, when asked what volume was, gave an obviously incorrect answer that linked volume closely with weight, even though she had just done an opening exercise which should have shown her otherwise. Rather than immediately correcting the teacher, the instructor allowed the discussion and contributions to continue until the group came to the realization that weight and volume were not necessarily related.

- The instructor of a primary science group asked the group to consider how a particular graph might look different if the children were to come from different kinds of backgrounds.

- The instructor of a 4-8 mathematics group had small groups of teachers go on a "scavenger hunt" for everyday objects that represented different geometrical solids and then present these to the class for their observations.

- The Mathematics Department had trips to the museum and planetarium to show teachers how such environments could be used for teaching math and to introduce teachers to the relevant staff in these organizations. These activities were further followed up in the next instructional time.

Not all instruction was equally good. Some activities that might have lent themselves well to cooperative learning were assigned individually. At times, instructors could have done more to elicit ideas for appropriate grade level adaptations of activities. Some instructors talked too much, did not try to engage the whole class, or did not allow sufficient time for answers. These failings were minimal compared with the overall assessment that good instruction was being modeled, especially the notion of teacher as facilitator of learning. As a note of caution, we should again point out that although we were able to observe a good sample of TAMS' instructors, we only visited one class session of each, for approximately two hours. Thus, we have "snapshots" of classes rather than a sustained moving picture.

Several TAMS staff in both the mathematics and science departments have been hired during this past academic year, and these new people seem especially well qualified for their responsibilities. However, these good hires took time. If TAMS is to expand more rapidly than it is able, quality staff may become more difficult to find. Compromise on this score would be a mistake since the program is only as good as those who deliver it. In addition, several of the current "crop" of new hires indicated that they had received little orientation to the other units of TAMS, unlike the earliest staff, who received training in both Math Tools© and TIMS© . Without a full understanding of how all the pieces fit together and an appreciation for the systemic model being espoused, staff may inadvertently shortchange teachers of the intended TAMS' experience and fail to model the integrated nature of the systemic approach.

6. **The coherence between mathematics and science teaching and learning is not formally addressed across TAMS' programs, but is treated in an ad hoc manner. Further, integration of mathematics with science is not modelled by TAMS' structure, which has two distinct science and mathematics departments characterized by minimal communication with each other.**

The clarion call in elementary learning is for integrated subject matter. Mathematics and science are considered to be one of the first logical areas where this integration can take place. Science staff talk frequently about mathematics, partly because the TIMS® program is an "integrated" program and includes the need for many mathematical concepts. Unfortunately, by having separate science and mathematics departments and programs, and a Resource Center, whose mission is also science education, TAMS staff have difficulty modeling this integration. The problem is compounded by the reality of the situation. Science staff unanimously agreed that they felt both the Mathematics Department and Resource Center "looked down" on them because their program wasn't as polished as the Math Department's program or their expertise in science was limited. Most staff in all departments also agreed that communication between the departments was poor. Fortunately, this problem is not a secret and, as was discussed in the organizational section, it is being addressed. Staff appear uninformed about what is going on in these other departments. One science staff member admitted to being embarrassed originally when asked by schools to talk about what the mathematics program involves. He has learned to say that the math department will explain it themselves, but he does not feel this is good for the organization. Another related difficulty stemming from this lack of communication (much less collaboration) is that there is a certain amount of overlap in the two programs. Graphing, for example, is a key process in the TIMS® program, but it is also taught through math. How much agreement is there about the way it is taught? Measurement is another area.

The lack of communication between departments manifests itself in other ways. At one point this year, the Science Department wanted to offer content workshops to its intensive schools. Already overworked staff created new content workshops which ended up not being well attended. Typically, the Resource Center, which is more used to marketing its services, develops these short-term content workshops. For a variety of reasons, this route was not chosen. In contrast, the Mathematics Department did offer a series of successful content workshops through the Resource Center.

7. **TAMS has made great strides in its programs. However, in trying to be on the cutting edge, TAMS may be undertaking too many projects before it has stabilized its programs, gained more secure funding, and solidified itself as an organization.**

With each visit, we found more new plans and developments. Each one was exciting and certainly contributed to the overall systemic model, but the new initiatives may be detracting from the central mission. TAMS' core program in science is still in development; the department has no Director. The scheme and tools for assessing readiness are not in place, yet all the while new schools must be recruited. A great deal of staff time has been devoted to the vital internal development of the organization and

its programs. In the meantime, pressure is still on to service more schools. Negotiations must be made for new space and perhaps a new partnership with the City Colleges.

Meanwhile, TAMS is working on developing a masters degree program for lead teachers. This is no small task if the job is to be done correctly, and there is no doubt it would make an important contribution by valuing professional development while providing an in-school source of expertise to carry on with TAMS' mission. In addition, TAMS is playing a key role in preparing Chicago schools for the state visitation process, has organized focus groups of teachers and principals, and has coordinated large conferences on assessment and science literacy.

8. **Short-term staffing issues have been addressed creatively in mathematics and elsewhere at TAMS, but continued efforts need to be made to fill key instructional roles to allow for intended growth.**

The mathematics program has been fortunate in having the instructional services of members of the University of Chicago staff, who have helped them pilot their new grade 4-8 mathematics program. In the short run, use of these instructors has allowed TAMS to offer quality teaching in mathematics at this new level. TAMS' mathematics instructors sat in on these sessions to receive training. However, it is unclear how the current staff will be able to carry the new load, given that the department is already understaffed. Lack of qualified individuals has been cited as one reason why vacancies have been slow to be filled. As previously stated, if, indeed, there are few individuals sufficiently qualified to teach at TAMS, it does not bode well for TAMS' planned expansion, nor for its replicability elsewhere. For its core program, a systemic organization cannot afford to rely on the services of those who are not invested in the vision or versed in all its aspects.

In addition, the Mathematics Department model uses different people for instruction and implementation. This division of labor may fragment staff and may not be the best model for teachers and schools in a change process, even though it capitalizes on different strengths of the instructors. In contrast, however, the science staff, who perform both roles, seemed more invested in and more knowledgeable about TAMS' whole vision, perhaps because they were responsible for carrying out so many different pieces. In all fairness, the mathematics implementation staff were all somewhat new when interviewed, so it may be too soon to judge the effects of this staffing pattern.

The Resource Center, including the technology department, also contracts out to others to teach. For shorter term instructional efforts, this arrangement may be quite workable. In fact, TAMS as a whole might benefit from exploring a "visiting scientist" model, which would allow a greater use of "experts" without relying on them for the core of the instructional program.

9. With a future goal of serving many more schools, TAMS needs to examine program delivery alternatives that capitalize on efficiency while minimally compromising flexibility and effectiveness.

TAMS' time investment in its schools and teachers makes it unusual, if not unique, among staff development programs in mathematics and science, but it might need to examine the efficiency of its delivery in practice, particularly with its ambitious goals for servicing more schools. The science staff had mixed opinions about whether they were serving too few teachers under the current model. Most felt that they were able to give quality time to their teachers in Phase II (the instructional phase). (Teachers in schools praised this aspect of their contact with TAMS the most.) With all the other expectations on them this year (strategic planning, staff development in science), science staff did not see how they could handle more teachers, although no one complained that they had responsibility for too many teachers. Most science staff reported working with ten to 15 teachers at any given time.

Some, however, felt that they would be using their time better if they taught larger groups since they had to prepare anyway. A typical class size for science is ten teachers or less. One pair of teachers has brought together the teachers from their two schools for Saturday sessions at TAMS. These teachers benefit from mixing with teachers from another school, as teachers in the mathematics program currently do. In addition, those classes with larger numbers of teachers allowed for more teacher input and interaction overall, even though individually teachers may not have had as much attention. A downside of the larger classes was that not all teachers actively participated in discussions. However, engagement appeared to be just as high as in smaller classes.

Combined classes need to be held away from an individual school, but this arrangement is not necessarily a disadvantage. The distractions for teachers at their schools were great and did not provide a good learning environment. Even on site, teachers did not always attend; in fact, sometimes commitment is less. However, adequate space for classes needs to be available. The current TAMS classroom space is inadequate for hands-on learning in large groups. If another space is not found, satellite campuses near to particular schools may be a possibility. Holding joint classes also decreases the flexibility of arrangements with an individual school, but this may be a smaller tradeoff than anticipated.

Inefficiencies in the Mathematics Department are different and are created when instructors and implementation specialists are different people. Time is wasted as each implementation specialist must get to know the needs and personalities of their individual teachers who have been through instruction. Mathematics implementation staff appear to serve a slightly larger number of teachers (up to 20) than do science staff, but they are not responsible for the original intensive instruction.

Purposeful and well planned experimentation that is *evaluated* may prove worthwhile in finding workable solutions. As mentioned previously, unassessed tinkering is not likely to be productive.

F. What's Happening in TAMS' Intensive Schools?

The purpose of this study was not to evaluate extensively how TAMS has influenced children and teachers in schools. However, in order to understand TAMS' full model and to provide our own check on other data collected through TAMS on teachers and children, we decided to visit four schools: two schools actively involved in the implementation process (one math, one science); and two "exemplary" schools who had participated in the complete math and/or science program, including follow-up. Three other schools were also visited briefly for other purposes. Our focus at the implementation schools was to gain a clearer idea of how that process works in schools. At the exemplary schools we were looking for a bigger picture of math and science and the impact of TAMS at those schools, from the principal, the teachers, the parents, and the children, and from our own observations of classrooms and the school as a whole. *It must be kept in mind that our sample was small, and the schools were considered by TAMS to be "best case" scenarios.*

Other available data from TAMS

In this report, we had hoped to be able to summarize and provide an additional assessment of data provided through TAMS own internal evaluation efforts, particularly the work of Robert Stake and his team, who were hired as consultants to the internal TAMS' team. Dr. Stake was to provide three case studies and analyses of interviews with 20 teachers and 20 principals of TAMS schools. In addition, TAMS' own evaluation staff have been analyzing teacher journals from the mathematics program. Unfortunately, none of these analyses was available in time for this report. The only teacher/principal data that were complete enough to use were a survey summary regarding classroom changes in Phase III schools, and summaries of focus groups held with TAMS and non-TAMS teachers. Findings from these studies are discussed in Chapter IV.

Preliminary observations from the schools

The observations below are intended to be *preliminary* since they are based on such limited data. They are more *impressionistic* than substantive and should not be quoted out of context of the small and specially selected sample from which they come.

Preliminary observation #1: Teachers and principals endorsed TAMS' comprehensive model, especially the follow-up in the schools and the materials provided to teachers. They had few criticisms.

One principal commented, "It's a unique effort--to train teachers and provide us with substitutes. Other cities have never heard of any program in the same vein." This same principal was favorably impressed by the initial orientations that helped to create a "buy-in" by all members of the schools community. Another concurred that TAMS was different from other programs: "There are a lot of workshops; there is nothing else out there that can transform a program the way this can. It's the total commitment over time that can make a change." She felt that the key to the program's success in her school was the time spent in classrooms by TAMS' staff. She felt that doing new things takes

"confidence and time," and that the TAMS model gave them both. Their TAMS implementation specialists helped organize the teachers and supplies and did school-wide graphing projects to help motivate everyone. She also believed that the continued interest TAMS had shown in her school allowed it to sustain the momentum generated by the school's participation in TAMS: "If we had been abandoned at an early time, I am not convinced this would have happened." They are still receiving help through their school improvement specialist and have offered to come back to teach Math Tools.

Several teachers noted how valuable it was to "put yourself in the place of a child" and do hands-on activities. They had a new appreciation for the child's experience of school. Although some had used manipulatives before, the difference was in being able to take them back to the classroom and use them the next day, often with the support of someone from TAMS. Implementation specialists were uniformly praised. "The implementation person was wonderful; she made things for us." "She'd help you work on certain things; she'd give demonstration lessons." "You would feel more confident that you got your point across. When you have 27 kids, sometimes you need an extra trained pair of hands." Teachers also valued the opportunity to interact with other teachers.

The only criticisms were about TAMS' earlier two-day-in-a-row substitution model, which has since been changed.

Preliminary observation #2: Teachers and principals feel that TAMS' involvement with their schools has made a difference in what happens in the classroom. They express some concern about the long run, but most feel that the course for improvement has been set.

One principal noted that one of her first grade teachers had been concentrating more on reading than math. However, after her involvement with TAMS, she now focuses on both. Her children tested at the 50% on the IGAP. Another said that at her school prior to TAMS, science had been a subject that teachers only did when they had the time. At the upper levels, science was out of the book. Now science is being taught at all grade levels. Many teachers have science centers in their classrooms. Teachers at a third school observed that the Math Tools® program allows them to introduce subjects much earlier than before. Several teachers commented that there was much more integration of all subjects, which they attributed to TAMS.

One administrator noted that teachers have learned to ask whether there are other ways of doing something. Children need not fear being wrong and are "beginning to see their worth." She also saw more use of questions that increased critical thinking skills, such as asking children how they arrived at their answers.

On being asked whether she felt permanently changed by the experience of TAMS, one teacher commented, "I look for the math; I see the relationship between science and math." Another acknowledged that it spurred her to do other things.

For some, the additional help was vital in keeping them going. The implementation specialist "was an extra vision that I don't have now. She was available and full of suggestions." "When you have someone who comes in and perks you up, it's very valuable."

However, teachers were not entirely confident that they could continue to practice what they had learned. One was worried that lack of time might prevent developing new activities and tools.

Preliminary observation #3: Schools have made some adjustments in their structures, internal processes, and expectations to accommodate the new ways of teaching and learning, but these have not been that easy to change.

One school decided that the 40 minute period was inadequate to accommodate hands-on science and mathematics in the upper grades as well as integration of these subjects (the lower grades already had more flexibility). Science and mathematics are now combined into a double period five days a week, offering many different options for teachers, such as the chance to follow through on a TIMS® experiment. This same school had also committed a great deal of money to buying manipulatives and had freed up one of the science teachers to act as a coordinator. In another school, the principal said that she was more flexible about time periods. As she commented, "Once you decide your school will come alive, you have to be ready to let it come alive."

Several teachers and principals commented on the new acceptability of a certain noise and activity level generated by hands-on activities. One school had switched their main math curriculum to one that was more compatible with TAMS.

The amount of collaboration among teachers is mixed, however. In one school the principal did not feel that the teachers collaborated more than before because of the tradition of independence in the classroom. The teachers from that school agreed that joint planning was difficult. The lack of overlap time for teachers was a problem mentioned by several.

Earlier TAMS data indicate that schools are not necessarily devoting more time to the teaching of mathematics and science despite an intervention that stresses these subjects. We did not have sufficient evidence to support or reject this conclusion with the schools we visited.

Preliminary observation #4: Through TAMS' efforts, parents feel better equipped themselves to understand mathematics and science. However, it takes time and effort to really involve the community.

Most of the parents in the focus groups we held had participated in Family Math and Science workshops and felt they had been worthwhile. "The Academy does a good job putting workshop materials together. The materials were simple, but they made it

interesting. A lot of times you are doing math, and you don't even know it." "We had a good turnout. Working with children helps parents understand what their kids do." "We can help our kids and not feel inadequate." "If we're trained in the techniques, this avoids confusion with the kids." A couple were now involved in teaching them. "I learned the math well enough to teach other parents. You don't have to be an expert." They also commented how amazed they were to discover that science and math could be fun.

At one school, which was small, parents noted that parent involvement was improving, and the principal concurred that parents do take ownership in the school. In another school, the parents thought many of the other parents in their community were somewhat apathetic and that they needed to be enticed to come. Overall, parent involvement is still small, and the impact is likely to be limited so far.

Preliminary observation #5: Teachers, parents, and principals see not only greater enthusiasm and excitement in the children about mathematics and science, but also a deeper understanding of these subjects.

Although most of the evidence for change in children is anecdotal so far, these school communities feel the difference in children since the introduction of new methods in their schools. Some of these differences would be difficult to measure.

"Kids do hands-on, and it's done wonders for their egos."

"They are more intent on solving problems."

"One eighth grader wants to go into electronics because of work he has done in hands-on science."

In the classes we visited, children, especially the younger ones, were eager to show us what they had been working on.

One parent noted that her eighth grade special education child had previously only been able to count. Since the introduction of manipulatives, her skills have improved to the point where she can do some pre-algebra work. Another said that her child was so excited about his work with measurement that he measured people at home. These parents in focus groups felt that their children talked more about what they were doing in school and that they were less afraid of math than previously. They also felt that this excitement was an important precursor to learning. Several principals and teachers felt that the quality of science fair entries had improved; exhibits were less showy, but more process driven, with students able to explain what they had done. However, changes have not necessarily occurred in formal tests of achievement. (See Chapter IV for a discussion of achievement test scores in mathematics.)

Preliminary observation #6: Observation of classes in these exemplary schools indicate that a lot of exposure to mathematics and science is taking place. It is unclear to what extent teachers have fully integrated the best of TAMS' methods into their own teaching.

Some of the schools we visited are old and uninviting from the outside, and the corridors were surprisingly barren of children's work. However, the insides of the classrooms showed evidence of mathematics and science. Almost all classrooms had some kinds of graphs of children's data on the walls: birthdays, pets, height, the weather. Rooms had number lines over boards; they had manipulatives in accessible places.

The classes we observed varied in the extent to which TAMS' entire philosophy was being implemented. One class about radius and diameter made use of manipulatives, with each child having a different size can or lid and most having their own tape measures. The children were clearly familiar with tape measures and hands-on work. The lesson, however, was taught to the whole class, and the pace was too quick to allow for real discovery of the principles in question (that the circumference is approximately three times the radius, for example). This class would have lent itself perfectly to cooperative grouping. Many teachers are clearly more comfortable with traditional whole class methods of teaching, which allow them to stay more in control.

We did see one TIMS® class (third grade) where children were sorting colored M and M's and were organized into small groups. The children appeared to understand the point of the activity, knew the process, and were able to answer questions about it. Two upper grade science classes were organized into pairs of students--a fish dissection exercise and an exercise on measurement of temperatures needed to induce certain states in naphthalene. Children in all three of these classes were highly engaged.

Some class lessons using manipulatives were more successful than others and linked in with other activities from the class. One involving calculators drew on children's interests; they had wanted to know how their teacher scored their tests. The teacher walked them through scoring each other's papers, using their calculators. Although the results of the test weren't very good, most of the children appeared to understand the scoring exercise, and each child who was able had a calculator. In a kindergarten class, the implementation specialist ran a review class on shapes. The classroom teacher then had children use shape templates to draw Zuni Indian symbols that they had been studying. The children's knowledge of shapes appeared quite sophisticated for kindergartners.

In our observations, we found questioning techniques generally relied on very short answer comprehension questions, rather than on engaging children in hypothesizing or inferring. With the small sample of classes we saw, it was difficult to judge the overall use of more inquiry based teaching.

Preliminary observation #7: These exemplary schools show evidence of momentum towards greater involvement with mathematics and science, especially when strong leadership was in evidence.

In one school, teachers and their principal continue to talk about important findings on educational research.

Parents in one school noticed that the number of field trips had increased, including some more unusual ones, like going to the stock market for mathematics.

Individual teachers seem to feel less hampered by the curriculum and are more willing to go off in some inventive directions. One upper level science teacher enthusiastically showed us her genetics curriculum, which brought together scientific processes and content in something that greatly interested the children.

Two of the schools now have "Discovery Centers" initiated by TAMS. In one, the children already come to classes there on a regular basis after school. The other Center had just been set up before our visit.

At least two of the schools have become special science and mathematics schools since participating in TAMS. Several have successfully applied for a variety of grants to support their continued work in science and mathematics.

Preliminary observation #8: These schools we visited were all characterized by a pride in themselves for embracing change.

It is difficult to separate out the effects of decentralized school reform from specific influences on the schools, but members of all the schools we visited exuded a positive feeling about the direction their school was headed. In one school, teachers seemed especially eager for us to visit their classrooms and were disappointed if we did not have enough time. The atmosphere in all these schools was positive. This attitude might be the necessary precursor for success of a program like TAMS rather than being a result of it. If so, the concept of "readiness" being emphasized currently by TAMS would be especially important.

Overall, our impressions of the kinds of activities taking place in mathematics and science at some of TAMS' exemplary schools was favorable. Of course, we do not know, other than from principals', teachers', and parents' retrospective accounts, what these schools and their classrooms were like before TAMS or on days when they don't have outside visitors. However, our sense is that some shifts both in activities and teaching style have taken place since participating in the TAMS programs, especially from the intensive involvement with the implementation specialists. However, it is important for us to emphasize once again that the only really valid evaluation of the effectiveness of TAMS' programs in changing teachers and students behavior, knowledge, and skills would come from systematically assessing schools both before and after their

involvement with TAMS and comparing these with schools who have no similar interventions.

G. Summary

When compared against "best practices," TAMS' overall intended program rates positively, addressing almost all of the key components on the program template. More importantly, TAMS is making excellent progress towards implementing its program, although perhaps not on the scale originally intended. There are still areas for concern, especially if TAMS grows in size. Staff and leaders alike will need to continue to work hard and pay attention to these aspects if the program is to succeed as intended.

However, two important policy questions remain unanswered. How essential are many of the systemic "best practice" elements in promoting effective learning in mathematics and science education, since many of these are not strictly proven? And what kinds of difference will this outlay of time, money, and expertise make to both the teachers and the children of Chicago? Time and more extensive systematic evaluation will help to answer both of these critical questions.

IV - ANALYSES AND REVIEW OF TAMS INTERNALLY COLLECTED DATA

One of the study questions for this NCISE study about TAMS was to assess what quantitative information is available about TAMS' delivery of its programs and its potential outcomes for schools. In our early orientation to TAMS, we learned that many stakeholders are very interested to know what objective data are available from and about TAMS and to have an outside assessment of TAMS' evaluation work to this point in its history.

This chapter addresses this study question, by examining quantitative data about TAMS to complement the more qualitative analyses presented in the prior chapters. The descriptive information about the content of TAMS programs and the analyses of its organizational history would be incomplete without also examining the scope of TAMS' work and the results of its own evaluations. This chapter has three sections:

- A) Examination of a database compiled by TAMS about the schools it has worked with, including data about students in its schools and some achievement scores. This database was intended to permit more specific documentation of TAMS' program delivery over time as well as to stimulate TAMS to start compiling and reporting from such a database. TAMS was only partially successful in compiling and cleaning these data for this study. The analyses presented here should be viewed as strictly exploratory to indicate the types of analyses that might be conducted with better data over longer time periods.

- B) Assessing data concerning the costs of TAMS' programs. We had hoped to calculate approximate estimates of costs for specific TAMS program components, but the data on program delivery were too fragmentary and the data on costs too recent for such comparisons.

- C) Summary and review of TAMS internal evaluations. This section describes the major evaluation studies that have been done by TAMS thus far, with brief methodological critiques.

A. Quantitative Data: TAMS' Schools and Student Outcomes

With the absence of a fully functioning evaluation unit, TAMS has not kept fully analyzable records of its program delivery through each year of its activities. The evaluation unit has kept data about its schools but has not analyzed it within a systematic database. Upon the request of the study team from NCISE, TAMS began to compile data about its schools into a statistical database. Data about each school that it has worked with intensively were entered into a database that facilitates examination of its work with schools over time and permits analysis among groups of schools. Data from

this database were then analyzed by NCISE for this report. Since the data analyzed in this section were compiled retrospectively by TAMS staff for all years since its beginning, they may not totally reflect all the previous program delivery or teachers participating in TAMS. Data that are compiled concurrently for each school and type of program participation would be more likely to provide accurate documentation.

Data sources in the database include TAMS' records of the intensive programs that each school participated in; data from CPS' Department of Research, Evaluation and Planning about the characteristics of the students and teachers in each school; and student achievement test scores in mathematics and science from the Illinois Goals Assessment Program (IGAP) tests for 1990 through 1993. Since TAMS has not initiated the collection of other outcome evaluation measures for teachers, only student achievements scores are available concerning outcomes[1].

Numbers of Schools

TAMS program focus has been centered on the systemic development of mathematics and science instruction in total schools, rather than on training individual teachers in isolation from each other. This focus means that TAMS' instructors work with the same school over a long period of time, as the teachers attend intensive instruction in mathematics and science, then work with TAMS' implementation specialists within their schools.

Data compiled thus far about program delivery are simply the dates when each intensive school *first started working with TAMS* and when its teachers received the instructional sessions in mathematics and/or science. Table 4-1 shows the programs that each school participated in for the 42 schools in its database. The rows in each panel of Table 4-1 show the start-up year with TAMS for each school, while the columns show when the schools received each program: Mathematics, ISMT©, or TIMS©. The far right column of each panel shows the total number of schools in TAMS' data base; note that the same schools may be shown in all three panels of Table 4-1 if that school participated in all three programs. The data indicate that many schools participated in more than one program within a school year although these may have been for different grade levels or in different semesters. For this reason, the subtotals across programs may sum to more than the total number of schools that started with TAMS each year.

---

[1] The database received from TAMS has a number of weaknesses and errors that hampered its analysis. For example: a) it did not include data fields for more than one session of a TAMS' program by teachers in the same school (e.g. the dates and numbers of teachers who participated in the Math 4-8 program, or when additional teachers participated in the Math program later than the first group in a school) although NCISE had requested this information; b) program participation data that were entered may not be accurate - one school was included in the database but had no programs entered; several other schools listed only one or two teachers as having participated in a major math or science program; for another school, the number of teachers was entered as having participated but not the semester of participation; c) data coming from other sources had unexplained anomalies that are likely to be invalid data, such as '0' as the mean test score for a grade in a school or what appeared to be numbers of students taking the test interchanged with the mean score. All these errors should have been "cleaned" before the data were sent to NCISE.

Table 4-1. Data from TAMS' Database on Numbers of Schools in TAMS' Intensive Programs By Year of School's Start in TAMS

a. Mathematics Program

Start-up Year in TAMS	Year School First Participated in TAMS Math Program					Total Number of Schools Starting in TAMS This Year
	'90 - '91	'91 - '92	'92 - '93	'93 - '94	Total Schools in Math Program	
'90-'91	4		1	1	6	9
'91-'92		13		2	15	21
'92-'93			4	2	6	7
'93-'94				1	1	5
Total	4	13	5	6	28	42

b. ISMT (Integrated Science and Mathematics Program)

Start-up Year in TAMS	Year School First Participated in ISMT© Program					Total Number of Schools Starting in TAMS This Year
	'90 - '91	'91 - '92	'92 - '93	'93 - '94	Total Schools in ISMT Program	
'90-'91	8				8	9
'91-'92		9			9	21
'92-'93						7
'93-'94						5
Total	8	9			17	42

c. TIMS (Teaching Integrated Science and Mathematics) Program

Start-up Year in TAMS	Year School First Participated in TIMS© Science Program					Total Number of Schools Starting in TAMS This Year
	'90 - '91	'91 - '92	'92 - '93	'93 - '94	Total Schools in TIMS Program	
'90-'91	4	5			9	9
'91-'92		10	2		12	21
'92-'93			2	1	3	7
'93-'94				3	3	5
Total	4	15	4	4	27	42

The years shown in Table 4-1 are school years; summer programs are included with the next school year. For example, line one of the data in each panel of Table 4-1 indicates that nine schools started in TAMS in 1990-91, mostly in the spring of 1991, with four of them in the Mathematics program that year, eight of them in ISMT©, and four in TIMS©. Several of these schools later participated in the Mathematics program, and four more participated in TIMS© during the next school year. During 1991-92, 21 new schools joined TAMS, with 13 of them in the Mathematics program, nine in ISMT©, and 10 in TIMS©. The ISMT© program was offered only for the first two years when it was discontinued as not being completely congruent with national recommendations for science teaching.

The data shown in Table 4-1 reinforce the descriptive picture of TAMS' history discussed in the second chapter. The Academy started up with a burst of activity in the spring of 1991, with nine schools. It added 21 additional schools in 1991-92 but could not cope with all this activity. It retrenched in 1992-93, which was the year of the sabbatical, by taking in only seven new schools in the spring term and including a few "old" schools in its instructional sessions. Within the current academic year, the data base shows only five new schools, plus an additional five schools in Mathematics and one in TIMS©. (However, the database may be incomplete for the 1993-94 year, although we requested that it include schools in spring semester programs.)

Some observations based on Table 4-1:

- The actual documented scope of TAMS program delivery has not been nearly as large as its intentions, with only 42 schools reached intensively in total.

- Only 28 (66%) of the 42 schools have had the Mathematics program, and 27 (64%) have been in TIMS©. Thus, TAMS' past program activities did not include the integrated sequence of involvement that is its current program design. Many of the early schools started with TIMS© or ISMT© rather than Mathematics.

- Only 15 (36%) of TAMS' 42 schools are in the database as having had both the Mathematics program and TIMS©, while another seven had both Mathematics and ISMT©. (Data from examination of complete data listing; not shown by Table 4-1). The partial coverage in the past is likely to be partly a consequence of schools own needs assessments and choices; prior to recruitment this year, TAMS has not emphasized a specific sequence of instructional programs.

- The database does not include records for more than one instructional program in mathematics, such as those schools that are currently involved in math for grades four to eight, or if a school sent other teachers in subsequent years.

Numbers of Teachers in Intensive Programs

Another way of looking at TAMS is to examine the numbers of teachers who have participated in its intensive instructional programs, tabulated in Table 4-2 from the database and in Table 4-3 from other TAMS records. In this case, the database

constructed by TAMS simply indicates the numbers of new teachers from each school who were in each program; some teachers may have been in more than one program, so the totals are for numbers of *participants*, not numbers of individual teachers. TAMS has not maintained a central database to track the participation of individual teachers in its various programs, but the Resource Center reports it has records for its participants. Further, it is likely that the data for 1993-94 shown in Table 4-2 are not complete, as they do not appear to reflect the scope of current activities, nor could they include summer 1994 activities.

**Table 4-2. Numbers of New Participating Teachers
in TAMS Intensive Programs, by Year of Participation
(from database provided)**

School Year	Mathematics	ISMT	TIMS	Total
1990-91	65	80	70	215
1991-92	319	152	339	810
1992-93	76	-	89	165
1993-94	73	-	106	179
Total in Program	533	232	604	1369*

*Note: Total of program participants, not individual teachers

The data shown in Table 4-2 again reflect TAMS' history of a rapid growth in numbers of teachers in the first two years, then a near collapse at the time of the sabbatical in 1992. The numbers appear to be still rather small in 1993-94, but they are not complete yet for this year. Further, they do not show the intensive follow-up with individual teachers in schools that is a part of these programs.

When combined with numbers of schools shown in Table 4-1, the following averages were calculated: (Note: Due to the quality of data in the TAMS database, these averages should not be taken as conclusive findings; they are provided only to illustrate the kind of analyses possible with adequate data.)

- 19 teachers per school, on the average, participated from each of the 28 schools in Mathematics;

- 14 teachers per school, on the average, participated from each of the 17 schools in ISMT;

- 22 teachers per school, on the average, participated from each of the 27 schools in TIMS.

Overall, the instructional programs have reached a large number of teachers, but do not reflect the large scale scope of operations that TAMS has intended for its systemic program.

**Table 4-3. TAMS' Report of Numbers of Teachers
in Its Instructional Programs, by Phase of Participation
(revised data)**

School Year	Instruction	Implementation	Follow-up (Institutionalization)	Year Totals
1990-91				
Science	61	0	0	
Math (K-3)	56	0	0	
TOTAL	**117**	**0**	**0**	**117**
1991-92				
Science	284	211	0	
ISMT⊕	232			
Math (K-3)	190	56	0	
TOTAL	**706**	**267**	**0**	**973**
1992-93 (Sabbatical Year)				
Science	77	134	211	
Math (K-3)	60	232		
Algebra Project	38	246	0	
TOTAL	**175**	**612**	**211**	**998**
1993-94				
Science	292	77	134	
Math (K-3)	214	88	190	
(4-8A)	55	0	0	
(4-8B)	250	0	0	
TOTAL	**811**	**165**	**324**	**1,300**
Grand Total 1990-94	1,809	1,044	535	3,388
Projected 1994-95	700	811	165	1,676

After reviewing a draft of this report, TAMS staff indicated that the numbers of teachers shown in Table 4-3 do not provide an accurate picture of the extent of teachers' participation either in its intensive programs, particularly for 1993-94, or in its implementation and follow-up phases. Apparently, the database did not include any records for teachers in these latter phases. TAMS requested that the revised numbers of teachers shown in Table 4-3 be included in this report, which we agreed to do. TAMS also supplied 28 pages of documentation to support the numbers shown in Table 4-3,

mostly about its 1993-94 programs. As in Table 4-2, the numbers shown in Table 4-3 are numbers of participants in a program or phase, not numbers of different teachers. Some teachers are likely to have participated in more than one program tabulated in the "Instruction" column, and all of those entered in the "Implementation" and "Follow-up" columns are likely to have been those in the prior instructional phase.

The data in Table 4-3 show a much greater extent of participation in TAMS' programs in 1993-94, which includes the programs to take place over the summer as well as the program variations offered through the mathematics unit. This table also shows the fuller picture of participation in TAMS' systemic program, by tracking the progression of numbers of teachers through instruction, implementation, and follow-up. It will be desirable for TAMS to update the elements and the data in its database to include this more detailed picture of its programs, so that full descriptive and statistical analyses of its schools may be undertaken in the future.

Characteristics of the Schools

Data from CPS school profiles for 1991 to 1993 were included in the database to characterize the types of schools that TAMS is working with. Data for the characteristics summarized below, including enrollment, ethnicity of students; percent of low-income students, attendance, and stability/mobility, were examined in detailed printouts (not shown here) to look for the extent to which TAMS' schools have undergone rapid change over the past several years:[2]

- Student enrollment in these schools did vary widely, from 190 students to 1281 in the 1993 data. When TAMS' 42 schools are grouped by size of student enrollment for 1993:

   12 schools had enrollment of less than 400 students
   20 schools had enrollment of 400 to 700 students
   10 schools had enrollment of more than 700 students

- Most of the schools were neither growing nor shrinking rapidly over this three year time period. Many were growing slowly, for a total gain of less than 100 students in the three years; only three schools had increased by more than 100 students. Some were decreasing slightly in enrollment, but only one had lost more than 100 students.

- In the ethnic make-up of their student bodies, few schools had changed dramatically within this period. Not surprisingly for a large city context, TAMS works with schools with large numbers of minority-group students. In 1993:

---

[2] TAMS did not provide any data about its schools from the years before they were affiliated with it, which we requested, so we are not able to examine any longer term trends in school characteristics with the data available thus far.

28 schools had greater than 70% African-American student enrollment
7 schools had 50% or more enrollment of Latino students
10 schools had mixed or other enrollments.

- In the percentage of low-income students (those qualifying for free or reduced price lunch), all but six schools had 80% or more of their students in low income status. This indictor was a bit more unstable than other characteristics, with eight schools increasing their low income percentage by more than 10% between 1991 and 1993.

- The percentage of student attendance recorded hovered about 90% for all schools, with none under 87% and only two schools above 95% attendance in 1993.

- The percentage of student *stability* (defined by CPS as "the number of students who remain enrolled in the same school for the entire school year divided by the membership") was surprisingly high, with figures generally over 90%. In 1993:

    27 of TAMS 42 schools had stability rates over 90%
    15 schools had stability rates of 80% to 90%.

- Further data on student *mobility* (defined as "the percent of students entering or leaving during a school year") revealed a different picture, with many schools having 20% to 40% mobility. This indicator is not the reciprocal of stability, for these two rates summed to over 100% for many schools. It would be desirable to obtain more information about the meaning of these two variables and how they are constructed.

- In general, TAMS schools do not show rapid changes from 1991 to 1993 in these characteristics.

Student Achievement in Mathematics

As indicated above, TAMS has not developed an evaluation design in which it spells out specific outcome variables and statistical designs that it will use for summative evaluation and for accountability purposes. It would be particularly valuable for TAMS to create specific measures that are summary indicators of teachers' progress in implementing TAMS' programs and guidance in the classroom. Such measures should then be analyzed in connection with measures of student outcomes since TAMS' ultimate purpose is to improve student learning in mathematics and science. One potential measure of student outcomes is standardized achievement test scores, particularly to examine improvement over time in the scores of students in the grades covered by TAMS' programs.

The use and interpretation of standardized achievement tests has become very controversial among educational researchers, evaluators, and policy makers. Further, their uses for educational program evaluation versus assessment of individual students

entail a large number of considerations that are too complex to be discussed here. Yet, the ultimate purpose of the federal agencies funding TAMS is to improve student knowledge of mathematics and science, so they are very interested in student achievement. TAMS *has* included selected results from achievement tests for its schools in its reports to federal agencies but has not provided a systematic statistical analysis of the scores. Therefore, we felt that it was appropriate to *cautiously* examine in this report some data about achievement scores of students in schools working with TAMS, particularly to illustrate simple but appropriate methodology, while recognizing that the results must be viewed as tentative. Systemic changes in schools will take several years to impact student learning.

The achievement scores available are from the Illinois Goals Assessment Program (IGAP), a state-constructed series of tests that are aligned with state curricular goals in each subject. These are tests that the state uses for accountability purposes and that are important for TAMS' schools and teachers. Some TAMS staff and advisors have had input into the types of items that are included, and state test developers are said to be aligning the test contents with recent national recommendations for each content area. These multiple choice tests were originally constructed to have a state-wide mean of 250 for each grade level, but the means each year may shift to reflect changes in student performance.

TAMS is compiling IGAP scores in science and mathematics for its schools. The pre-high school IGAP science tests were started up for the first time in Grades Three, Six, and Eight in 1992 but then switched to Grades Four and Seven in 1993. A state report about the science testing program[3] indicates a thoughtful test development process, emphasizing use of a productive thinking scale. A brief inspection of sample items showed many that would flow from a "hands on/minds on" science program, and few that would require rote memorization. However, since the science scores were not appropriate for trend analysis, they were not analyzed for this report. IGAP tests in mathematics have been administered in Grades Three, Six, and Eight each spring since 1990 and are examined here. We did not have any documentation for the IGAP mathematics tests similar to that for the IGAP science tests. In the future, it would be desirable to do a fuller examination of the alignment of both the science and mathematics tests with TAMS' programs and guidance for teachers.

In order to provide a comparative basis for looking at mathematics achievement, we grouped TAMS' schools by the year when they first participated in the Mathematics program, with a residual group that has not had Mathematics. We reasoned that if TAMS math program is making a difference, it ought to begin showing up in student achievement in several years, after the TAMS' staff development has had a chance to be applied in the classroom. Further, since TAMS has focused most heavily on the primary grades, *students in Grade Three are likely to be affected first*. We constructed a "gain

---

[3] Illinois State Board of Education, *Illinois Goal Assessment Program: Sample Tests of Illinois Goals in Science, Grades 4, 7, 11.* 1993.

score" for each school and each grade level, by calculating the increase in average student achievement over the three year period from 1990 to 1993.

The results of separate statistical analyses of the mathematics gain scores at each grade level,[4] grouped by the school's first year in the Mathematics program, are shown in Table 4-4. Unfortunately, the number of schools available for analysis was very small, because missing or out-of-range data were still in the data base for many schools. For both Grades Three and Six, 10 of the 42 schools' data (24%) were not present in both years to construct the gain score.[5] The small numbers of schools greatly reduces one's ability to test whether or not any differences occurring among schools that had the Mathematics program in different years reflect real trends or are simply chance variations.

Table 4-4. Analysis of Mean Gains or Losses in IGAP Math Scores 1990-93, by Year School was in TAMS' Mathematics Program

	Grade 3		Grade 6		Grade 8	
Year in Math	N of Schools	Mean Gain	N of schools	Mean Gain	N of Schools	Mean Gain
90	3	15.0	3	-38.0	3	-60.0
91	10	32.0	10	2.1	7	18.9
92	5	-6.0	5	15.0	4	14.5
93	6	4.0	6	13.3	6	35.5
Not in TAMS' Math	8	-0.5	12	4.0	12	-15.8
Total - All	32	11.1	36	3.1	32	1.03

ANOVA: Differences among years not significant for Grade Three or Grade Six. Grade Eight differences are significant at p <.01 but show an unclear pattern.

- **The Grade Three results show tentative trends in the direction predicted if TAMS is having an effect on student mathematics achievement, but the differences are not significant.**

The results for Grade Three in the first columns of Table 4-4 show trends in the predicted direction, with an average Grade Three *gain* between 1990 and 1993 of 15

---

[4] The analyses was a one-way analyses of variance for every grade level, using the school as the unit of analysis, with Year in Mathematics or "No Mathematics" as the grouping variable. This grouping resulted in comparisons among five groups of schools, as shown in Table 4-4 for each grade level.

[5] Scores in the data that were lower than 50 were changed to "missing data", as they are likely to be invalid data when scores'for the same grade in other years were much higher. However, a few scores were in the 50 to 100 range, and may still be inaccurate data.

points on the IGAP for schools starting Mathematics in 1990, and an average *gain* of 32 points for schools starting Mathematics in 1991. TAMS schools that started in Mathematics in 1992 and 1993, as well as those schools that had only TAMS' science programs, but not mathematics, have not yet shown similar gains. However, these differences at Grade Three are not statistically significant; we cannot reject the possibility that they are simply variations among schools whose gain scores are not related to when they were in Mathematics.

- **By 1993, Grade Six and Grade Eight mathematics achievement scores did not show any indications of being influenced by their school's participation in TAMS. Since the math program did not include teachers from Grades Four through Eight until 1993-94, no gains in student mathematics achievement would be likely.**

The Grade Three achievement scores for individual schools for each year were also examined to see if the trends for improvement occurred for many schools, or only a few. Looking at 1993 versus 1992, we found that 19 of the 28 schools that had participated in Mathematics (68%) made an average gain of 10 points or more between 1992 and 1993. But 4 of 7 schools not participating in Mathematics (57%) also made gains of 10 points or more. Again, the results suggest that TAMS' work with teachers may be influencing student learning as reflected in the achievement tests, but are not conclusive.

B.   Assessing the Cost of TAMS' Programs

Several important questions in overall assessments of The Teachers' Academy as a staff development program concern the costs of TAMS' programs:

- What are the costs associated with these intensive school development efforts?

- How much has it cost for TAMS work with schools thus far?

- Is TAMS a cost effective program model of school development?

The NCISE project requested and received financial information from TAMS Chief Financial Officer, to examine in connection with the data about program delivery in the previous section. This section presents the data available so far about TAMS costs.

A caveat about cost-benefit analysis may be in order here. It was not feasible to attempt actual cost-benefit analysis for this project. Cost-benefit analysis would require, first, credible outcome analyses showing the extent of "benefits" caused or produced by TAMS. Such analysis would require a much stronger evaluation design than TAMS has proposed to assess the effectiveness of TAMS programs, including experimental or quasi-experimental comparisons. Second, an accurate cost-benefit analysis would require data concerning the costs of the specific program activities that produced those benefits, disaggregated from other operational costs of TAMS. While TAMS now (since the start of FY '94) has an accounting system that maintains careful records of costs for each

major program unit, such program-specific cost records are not available for TAMS' prior years. Further, no quantitative data are available for prior years about the benefits of TAMS' programs. TAMS has not collected systematic data from its teachers, and even the data analyzed above concerning student achievement show a very mixed picture of "benefits."

TAMS' Overall Costs to Date

An overview of TAMS costs can be obtained by examining its aggregate revenues to date, on the assumption that this revenue was spent on its program development and delivery, as well as on maintaining TAMS as an organization. Table 4-5 shows TAMS revenues by source, for its start-up period prior to October, 1990, and for its Fiscal Years 1991 through 1994. The revenue sources are shown in the year they were awarded from each funding source, which is not necessarily the year that the dollars were actually received. In many cases, the award may have been received late in the fiscal year from a government agency, with the actual disbursement carried over to the next fiscal year. Therefore, the figures in Table 4-5 would not be equivalent to TAMS' accounting records of funds received and disbursed in each year.

Table 4-5. TAMS Revenues, by Source
1990 - 1994 (in millions)

SOURCE	START-UP PRIOR TO 10/90	FY '91 10/90 - 9/91	FY '92 10/91 - 9/92	FY '93 10/92 - 9/93	PROJECTED FY '94 10/93 - 9/94	TOTAL
FEDERAL						
D.O.E.	$.215	$2.000	$4.002	$1.350	$1.350	$8.917
NSF	.200	1.268	1.288	2.433	3.500	8.689
D.O.ED.			.337	.142	.239	.718
OTHER						
STATE OF ILLINOIS	.750	2.055	1.358*	.850	1.000	4.655
DONATIONS	.040	.285	.642	.672	.257	1.896
SCHOOL FEES			.100	.110	.150	.360
TOTAL (NEW FUNDS)	$1.205	$5.608	$6.369	$5.557	$6.496	$25.235

*Carried from FY '91

Source: Figures derived from TAMS "5-year strategic plan," of May 1993, and checked by TAMS Chief Financial Officer.

As shown, TAMS has been awarded more than $5 million each year since 1991, for a total of more than $25 million in total funding. The majority of TAMS' funding, $18.324 million, has come from the three federal agencies, the Department of Energy, the

National Science Foundation, and the Department of Education. For FY '94, these figures are projected, as not all revenues for this year are yet known. Additional data supplied by TAMS indicated that TAMS had spent a total of $2.385 million for its first two quarters of FY '94, out of a projected budget of $6.972 million.

The total cost per school for the 42 schools that TAMS has served intensively thus averages more than 1/2 million dollars per school. However, this figure includes the costs of TAMS multiple activities, such as the Resource Center and TAMS' work with the total educational context in the city and state. It also includes the substantial developmental costs incurred during TAMS' organizational turmoil. While lower costs per school even for TAMS intensive staff development are likely to be possible in the future, this has not yet been demonstrated.

TAMS' Program Specific Costs

We had wanted to calculate the per school (or per teacher) cost of more specific program components, but this has not been feasible thus far. Even conceptually, the costs per school are difficult to specify, for several reasons. Since TAMS' total program is multi-faceted, each school usually participates in several different aspects of TAMS each year. For example, a school may have some teachers in a-Mathematics program, other teachers working with an implementation specialist for science, specific short-term use of Resource Network activities, and overall guidance from the School Improvement Unit. The costs of each of these activities would come from the budgets of different TAMS units. Further, a school's involvement with TAMS extends over several years, but with different levels of intensity, which would involve different levels of cost each year. Some teachers may participate in many of TAMS' components, others just a few, so the cost per teacher would be difficult to calculate, and might not be meaningful. Not enough specific data were available about program delivery during 1993-94 to calculate the costs for specific components for this report. Further, no data are available about the effectiveness of specific TAMS program from which to calculate comparative cost-effectiveness ratios.

C. Review of TAMS-Produced Program Evaluations

As indicated in Chapter II, TAMS' original plans included intentions to evaluate its programs, and it received a three-year grant for this purpose from the Department of Education in late 1991. However the Associate Director for Evaluation was not hired until mid-1992, near the time when TAMS was attempting to reorganize itself via a "sabbatical" period. Thus, evaluation did not get off the ground during the first wave of TAMS' program delivery and has remained an underdeveloped sector within the organization. The evaluation unit has focused on various types of formative evaluation and has not put in place systematic methods to document program delivery nor specified one or more designs for assessing outcomes of TAMS' teacher focused programs.

TAMS Evaluation in 1991-92

Planning efforts were prominent in TAMS' initial evaluation work, with several versions of a comprehensive plan produced in 1992. The plans appropriately used a multi-method framework and intended to collect data about four aspects of TAMS' work: context, inputs, processes, and products (outcomes). The evaluation plan listed a wide variety of potential data types to assess TAMS' diverse goals but did not prioritize among these approaches. The evaluation plans produced by TAMS have not appeared to guide its actual data collection efforts.

In 1991-92, TAMS' reports reflect several types of data being gathered:

- A one-page questionnaire for teachers to rate TAMS instructors in each program component, with items similar to a conventional end-of-session evaluation form. Data were collected for 652 teachers, with mostly favorable ratings of TAMS' instructional quality. Although some instructors received less favorable ratings, we do not know whether these data were used in staffing decisions or as a stimulus for more TAMS' staff training.

- A questionnaire reported in "participating teacher survey results," which was completed by 202 teachers (May, 1992). Data were collected about teachers' backgrounds and for 18 attitudinal-type items about their experiences with TAMS. The data report is oriented toward using teachers' feedback for program improvement in TAMS, but few items were asked about their use of TAMS' instruction in their classrooms. There is no methods section to indicate how the data were collected, or how representative the 202 teachers are of the approximately 1,000 teachers that had participated in TAMS' intensive programs by this date.

- Data were requested and received from CPS' Department of Planning, Research and Evaluation about the 30 schools that had participated in TAMS, including student and teacher demographics and current test scores on the Iowa Test of Basic Skills (ITBS) and the Illinois Goal Assessment Program (IGAP). However, TAMS' evaluation unit has merely reported or graphed these data for each school individually. It has not provided comparisons of its schools with any similar ones that have not undertaken the intensive TAMS programs.

TAMS Evaluation in 1992-93

TAMS revised its evaluation planning documents during this period, and continued its emphasis on formative assessment. But it did not specify outcome measures that would be used to document TAMS' effectiveness, nor develop a data collection and analysis design for this purpose. The extensive use of self-report data from teachers who participated in TAMS without any comparison schools neglects the positive bias that is likely to be present in this data source. TAMS' major evaluation reports during this period include:

- Item analysis for what appears to be pre and post-TIMS© tests for students and teachers in three schools, for the conceptual skills taught in this program. The report is very poorly written and does not communicate well who the test-takers were, the program interventions between pre- and post-tests, the meaning of these scores, and whether test-retest bias is present.

- Survey data results from 166 teachers, 14 principals, and TAMS' implementation specialists' reports on 22 classrooms. These report retrospectively about perceived changes that are aligned with TAMS' instructional methods and suggest that changes might be taking place. However, the survey numbers are only a small fraction of the teachers who had received intensive TAMS programs, and no indication is present that sampling techniques were used. The methodology for selecting the teachers to respond and for administering the survey is not reported.

- Data reports and graphs of test scores with 1992 data for individual TAMS schools, but again no comparison schools, and no aggregate analysis to examine overall trends.

TAMS Evaluation in 1993-94

TAMS continued its focus on formative evaluation, but expanded these efforts by contracting with several external evaluators to conduct additional studies. These include the following:

- Case studies of three schools and interviewing one teacher or principal in about 40 other schools, under the direction of Dr. Robert Stake of the University of Illinois.

- Interview-based assessment of the Resource Network and of schools that dropped out of TAMS by Dr. Terry Denny, also of the University of Illinois.

The results of these studies are not yet available, nor are further internally-conducted studies by TAMS during 1993-94, such as an analysis of teacher journals.

TAMS conducted focus groups of teachers (six groups) and principals during spring, 1994, with support from the Illinois State Board of Education. These groups were conducted in several places throughout Illinois to support the state's assessment of teachers' needs for staff development. The results from the 13 TAMS teachers (in two groups) and 21 non-TAMS teachers (in three groups) suggest that TAMS teachers are seeing themselves as contributing to the solutions for revitalization of mathematics and science teaching, while non-TAMS teachers see the solutions coming from external sources -- more money, more supplies, and better textbooks. Again the results are suggestive that TAMS may be changing the ways that teachers think about their roles. But the numbers are quite small and there is no assurance from the focus group data that even TAMS' teachers are implementing the new methods appropriately in their classrooms.

Summary of TAMS-produced Evaluations

TAMS' evaluation unit has tried many different data collection methods during its approximately two years in existence, but most seem more like pilot efforts rather than full-scale program evaluations. The numbers of respondents in most tend to be small, with no indication of how representative the results are of the large-scale TAMS program delivery efforts. Several weaknesses are common across these reports:

- The data collection and analysis methods are often not clearly presented, so it is difficult to assess the validity and scope of the reported findings.

- The focus has been nearly entirely on formative assessments, with an absence even of planning appropriate designs and data for outcome assessment. We have no information on how these results were used within TAMS.

- Great reliance is placed on the self reports from teachers, with no acknowledgement of the likely biases from social desirability response bias, and no attempt to cross validate self reports with classroom observations of the same teacher.

- Few comparative assessments were reported, to know whether teachers in non-TAMS schools were undergoing the same types of changes, perhaps because of the changes included in the school reform legislation.

- Until the request was made by this NCISE study, TAMS' evaluation unit did not have a statistically analyzable database to maintain on-going information about its schools and their participation in diverse programs. Even documenting how many schools and teachers are involved with TAMS is still an ad hoc matter.

- These reports and evaluation planning documents do not include critically important measures and plans for summative (effectiveness) evaluation that are needed by TAMS' external audiences.

In short, TAMS' evaluation has not kept pace with the "best practices" status of its programs and is not providing the quality and types of data that are needed to provide accountability to its funders and quality assurance to its diverse stakeholders.

V - CONCLUSIONS AND RECOMMENDATIONS

This multi-method assessment of The Teachers' Academy for Mathematics and Science has considered many detailed aspects of its organizational evolution and its programs for systemic teacher development in Chicago schools. Many conclusions about specific aspects of TAMS have already been discussed in the text of Chapters II through IV and are summarized in the Executive Summary. These conclusions are not repeated here.

This chapter focuses on cross-cutting conclusions from our study, based on drawing out implications from several parts of our analyses. Following these conclusions, we list several recommendations that stem from the study, organized into three sections: a) recommendations for the federal level which has provided major funding for TAMS; b) those that apply to systemic staff development organizations, in general; and c) recommendations specifically for TAMS itself. These are major recommendations only, as nearly every "lesson learned" or theme in the text could be re-worded into the form of a recommendation.

Conclusions

1. There is no one "key" to systemic change.

Staff development in an urban context and organizational change are both very complex phenomena that require careful attention to a large number of detailed aspects. Two "templates" were developed for this project, one for examining mathematics and science staff development programs in a systemic context, and the other for assessing the components of effective new organizations. Each of these templates required multi-page documents just to describe the elements likely to be needed for success. We cannot conclude that any one of these elements is the key to success, nor that a formula will be found for assuring more rapid systemic change.

2. Program development and delivery are inseparable from good management of an organizational context.

This study examined TAMS' organizational evolution and its current program components. Although our analyses of TAMS broke apart these two major facets for analytic feasibility, in reality they were constantly influencing each other. The complex nature of the programs that form TAMS' mission affected the types of organizational structures and processes needed, the organization's relationships with its external stakeholders and funders, as well as its staffing and internal communications. In turn, TAMS' efforts to work with teachers toward systemic change have continually been affected by many organizational features: the scope of operations promised in order to gain funding, the staffing and leadership available to deliver the programs, the support provided through management systems, and so forth.

3. **TAMS' history illustrates well the difficulties that arise when high levels of funding are attached to unrealistic expectations, and large-scale programs are expected to be carried out by a newly formed organization in a turbulent environment.**

A major theme that pervades this report is that TAMS tried to do too much, too fast and did not have the organizational underpinnings to support its program operations. It might have benefitted organizationally by initial affiliation with a larger organization, such as one of Chicago's universities or museums, but TAMS chose not to do this in order to maintain its independence. Consequently, TAMS encountered all the problems and work of creating a new organization from the ground up. TAMS further promised to engage large numbers of Chicago's teachers in staff development, but did not have the needed program delivery mechanisms and staff in place to carry out its promises. These are difficulties that could have been anticipated during the start up of TAMS if realistic planning and testing of program components had taken place.

4. **Balancing between many critical elements may be a primary ingredient for managing systemic change in the urban context.**

When TAMS tried to do everything at once, it was unable to find a good balance among the concerns of many stakeholders, its needs for program development and testing, and its requirements for internal management and support systems. Program resources can readily be wasted if there is not a balanced development among all the major ingredients for change.

5. **TAMS might become a national exemplary "model" for urban staff development, but is not there yet.**

TAMS' current program activities are putting into place the program elements needed to operationalize the current literature and recommendations concerning "best practices" for staff development in science and mathematics education. If TAMS has several more years (e.g., three to five years minimum) to work with schools using its current intended program, it might become a national model program that documents how to improve urban student achievement in math and science. But it will need a much stronger evaluation component in order to document its effectiveness.

6. **TAMS is a staff-intensive program, which seems aligned to the deep-seated needs of many teachers, but it has potential feasibility problems for transferral to other locations.**

TAMS current intended program description calls for three and a half years of intensive work with each school, primarily using small group instructional sessions and one-on-one work with teachers in their classrooms. Such intensive use of TAMS' staff may well be needed to help bring about major changes in teachers' classroom practices, since many teachers are at first uncomfortable with these methods and are unfamiliar with the content material, particularly in science. But TAMS is expensive because it is staff intensive, and may incur feasibility problems in attempts to rapidly transfer its

approaches to other locations, even if TAMS programs do attain documented effectiveness in the future.

7. Extensive stakeholder involvement has both positive and negative aspects and is not a panacea for systemic change.

TAMS was born out of the frustrations of a diverse group of Chicago-area scientists, citizens, and educators who had the·passion to pursue increased educational quality in science and mathematics. But their different views concerning how to bring about educational change and how to manage this organization was a prime factor contributing to its organizational problems in its first two years. The staff time required to obtain and reconcile multiple stakeholder views is a major commitment of organizational resources and skills. In TAMS' case, extensive involvement from educators over time has achieved the confidence and support of the teachers it serves, and TAMS continues to solicit extensive input from stakeholders as feedback for its operations.

8. Evaluation procedures for documenting program delivery and assessing outcomes need to be built into any large scale change effort such as TAMS.

By the term "program evaluation" we mean at least three types of systematic efforts: data to document the activities and participants in actual program delivery, "formative" information to provide quick feedback on how well new program components seem to be working, and "summative" designs and data to assess how effective the program components are in operation. TAMS has focused only on formative information. Its neglect of the other evaluation types has contributed to other problems, such as knowing when a program component is ready for large scale use and providing accountability to funders. It is a common but unfortunate error of managers to believe that program evaluation should come *after* delivery, because data collection usually needs to be simultaneous with program delivery, and appropriate planning for evaluation is needed *before* delivery.

9. Methodologically, our use of "templates" has been very helpful to the study.

This study was, in essence, a large-scale case study approach to the assessment of TAMS. The templates we developed (based on prior NCISE work) were very useful as frameworks for collecting this qualitative information, for organizing and analyzing the information, and as a normative standard against which to compare actual events in TAMS. We also attempted to use the templates for the presentation of findings in this final report, but this effort would have resulted in a much longer report that did not seem suited to its federal audience, so it was abandoned. The use of a template helps to systematize a qualitative evaluation, which have traditionally been based primarily on the judgements of the evaluator.

Recommendations

Many other recommendations are implied in the conclusions and "lessons learned" in each chapter. The following are major overarching recommendations, but those interested in the details required for systemic change in science and mathematics education should refer to the prior chapters.

At the Federal Level:

1. **Multi-year funding is needed.** Federal agencies should expect large scale and systemic change to require several years for development, and should award multi-year funding (a three to five year commitment, given relevant Congressional appropriations) that the recipient organizations can reasonably expect to receive annually, if they are making reasonable progress.

2. **Federal agencies should fund for phased growth, rather than explosive change.** It is realistic to expect (at best) incremental, phased growth in systemic change projects, and federal agencies should plan funding allocations accordingly. The funding agencies should require detailed management plans for the staffing and other resources to be allocated to specific program activities. Detailed plans are particularly needed to document the feasibility of requests for rapid growth (e.g., growth rates of over about 30% each year, which are likely to require approximately one new staff member for every three current staff).

3. **Monitor past activities, phased accomplishments, and expenditures.** Federal agencies should fully monitor the progress and uses of funding for large scale systemic change projects, particularly by requiring documentation of project activities (e.g., from data in a systematically compiled database) in relation to expenditures rather than by annual proposals emphasizing future aspirations.

4. **Federal proposal review should include a substantial weight on organizational factors.** Federal review of project proposals for systemic educational change should include full attention to the personnel, organizational components, and management systems proposed for delivering the project activities (for example, giving these aspects as much as 50% of the points in a set of contract or grant review criteria, and by including organizational analysts among the peer reviewers).

5. **Federal agencies should expect uneven development, political tensions, and some "false starts" within systemic change projects.** They should not monitor such projects only against outcomes achieved, but also pay close attention to the nature of the problems being faced, the solutions attempted, and the quality of the project's documentation of its unsuccessful trials, as well as its achievements. This type of monitoring is likely to require a different type of federal staff role than was common in the past.

Systemic Staff Development Organizations, in General

1. **Involve stakeholders judiciously and provide staff time and resources for working with stakeholders.** Systemic change efforts should involve multiple relevant stakeholders, but should do so cautiously, and with adequate attention to the staff and management time needed to work with multiple stakeholders. Recognize that stakeholders come to an educational project with different agendas, frames of reference, and organizational cultures.

2. **Plan the resources and staff needed for management systems.** Large-scale change organizations need to plan fully for the development of all needed management systems, such as financial management, human resources support systems, space and facilities management, and internal communications.

3. **Develop and test programs before attempting large scope delivery.** Systemic change efforts need to allow time for the development and testing of programmatic activities before applying the programs to large numbers of schools.

4. **Pay close attention to staffing for a diversity of roles.** Because of the necessary long term commitment to teachers and schools *and* the complex nature of the tasks, staff in systemic staff development organizations must be well qualified in the needed areas of expertise, but adaptable to constantly changing situations.

It is likely that many of the recommendations for TAMS specifically will also apply to organizations with similar missions.

Recommendations for TAMS, Specifically

1. **Monitor and evaluate new science program before large-scale delivery.** TAMS is currently undertaking extensive re-development of its instructional approaches in science, to expand beyond its prior TIMS©-based approach. The new instructional program should be tried out, monitored carefully, and tested with feed-back data in a few schools *before* being used in large numbers of schools.

2. **Continue to develop the staffing for mathematics program.** The Mathematics Unit is still short on staff. In light of the new instructional offerings this Spring at the Grade Four to Eight level, it is important that TAMS not only develops its own instructors' capabilities to deliver its classes but tries to find other qualified staff to share instructional tasks.

3. **Continue to focus on and develop internal coordination and communications.** TAMS should continue emphasis on improving its internal communications, particularly for increasing the integration among its program units, so that management coordination continues to improve and program efforts are not fragmented. The efforts to delegate management responsibility to unit heads should continue, along with the review meetings, staff meetings and other strategies to coordinate the work of the separate units. Additional work is needed to avoid "top-down" management.

4. **Attach staff allocation plans to funding requests.** TAMS should prepare more detailed overall staffing allocation plans, so that the staff resources are clearly allocated to specific schools, tasks, and projects, and the staffing needs for expansion are identified. These plans should include the staff time needed for special projects, working on program development, and for internal communications (e.g., Learning Leadership Teams, School Assessment Teams), as well as staff time in schools and for instructional preparation and delivery.

5. **Place strong emphasis on developing and modifying evaluation activities. TAMS' evaluation efforts should include attention to all three evaluation types: a) systematically documenting program delivery and participation by schools and teachers; b) formative studies to obtain feedback about new program components; and c) designing and carrying out data collection for later outcome assessment.** Substantial work is needed on many aspects of evaluation. Participation in data collection and receiving feedback should be a part of the requirements for new TAMS intensive schools.

6. **TAMS' leaders should continually assess the balance they are achieving in their focus among four major aspects: external relationships and stakeholder concerns; internal management and systems development; oversight of program development; and involvement in program delivery.** The top managers seemed to lack time for adequate involvement in program delivery, due to the extensive agenda of external activities. A potential for neglect of program delivery may occur when responsibility is appropriately delegated to unit heads, which has been interpreted by other staff as lack of interest in and priority on their work with teachers.

7. **Avoid fragmentation of efforts.** A dilemma for TAMS, and for other organizations attempting systemic change, is where to draw the boundaries of their focal system, since each aspect is legitimately connected to many other aspects of education. TAMS has a tendency to try to tackle everything itself, rather than to focus on solid program development and delivery of staff development with teachers as its central mission. For example, its recent proposal to NSF to take a lead role in developing a Master's level program for lead teachers and content specialists may divert the attention of TAMS managers at this critical stage of its classroom programs. Although the need for a Master's level program seems justifiable, for TAMS to take a lead role in this effort is likely to dilute the priority of its current work in revising its science program, consolidating its mathematics instruction, recruiting schools for its intensive program, and creating its evaluation systems.

This study has examined the Teachers' Academy for Mathematics and Science more than four years after its start-up. TAMS has made great progress in developing a high quality, comprehensive school development program in mathematics and science education. It has had major organizational development problems, but is now restructuring itself for better organizational management. This study has found that TAMS' intended program designs are by and large congruent with national standards and recommended "best practices" for staff development. However, continued intensive work is needed internally to unify these efforts, test out new programs, and continue its expansion to reach the intended scope of schools. As this work occurs, evaluation efforts should focus both on documenting the program delivered and defining and assessing outcomes.

APPENDIX 1

METHODOLOGY
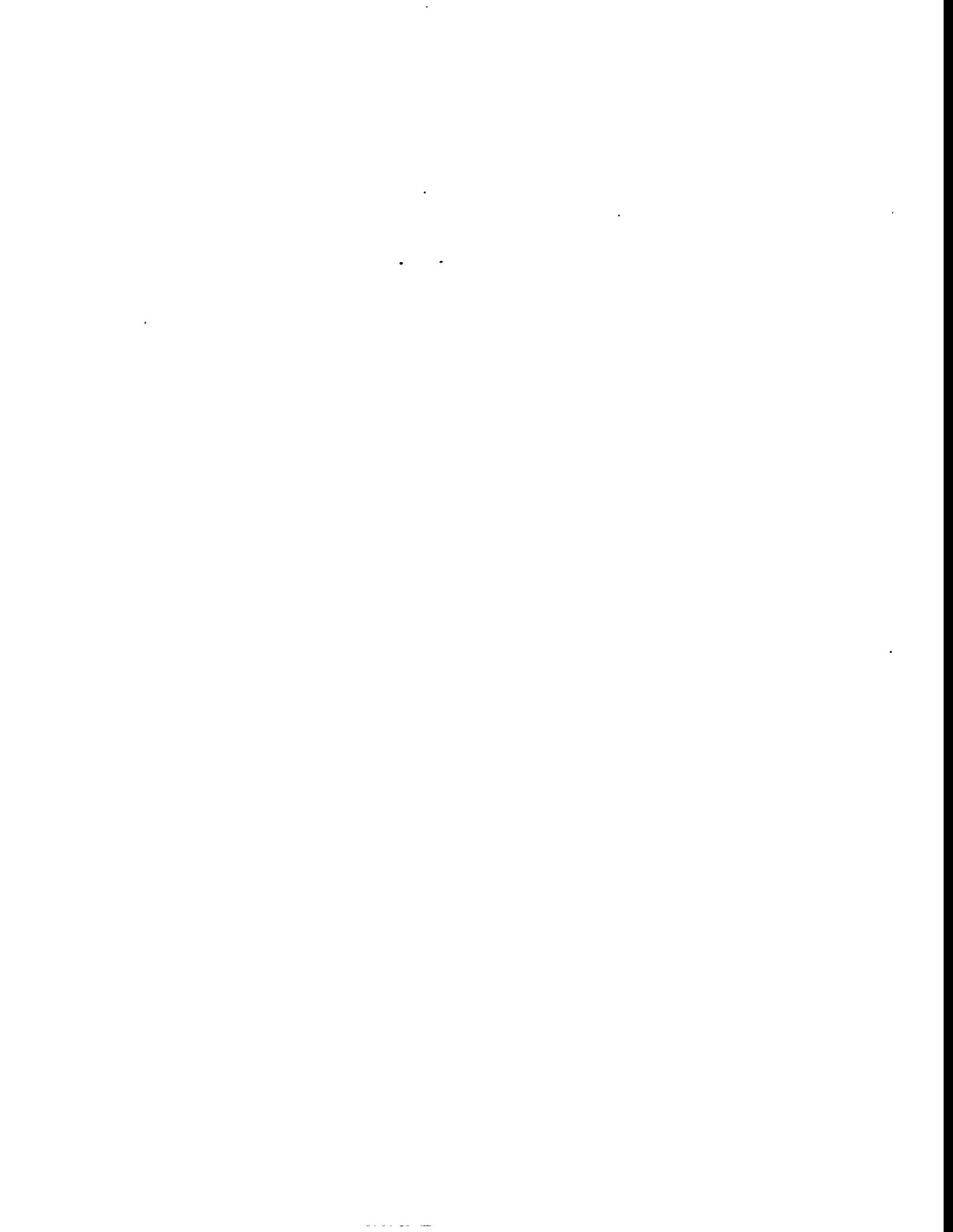
A. SITE VISIT SCHEDULE AND ACTIVITIES

Visit 1:   September 28 to September 30, 1994

NCISE affiliated participants:
>Belle Brett
>Mary Ann Scheirer
>Judy Sparrow (9/29 only)

Major activities:
>Interviews with key TAMS staff, Board members, and other stakeholders

Visit 2:   January 12 to January 14, 1994

NCISE affiliated participants:
>Belle Brett
>Mary Ann Scheirer

Major activities:
>Interviews with program designers (TIMS and Math Tools) and staff
involved   with program design
>Consultation with evaluation staff and consultants
>Attendance at in-house meetings
>Preliminary class observation

Visit 3:   February 16 to February 19, 1994

NCISE affiliated participants:
>Belle Brett
>Judy Sparrow

Major activities:
>Interviews and science and mathematics staff ·
>Observation of TAMS' classes
>Attendance at in-house meetings

A. SITE VISIT SCHEDULE AND ACTIVITIES (page 2)

Visit 4:   March 23 to March 26, 1994

NCISE affiliated participants:
> Belle Brett
> Mary Ann Scheirer (3/23- 3/25)
> Sandra Thibodeau

Major activities:
> Interviews with science staff, school improvement staff, and several stakeholders
> Observation of TAMS' classes
> Site visit to exemplary mathematics school
> Attendance at in-house meetings

Visit 5:   April 19 to April 21, 1994

NCISE affiliated participants:
> Belle Brett
> Mary Ann Scheirer

Major activities:
> Interviews with School Improvement staff, Resource Center staff, Chicago Public Schools personnel
> Site visits to two implementation schools
> Site visit to exemplary science school
> Attendance at assessment conference
> Attendance at in-house meetings

B. PEOPLE INTERVIEWED BY NCISE, BY DEPARTMENT/CATEGORY

TAMS STAFF
(Note: the following is for staffing at 1/94; some changes have occurred since that date)

Administration

Total size of department: 5
3 administrators
2 support staff

Interviewed: 2
Lourdes Monteagudo, Executive Director*
Joseph Frattoroli, Chief Operating Officer*

Finance, Human Resources and Facilities

Total size of departments (combined): 11
6 administrators
5 support staff

Interviewed: 1
Deborah Henderson, Chief Financial Officer*

Science

Total size of department: 16
14 instructors/administrators
2 support staff

Interviewed: 11
William Mitchell, Lead Faculty, Science*
Arlene Kanno, Coordinator of Science (now Instructor)

Lynn Beauprez, Instructor
Marvice Box, Instructor
Jeanne Brady, Instructor
Marc Crenshaw, Instructor
Barb Crum, Instructor
Erin Flanagan, Instructor
Greg Freedman, Instructor
Sally Freeman, Instructor
Danusia Gerlach, Instructor

B. PEOPLE INTERVIEWED BY DEPARTMENT/CATEGORY (page 2)

Mathematics

Total size of department: 9
8 instructors/specialists/administrators
1 support staff

Interviewed: 8
Sylvia Smith, Director of Mathematics*

Tom Berdusis, Instructor
Marshall Brown, Instructor
Ray Ulrich, Instructor

Anastasia Brelias, Implementation Specialist
Abraham Smith, Implementation Specialist
Diane Moore, Implementation Specialist
Darlene Ulrich, Implementation Specialist

School Improvement/School Community Partnerships

Total size of department: 10
9 specialists/administrators
1 support staff

Interviewed: 8
Eileen Bradley, School Improvement Specialist
Helen Chang, School Improvement Specialist
George Isaacson, School Improvement Specialist
Shirley Pittman, School Improvement Specialist
Steve Walsh, School Improvement Specialist

Ted Lucas, Faculty Technology

Linda Bush, School/Community Partnership Coordinator
Bruce Rickley, School/Community Partnership Coordinator

B. PEOPLE INTERVIEWED BY DEPARTMENT/CATEGORY (page 3)

<u>Resource Network Center</u>

Total size of department: 8
7 specialists/administrators
1 support staff

Interviewed: 4
Barbara Radner, Director
McKinley Brister, Instructor
Ed Green, Technician
Jose Velasquez, Assistant to the Director*

<u>Evaluation</u>

Total size of department: 3

Interviewed: 2
Larry Cross, Associate Director of Evaluation*
Kristen Powell, Evaluation Assistant

<u>Board Members</u>

Total size of Board: 42

Interviewed: 11 current, 1 past
Leon Lederman, Chairman of the Board, co-founder of TAMS, Fermilab*
Lewis Collens, President, President of Illinois Institute of Technology
Earl Neal, Executive Committee chairman, Earl L. Neal and Associates
Paul Heltne, Secretary, Chicago Academy of Sciences
Adrienne Bailey, was CPS representative at time of interview, Co-chair of Program
    Operations committee
Sam Bowen, member of Program Operations Committee, Argonne Lab (not officially a
    Board member, but represents a Board member)
Marjorie Branch, current CPS representative
Karen Carlson, principal representative, Prescott School
Gordon Lamb, past President of Board, President of Northeastern Illinois University
Coretta McFerren, community representative, Executive Committee member, former
    TAMS director, WSCORP
Joe Reed, past Board member, former CPS Interim Board member
Lynn Haeffele, Illinois State Board of Education representative--by phone

B. PEOPLE INTERVIEWED BY DEPARTMENT/CATEGORY (page 4)

<u>Mathematics and science program designers (external)</u>

Sheila Sconiers, University of Chicago School Mathematics Program
Howard Goldberg, University of Illinois, Chicago (TIMS developer)
Marty Garzman, University of Illinois, Chicago (TIMS)

<u>Consultants to TAMS</u>

Robert Stake, University of Illinois at Champagne-Urbana (evaluation)
Terry Denny, Consultant (evaluation)
Ed Bales, Motorola University (management)--by phone
Romelle Robinson, Motorola University (management)
Jim Ellis, Biological Sciences Curriculum Study (science staff development)--by phone

<u>Chicago Public Schools representatives</u>

(note: Adrienne Bailey, former Board member and Marjorie Branch, current Board
member, are/were CPS representatives as well)

Adrian Beverly, Department of Instructional Support, CPS
Margie Ragosa, Prescott School (interviewed with Karen Carlson)
Telkia Rutherford, Department of Instructional Support, CPS
Dorothy Strong, Director of Mathematics, CPS
Melanie Wojtulewicz, Department of Instructional Support, CPS

<u>Funders</u>

Marge Dwyer, Program Manager, Department of Energy, University and
   Science Education
Talitha Powell, Department of Energy, University and Science Education
Rich Stevens, Director, Department of Energy, University and Science Education
Joe Stewart, National Science Foundation
Eleanor Dougherty, OERI (FIRST)

<u>Other stakeholders</u>

Ron Gitwitz, Chairman of the Board, City Colleges of Chicago
Jon Thompson, former Executive Director of TAMS--by phone

Note: This schedule does not include interviews with school representatives from the site
visit schools, nor informal conversations with staff and others.

*interviewed more than once

C. MEETINGS AND PRESENTATIONS ATTENDED AT TAMS

January:

Executive Committee (on the strategic plan)
School Assessment Team

February:

Pilot focus group of TAMS teachers
State legislature (introduction to TAMS)
Mathematics staff weekly meeting
BSCS staff development with TAMS

March:

Science staff weekly meeting

April:

Program Operations Committee
Authentic Assessment Institute at Museum of Science and Industry
Budget Review--Mathematics
Budget Review--Resource Center
Presentation at Beethoven School (about participating in science program)
Chicago Public School representatives

D. SCHOOL VISITS

<u>Exemplary school, math:</u>*
Interviewed principal
Focus group, parents (n=3)
Focus group, teachers (n=6)
Informal visit of classes

<u>Exemplary school, science:</u>
Interviewed current principal
Interviewed former principal
Focus group, parents (n=10)
Focus group, teachers (n=17)
Visits to 5 classrooms
Visit to new Discovery Center

<u>Implementation school, math:</u>
Observed 2 classes
Interviewed assistant principal (also teacher)

<u>Implementation school, science:</u>
Observed 2 classes
Talked informally with 2 teachers

*The names of the schools are withheld to preserve confidentiality.

E. LIST OF TAMS RELATED DOCUMENTS REVIEWED BY NCISE

Planning Documents/Descriptive Material

Grecian Urn proposal (original proposal for establishing the Teachers' Academy for
    Mathematics and Science in Chicago) (2/28/90)
Philosophy of Educational Intervention and Staff Development (drafts, Committee
    on Programs) (11/91)
Blueprint for Systemic Change in Math and Science Teaching in the City of Chicago
    (Portia Eliot)(8/92)
Action Plan for University/Academy Connections (9/22/92)
Order of Events (leading up to founding of TAMS)
The Academy Program, Summary Document (12/14/92)
"An Educational Laboratory for Systemic Reform" (TAMS planning document) (no date)
TAMS Program Policies and Guidelines (7/22/93)
A Comprehensive School Development Program in Science, Mathematics, and
    Technology (2/93)
Strategic Plan (draft 1/14/94)

Board and Committee Meetings Minutes and Materials

Minutes, Meeting of the Council of Presidents (11/2/93)
Minutes, Exec. Committee Meeting (8/10/93)
Minutes, Exec. Committee Meeting (9/1/93), Operational Framework/Plan (FY94)
    attached
Minutes, Executive Committee Meeting (12/1/93)
Minutes, Program Operations Committee (1/24/94)
Programs Operations Committee Meeting (includes NSF proposal, focus group
    feedback/evaluation) (4/20/94)

Renewal Proposals/Correspondence with Federal Agencies

TAMS NSF Proposal (4/1/94)
TAMS DOE Renewal Proposal (12/14/93)
Selected correspondence between TAMS and the Department of Energy (7/92-10/93)

Site Visits/Reviews/Progress Reports

Survey Results, Intensive Staff Development Pilot Program (data collected in 1991)
Department of Energy Debriefing Session (10/25/91)
Report of the Special DOE Task Force on the Chicago Teachers Academy
    (site visit conducted in 10/91)
Progress Report (FY1992)
1992 Progress Report
Progress Report (10/1/93)
TAMS Report to DOE (1/94)

E. LIST OF TAMS RELATED DOCUMENTS REVIEWED BY NCISE (page 2)

<u>Science Documents/Materials</u>

TIMS curriculum (list of experiments and assessment content, grades 1-5)
Examples of TIMS experiments/lesson materials:
    "Wherefore Art Thou, Romeo," grade 4 (story book)
    "A Walk in the Woods I," grade 4 (story book)
    "Shape"
    "Pockets"
    "Boyant Force"
    "Sink and Float"
    "Arm Span vs. Height"
    "Mass vs. Volume"
    "Spreading Out" I and II
    "View Tube"
    "The Bouncing Ball"
Examples of student work (6 students)
TIMS Feedback Instruments:
    TIMS Science PreTest (g.3-8)
    Journal Questions (Science Staff Development)
    Class observation sheet
    TIMS classroom Experiment Log
TIMS Document Catalog
Article: Focus on Integrating Science and Math (2/89 <u>Science and Children</u>)
A Teacher's View of TIMS (write-up based on interview with Leona Peters)
TIMS Teacher Lab Discussions/Tables of Content, introduction, sequences (by grade)
TIMS Tutors/Table of Contents and Introduction
Evaluation of a Model Integrated Math/Science Program for the Elementary School
A Four Year Achievement Study (TIMS Program)
Article: "Doin' What Doesn't Come Naturally" (<u>Newsweek</u>, 11/29/93)
Article: Teaching Integrated Math and Science: A Curriculum and Staff Development
    Project for the Elementary School (Goldberg and Wagreich)
Article: A Model Integrated Mathematics Science Program for the Elementary School
    (Int'l. Journal of Educ. Research, Goldberg and Wagreich)
Science Staff Development: Engage Stage (draft, 6/94)
Primary Science Curriculum (draft, 6/94)
Intermediate Science Curriculum (draft, 6/94)
Upper Grade Science Curriculum (draft, 6/94)

E. LIST OF TAMS RELATED DOCUMENTS REVIEWED BY NCISE (page 3)

<u>Mathematics documents/materials</u>

Mathematics Component Program Information (FY 1994)---(notebook of materials)
Article: "Elementary Teacher Development Component" (Sconiers, UCSMP)
Article: "Evaluation Activities" (Hedges, UCSMP)
Mathematical Framework for Grades 4-6 Curriculum Development
Comprehensive Change Matrix: Restructuring for Improved Achievement in
     Mathematics
Using Mathematics: From Your Backyard to the Great Wall, UCSMP (materials used in
     math program)
Using Mathematics: From the Seas to the Stars, UCSMP (materials used in math
     program)
If I Walk in the Woods, Will I Run Into a Bear?, Using Mathematics and Science to
Explore Our World series (materials used in math program)
Do Elephants Eat Too Much?, Using Mathematics and Science to Explore Our World
     series (materials used in math program)

<u>School Community Partnership</u>

Goals
FY94 Family/Community Initiative schedule and model
Workshop registration form

<u>School Improvement</u>
Comprehensive School Development Process, Leadership Materials
Staff Development for Teacher Enhancement in Elementary School Science (goals,
     indicators, and activities)--used for recruiting new schools
Vacancy Announcement (School Improvement Specialist)
"Authentic Assessment" conference brochure/registration form
"Authentic Assessment" conference notes, agenda, materials from sessions
Assessment conference follow-up plans
"Science Matters" conference brochure/registration form
Educational Events list
School Assessment Tool Rubrics (draft)
Memo re. School Assessment Team meetings
Memo re. School Assessment Team (SAT) meetings feedback
SAT meeting questionnaire
TAMS intensive school profile (blank form)
TAMS orientation meeting flyer/registration form
Principal's Leadership Consortium agenda, participant sign-in sheets, and
     evaluation forms

E. LIST OF TAMS RELATED DOCUMENTS REVIEWED BY NCISE (page 4)

Resource Center

Directory of Teacher Workshops (4/1-8/31/94) (listing for Chicago)
Staff Development Opportunities for Teachers Summer 1994 (listing for Chicago)
Resource Network Workshop newsletters (Fall 1993, Spring 1994)
Resource Network Monthly Report (November through May)
Resource Network Information Questionnaire
School Liaison Connection Meeting flyer (topic: Frameworks of Science Education)
Workshop scores (spreadsheet data, 12/93)
Teaching Beyond the Test: Community and City Contexts for Teaching (x2)
Resource Network Workshops, FY 93
Organizing for Progress: A Structure, School Development Focus Areas (network
    meetings and workshops
Chicago History Time Line Projects (social studies skill development materials)
Resource Network Site Program Activities
The School Liaison: Linking Your School to Chicago Resources through TAMS
New Resource Center Network (School-Museum-University linkages)
Resource Banks: A Guide to Developing In-School Resource Areas
Resource Center information packet (includes Smithsonian Magazine, workshop
    newsletters, flyers and registration forms)

Evaluation Documents

Lists of 1992 and 1993 Evaluation Documents (from Larry Cross)
Survey Summary Data: Profile of Local School Councils re. Support of Math/Science
TIMS Pre/Post Test Summary Data and Analysis (8/93); also -- copy with comments
IGAP Science and Math Test Results (for individual schools) (1992-1993)
Teacher and Principal interviews (blank forms)
1992 Evaluation folder:
    Preliminary Evaluation Plan
    Participating School Test Results
    Attachment III: Evaluation Process/System
    Evaluation of Instructors by participating teachers (5/92)
    Participating Teacher Survey Results Summary (5/92)
    Memo/Internal Evaluation Progress Report
1993 Evaluation folder:
    Evaluation Activities for FY 1994
    TIMS Pre/Post Test Summary Data
    Profile of Local School Councils re. Support of Science/Math
    Evaluation results for participating schools (Phase III)
    Survey Data from principals, teachers, and academy implementation specialists

E. LIST OF TAMS RELATED DOCUMENTS REVIEWED BY NCISE (page 5)

Evaluation Documents (cont.)
1993 Evaluation folder (cont.):
   Aggregated Data for Spring 1991, Summer/Fall 1991, and Spring 1992 cohort
schools
      Internal Evaluation Plan
      IGAP Math Test Results (1991 and 1992)
      IGAP Science Test Results (1992 and 1993)
      ITBS Math Test Results (1991 and 1992)
      Time Devoted to Teaching Math and Science (Spring 1991)
      Evaluation Advisory Panel Meeting (3/12/93) minutes
Teacher's Interview (draft)
Principal's Interview (draft)
Analysis of TIMS Follow-Up/Implementation Activity reports (9/30/93)
Historical Background and Framework (evolution of Evaluation component)
Citywide test results (only for District 8)
Internal Evaluation Plan (draft, 1992-1993)

Curriculum Frameworks/Standards Documents

Learning Outcome Standards: Transforming Teaching and Learning" (CPS)
Newspaper clip: "School Statistics Can Be Misleading" (Chicago Tribune, 1/8/94)
Illinois Goal Assessment Program: Sample of Tests of Illinois Goals in Science (1993)
The Productive Thinking Scale: A User's Guide to Classifying Science Test Items
Highlights of the IGAP Science Assessment (1992-93)
Notes from Illinois Science Teacher's Association Convention (10/92, handwritten)
Summary of the 1992 Legislation H.B. 1890 Affecting School Improvement Process
Frameworks of Science Education (includes BSCS/NCISE blueprints, IL State Science
   Goals, NSE standards)
Science Teacher's Desk Reference (of standards)

Chicago Public Schools aand the Illinois State Board of Education Documents

Catalyst: Voices of Chicago School Reform (select copies of newsletter, 1991-94)
1987-1988 Test Scores and Selected School Characteristics (Elementary Schools)
.Best Practice newsletter (Fall 1989)
.Rethinking Schools: An Urban Educational Journal (March/April 1991)
"Rethinking Urban Schools: The Chicago Agenda" (Chicago School Reform Effort
   packets)
Reform Report (monthly publication of Chicago Panel on Public School Policy and
   Finance, Feb. 1993)
Helping Your Child Use the Library (OERI/USDOE publication)
Chicago Systemic Initiative (CSI) Summary and NSF proposal (1/94)

E. LIST OF TAMS RELATED DOCUMENTS REVIEWED BY NCISE (page 6)

<u>Chicago Public Schools and the Illinois State Board of Education Documents</u> (cont.)

Comprehensive School Improvement Planning, Chicago Public Schools
   Dept. of Research, Evaluation, and Planning
Introduction to the Illinois School Improvement Plan
Chicago Public Schools Urban Systemic Initiatives in Science, Mathematics and
   Technology Education Teacher Survey (draft)
Chicago Public Schools Urban Systemic Initiatives in Science, Mathematics and
   Technology Education Principal Survey (draft)

<u>Other Research Reports/Documents about Chicago</u>

Charting School Reform: The Teachers' Turn (survey for CPS Elementary School
Teachers, Spring 1991)
Charting Reform: The Principals' Perspective (survey, Spring 1992)
Achieving School Reform in Chicago: What We Need to Know (report of the Consortium
   on Chicago School Research: Bryk and Sebring, 1991)
A View from the Elementary Schools: The State of Reform in Chicago (report of
   the Steering Committee Consortium on Chicago School Research: Bryk, Easton,
   Kerbow, Rollow, and Sebring, July 1993)

F. PROTOCOL FOR INSTRUCTOR INTERVIEWS

Background

How long have you been with TAMS? Were you always in this position?

What was your history prior to TAMS--educational background and work history?

Science/math background?

What brought you here?

Current work with TAMS

(Describe your role)

[What teaching are you currently responsible for at TAMS?]

What kind of vision for the classroom back in the schools do you think the program (e.g. Mathtools, TIMS) emphasizes?

[Briefly describe your program. What is the balance between content and process? How do you try to achieve that balance?]

What elements do you think are most important?

[How do these elements play out as you work with teachers?]

(How do these elements play out in your own teaching?)

How formally laid out are expectations for what you will do in the (TAMS) classroom? Have these changed over time?

How much have you adapted any of these to fit your own style? In what ways?

What have you found to be particularly effective? less effective?

How do you know if you have been successful with teachers? Short-term indicators? Long term indicators? Would you like some way of assessing this that you do not now have?

How has the program changed over time? How have you changed the way you approach this material over time and why (if not so new at TAMS)?

To what extent are you involved in helping teachers think about systemic change?

What do you find most difficult about your role?

F. INSTRUCTOR/IMPLEMENTATION SPECIALIST PROTOCOL (page 2)

Optional: Take one concept or activity that you have already taught and describe how you taught it.

(If observed class, ask about aspects of teaching?)

If you were in charge of designing the perfect staff development program, how might it look different from the one you are currently teaching? Why?

In your mind, how is teaching adults different from teaching children?

Experiences at TAMS

What kinds of input and or involvement in decisions about content, process, implementation, and/or evaluation of learning experience do instructors have, if any?

What kinds of help or support do you receive to do your job? How effective are those for you? What has been the role of staff development at TAMS for you?

Describe the channels of communication for you at TAMS--with your fellow instructors? with people in other departments? with those that manage TAMS? How do you feel about these?

How well do these work for you? Would you like to see something different?

How adequate are the resources at TAMS for you: space for teaching, materials, time?

How satisfied are you with the salary structure? Other working conditions?

Were you involved with the strategic planning process? If so, what was that experience like for you? If not, what was your sense of what happened?

How well do you think you understand the mission of TAMS and the way all the different components fit together? Where does this understanding come from?

What thoughts to do you have about the way TAMS is organized? Run? In what ways have you experienced any changes in TAMS' management as the players have changed?

What do you think are its strengths as a total program? What would you change?

Overall, how do you feel about working here?

Where do you see yourself going?

F. INSTRUCTOR/IMPLEMENTATION SPECIALIST PROTOCOL (page 3)

Additional questions if we observed their class--

Share with me what led up to this class.

What were you hoping to accomplish?

How did you feel about the way the class went?

What went as planned? What went differently?

How did you feel the teachers responded?

What were the unexpected gains?

What might you do differently next time?

Tell me a little about the group you had today, and how it may be different from other groups you have. Tell me a little about the group dynamics.

Ask about specific aspects as observed.

NOTE: Questions in [] are for instructors only; questions in ( ) are for implementation specialists only.

G. OBSERVATIONAL PROTOCOL FOR TAMS

I. BASIC INFORMATION

Observer's name:

Date:

Length of session:

Time visited: to

Subject/program:

Grade levels:

Schools participating:

Site location (place/room):

Name of instructor(s):

Usual number of participants:

Description of participants present:
    Men:
    Women:
    Ethnic/racial makeup:
    Approximate ages:

Place of session within the program:

Purpose/overall objective of class (from instructor):

Description of room: (placement of tables, chairs; walls; special equipment/materials; how students are seated in relation to teacher, etc.)

Belle Brett, revised 4/1/94

Observation protocol, p. 2

II. NATURE OF ACTIVITIES

Activity (e.g.class presentation of exploration of solids)	**How organized** (e.g. whole class, individual student presenting to class)	**Amount of time** (e.g. each participant took about ten minutes, including discussion)

Approximate percentage of time instructor talks in relation to participants (in whole group events):

Nature of non-academic/procedural issues:

Total time on non-academic/procedural issues:

Observation protocol, p. 3

III. SPECIFIC INSTRUCTOR/PARTICIPANT BEHAVIOR

Provide examples or comments about the following, as appropriate:

1. Nature of instructor questions

a. Asks questions relating to classroom procedures:

b. Ascertains class's understanding:

c. Seeks specific facts:

d. Seeks comprehension:

e. Probes participant for additional clarification:

f. Probes for meaning: conceptualizing, making connections with other things:

2. Other instructor commentary

a. Provides answers:

b. Gives praise:

c. Gives criticism:

d. Clarifies a participant's answer further:

e. Makes an observation:

Makes a connection--

f. with concepts in math or science:

g. with other familiar/real world ideas:

h. with classroom teaching practices:

i. with child development concepts:

j. Follows up on a participant's concern:

k. Reviews what has been said:

Observation protocol, p. 4

3. Participants' questions/comments

a. Participant present facts:

Participants ask questions--

b. clarification about an activity/procedure:

c. factual/clarification about content:

d. why:

e. Participant offers an analysis:

f. Participant makes an observation/presents an example:

g. Participant shows conceptual understanding:

Participant makes a connection--

h. with concepts in math or science:

i. with other familiar/real world ideas:

j. with classroom teaching practices:

k. with child development concepts:

l. Participant builds on what others are saying:

m. Participant questions/challenges what others are saying:

m. Participant uses evidence to support claims:

o. Participant hypothesizes about other activities:

p. Participant initiates activities:

Observation protocol, p. 5

IV. OTHER OBSERVATIONS/REACTIONS

(to be filled out immediately after session, or during lulls)

Notable non-verbal behavior

What doesn't happen

Observer's reactions

Observer's interpretations

Alternative ways instructor might have handled a question/situation

Questions/feedback for instructors

Observation protocol, p. 6 V. SUMMARY OF BEHAVIORS

To be filled out after the session and review of notes. To what extent are the following true?

Note 1: "NO" stands for "not observed," if observer was not in a position to observe whether or not a particular activity took place.
Note 2: "4" is a midpoint to represent that the behavior was somewhat present.
Note 3: Space under each statement is for comments.

	not true						very true

1.Summary of activities:

a. Participants engage in open-ended investigations	NO 1	2	3	4	5	6	7
b. Participants engage in hypothesis testing activities	NO 1	2	3	4	5	6	7
c. Activities allow for participant input, rather than relying on "cookbook" formulas	NO 1	2	3	4	5	6	7
d. Participants learn cooperatively	NO 1	2	3	4	5	6	7
e. Content is imbedded in real world problems	NO 1	2	3	4	5	6	7
f. Activity is hands-on, using manipulatives and concrete experiences	NO 1	2	3	4	5	6	7
g. A variety of modes of instruction are used	NO 1	2	3	4	5	6	7
h. Activities use the tools, methods, and processes of scientists	NO 1	2	3	4	5	6	7
i. Activities include opportunities to practice/discuss new classroom behaviors or strategies	NO 1	2	3	4	5	6	7

Observation protocol, p. 7

| | not true | | | | | | very true |

2. Summary of instructor behavior:

A. Organization/structure

a. Instructor provides an overview of content and objectives of period's activities	NO	1	2	3	4	5	6	7
b. Instructor explains how today's activities are related to previous lessons and the topic	NO	1	2	3	4	5	6	7
c. Instructor provides rationale for today's work	NO	1	2	3	4	5	6	7
d. Instructor appears to be prepared/ organized for class	NO	1	2	3	4	5	6	7
e. Activities build in an appropriate fashion	NO	1	2	3	4	5	6	7
f. Overall level of material seems appropriate for class	NO	1	2	3	4	5	6	7
g. Instructor offers clear explanation of activities to be undertaken	NO	1	2	3	4	5	6	7
h. Class is well paced	NO	1	2	3	4	5	6	7
i. Instructor provides summary at end	NO	1	2	3	4	5	6	7
j. Instructor uses own materials in addition to those in program	NO	1	2	3	4	5	6	7

Observation protocol, p. 8

		not true						very true

2. Summary of instructor behavior: (cont.)

B. Instructor behavior and affect

a. Instructor is enthusiastic	NO	1	2	3	4	5	6	7
b. Instructor is sensitive to issues of difference (e.g., race, gender, disability)	NO	1	2	3	4	5	6	7
c. Instructor demonstrates good inter-personal relations with students	NO	1	2	3	4	5	6	7
d. Instructor monitors small group or individual activities	NO	1	2	3	4	5	6	7
e. Instructor is responsive to student questions	NO	1	2	3	4	5	6	7
f. Instructor is responsive to student interests/concerns	NO	1	2	3	4	5	6	7
g. Instructor models teaching principles and strategies that can be transferred to classroom	NO	1	2	3	4	5	6	7
h. Instructor moves students through different cognitive levels of understanding	NO	1	2	3	4	5	6	7
i. Instructor acts as facilitator rather than as source of knowledge	NO	1	2	3	4	5	6	7

Observation protocol, p. 9

not true   very true

2. Summary of instructor behavior: (cont.)

C. Instructor's questioning behavior

a. Questions are neither too difficult,
nor too easy   NO   1   2   3   4   5   6   7

b. Questions are clear   NO   1   2   3   4   5   6   7

c. Instructor allows students enough
time to answer questions   NO   1   2   3   4   5   6   7

d. Instructor tries to engage the
whole class   NO   1   2   3   4   5   6   7

e. Instructor gives feedback to student
responses   NO   1   2   3   4   5   6   7

f. Instructor paces questions approp-
riately within the context
of the session   NO   1   2   3   4   5   6   7

g. Instructor encourages student-student
interactions   NO   1   2   3   4   5   6   7

D. Instructor's knowledge

a. Instructor demonstrates knowledge/
understanding of specific topic   NO   1   2   3   4   5   6   7

b. Instructor demonstrates knowledge/
understanding of subject   NO   1   2   3 . 4   5   6   7

c. Instructor demonstrates knowledge/
understanding of specific
curriculum/program   NO   1   2   3   4   5   6   7

Observation protocol, p. 10

<u>not true</u>   <u>very true</u>

<u>2. Summary of instructor behavior: (cont.)</u>

D. Instructor's knowledge (cont.)

d. Instructor demonstrates/illustrates how lesson can be used in classroom	NO	1	2	3	4	5	6	7
e. Instructor demonstrates knowledge of pedagogy	NO	1	2	3	4	5	6	7
f. Instructor demonstrates knowledge of androgogny (concern for participants' needs/interests, utilizes experience, self-directed, accommodates different styles)	NO	1	2	3	4	5	6	7

<u>Other comments:</u>

Observation protocol, p. 11

| | not true | | | | | | very true |

3. Summary of participants' behavior:

a. Participants are attentive	NO	1	2	3	4	5	6	7
b. Participants are well-prepared (homework, materials, etc.)	NO	1	2	3	4	5	6	7
c. Participants actively participate in class discussions	NO	1	2	3	4	5	6	7
d. Participants actively participate in hands-on activities	NO	1	2	3	4	5	6	7
e. Participants are actively engaged	NO	1	2	3	4	5	6	7
f. Participants stay on task	NO	1	2	3	4	5	6	7
g. Participants work cooperatively with other participants	NO	1	2	3	4	5	6	7
h. Participants seek help from other participants	NO	1	2	3	4	5	6	7
i. Participants engage each other in discussion, rather than relying on instructor	NO	1	2	3	4	5	6	7
j. Participants' questions and comments exhibit good understanding of content area being addressed	NO	1	2	3	4	5	6	7

Other comments:

OBSERVATIONAL GUIDELINES

Person one

1. Fill out page one of the observational protocol as much as possible before the class starts

2. Record nature of activities as they proceed.

3. Record instances of participant/instructor behavior. (Recorder may find it useful to take notes of key examples of instructor/participant questions/comments.)

4. Fill out page five ongoing, and immediately after.

5. If activity takes place in a small group, observe one group and record action and conversation. Observe a different group in next activity.

6. Ask participants: what are they doing? why are they doing it? what they are learning about the topic? About teaching?

7. Fill out pages six to eleven as soon after session as you can, adding comments to explain your answers if necessary.

8. Prepare a brief summary of your observation.

Person two

1. Observe and record as much of what you see and hear as possible: be literal and record as much verbatim as you can, especially questions.

2. Fill out page five ongoing (as you have time), and immediately after, or make marginal notes on reactions.

3. If activity takes place in small groups, follow one instructor around and observe what s/he he does/says as closely as possible. If activity is long, change instructors. If more than one group activity, visit with different instructor.

4. Fill out pages six to eleven as soon after session as you can, adding comments to explain your answers if necessary.

5. Transcribe notes from session.

Observational guidelines, p. 2

Persons one and two together

Compare your answers to pages six to eleven after reviewing your notes. Fill out a joint protocol for these pages. Answers that are only one number apart can be indicated with an adjoining mark. Answers that are more than one point apart should be discussed and a consensual answer arrived at. Indicate reasons for original disagreement (e.g. in first part of class, instructor acted more as a facilitator, but later lectured).

Questions to ask participants after session:

What do you think of what went on?
How did you feel about the activities?
    the pace of the class? the difficulty level?
What did you learn?
How did you feel about your own participation today?
Did you have any concerns that were not addressed?
How did what went on fit with whole TAMS program?
How might you use this back in your classroom?
How was today typical or not?

Ask about specific activities.

Questions to ask instructor(s) after session:

How did you feel about today's session?
Did you do what you set out to do?
What did you like about what you did?
What did you like about what happened?
How was it different from what you expected?
What might you change the next time?

Ask questions that might refer to specific events.

Joint activities of observers

Review all observational materials and by consensus fill out pages 6-11 together, giving both extent and commentary.

H. IMPLEMENTATION OBSERVATION PROTOCOL FOR TAMS

I. BASIC INFORMATION

Observer's name:

Date:

School:

Exposure to TAMS: (programs)

Name of TAMS instructor:

Name of teacher:

Grade level(s):

Time visited: to

Subject:

Number of students:

Description of students present:
    Ethnic/racial makeup:

Purpose/overall objective of class:

Description of room: (placement of tables, chairs; walls; special equipment/materials; how students are seated in relation to teacher, etc. Especially note how much evidence of hands-on and project type activities)

Description of school: (age, walls, movement of children, general atmosphere)

Level of support/enthusiasm for TAMS--principal support and expectations, LSC, materials, planning time: (obtain from instructor and teacher)

prepared by BB, 4/14/94

Observation protocol, p. 2

II. NATURE OF CLASSROOM ACTIVITIES

Activity Time	How organized	Instructor/teacher roles	Materials
(e.g exploration of solids)	(e.g. whole class discussion)	(e.g. instructor modelled)	(teacher made?)

Source of lesson:

Instructor   1   2   3   4   5   6   7   Teacher

Percent of observed time the following occur:

Instructor models   _____ %

Instructor co-teaches   _____ %

Instructor coaches   _____ %

Instructor observes   _____ %

Observation protocol, p. 3 III. SUMMARY OF BEHAVIORS

To be filled out after the session and review of notes. To what extent are the following true?
Note 1: "NO" stands for "not observed," if observer was not in a position to observe whether or not a particular activity took place.
Note 2: "4" is a midpoint to represent that the behavior was somewhat present.
Note 3: Space under each statement is for comments.

<u>1.Summary of classroom activities:</u>

<u>not true</u>   <u>very true</u>

a. Students engage in open-ended or
hypothesis testing investigations.   NO   1   2   3   4   5   6   7

b. Activities allow for student input
rather than relying on "cookbook"
formulae.   NO   1   2   3   4   5   6   7

c. Students learn cooperatively.   NO   1   2   3   4   5   6   7

d. Content is imbedded in real
world problems.   NO   1   2   3   4   5   6   7

e. Activity is hands-on, using
manipulatives and concrete
experiences.   NO   1   2   3   4   5   6   7

f. A variety of modes of instruction
are used.   NO   1   2   3   4   5   6   7

g. Activities use the tools, methods,
and processes of scientists.   NO   1   2   3   4   5   6   7

h. Activities use teacher made
materials rather than relying
on prescribed texts.   NO   1   2   3   4   5   6   7

i. Activities use or build on TAMS'
programs and philosophies.   NO   1   2   3   4   5   6   7

Observation protocol, p. 4

<u>2. Summary of instructor behavior:</u>

A. Instructor organization/structure	**A. Teacher organization/structure**

a. Instructor appears to be prepared/ organized for class.
not true NO 1 2 3 4 5 6 7 true

a. Teacher appears to be prepared/ organized for class.
not true NO 1 2 3 4 5 6 7 true

b. Activities build in an appropriate fashion.
not true NO 1 2 3 4 5 6 7 true

b. Activities build in an appropriate fashion.
not true NO 1 2 3 4 5 6 7 true

c. Overall level of material seems appropriate for class.
not true NO 1 2 3 4 5 6 7 true

c. Overall level of materials seems appropriate for class.
not true NO 1 2 3 4 5 6 7 true

d. Class is well paced.
not true NO 1 2 3 4 5 6 7 true

d. Class is well paced.
not true NO 1 2 3 4 5 6 7 true

B. Instructor behavior and affect	**B. Teacher behavior and affect**

a. Instructor is enthusiastic.
not true NO 1 2 3 4 5 6 7 true

a. Teacher is enthusiastic.
not true NO 1 2 3 4 5 6 7 true

b. Instructor is sensitive to issues of difference (e.g., race, gender, disability).
not true NO 1 2 3 4 5 6 7 true

b. Teacher is sensitive to issues of difference.
not true NO 1 2 3 4 5 6 7 true

c. Instructor demonstrates good inter-personal relations with students.
not true NO 1 2 3 4 5 6 7 true

c. Teacher demonstrates good inter-personal relations with students.
not true NO 1 2 3 4 5 6 7 true

d. Instructor monitors small group or individual activities.
not true NO 1 2 3 4 5 6 7 true

d. Teacher monitors small group or individual activities.
not true NO 1 2 3 4 5 6 7 true

Observation protocol, p. 5

<u>2. Summary of instructor behavior: (cont).</u>

C. Instructor's questioning behavior

a. Instructor questions are neither
   too difficult, nor too easy.
   not true NO 1 2 3 4 5 6 7 true .

b. Instructor questions are clear.
   not true NO 1 2 3 4 5 6 7 true

c. Instructor allows students enough
   time to answer questions.
   not true NO 1 2 3 4 5 6 7 true

d. Instructor tries to engage
   individual students through
   appropriate follow-up questions.
   not true NO 1 2 3 4 5 6 7 true

e. Instructor tries to engage the
   whole class, not just students
   who volunteer.
   not true NO 1 2 3 4 5 6 7 true

f. Instructor gives feedback to student
   responses (e.g. praise, acknowledgement)
   not true NO 1 2 3 4 5 6 7 true

g. Instructor paces questions/comments
   appropriately within the context
   of the session.
   not true NO 1 2 3 4 5 6 7 true

h. Instructor is responsive to student
   questions/concerns.
   not true NO 1 2 3 4 5 6 7 true

C. Teacher's questioning behavior

a. Teacher questions are neither
   too difficult, nor too easy.
   not true NO 1 2 3 4 5 6 7 true

b. Teacher questions are clear.
   not true NO 1 2 3 4 5 6 7 true

c. Teacher allows students enough
   time to answer questions.
   not true NO 1 2 3 4 5 6 7 true

d. Teacher tries to engage
   individual students through
   appropriate follow-up questions.
   not true NO 1 2 3 4 5 6 7 true

e. Teacher tries to engage the
   whole class, not just students
   who volunteer.
   not true NO 1 2 3 4 5 6 7 true

f. Teacher gives feedback to student
   responses.
   not true NO 1 2 3 4 5 6 7 true

g. Instructor paces questions/comments
   appropriately within the context
   of the session.
   not true NO 1 2 3 4 5 6 7 true

h. Teacher is responsive to student
   questions/concerns.
   not true NO 1 2 3 4 5 6 7 true

Observation protocol, p. 6

<u>2. Summary of instructor behavior: (cont).</u>
C. Instructor's questioning behavior (cont)

i. Instructor questions ask for
    comprehension/inference/opinion
    rather than facts.
    not true NO 1 2 3 4 5 6 7 true

j. Instructor asks open-ended questions
    rather than closed questions.
    not true NO 1 2 3 4 5 6 7 true

k. Instructor moves students through
    different cognitive levels of
    understanding.
    not true NO 1 2 3 4 5 6 7 true

l. Instructor acts as facilitator
    rather than as source of knowledge
    not true NO 1 2 3 4 5 6 7 true

m. Instructor encourages student-student
    interactions.
    not true NO 1 2 3 4 5 6 7 true

D. Summary of instructor behavior

a. Instructor models teaching principles
    and strategies that are congruent
    with TAMS' philosophy.
    not true NO 1 2 3 4 5 6 7 true

<u>3. Instructor's knowledge</u>

a. Instructor demonstrates knowledge/
    understanding of specific topic.
    not true NO 1 2 3 4 5 6 7 true

b. Instructor demonstrates knowledge/
    understanding of subject.
    not true NO 1 2 3 4 5 6 7 true

C. Teacher's questioning behavior (cont)

i. Teacher questions ask for
    comprehension/inference/opinion
    rather than facts.
    not true NO 1 2 3 4 5 6 7 true

j. Teacher asks open-ended questions
    rather than closed questions.
    not true NO 1 2 3 4 5 6 7 true

k. Teacher moves students through
    different cognitive levels of
    understanding.
    not true NO 1 2 3 4 5 6 7 true

l. Teacher acts as facilitator
    rather than as source of knowledge.
    not true NO 1 2 3 4 5 6 7 true

m. Teacher encourages student-student
    interactions.
    not true NO 1 2 3 4 5 6 7 true

D. Summary of teacher behavior

a. Teacher demonstrates principles and
    and strategies congruent with TAMS'
    philosophy.
    not true NO 1 2 3 4 5 6 7 true

<u>3. Teacher's knowledge</u>

a. Teacher demonstrates knowledge/
    understanding of specific topic.
    not true NO 1 2 3 4 5 6 7 true

b. Teacher demonstrates knowledge/
    understanding of subject.
    not true NO 1 2 3 4 5 6 7 true

Observation protocol, p. 7

not true_____very true

<u>4. Summary of participants' behavior:</u>

a. Students are attentive.	NO	1	2	3	4	5	6	7
b. Students are well-prepared (homework, materials, etc.)	NO	1	2	3	4	5	6	7
c. Students actively participate in class discussions.	NO	1	2	3	4	5	6	7
d. Students actively participate in hands-on activities.	NO	1	2	3	4	5	6	7
e. Students are actively engaged.	NO	1	2	3	4	5	6	7
f. Students stay on task.	NO	1	2	3	4	5	6	7
g. Students work cooperatively with other participants.	NO	1	2	3	4	5	6	7
h. Students seek help from other participants.	NO	1	2	3	4	5	6	7
i. Students engage each other in discussion, rather than relying on instructor	NO	1	2	3	4	5	6	7
j. Students' questions and comments exhibit good understanding of content area being addressed	NO	1	2	3	4	5	6	7

<u>Other comments/reactions:</u> (include non-verbal behavior; what didn't happen)

OBSERVATIONAL GUIDELINES FOR IMPLEMENTATION

Person one

1. Fill out page one of the observational protocol as much as possible before the class starts

2. Record nature of activities as they proceed (p. 2).

3. Record instances of instructor/teacher/student behavior. (Recorder may find it useful to take notes of key examples of instructor/teacher/student questions/comment.)

4. If activity takes place in a small group, observe one group and record action and conversation. Observe a different group in next activity.

5. Ask students: what are they doing? why are they doing it? how do they like it? what have they learned or discovered?

6. Fill out pages three to seven as soon after session as you can, adding comments to explain your answers if necessary.

7. Prepare a brief summary of your observation.

Person two

1. Observe and record as much of what you see and hear as possible: be literal and record as much verbatim as you can, especially questions.

2. If activity takes place in small groups, follow one teacher around and observe what s/he he does/says as closely as possible. If activity is long, observe instructor, if active.

3. Fill out pages three to seven as soon after session as you can, adding comments to explain your answers if necessary.

4. Transcribe notes from session.

Persons one and two together

Compare your answers to pages three to seven after reviewing your notes. Fill out a joint protocol for these pages. Answers that are only one number apart can be indicated with an adjoining mark. Answers that are more than one point apart should be discussed and a consensual answer arrived at. Indicate reasons for original disagreement (e.g. in first part of class, instructor acted more as a facilitator, but later lectured).

Observational guidelines, p. 2

<u>Questions to ask teacher after session:</u>

How did you feel about today's class?

What went well? How was it different from what you expected (in both good and bad ways)?

Ask about specific activities.

What would you do differently next time?

How was today typical or not of what you do in math/science when the implementation specialist is not with you?

How did you feel about the participation of the implementation specialist?

How much have you changed your teaching style because of your experiences with TAMS? In what ways?

How much have you changed the content of what you teach because of your experiences with TAMS?

In what ways has TAMS been helpful?

What kinds of support do you get from your principal, LSC? (encouragement, materials, time)?

What suggestions do you have for TAMS?

<u>Questions to ask instructor after session:</u>

How did you feel about today's class?

What did the teacher do well? What did you like about what happened?

What did you like about what you did?

How was it different from what you expected (in both good and bad ways)?

Ask about specific activities.

Observational guidelines, p. 3

What would you do differently next time?

- What would you like the teacher to do differently?

How was today typical of your experiences with this teacher?

- How was this session typical of your experiences with other teachers in this school?

I. TEACHER FOCUS GROUP PROTOCOL

When did you first become involved with TAMS as a school? What is your current involvement (only need as baseline information from one person, with corroboration from others)? Have others' experiences been different?

Please describe the initial process of becoming involved--how were you introduced to TAMS, how much information did you get, how was it decided that your school would participate? What were your initial expectations?

What did you find helpful about the way the formal instruction was organized?

I'd like to hear your views about the good features and any problems you noted with the formal instructional part of the math program. First, the good features?

Any problems?

Describe your experiences during the "intensive phase" with the instructor(s) who came to your school.

What was it like for you when you went into the less intensive phase?

How applicable and adaptable did the material/processes seem to what you were doing in your classroom?

Personally, what have you gained as a teacher from your involvement with TAMS? (interest, enthusiasm, knowledge of instructional methods, knowledge of science/math, new ways to think about curriculum, assessment....) Was there one particular aspect that was most important?

In what ways have you changed your own classroom practices because of what you learned at TAMS? Give me an example of something you do differently now. What has that replaced?

How responsive have the children been? Do you see changes in their understanding of science/math? In their interest and enthusiasm for science/math? How do you know?

How much do you participate in other TAMS related activities--the Resource Network workshops, e-mail, etc. -- and in what ways are these helpful?

Are there any other kinds of assistance given by TAMS that no one has mentioned? If so, how helpful have these been?

I. TEACHER FOCUS GROUP PROTOCOL (page 2)

Specifically (if not mentioned), what kinds of assistance did you get on how to adapt the material you covered to your curriculum?

How has your whole school experience changed because of working with TAMS--how do teachers work together? What has been parent interest/involvement?

How is TAMS' staff development program related to the changes towards school-based management?

How do you plan to keep the ideas alive once TAMS staff are no longer at your school?

How would you compare the Academy's programs to other science/math staff development programs you've participated in?

What suggestions would you like to give the people at TAMS to make their program work even better?

J. PARENT FOCUS GROUP PROTOCOL

How long have you been connected with the xxxxx School? What children do you have in the xxx School now? In the past? (ask each person)

In what ways have you been active in the school? (ask each person)

For those of you who have been connected with the xxx School since before the Local School Councils were created, how is the xxx School different now?

How do you feel about the kinds of changes that have occurred?

When and how did you first hear about the work of the Teachers' Academy?

What do you know about what the Academy is trying to do at the xxx School? As a parent, how do you feel about its goals and its activities at the xxx School?

Have you participated in any workshops that the Teachers' Academy has given to parents and families, like Family Math and Family Science? What were those like? How many parents from the xxx School participated in these activities? Did they change the way you work with your child at home? In what ways?

How many of you are a part of a parent group that regularly meets to talk about education in science and math? How many parents are regularly a part of that group? What happens in that group? Has it been helpful? What would you like to see happen in the group?

Are there any other ways that the Teachers' Academy has helped you as a parent?

Do you feel that teaching of science/math has changed since the Academy has been at the school? In what ways? How do you know this?

Have your children talked about new kinds of science/math activities at school? How do they seem to like these activities?

Do you think your attitudes toward or understanding of math and science education have changed because of any activities the Teachers' Academy has sponsored? If so, in what ways have they changed? (Do math and science seem more important, more relevant?)

Do you think that the Academy does enough to inform parents about what it is doing and why science and math are important? What else might it do?

J. PARENT FOCUS GROUP PROTOCOL (page 2)

What kind of contact have you had with any of the staff from the Academy? Which staff?

Have you made any suggestions to any of them, and if so, how responsive have they been to any of your suggestions?

What questions do you have for the Academy? Suggestions?

APPENDIX 2

TOWARD A TEMPLATE FOR THE COMPONENTS OF BUILDING EFFECTIVE NEW ORGANIZATIONS

TOWARD A TEMPLATE FOR THE COMPONENTS OF

BUILDING EFFECTIVE NEW ORGANIZATIONS

by Mary Ann Scheirer and Belle Brett

Developed for the

Study of the Teachers' Academy for Mathematics and Science in Chicago

By the
National Center for Improving Science Education
A Division of THE NETWORK, Inc.
Andover, MA

Under a grant from the U.S. Department of Energy
Margaret Dwyer, Program Officer

March, 1994

TOWARD A TEMPLATE FOR THE COMPONENTS OF BUILDING EFFECTIVE NEW ORGANIZATIONS

Introduction

This document draws upon the experience of the National Center for Improving Science Education (NCISE) in developing templates for profiling effective teaching practices in science and mathematics education. A template is a tool, intended initially for formative evaluation, that provides an outline for describing what is happening in a program. Other templates developed by NCISE focus on specific types of programs for improving science education, such as teacher development programs or systemic change programs. Such templates can be used internally by project staff or by external project evaluators to analyze what is happening in the project in comparison with what is considered "best practices" in that program area.

In contrast to other templates developed by NCISE, the literature about starting up new organizations does not yet present a well-agreed on picture of what the "best practices" for building effective new organizations might be. Therefore, this template contains our consensus on what organizational components ought to be considered by those responsible for a new organization, and hypotheses about what is needed to get a new unit off the ground. It is intended to be suggestive, rather than prescriptive.

In our current study of the Teachers' Academy for Mathematics and Science (TAMS), it became apparent early in our orientation that the development of TAMS as an organization played a large role in its capacity to engage teachers in effective professional development activities. Thus, our study undertook to examine what could be learned about TAMS' history as an organization, that might be helpful in a broader context. New organizations, or new organizational units within a larger organization, are frequently started up to address an emerging problem area or to deliver an innovative program. Can TAMS' experience provide guidance for other developing organizations that will ease their growing pains?

It is important for new and developing educational assistance organizations to focus both on the content of their programs and on how to establish and maintain a viable organization to implement the program elements. Too often, the organizational aspects are not planned for when developers' focus is on creating and delivering an exciting new program. Or worse, a smoothly functioning organization is viewed as unnecessary "bureaucracy" and project leaders attempt to avoid thinking about these components entirely. In any project requiring more than a handful of staff members, some organizing processes will be necessary. The literature about the implementation of new programs is full of examples about well-intended programs sinking into a morass of organizational problems that could have been anticipated.

Purposes

As it exists now, this organizational template has several potential areas of use: 1) initially, for NCISE's summative analysis of TAMS, to examine how it developed in relation to these components; 2) for use as a formative assessment and planning tool by TAMS and other new start-up organizations (or new units growing out of older organizations); and 3) as a tool for governmental agencies to use in analyzing proposals for funding. Has the proposal addressed the major components for effective organizational growth with a developmental plan that seems realistic? Thus, the primary purpose of our initial work with TAMS is <u>not</u> technical assistance to aid its current developmental status, but summative evaluation to assess how it "arrived at" its current organizational state.

This template provides an introductory checklist of key elements that are likely to affect organizational success, along with brief commentary and some references. The term "organizational success" refers to the organization's capacity to maintain itself as an organization, to operate reasonably smoothly and efficiently, and to provide a satisfactory working environment for its members. For this template, we are <u>not</u> referring to the effectiveness of its program activities in addressing its goals. Analytically, it is possible for an organization to be "successful" in maintaining itself as an entity without effectively serving its goals, or an entity may be attempting to deliver very effective program activities while not maintaining itself as an organization. Ideally, the program content activities will be supported by a successful organization, but in many real world cases there is divergence between these two major strands, especially in non-profit or governmental organizations. This template is intended to aid in the analysis of the organizational components, while other templates developed by NCISE address the program components involved in teacher development or educational system change, for example.

The template is based on the authors' twenty years of organizational analysis, on consultation with the research literature about organizational behavior, and on commentary and feedback from others at NCISE and DOE. This work is intended to be suggestive, as the literature is not definitive about which components are *necessary* for an organization to be developed, and which are merely desirable, but not critical to achieving a smoothly running new organization. Particularly in this project assessing TAMS, our purpose is to draw lessons learned from its experience, rather than to criticize it against a set of criteria that were not available in this form in its beginning.

The format of this template has been changed from others developed by NCISE, which had three columns: 1) the "Components of Effective Practice;" 2) the elements or design of the "Intended Program;" and 3) the "Actual Program," as observed. These categories may be less applicable to the topic of TAMS' organizational implementation, which took place over an extended period of time, and is being examined retrospectively. Particularly for TAMS, the intended organizational components would be difficult to reconstruct for this analysis, which was undertaken more than four years after TAMS' start up. Therefore, we changed the column headings for this draft version to: 1) specifying the "Components of Effective New Organizations;" 2) a column to summarize

"What Happened at TAMS?," and a third column to record our assessment of the "Likely Consequences" of the way each component has been addressed. For use as an evaluation tool, the "likely consequences" column will be used to attempt to trace the later results of the early organizational set up. In essence, it attempts to look at "so what?" if a particular organization component was not well developed.

For use as a planning tool to advise current practice, a two column format may be sufficient, with one column specifying the organizational components and a second for the specific plans for addressing that component. For formative evaluation, a three column format may be useful, particularly if the items in the template are used for technical assistance, with a second column for "Intended Components" and a third for "Current Status." The column headings can easily be adapted to its specific use.

The use of such a template in the context of government proposal review has not yet been explored. The template is likely to require modification to summarize some sections and to focus on the components that are documentable in a written proposal. Reviewers may need prior background in organizational *analysis* in order to review and score these factors. Again, the column headings would need to be modified for this use.

In the draft template which follows, we use the word "unit" rather than "organization" to refer to the entity being developed, because the template is intended to apply both to a new, free-standing organization, such as TAMS, and to a reasonably distinct new branch or division that is formally part of an existing larger organization, such as a new "Center for ....." or new Division of XXX. For an entity that is formally part of a larger organization, further examination of its location within, and relationships with, the larger organization may be desirable. The template may also apply to other non-profit organizations, in addition to educational organizations, which operate as service providing organizations whose funding sources are not derived from the clients who receive the services. This characteristic makes such organizations quite different from commercial organizations whose revenues are derived directly from the services provided.

References

The literature consulted in deriving this template includes both academic, research-based references on organizational behavior and several sources aimed particularly at helping people to create new entities. We have included several sources about entrepreneurship, because these writers explicitly confront the problems of *new* organizations, which is not frequently a topic covered in general works about organizational topics. Key references are listed after the template.

TEMPLATE FOR BUILDING EFFECTIVE NEW ORGANIZATIONS

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
1. Mission/Goals of Organizational Unit		
a. Key developers have agreement on and commitment to a well-understood mission and goals for the unit.		
b. The nature and the needs of intended clients are clearly identified, and clients are included in organizational planning, if feasible.		
c. The unit's goals are clearly connected with a set of intended outcomes, specified in measurable terms.		
d. Establishing and maintaining itself as an organization is included as a legitimate part of the organization's mission.		
2. Program Components		
a. The program components to be delivered are clearly connected to the overall mission, and to the needs articulated for and by the organization's clients.		
b. The effectiveness of the specific program components has been established by prior research; or the unit includes a research component to rigorously assess the effectiveness of its components, as delivered.		
c. A clear picture is articulated of the feasibility of the program components for addressing the unit's mission and goals (over–simplification and over-promising are avoided).		
d. The program components are comprehensive enough to address key aspects of the needs identified.		
e. Marketing plans and procedures are established to obtain and continue intended client participation.		

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
3. Evaluation Plans and Processes		
a. The unit establishes a plan for collecting and using evaluative data that articulate its operational goals.		
b. Evaluation data assess whether the clients served are those appropriate for its mission and goals.		
c. Evaluation plans and processes include indicators of success linked to each stage of the intended program components (e.g., in a management information system).		
d. A realistic time line for conducting different types of evaluation (formative and summative) is established.		
4. Legal Entity Established		
a. The organization's legal status (e.g., as a free-standing structure, part of a governmental organization; or part of another private organization, such as a university) is appropriate for its mission and environment.		
b. If a Board of Directors is established as the governing body having legal responsibility for the unit, it focuses on major decisions pertaining to broad courses of action, rather than decisions about day-to-day operations.		
c. If an Advisory Council is established, it helps to link the unit with other key organizations in its environment and/or to provide expertise needed by the unit.		
d. Members of any Board of Directors or Advisory Council are chosen for their relevance to the functions they are to serve, and receive orientation and training as needed for boardsmanship.		
5. Leadership		
a. A single person has overall authority for managing the organization, as well as the charisma to articulate its mission both internally and externally.		

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
b. The key leadership team has skills and experience in the content area of the program components (e.g., in math and science education) and in both external and internal management.		
c. There is continuity of leadership from the period of establishing the organizational unit through the first several years of operation, although the leadership emphasis may evolve as the organization grows.		
d. The leadership team is able to balance priorities between developing the programmatic mission, creating the necessary administrative mechanisms, and supporting creative growth and contributions among staff members.		
e. If the new unit is part of an existing organization, there is strong support from the leaders of the larger entity.		
f. As the unit grows, leadership is delegated appropriately to sub-division heads, for example, in becoming part of the leadership team.		
g. The staff leadership and the Board of Directors remain in harmony, with clearly differentiated roles.		
6. Staffing		
a. The roles needed (both professional and support) to carry out the program components and all other tasks are appropriately identified and related to each other in an organizational structure.		
b. Supporting staff are included in appropriate relationships to senior staff.		
c. People with needed skills and experience backgrounds are available, recruited and hired, in a timely manner.		

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
d. Staff members' skills are effectively utilized and rewarded, both financially and via feedback from supervisors and co-workers.		
7. Resources/Finances		
a. The financial resources available are appropriate for the stage of organizational development and scope of program activities.		
b. Funding organizations' goals and priorities are fully congruent with the mission of this organizational unit.		
c. Resources are appropriately allocated among both programmatic and support components.		
d. Sufficient time and attention are allocated for generating new and continuing resources, and responsibility assigned for resource development.		
e. Some flexibility in allocation of resources is maintained, with slack for meeting unforseen contingencies.		
f. Space and physical facilities are obtained that are adequate for the numbers of staff members and the program activities being carried out.		
8. Administrative Processes		
a. Normal operating routines and procedures are established, but are not used as rigid rules.		
b. Modern procedures are established for support functions, such as financial management, personnel recruitment and administration, purchasing supplies and equipment, and operating and maintaining equipment, such as computers.		
c. Procedures for trouble-shooting and problem solving are built into the organization's operating culture and expectations.		

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
9. Communications		
a. Good internal communication channels are established to foster both formal and informal communications, both vertically and horizontally.		
b. Administrators actively support and work with staff members in developing and delivering the program components, while utilizing the contributions of each staff member in their areas of expertise.		
c. The sub-divisions of the unit maintain good communications with each other, as the organization grows.		
10. Relationships with Environments		
a. Key leaders (or others influential in the start up) maintain strong lines of communication with all important sectors of influential environments: clients, fundors, regulating agencies, and potential competitors.		
b. The processes of establishing the new organization do not alienate key figures in related organizations, if the support of those organizations will later be crucial.		
c. If part of a larger organization or collaborating coalition, the unit has appropriate linkages and division of tasks/activities with the collaborating entities.		
d. Staff members monitor and contribute to their broader environments, such as the local and national media, and professional (educational and scientific) organizations.		
e. The unit does not experience excessive disturbance from the environment, such as political controversies or the exit of key supporters.		

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
11. Time Table and Scope of Operations		
a. The scope of program delivery is scaled to start small, then expand in an ordered process in relation to resources and staffing available.		
b. Adequate time is allowed for program development and testing before expanding to full scale delivery.		
c. Schedules for accomplishment of interim milestones are present, but are not inflexible when unforeseen problems occur.		
d. Organizational plans include expectations for organizational growth and change that cannot be anticipated at the beginning.		
e. Sufficient elapsed time is allowed before expecting outcome effects to be evaluated.		

REFERENCES

Basch, Charles, et al., "Avoiding Type III Errors in Health Education Program Evaluations: A Case Study." *Health Education Quarterly.* 1985, *12*, 315-331.

Berman, Paul. "The Study of Macro- and Micro-Implementation." *Public Policy,* 1978, *26*, 157-184.

Dyer, Delwyn A. and Oscar M. Williams. *Developing Effective Boards, Councils and Commissions.* Center for Volunteer Development, Virginia Cooperative Extension Service, Virginia Polytechnic Institute and State University, Blacksburg, VA, 1991. (Available through ERIC, ED 340 913).

Goggin, Malcolm. *Policy Design and the Politics of Implementation: The Case of Child Health Care in the American States.* Knoxville, TN: University of Tennessee Press, 1987.

Goggin, Malcolm, Ann O'M. Bowman, James P. Lester and Laurence J. O'Toole, Jr. *Implementation Theory and Practice: Toward a Third Generation.* Glenview Il: Scott, Foresman/Little Brown, 1990.

Goodman, R.M. and A.B. Steckler. "Mobilizing Organizations for Health Enhancement: Theories of Organizational Change." In K. Glanz, F.M. Lewis, and B.K. Rimer (Eds.). *Health Behavior and Health Education: Theory, Research and Practice.* San Francisco: Jossey-Bass, 1990.

Hall, G.E. and S.F. Loucks. "A Developmental Model for Determining Whether the Treatment is Actually Implemented. *American Educational Research Journal,* 1977, *14*, 263-276.

Hatry, Harry P., Elaine Morley, Brenda Ashford and Timothy M. Wyatt. *Implementing School-Based Management: Insights into Decentralization from Science and Mathematics Departments.* Washington DC: The Urban Institute, 1993.

Herriott, Robert E. and Neal Gross, Eds. *The Dynamics of Planned Educational Change.* Berkeley, CA: McCutchan, 1979.

Jacobson, Harvey. "The Michigan Awareness Program: A Case Study in Effective External and Internal Organizational Communication." Paper presented at the Annual Meeting of the International Communication Association. Honolulu, HI, May 23, 1985. ERIC # ED 261 441

Katz, Daniel and Robert L. Kahn *The Social Psychology of Organizations.* New York: John Wiley, 1966 (new edition?)

Krepel, Thomas L. et al. "The Minnesota Educational Effectiveness Program Research and Development Project: An Analysis of the Organizational Characteristics of the Minnesota Educational Effectiveness Program." Unpublished Report, Saint Cloud University, Minnesota. 1991. ERIC # ED 344 289.

McDonald, R.M. "Assessment of Organizational Context: A Missing Component in Evaluation of Training Programs." *Evaluation and Program Planning*, 1991, *14*, 273-279.

Palumbo, D. J. and D. J. Calista, Eds. *Implementation and the Policy Process: Opening Up the Black Box.* New York: Greenwood Press, 1990.

Pressman, J.L., and A.B. Wildavsky. *Implementation, 2nd Edition.* Berkeley: University of California Press, 1984.

Roberts-Gray, C. and M.A. Scheirer. "Checking the Congruence Between a Program and Its Organizational Environment." In K.J. Conrad and C. Roberts-Gray (eds.) *Evaluating Program Environments,* New Directions for Program Evaluation, No. 40. San Francisco: Jossey-Bass, Winter, 1988.

Sarason, Seymour B. *The Creation of Settings and the Future Societies.* San Francisco: Jossey-Bass, 1972.

Scheirer, Mary Ann. *Program Implementation: The Organizational Context.* Beverly Hills, Sage, 1981.

Scheirer, Mary Ann, et al. *Innovation and Enterprise: A Study of NSF's Innovation Centers Program.* Unpublished report prepared for the National Science Foundation. Rockville, MD: Westat, Inc. December, 1985.

Welsh, John A. and Jerry F. White. *The Entrepreneur's Master Planning Guide: How To Launch a Successful Business.* Englewood Cliffs, NJ, 1983.

APPENDIX 3

TOWARD A TEMPLATE FOR MATHEMATICS AND SCIENCE STAFF DEVELOPMENT PROGRAMS IN A SYSTEMIC CONTEXT
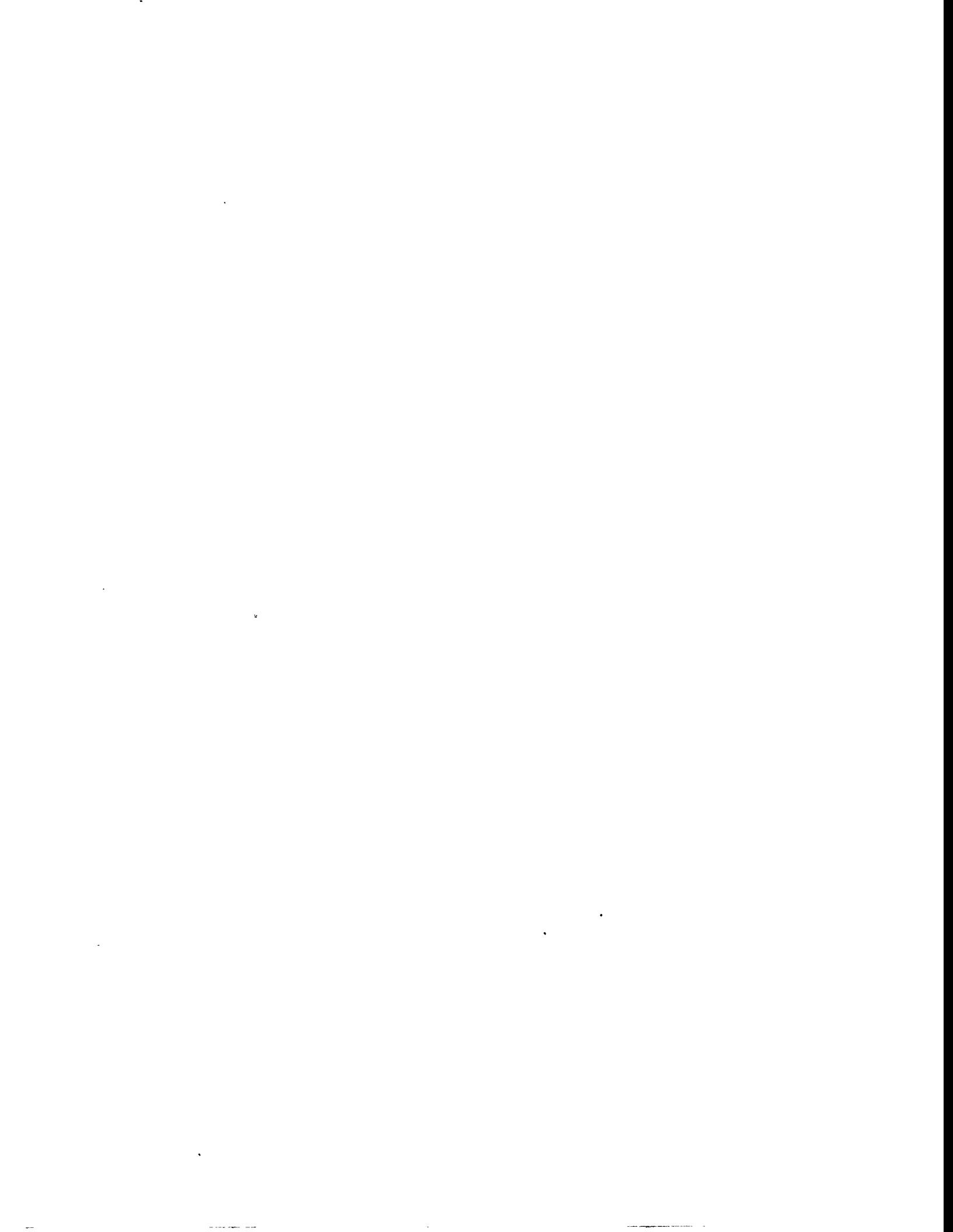
TOWARD A TEMPLATE FOR MATHEMATICS AND SCIENCE STAFF DEVELOPMENT PROGRAMS IN A SYSTEMIC CONTEXT

This document presents a newly adapted instrument, "A Template for Mathematics and Science Staff Development Programs in a Systemic Context", for use as both a formative and summative evaluation tool. A template is a tool that provides an outline for describing what is happening in a program. Templates for formative evaluation have been developed by the National Center for Improving Science Education (NCISE) for profiling effective practices in science and mathematics education. Templates can be used internally by project staff or by external project evaluators to describe what is intended to happen in the program and what is actually happening in the program in comparison with what is considered "best practice" in that program area.

The NCISE template series, which is still under development, includes a template for staff development and one for systemic programs. The literature on staff development is somewhat clearer about what constitutes "best practice" than is the literature on systemic initiatives. The research and evaluation field has not yet had time to assess which combinations of factors may be most effective for systemic change in education. However, the literature *is* suggestive of a number of aspects that help define whether or not an initiative is systemic.

This template was developed specifically for our current study of the Teachers' Academy for Mathematics and Science (TAMS). TAMS is playing a rather unusual role in the world of educational reform. As an independent, not-for-profit organization, not formally affiliated with any school system, school, university, or state board of education, TAMS has outlined its stated purpose as to "enable the 'systemic reform' of instruction in science, mathematics, and technology (TAMS renewal application to DOE, p. 1, 1993). Most of the literature on systemic reform refers to larger entities, especially states, as the chief instigators of such reform. The systemic template developed by NCISE also pertains more appropriately to larger initiatives, whose goal is to have many players take responsibility for change. TAMS hopes to involve others in a partnership for change, but on a smaller scale. Its own focus for change is at the school level.

Because of the particular mission and activities of TAMS, it made sense to combine the appropriate components from NCISE's staff development and systemic templates, rather than complete two separate templates. Most components from both templates were used as developed or slightly modified. Only those elements which overlapped with the new organizational template (see Appendix 2) were eliminated completely. Some additional components not on either template were added after reviewing the literature on systemic change. The resources list at the end of this appendix includes the resources from both the original staff development and systemic templates as well as many new listings. The template was reviewed by key NCISE staff, including the key developers of the original templates.

For this study, the template has been used as a summative instrument, to analyze the current status of TAMS, with the understanding that TAMS is still evolving its organization and its programs. The data presented are akin to a frame from a moving picture film and will no doubt be revisited. In this sense, the findings will serve formative purposes as well.

A TEMPLATE FOR MATHEMATICS AND SCIENCE STAFF DEVELOPMENT PROGRAMS IN A SYSTEMIC CONTEXT*
(to be used in conjunction with "A Template for the Components of Building Effective New Organizations")

Components of Effective Practice	Intended	Actual
1. Vision of the Program		
a. Developed through a collaborative, consensus process by all relevant stakeholders (e.g. teachers; school leaders; community, college, university, and state board of education representatives, and scientists/mathematicians)		
b. Shared and articulated by all relevant stakeholders.		
2. Program Design and Delivery		
a. Within the program, curriculum and materials, instructional strategies, and assessment are aligned with-- • the vision • each other • best practices for teaching students in mathematics/science and for teaching adults • district, state, and national standards • school infrastructure issues • community support		
b. The program emphasizes development among teachers of higher order skills, a common core of content, and judgment about how to make decisions regarding curriculum.		

---

*Focus is on school as the unit of change.

National Center for Improving Science Education

Components of Effective Practice	Intended	Actual
c. Learning activities are spread out over time.		
d. The school as the unit for program delivery (e.g. teachers may not participate as individuals but only as part of a school team).		
e. A majority of teachers in each school unit agree to participate in the staff development program.		
f. Schools engage in collaborative needs assessment and program planning with the staff development program to take into account individual needs.		
3. Attention to Equity Specific strategies address equity issues (e.g. gender, race, ethnicity) issues, including--		
a. Equitable recruitment and selection of schools.		
b. Sensitivity by program instructors and implementers in choice of instructional strategies and practices used with participating teachers and with children in relation to different cultures, languages, learning styles and gender.		
c. Sensitivity in materials and program content in relation to different cultures, languages, learning styles, and gender.		
d. Equitable allocation of resources among schools and teachers.		
4. Vision of the School and Classroom Emphasizes		
a. A belief that all children can learn challenging material in mathematics and science.		

Components of Effective Practice	Intended	Actual
b. Deep understanding by students of major science/math concepts or principles, development of skills, and scientific habits of mind.		
c. A hands-on, minds-on instructional approach that includes student investigations, discovery, and application.		
d. Depth of study (fewer concepts) in classroom instruction.		
e. Balance between content and process in classroom instruction of science and mathematics.		
f. Use of real world problems.		
g. Ongoing, authentic assessment of important learning outcomes for students.		
h. Integration of mathematics and science, and with other areas of study		
i. Active use of learning resources within the community (e.g. museums).		
5. Teacher Development Program Activities		
a. Are appropriately designed for adult learners; • focus on growth rather than defects • relevant and practical • focus on teachers' interests and concerns • link teachers to resources and support • build on teachers' current knowledge and experience		

Components of Effective Practice	Intended	Actual
b. Model teaching principles and strategies that can be transferred to the classroom.		
c. Allow teachers to actively construct knowledge through hands-on activities.		
d. Include the use of tools, methods, and processes of scientists and mathematicians.		
e. Include actual or simulated problems or challenges of "real world" science or math.		
f. Are designed so teachers learn cooperatively in small groups.		
g. Include opportunities to practice and discuss new classroom behaviors or strategies.		
h. Include opportunities for teachers to plan together (at their own grade level and with others from their own schools) for use of new knowledge and skills in their own classrooms, with their own curricula.		
6. Follow-Up Support for Teachers		
a. Follow-up is provided over time to create sustained change in teacher classroom behaviors.	.	
b. Follow-up focuses specifically on the use of new knowledge and skills in the classroom.		
c. Follow-up takes a variety of forms, including additional training (e.g. direct instruction, modeling, co-teaching, coaching), problem-solving or sharing meetings, on-site or telephone conversations, networking through newsletters or telecommunications, training and support of local resource teachers or others to provide ongoing assistance.	.	

Components of Effective Practice	Intended	Actual
d. Long-term commitment includes material, moral, logistical, technical, and symbolic support from the teacher enhancement program staff, or as a result of arrangements made by the program from the school or community.		
7. Teachers' Leadership Responsibility		
a. Some teachers take on leadership responsibilities in aspects such as program development, delivery, implementation, follow-up and spread to other colleagues.		
b. Teachers have input and/or involvement in decisions about the content, process, implementation, and/or evaluation of their learning experiences.		
c. Teachers are given support by the teacher enhancement program for leadership and networking with people outside the program, such as teacher colleagues and professional associations.		
8. Building the Capacity of the School as a System The staff development program and the participating teachers and principal pay attention to:		
a. Showing commitment to change by creating and institutionalizing an infrastructure for change and renewal, including commitment of: • time • money • personnel • other resources • creation of appropriate learning environment		

Components of Effective Practice	Intended	Actual
b. Developing collaboration skills among teachers.		
c. Developing leadership and change agent skills and attitudes among teachers and principals.		
d. Developing an understanding of and use of systems thinking concepts, disciplines, and tools (including an understanding of how all parts of the system align).		
e. Active networking among participants and with other change efforts (e.g. state and district policies).		
f. Development of parental support for and understanding of changes.		
g. Integrating all the components.		
h. The teacher enhancement program models behaviors and strategies of collaboration, risk-taking, continuous reflection, and quality.		
9. Program Evaluation		
a. Monitoring of participant satisfaction during the program and follow-up activities identifies needed changes which are made immediately as soon as appropriate and feasible.		
b. Ongoing formative and summative evaluation of important program outcomes involves data collection from a variety of sources, with resulting changes in program design.		

Components of Effective Practice	Intended	Actual
10. Public Support		
a. Specific strategies are used to mobilize public support for change.		
b. Specific communication and engagement strategies are used to involve non-collaborating stakeholders (e.g. legislators, special interest groups) in the effort.		
c. The teacher enhancement program examines and is involved with state and local policymaking that has an impact on school and classroom practices and allocation of resources (e.g. assessment, standards).		

Developed by the National Center for Improving Science Education, 1994

REFERENCES

American Association for the Advancement of Science. *Science for All Americans: A Project 2061 Report on Literacy Goals in Science, Mathematics, and Technology.* Washington, D.C.: American Association for the Advancement of Science, 1989.

Anderson, B. "The Stages of Systemic Change." *Educational Leadership,* 1993, 51:1, 14-17.

Astuto, T.; Clark, D.; Read, A-M.; McGree, K.; deKoven Pelton Fernandez, L. *Roots of Reform: Challenging the Assumptions that Control Change in Education.* Bloomington, IN: Phi Delta Kappan Educational Foundation, 1994.

Brandt, R. "On Restructuring Schools: A Conversation with Mike Cohen." *Educational Leadership.* May 1991, 54-58.

Bybee, R.; Buchwald, C.E.; Crissman, S.; Heil, D.R.; Kuerbis, P.; Matsumoto, C.; and McInerney, J. *Science and Technology Education for the Middle Years: Frameworks for Curriculum and Instruction.* Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1990.

Bybee, R; Buchwald, C.E.; Crissman, S.; Heil, D.R.; Kuerbis, P.; Matsumoto, C.; and McInerney, J. *Science and Technology Education for the Elementary Years: Frameworks for Curriculum and Instruction.* Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1989.

Clark, D. and Astuto, T. "Redirecting Reform: Challenges to Popular Assumptions about Teachers and Students." *Phi Delta Kappan,* March 1994.

Corcoran, T.; Goertz, M.; and Shields, P. *Study of NSF's Statewide Systemic Initiatives (SSI) Program: Case Study Data Collection Plan.* Menlo Park, CA: SRI International, 1992.

David, J. "What It Takes to Restructure Education." *Educational Leadership.* May 1991, 11-15.

Division of Research, Evaluation, and Dissemination Directorate for Education and Human Resources. *Indicators of Science and Mathematics Education 1992.* Ed. Larry Suter. Washington, D.C.: National Science Foundation, 1993. NSF 93-95.

Elmore, R. and Associates. *Restructuring Schools: The Next Generation of School Reform.* San Francisco: Jossey Bass, 1990.

Frechtling, J. "The Many Faces of Systemic Change." Paper presented at the American Educational Research Association, New Orleans, April 1994.

Fuhrman, S. *Designing Coherent Education Policy: Improving the System.* San Francisco: Jossey-Bass, 1993.

Fullan, M. *Change Forces: Probing the Depths of Educational Reform.* London: The Falmer Press, 1993.

Fullan, M. and Hargreaves, A. (Eds.) *Teacher Development and Educational Change.* London: The Falmer Press, 1992.

Fullan, M. "Staff Development, Innovation, and Institutional Development." In B. Joyce (Ed.), *Changing School Culture through Staff Development*, The 1990 ASCD Yearbook. Alexandria, VA: Association for Supervision and Curriculum Development.

Joyce, B. and Showers, B. *Student Achievement through Staff Development.* New York: Longman, 1988.

Knowles, M. *The Adult Learner: A Neglected Species.* Third Edition. Houston: Gulf Publishing Company, 1984

Kober, N. *EDTALK: What We Know about Science Teaching and Learning.* Washington, D.C. Council for Educational Development and Research, 1993.

Krupp, J. "Staff Development and the Individual." In S. Caldwell (Ed.). *Staff Development: A Handbook of Effective Practices.* Oxford, OH: National Staff Development Council, 1989.

Lacampagne, C. *State of the Art: Transforming Ideas for Teaching and Learning--Mathematics.* Washington, D.C.: U.S. Department of Education, 1993.

Lieberman, A.; Darling-Hammond, L.; Zuckerman, D. *Early Lessons in Restructuring Schools.* New York: National Council for Restructuring Education, Schools, and Teaching, 1991.

Lieberman, A. and McLaughlin, M. "Networks for Educational Change: Powerful and Problematic." *Phi Delta Kappan,* May 1992, 673-677.

Lieberman, A. and Miller, L. "Restructuring Schools: What Matters and What Works." *Phi Delta Kappan,* June 1990, 759-764.

Little, J. *Teachers' Professional Development in a Climate of Educational Reform.* New York: National Council for Restructuring Education, Schools, and Teaching, 1993.

Little, J. "Teachers as Colleagues." In. V. Koehler (Ed.), *Educator's Handbook: A Research Perspective.* New York: Longman, 1987.

Loucks, S. *The Concerns-Based Adoption Model.* Chapel Hill: The Technical Assistance Development System, 1983.

Loucks-Horsley, S.; Harding, C.; Arbuckle, M.; Murray, L; Dubea, C.; and Williams, M. *Continuing to Learn: A Guidebook for Teacher Development*. Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1987.

Loucks-Horsley, S.; Brooks, J.; Carlson, M.; Kuerbis, P.; Marsh, D.; Padilla, M.; Pratt, H.; Smith, K. *Developing and Supporting Teachers for Science Education in the Middle Years*. Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1991.

Loucks-Horsley, S. and Stiegelbauer, S. "Using Knowledge to Change and Guide Staff Development." In A. Lieberman and L. Miller (Eds.), *Staff Development for Education in the 90's: New Demands, New Realities, New Perspectives*. New York: Teachers College Press, 1991.

Loucks-Horsley, S.; Carlson, M.; Brink, L; Horwitz, P.; Marsh, D.; Pratt, H.; Roy, K.: and Worth, K. *Developing and Supporting Teachers for Elementary School Science Education*. Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1981.

Lusi, S. "Systemic School Reform: The Challenges Faced by State Departments of Education." In *The Governance of Curriculum*. Alexandria, VA: Association for Supervision and Curriculum Development, 1994.

Mace-Matluck, B. *Research-Based Strategies for Bringing about Successful School Improvement*. Austin: Southwest Educational Development Laboratory, 1986.

Mills, G. *Trends and Issues:A Consumers' Guide to School Improvement*. Eugene, OR: ERIC Clearinghouse on Educational Management, 1990.

Murphy, J. *Policy Issues: Restructuring America's Schools*. Charleston, WV: Appalachia Educational Laboratory and Nashville: National Center for Educational Leadership, 1990.

National Center for Improving Science Education. *Profiling Teacher Development Programs: An Approach to Formative Evaluation*. Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1993.

National Center for Improving Science Education. *Profiling·Systemic Programs*. (draft version). Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1994.

North Central Regional Laboratory. *1992 Chicago School Reform Study Project*. Oak Brook, IL: North Central Regional Laboratory, 1992.

Northwest Regional Educational Laboratory. *Effective Schooling Practices: A Research Synthesis 1990 Update*. Portland: Northwest Regional Educational Laboratory, 1990.

Northwest Regional Education Laboratory. *Summary of National Reform Recommendations*. Portland: Northwest Regional Educational Laboratory, 1987.

Raizen, S; Baron, J: Champagne, A; Haertel, E; Mullis, I; and Oakes, J. *Assessment in Elementary School Science*. Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1989.

Raizen, S; Baron, J: Champagne, A; Haertel, E; Mullis, I; and Oakes, J. *Assessment in Science Education: The Middle Years*. Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1990.

Regional Laboratories. *Facilitating Systemic Change in Science and Mathematics Education: A Toolkit for Professional Developers* (Field test version). Andover, MA: NorthEast Regional Laboratory, 1993.

O'Neil, J. "On Systemic Reform: A Conversation with Marshall Smith." *Educational Leadership*. September 1993, 12-18.

Rosenholtz, S. *Teachers' Workplace*. New York: Longman, 1989.

Senge, P. *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday, 1990.

Shields, P.; Zucker, A.; and Hawkins, E. *Identifying Indicators for NSF's Statewide Systemic Initiatives (SSI) Program*. Menlo Park, CA: SRI International, 1993.

Siversten, M. *State of the Art: Transforming Ideas for Teaching and Learning — Science*. Washington, D.C.: U.S. Department of Education, 1993.

Smith, M. and O'Day, J. "Systemic School Reform." Politics of Education Association Yearbook 1990, 233-267.

SouthEastern Regional Vision for Education. *Hot Topics: Usable Research: Comprehensive School Improvement*. Tallahassee: SouthEastern Regional Vision for Education, 1991.

Sparks, D. "Evaluating Staff Development within Systemic Improvement Efforts: Part 2." *National Staff Development Council*. December, 1993/January 1994, 2-4.

The National Center for Improving Science Education's Study Panel. *The High Stakes of High School Science*. Andover, MA: The National Center for Improving Science Education, The NETWORK, Inc., 1992.

Timar, T. and Kirp, D. "Education Reform in the 1980's: Lessons from the States." *Phi Delta Kappan*. March 1989, 505-511.

Tobin, K. and Fraser, B. "What Does it Mean to Be an Exemplary Science Teacher?" *Journal of Research in Science Teaching.* 27, 1, 1990, 3-25.

Weiss, I. *Ohio SSI Year Three Evaluation Plan.* Chapel Hill, NC: Horizon Research, 1993.

Working Groups of the Commission on Teaching Standards. *Professional Standards for Teaching Mathematics.* Reston, VA: National Council of Teachers of Mathematics, 1991.

Working Groups of the Commission on Teaching Standards. *Curriculum and Development Standards for School Mathematics.* Reston, VA: National Council of Teachers of Mathematics, 1989.

APPENDIX 4

TEMPLATE FOR BUILDING NEW ORGANIZATIONS: TAMS' FIRST THREE YEARS

TEMPLATE FOR BUILDING NEW ORGANIZATIONS:
TAMS' FIRST THREE YEARS (1990-1992)

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
1. Mission/Goals of Organizational Unit		
a. Key developers have agreement on and commitment to a well-understood mission and goals for the unit.	**Not followed.** Developers had broad mission, but not consensus on specifics. Goals more political and personal (to create large scale change and to participate in reform movement), than programmatic.	Substantial contention arose among stakeholders during oversight of initial program delivery.
b. The nature and the needs of intended clients are clearly identified, and clients are included in organizational planning, if feasible.	**Minimally included.** Some teachers and principals included in initial planning; no systematic analysis of teacher's needs. Founders thought they knew teachers' needs.	Not a major problem in comparison with other aspects.
c. The unit's goals are clearly connected with a set of intended outcomes, specified in measurable terms.	**Not done.** Goals were not well specified enough to be measurable.	TAMS' evaluation has stumbled in attempts to measure broad goal statements; neither program delivery nor its management has been data-based.
d. Establishing and maintaining itself as an organization is included as a legitimate part of the organization's mission.	**Partially;** fund-raising has been the focus of much attention; but little explicit thought given to other original aspects.	Substantial time devoted to fund raising, perhaps to detriment of other components; organizational growth not explicitly managed.
2. Time Table and Scope of Operations		
a. The scope of program delivery is scaled to start small, then expand in an ordered process in relation to resources and staffing available.	**Not followed.** Vision was to start up a large scale program in first year. $5.6 million in funding obtained for FY '91.	TAMS had no time to grow organizationally or to develop its programs. The large scale aspirations dominated many other aspects.
b. Adequate time is allowed for program development and testing before expanding to full scale delivery.	**Not done.** Little understanding existed that program components needed to be developed.	Many staff members hired before their job roles defined; then their skills were not appropriate for the tasks to be done; credibility with CPS, schools and funders damaged.
c. Schedules for accomplishment of interim milestones are present, but are not inflexible when unforeseen problems occur.	**No realistic schedules developed;** planning was haphazard or non-existent.	In absence of realistic planning, staff efforts dominated by attempts to reach unrealistic numbers of teachers.

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
d. Organizational plans include expectations for organizational growth and change that cannot be anticipated at the beginning.	**Not done.** No contingency plans.	Difficulties of the tasks overwhelmed the organizational capacities; blamed on individuals rather than on absence of realistic planning.
e. Sufficient elapsed time is allowed before expecting outcome effects to be evaluated.	**Some recognition** that increase in student achievement should not be expected quickly; planning for measurement of intermediate outcomes not done until '92.	Funders kept pressing for results data to show to their audiences; pressure on TAMS to demonstrate results rather than to develop its program.
3. Program Components		
a. The program components to be delivered are clearly connected to the overall mission, and to the needs articulated for and by the organization's clients.	**Not fully done.** Major math (based on Math Tools©) and science (TIMS©) programs were related to overall mission, but other pieces developed in ad hoc fashion; many aspects remained vague, even though large scale delivery was being attempted.	Program not a fully systemic approach; much program development work was still needed, but not included in the staffing or time allocations.
b. The effectiveness of the specific program components has been established by prior research; or the unit includes a research component to rigorously assess the effectiveness of its components, as delivered.	**Partially followed.** Both Math Tools© and TIMS© had a basis in prior research, but not as a large-scale school change operation; evaluation unit funded by ED in late '91, but not well implemented.	TAMS has never had a data-based program development or management capability; not clear that its activities will result in intended outcomes for teachers or students.
c. A clear picture is articulated of the feasibility of the program components for addressing the unit's mission and goals (over-simplification and over-promising are avoided).	**Feasibility not addressed.** Much over-promising to funding agencies; extensive oversimplification among founders of the difficulties of changing teachers' behaviors.	Promises put pressure on staff to meet the unrealistic expectations; much time and effort expended in major re-assessments of activities and continued negotiations with funders, when initial promises not met.
d. The program components are comprehensive enough to address key aspects of the needs identified.	**Intended program somewhat comprehensive;** multiple components started up, including all-day programs for teachers, classroom follow-up, involvement of principals and parents, resource center; many aspects not fully implemented.	Staff attempted to do lots of different activities, without clear role definition; staff overload and confusion.
e. Marketing plans and procedures are established to obtain and continue intended client participation.	**Not done systematically.** Recruitment apparently done in ad hoc fashion; little analysis of whether a school was "ready" for TAMS approach.	Many schools brought in to intensive staff development that were not ready for this activity; staff time and efforts may have been wasted.

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
4. Evaluation Plans and Processes		
a. The unit establishes a plan for collecting and using evaluative data that articulate its operational goals.	**Evaluation was intended, but not well implemented.** Some funding for evaluation obtained by 1991; but collecting data was neglected in the confusion of program delivery and organizational growth.	TAMS decisions and actions not data based; scant data available for documenting activities or accomplishments for funders, which contributed to funding instability.
b. Evaluation data assess whether the clients served are those appropriate for its mission and goals.	**Not followed.** No formal attempts in the early period to assess readiness of schools or teachers, or to match program activities to differential backgrounds of teachers.	Some teachers and schools in TAMS who did not want to be in the program: frustration for staff and some wasted resources.
c. Evaluation plans and processes include indicators of success linked to each stage of the intended program components (e.g., in a management information system).	**Not done.** Intended program components not well enough specified; no data bases established in evaluation unit. Resource Center established a database.	Program components not systematically based on data feedback; little accountability data available for funders.
d. A realistic time line for conducting different types of evaluation (formative and summative) is established.	**Not done.** Evaluation plans not developed until 1992, and these do not include timelines for specific data collection or types of evaluation. No attention to collecting data suitable for inferring overall effectiveness at a later time.	Evaluation efforts mainly done on pilot basis; no systematic development from pilot to full-scale data collection; evaluation priorities not established within TAMS and among its funders.
5. Legal Entity Established		
a. The organization's legal status (e.g., as a free-standing structure; part of a governmental organization; or part of another private organization, such as a university) is appropriate for its mission and environment.	**Probably appropriate.** TAMS established as a free-standing organization, to be independent of CPS; also separate from university-based founders.	TAMS' ability to pursue activities independently has not been compromised; has high credibility among teachers and other stakeholders. But TAMS received little help in setting up its administrative systems, since it was not affiliated with a larger organization.
b. If a Board of Directors is established as the governing body having legal responsibility for the unit, it focuses on major decisions pertaining to broad courses of action, rather than decisions about day-to-day operations.	**Not done.** Governing structure was very complex, with a Council of University Presidents, a large Board of Trustees, and an Executive Committee of the Board. Founders on these bodies continued to intervene in many decisions.	Stakeholders were involved in daily operations; sometimes delaying or preventing actions of its leadership. Struggles for control appeared to take precedence over developing program components or sound organizational practices.

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
c. If an Advisory Council is established, it helps to link the unit with other key organizations in its environment and/or to provide expertise needed by the unit.	**Yes, partially.** The large Board of Trustees provided links to the many stakeholders groups involved; many groups continued active involvement. Not based on providing expertise for specific components.	TAMS established good links with many community & national components - universities, businesses, schools, CPS, museums, labs, federal agencies. These helped to bring eventual changes.
d. Members of any Board of Directors or Advisory Council are chosen for their relevance to the functions they are to serve, and receive orientation and training as needed for boardsmanship.	**Partially.** Chosen to be stakeholders for involved groups; distinctions between advisory and executive functions not maintained; no orientation or training for roles as Board members appears to have been provided.	Board got involved in political struggles among its members; initially, not helpful in solving TAMS internal problems.
6. Resources/Finances		
a. The financial resources available are appropriate for the stage of organizational development and scope of program activities.	**Not followed.** Initial resource allocation called for large scale program delivery, before organization or program components were developed. Aspirations were even larger than funding; so early efforts devoted to increased funding, rather than internal development.	A major error - created pressures to do too much too fast; many other organizational problems resulted from this.
b. Funding organizations' goals and priorities are fully congruent with the mission of this organizational unit.	**Not fully true.** Although NSF has had major mandates to improve science and math education, this is not historically a central part of DoE's mission.	Does not seem to have affected TAMS extensively, as DOE's involvement has been a positive push toward organizational and program improvement. Might have contributed to DOE's ambivalence over funding decisions.
c. Resources are appropriately allocated among both programmatic and support components.	**Partial.** Support systems not adequately developed, but probably not due to lack of funds.	Not a major problem.
d. Sufficient time and attention are allocated for generating new and continuing resources, and responsibility assigned for resource development.	**Partially followed.** Obtaining financial support was a continuing struggle; unclear whether staff members (who have since left) were assigned to it.	Obtaining financial support consumed much attention of senior administrators; the short-term nature of financial support meant recruitment and hiring were uncertain, and TAMS could not offer long-term job security to attract senior staff.

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
e. Some flexibility in allocation of resources is maintained, with slack for meeting unforeseen contingencies.	**Partially followed.** Financial allocation seems to have been flexible, even loose, given lack of an adequate accounting system.	Lack of resources has not hampered delivery of needed teaching methods and classroom materials within staff development; TAMS' ability to supply materials also provides incentives for teachers to participate.
f. Space and physical facilities are obtained that are adequate for the numbers of staff members and the program activities being carried out.	**Partial yes.** Space at IIT was obtained early in TAMS history, but as more teacher workshops were offered, space became inadequate.	Appropriate space was not a major problem in early years.
7. Relationships with Environments		
a. Key leaders (or others influential in the start up) maintain strong lines of communication with all important sectors of influential environments: clients, funders, regulating agencies, and potential competitors.	**Mostly yes.** TAMS was started up with extensive involvement from many stakeholders, who continued to be involved via its Board of Trustees. Lines of communication became strained as disagreement arose; several major business participants withdrew their involvement.	TAMS has continued to be a positive force for teacher re-development, with stakeholders in some degree of communication with each other.
b. The processes of establishing the new organization do not alienate key figures in related organizations, if the support of those organizations will later be crucial.	**Not followed.** Some of TAMS founders were openly critical of CPS administration and staff development programs which contributed to substantial alienation; a basic premise of TAMS was to remain independent of the CPS bureaucracy, while having a CPS administrator as a key member of TAMS Board of Trustees.	Federal funders felt that TAMS should work closely with CPS, so that both organization's efforts in science and math education are coordinated; the poor relationships between TAMS and CPS was a source of concern to its federal sponsors. The alienation made resolution of program delivery issues more difficult, such as the use of "replacement teachers" in the classrooms.
c. If part of a larger organization or collaborating coalition, the unit has appropriate linkages and division of tasks/activities with the collaborating entities.	**Not very relevant to TAMS,** which is a free-standing organization. TAMS developed cooperating relationships with a large number of organizations, many of which provided activities opportunities listed though TAMS Resource Center.	Enabled TAMS to publicize opportunities for teacher development, beyond its own programs.

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
d. Staff members monitor and contribute to their broader environments, such as the local and national media, and professional (educational and scientific) organizations.	**Probably followed, in background.** Not a major theme in this period; TAMS start up struggles probably precluded major contributions to the broader environment.	TAMS' vision of providing a national model for science and mathematics education was not fulfilled, during this period.
e. The unit does not experience excessive disturbance from the environment, such as political controversies or the exit of key supporters.	**Stability not present.** Much of TAMS immediate political environment remained very turbulent, as CPS' financial, leadership, and political crises continued.	e. Morale among teachers that TAMS worked with was depressed by all the uncertainty in their schools; this carried over to TAMS staff morale to some extent.
8. Leadership		
a. A single person has overall authority for managing the organization, as well as the charisma to articulate its mission both internally and externally.	**Not present.** Leadership and authority badly divided between charismatic scientist and "outsider" Executive Director; leadership weak for developing vague initial plans into implemented program.	Many aspects of TAMS remained in controversy; organizational components not developed.
b. The key leadership team has skills and experience in the content area of the program components (e.g., in math and science education) and in both external and internal management.	**Partial;** substantial content expertise present, but not well integrated into program components; organizational management neglected.	Program components developed into separate departments, not an integrated whole; organizational management problems were severe.
c. There is continuity of leadership from the period of establishing the organizational unit through the first several years of operation, although the leadership emphasis may evolve as the organization grows.	**Continuity not present,** except for charismatic scientist. 3 Executive Directors within first year. Frequent changes of leadership required continued intensive involvement by Board of Directors and contention among its diverse factions.	Much time and energy of Board, funders and administrators spent on political and leadership issues; program staff may have developed on own.
d. The leadership team is able to balance priorities between developing the programmatic mission, creating the necessary administrative mechanisms, and supporting creative growth and contributions among staff members.	**Not well done.** Management appeared to have been continually in crisis mode; not focusing systematically on balancing priorities for building the organization or its programs.	Problems noted elsewhere in this Template mounted and went unresolved.

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
e. If the new unit is part of an existing organization, there is strong support from the leaders of the larger entity.	Not applicable to TAMS.	
f. As the unit grows, leadership is delegated appropriately to sub-division heads, for example, in becoming part of the leadership team.	**Probably not explicitly done.** Organizational structure was often "fuzzy," with changes in directors of mathematics unit, no director of science unit, and little explicit delegation of leadership.	Senior staff members unsure of their roles, what they were responsible for, and whether and how to work together; hiring of most staff members done centrally, rather than by sub-division directors.
g. The staff leadership and the Board of Directors remain in harmony, with clearly differentiated roles.	**Not followed.** Dissension among founders and with Executive Director was great as troubles mounted; Board of directors became involved in day-to-day operations.	Continued struggles for control among board members and between board and staff; diverted attention away from building program components and other issues.
9. Staffing		
a. The roles needed (both professional and support) to carry out the program components and all other tasks are appropriately identified and related to each other in an organizational structure.	**Not explicitly followed.** Staff roles seemed to evolve quickly as activities were designed and re-designed. As roles and tasks were not defined a priori, some staff hired who were not appropriate for jobs needed later. Activities tended to flow from what staff members knew about.	Morale and training delivery suffered when many people had to be fired who were not appropriate. Credibility with schools damaged when inadequately trained people sent as replacement teachers.
b. Supporting staff are included in appropriate relationships to senior staff.	**Some support staff hired, but in a** rather ad hoc manner.	Sub-division directors appeared to have few support staff who were not working directly in schools.
c. People with needed skills and experience backgrounds are available, recruited and hired, in a timely manner.	**Mixed picture.** A number of staff members with excellent skills and dedication were hired and remain; all had to re-apply in summer of '93 and many others were not re-hired. Some key positions have never been filled, especially Director of Science.	Program delivery to teachers has continued, based on strength of individual staff members within sub-divisions. Lack of science director has probably slowed development of science content teaching.
d. Staff members' skills are effectively utilized and rewarded, both financially and via feedback from supervisors and co-workers.	**Partially yes.** Staff had considerable freedom to apply their individual skills. Salaries have been reasonably high, and staff members reported feeling personally challenged by the work. Internal feedback was informal.	Rewarding nature of the work with teachers has been a major positive force keeping TAMS going, in spite of other problems.

Components of Effective New Organizations	What Happened at TAMS?	What Consequences?
10. Administrative Processes		
a. Normal operating routines and procedures are established, but are not used as rigid rules.	**Done only minimally.** Operating procedures still being developed by 1994, e.g., for personnel policies.	Other problems predominated, but a "sink or swim" atmosphere prevailed concerning administration.
b. Modern procedures are established for support functions, such as financial management, personnel recruitment and administration, purchasing supplies and equipment, and operating and maintaining equipment, such as computers.	**Minimally done.** The accounting system adopted was designed for school systems and was not appropriate for TAMS' complex picture of multiple funders, each for different sets of activities. Little attention was devoted to these aspects of TAMS functioning.	Accounts were not appropriately maintained; neither managers nor funders could obtain accurate data about expenditures.
c. Procedures for trouble-shooting and problem solving are built into the organization's operating culture and expectations.	**Not explicitly done.** The founding group apparently did not expect problems to arise; problem solving during this period came primarily from the members of the Executive Committee and Board of Trustees.	Problems tended to be seen as caused by the individuals involved, rather than a result of TAMS structure and lack of planning time.
11. Communications		
a. Good internal communication channels are established to foster both formal and informal communications, both vertically and horizontally.	**Not likely.** The broader problems of leadership, scope of efforts, and inadequate program development led to some internal dissension. Staff members tended to compartmentalize themselves within their units.	Little communication developed across TAMS' units, which tended to be working with different schools. A fully integrated, systemic approach to teacher's professional growth was not developed.
b. Administrators actively support and work with staff members in developing and delivering the program components, while utilizing the contributions of each staff member in their areas of expertise.	**Not extensively.** Leadership seems to have been preoccupied by problems of dealing with its Board and financial support. Some good internal communication existed within units, but unit heads were uncertain about their supervisory responsibilities, as authority had not been clearly delegated.	Some growth of internal staff cohesion grew within units, but hampered by confusion over roles and responsibilities.
c. The sub-divisions of the unit maintain good communications with each other as the organization grows.	**Only minimally.** Sub-divisions tended to become independent in delivering their own programs, with little attention given to fostering communication among them.	Program components did not develop into an integrated whole; some rivalry among units.

APPENDIX 5

**TEMPLATE FOR BUILDING NEW ORGANIZATIONS:
TAMS RECENT EVOLUTION**
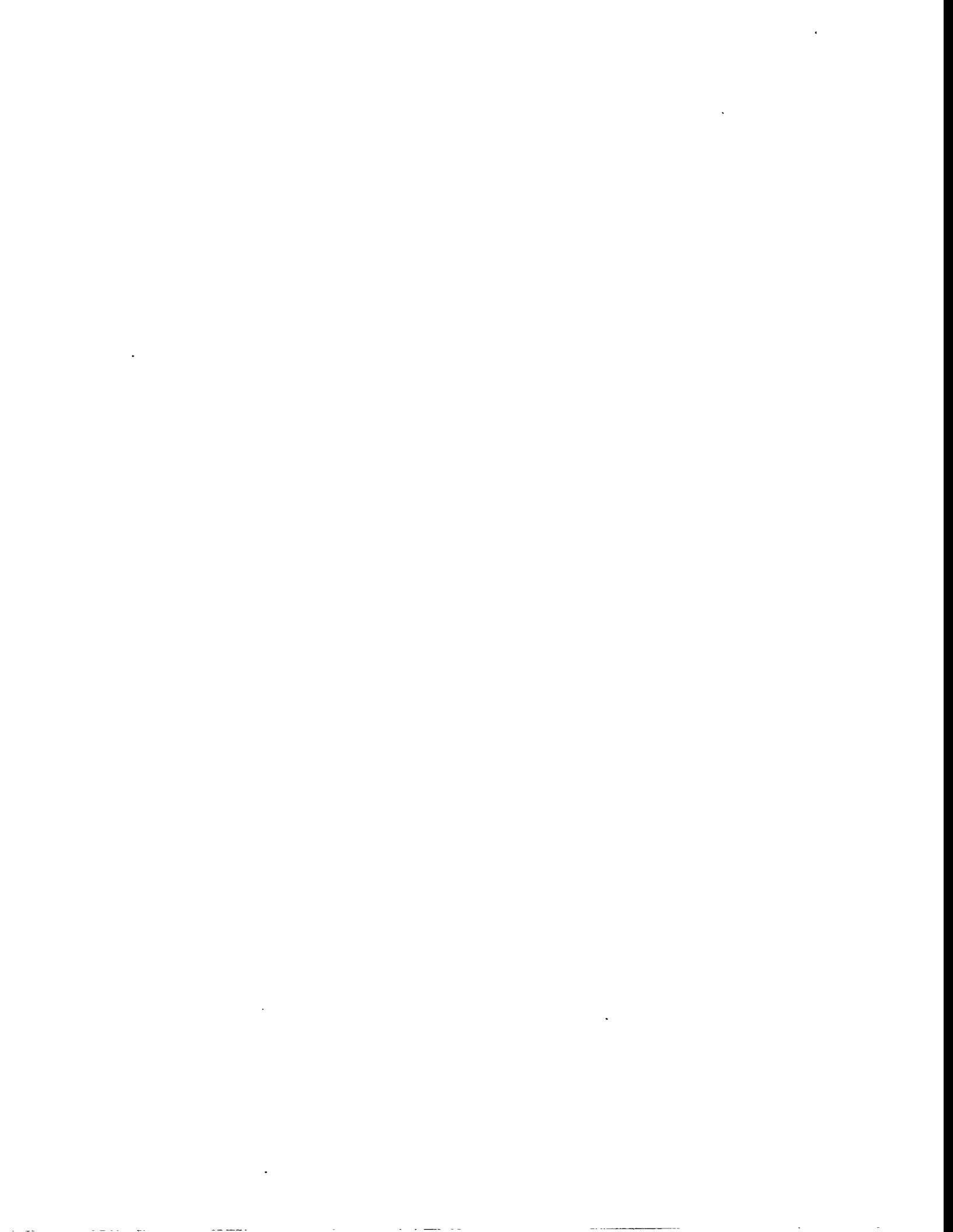
TEMPLATE FOR BUILDING NEW ORGANIZATIONS:
TAMS RECENT EVOLUTION (1993 - Spring, 1994)

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
1. Mission/Goals of Organizational Unit		
a. Key developers have agreement on and commitment to a well-understood mission and goals for the unit.	Generally yes. Strategic Plan articulates mission broadly; mostly congruence among various mission statements, although NSF proposal focuses on teacher development, rather than change in whole schools (probably because of NSF program focus). Interviewees felt mission is now clear and agreed on.	TAMS is moving ahead with implementing the mission. Little conflict exists over what TAMS is trying to do, although some staff still felt confused about TAMS broader picture (in early '94).
b. The nature and the needs of intended clients are clearly identified, and clients are included in organizational planning, if feasible.	Generally yes. TAMS has focused on teachers' needs for long-term, intensive staff development; this analysis of need was seen a appropriate by those interviewed. Teachers only slightly involved in Strategic Planning process, but not a problem.	Rapport exists between TAMS and its schools on what interventions are needed; TAMS also works with readiness to build self assessment of needs within new schools.
c. The unit's goals are clearly connected with a set of intended outcomes, specified in measurable terms.[1]	Not yet. Goals in Strategic Plan are quite broad, not tied to specific measures. Measuring points and instruments for interim or long-term outcomes not yet developed.	Evaluation is still a weak component; data not collected to tie into key outcomes.
d. Establishing and maintaining itself as an organization is included as a legitimate part of the organization's mission.[2]	Partly yes. Much emphasis has been placed on securing long term financial support; considerable work is occurring informally in improving original functioning, but not always included in formal mission statements, e.g., in NSF proposal.	This component is accepted internally, but may be seen as not legitimate by some of TAMS' funders; underlying tension may persist.

---

[1] TAMS indicates that its organizational planning advisor, Motorola, has stated that goals should be "lofty" aspirations, rather than realistically measurable outcomes. This influenced its Strategic Plan statements.

[2] TAMS states that Motorola advises that maintaining itself should not be part of a formal "mission" statement.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
2. Time Table and Scope of Operations		
a. The scope of program delivery is scaled to start small, then expand in an ordered process in relation to resources and staffing available.	Scale of aspirations may still outreach TAMS' capabilities. For example, Strategic Plan calls for a doubling of funding between FY '94 and 'FY 95, and for 25 new schools in '95, 50 new schools in '96. Realistic plans not established, e.g. for staffing.	TAMS may still be trying to meet unrealistic aspirations; with likely later disappointment among funders and staff. Program components still need consolidation and growth from greater staff experience before rapid expansion.
b. Adequate time is allowed for program development and testing before expanding to full scale delivery.	Not fully followed. Parts of program (e.g., math) have been experientially tested, but none have been fully validated by systematically collected data within TAMS. No plans in place for confirming effectiveness of new science components before expanding to large scale delivery.	Documented effectiveness of program components is still weak; rationale is that they are following national standards. Serious waste of resources could occur, if these practices are not fully effective in classrooms.
c. Schedules for accomplishment of interim milestones are present, but are not inflexible when unforeseen problems occur.	Partial yes. Long term plans and schedules are present, but vague in both Strategic Plan and NSF proposal. Interim milestones do not include measures of near-term changes among teachers and schools. Strategic Plan does include dates for review of action plans. Recruitment of new schools not fully planned for.	The planning seems divorced from the logical continuation of on-going program delivery. Parts of program delivery still occur on an ad hoc basis, when results of recruitment not known until last minute.
d. Organizational plans include expectations for organizational growth and change that cannot be anticipated at the beginning.	Yes, beginning by establishing Learning Leadership Teams, and in semi-annual review meetings with each unit. Informal self-reflection is continuous, but did not seem fully tied to strategic planning. Financial instability and not knowing status of future awards has greatly inhibited planning for future.	This aspect of TAMS is likely to require continued nurturance; concrete plans are routine practice.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
e. Sufficient elapsed time is allowed before expecting outcome effects to be evaluated.	**Still a problem.** Funders want to see outcome evidence, and disregard TAMS rocky start-up in program delivery when anticipating outcome evidence. Strategic Plan states that TAMS "will have demonstrated an effective model for systemic improvement in science and mathematics within urban schools" by 1996. Yet program design is for 3 years of intervention, and no evaluation design is yet in place to demonstrate effectiveness 2 years from now.	TAMS' program development plans are not yet integrated with evaluation plans, and with promises to funders. Even if its funding is secured, TAMS is likely to need 3 to 5 more years to provide firm evidence of success, in terms of institutionalizing new teaching methods into many schools or in terms of improved achievement of students.
3. Program Components (See Appendix 6 for more detail on program components)		
a. The program components to be delivered are clearly connected to the overall mission, and to the needs articulated for and by the organization's clients.	**Good progress.** TAMS has created a well integrated set of *intended* program components that embody the relevant national standards, and are supported by its stakeholders. (See Appendix 6)	TAMS staff, consumers and stakeholders have good agreement on what needs to be done; progress in implementing these components is likely.
b. The effectiveness of the specific program components has been established by prior research; or the unit includes a research component to rigorously assess the effectiveness of its components, as delivered.	**Partially yes.** Specific components of TAMS' programs have been evaluated in other contexts, and TAMS is generally following nationally developed recommendations. Its own evaluation of effectiveness/outcomes has been weak.	If TAMS can increase the strength of its implementation, it is likely to provide a model program for testing national standards in the large city context. Needs stronger evaluation.
c. A clear picture is articulated of the feasibility of the program components for addressing the unit's mission and goals (over-simplification and over-promising are avoided).	**Only partial.** Formal documents such as Strategic Plan and NSF proposal are likely to overpromise in scope of feasible delivery, but indicate the complexity of needed components; internal planning is improving, but not clearly linked to long term goals.	Actual program delivery likely to fall short of promises; continued work on internal planning needed, but relates to expectations for funding.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
d. The program components are comprehensive enough to address key aspects of the needs identified.	Yes, good comprehensiveness. See Section II for discussion of the breadth and integration of TAMS components, which encompass both direct staff development and supporting change in CPS, among policy-makers, and in universities.	TAMS leaders have grasped the broad scope of actions related to changing teaching; a danger is TAMS leaders attempting to do too much at once and having not enough time for internal organizational and program development and support; not all staff fully oriented toward a comprehensive program.
e. Marketing plans and procedures are established to obtain and continue intended client participation.	Partially yes. TAMS is developing strategies for recruiting schools and teachers, and for integrating Resource Center activities into recruitment efforts. Success of these not yet established. TAMS working with CPS to collaborate on recruitment with CSI (funded by NSF).	If successful, these strategies will smooth out the process of bringing in new schools; further testing and experience still needed. Written documentation of plans, actions, and their results would be useful.
4. Evaluation Plans and Processes		
a. The unit establishes a plan for collecting and using evaluative data that articulate its operational goals.	Partial. TAMS formal documents state intentions to obtain and use evaluation, but actual plans for it are weak: these tend to list many possible types of data collection, but do not prioritize well. No concrete plans for systematic outcome assessment with a design for inferring effectiveness.	TAMS' capabilities to manage its programs using data, and to document its accomplishments remain unrealized; (see Chapter IV).
b. Evaluation data assess whether the clients served are those appropriate for its mission and goals.	Partial. Evaluation unit is developing school assessment tools which include assessing "readiness;" not yet tested as of 4/94. Draft conceptual framework includes a 15-page matrix of concepts; concrete data collection plans not yet in draft.	If this instrument works well, will help avoid working with schools where teachers have strong resistance to change; may provide instrument for assessing teachers' progress. Draft of 6/94 seemed quite complex and does not specify data collection plans.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
c. Evaluation plans and processes include indicators of success linked to each stage of the intended program components (e.g., in a management information system).	Only partially developed. With NCISE guidance, TAMS is developing a unified data base for schools. The Resource Center maintains its own data base. Many measuring efforts being attempted, but not carefully linked to the stages of intended program components. Continuity low from one year to the next. Strategic Planning not linked to measures for each objective or to data collection plans.	Evaluation data present vignettes and pieces of data about TAMS, but not yet a fully developed picture. (See section IV). Data-based management using strategic planning, program delivery, then feedback may not be possible without better data.
d. A realistic time line for conducting different types of evaluation (formative and summative) is established.	Not yet. Plans do not include time lines beyond the current year. Focus is on formative evaluation; absence of plans and of data collection for long-term summative evaluation.	Summative evaluation results are not likely to be available, even several years from now, if not started now.
5. Legal Entity Established		
a. The organization's legal status (e.g., as a free-standing structure; part of a governmental organization; or part of another private organization, such as a university) is appropriate for its mission and environment.	Yes, but may be changing. TAMS current status as a free-standing organization is well supported by its stakeholders, and is appropriate for its mission and politically volatile context. [Current negotiations with Chicago City Colleges (CCC) might establish greater linkage with CCC.]	A problem with current status is financial instability. Resources through CCC could help, but might carry disadvantages in loss of credibility with teachers, or becoming involved in CCC's changing political & financial statuses.
b. If a Board of Directors is established as the governing body having legal responsibility for the unit, it focuses on major decisions pertaining to broad courses of action, rather than decisions about day-to-day operations.	Much improved. TAMS' still has a complex governing structure: Council of University Presidents, large Board of Trustees, 16-member Executive Committee and 4 working committees. Board members no longer trying to micro-manage, but work through the committees.	Considerable time of TAMS' leaders is still needed for managing and meeting with these groups. Committee members are providing constructive help and advice.
c. If an Advisory Council is established, it helps to link the unit with other key organizations in its environment and/or to provide expertise needed by the unit.	Yes, linkage established. Board of Trustees has this function, by including stakeholders from many groups. 38 member current Board has representatives from business, CPS, universities, scientists, and community groups.	Board provides links with many types of stakeholders; this might help to generate new resources or in-kind support.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
d. Members of any Board of Directors or Advisory Council are chosen for their relevance to the functions they are to serve, and receive orientation and training as needed for boardsmanship.	**Partially yes.** Members of working committees are particularly chosen for their expertise and background; other Board members are stakeholder representatives. Little orientation for new Board members.	Board members' specific expertise is contributing to solving TAMS' problems. Absence of orientation for new Board members may create communication problems and undermine consensus on mission and strategies.
6. Resources/Finances		
a. The financial resources available are appropriate for the stage of organizational development and scope of program activities.	**Not established.** TAMS major sources of funding still come from annual grants from DoE and NSF; very uncertain. Other potential sources are being explored, with unknown likelihood of success (see text). Stakeholders expressed strong views that federal support is still needed.	Continuing instability over continuity of TAMS; contributes to internal weaknesses such as staff vacancies, inadequate attention of administrators to program development and delivery; continued major gap between TAMS aspirations and its resources.
b. Funding organizations' goals and priorities are fully congruent with the mission of this organizational unit.	**Not entirely.** TAMS funding from NSF has come from NSF's Teacher Enhancement and Development program, rather than from its systemic change unit; contributes to Goal 5 within Science and Technology of DoE's Strategic Plan of 4/1994, but unclear whether DOE has a long term commitment toward developing elementary schools and teachers, as this area is outside DoE's traditional focus. Uncertain congruence with priorities of CCC.	TAMS funding proposals must be oriented toward the program expectations and review mechanisms of its funders, rather than seeking support for its intended systemic operations. Leads to some divergence between different sources of funding, although this is a less serious problem than the instability of funding.
c. Resources are appropriately allocated among both programmatic and support components.	**Partially.** Lack of resources was not a major complaint from program staff, but some key items were lacking (e.g., file cabinets, reference materials). Programmatic budgeting just starting up; appropriate allocations still being negotiated.	TAMS' unit directors appear to have only limited experience in projecting their units' needs and budgets; still working toward appropriate allocations.
d. Sufficient time and attention are allocated for generating new and continuing resources, and responsibility assigned for resource development.	**Being addressed.** Explicitly included as a responsibility of "Administration" in Strategic Plan. Also working with unit heads for them to watch for opportunities for schools to purchase TAMS' services.	Strong attention is being given to this; perhaps to some neglect of internal program development by administrators.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
e. Some flexibility in allocation of resources is maintained, with slack for meeting unforeseen contingencies.	**Flexible planning is intended.** With greater attention to TAMS planning and budgeting, some flexibility seems to be included.	Not a major problem.
f. Space and physical facilities are obtained that are adequate for the numbers of staff members and the program activities being carried out.	**Problems here, being addressed.** TAMS is outgrowing is current space; also lack of physical safety in current facility (due to gun shots through windows). Potential for moving to other facilities is part of negotiations with CCC.	TAMS staff are cramped in current quarters; moving to better facilities would be beneficial. Capability to continue attracting teachers for workshops in current location may be doubtful.
7. Relationships with Environments		
a. Key leaders (or others influential in the start up) maintain strong lines of communication with all important sectors of influential environments: clients, funders, regulating agencies, and potential competitors.	**Yes, strong communications now established.** TAMS leaders and Strategic Plan put major emphasis on continuing collaboration with multiple groups of "customers;" TAMS Board and major conferences help to cement relationships. Several funders have been positively involved.	TAMS has re-established active relationships and good will within many sectors. Likely to help TAMS to continue working toward systemic change, perhaps with additional in-kind resources.
b. The processes of establishing the new organization do not alienate key figures in related organizations, if the support of those organizations will later be crucial.	**Improving relationships with CPS.** TAMS and CPS representatives have met several times, particularly concerning NSF's Urban Systemic Initiative. New, high level CPS representative on TAMS Board and on Program Operations Committee. CPS has stated commitment to fund financial liabilities to TAMS incurred in earlier years by schools. Differences in strategies and operating cultures remain; TAMS sees itself as a "critical friend" of CPS.	A possibility exists that TAMS and CPS can co-exist more readily, if TAMS leaders can tone down their more assertive style in approaching the CSI. Still need more information exchange, and negotiation of specific contributions to CSI. Not clear that federal support should be contingent on relations with CPS administration.
c. If part of a larger organization or collaborating coalition, the unit has appropriate linkages and division of tasks/activities with the collaborating entities.	**Not very relevant to TAMS,** since it is not part of a larger organization. TAMS is developing multiple collaborations; roles and tasks need further definitions. Full collaboration with CPS not established. TAMS appears to be playing a brokering role in math/science education.	Working with other organizations is rather time consuming for TAMS leaders and drains time and resources from internal program delivery.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
d. Staff members monitor and contribute to their broader environments, such as the local and national media, and professional (educational and scientific) organizations.	**Is beginning to happen.** Included in Strategic Plan as part of professional development of TAMS' staff. May be premature, as TAMS programs have not yet been fully validated.	TAMS could become recognized as a national model; focus on this too early could become only a public relations effort.
e. The unit does not experience excessive disturbance from the environment, such as political controversies or the exit of key supporters.	**Turbulence in environment still high.** Relationships with schools and teachers' motivations for change likely to be influenced by CPS problems: financial crisis in 9/93, school shut downs, new superintendent, actions of Local School Councils to fire many principals, high staff turnover, etc. Also, gunshots though windows of TAMS' building in spring, '94 required relocations of many TAMS staff members.	Situation in schools likely to slow pace of teacher change; principals may orient schools toward LSC wishes rather than to high quality instruction. Disturbances of staff may contribute to delay in accomplishments.
8. Leadership		
a. A single person has overall authority for managing the organization, as well as the charisma to articulate its mission both internally and externally.	**Much improved since 1993.** Leadership is shared between the Executive Director and the Chief Operating Officer, and this arrangement appears to work well. Several of those interviewed stated that their skills and styles are different, but complementary.	Conflicts over leadership have stopped and observers are positive about their capabilities. Leadership is in place to continue internal development.
b. The key leadership team has skills and experience in the content area of the program components (e.g., in math and science education) and in both external and internal management.	**Generally good, but some weaknesses remain.** Top administrators have strong skills in negotiating external relationships, and in organizational management, but lack educational credentials in science or math education. Strong program expertise provided by Director of Mathematics; Director of Science position still vacant. More emphasis on collaborative internal communications needed.	Top administrators have focused primarily on external matters (fund raising, gaining political support) and on improving internal management; may need more involvement in oversight of program content in science and math.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
c. There is continuity of leadership from the period of establishing the organizational unit through the first several years of operation, although the leadership emphasis may evolve as the organization grows.	**So far, so good.** Leadership has gained stability since early 1993.	A major positive aspect of this period of TAMS; contributes to future stability.
d. The leadership team is able to balance priorities between developing the programmatic mission, creating the necessary administrative mechanisms, and supporting creative growth and contributions among staff members.	**Reasonably good.** TAMS has stabilized, and is moving ahead on several fronts: developing its financial and planning systems; expanding and re-orienting its science program; creating political support for TAMS; and improving internal cross-unit communications. More collaborative strategies and resources needed for supporting development among its own staff to avoid "top down" approach.	In general, balanced development is occurring. Staff mentioned need for more support of and involvement in their professional development. Staff do not <u>feel</u> supported for their own choices; this may lower morale among staff.
e. If the new unit is part of an existing organization, there is strong support from the leaders of the larger entity.	**Not relevant to TAMS.**	
f. As the unit grows, leadership is delegated appropriately to sub-division heads, for example, in becoming part of the leadership team.	**Is developing.** Top administrators are working with unit heads on delegation of authority, e.g., for hiring new staff members, for programmatic budgeting, for prioritizing among potential activities, etc. Some unit heads have focused on content expertise and may need to develop stronger managerial skills.	If strong unit heads can be developed, their skills will support further expansion in the future, and a stronger internal management system for TAMS.
g. The staff leadership and the Board of Directors remain in harmony, with clearly differentiated roles.	**Apparently, yes.** Board members expressed strong support of current leadership team; Board has reduced micro-management.	Much smoother working relationships established; much less conflict.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
9. Staffing		
a. The roles needed (both professional and support) to carry out the program components and all other tasks are appropriately identified and related to each other in an organizational structure.	**Partially.** A number of new job roles are being developed, e.g., "implementation specialist" in math and science, and in School Improvement Unit. Formal documents (Strategic Plan, NSF proposal) have not explicitly defined tasks and roles. Some staff rather unclear about what they were supposed to do, especially when first hired.	Continued self-analysis of job roles likely to be needed, to ensure that staff members do not drift, and that those in similar roles are doing similar jobs, especially when in schools. If TAMS is to present itself as a model program, it will need to document more clearly what its staff members _do_ when working with teachers.
b. Supporting staff are included in appropriate relationships to senior staff.	**Mostly yes.** Provision for support staff included in recent proposals. Some staff mentioned current lack of adequate supports for doing workshops.	Needs continued assessment, to ensure that senior staff are not spending extensive time on tasks that could be done by a less experienced person.
c. People with needed skills and experience backgrounds are available, recruited and hired, in a timely manner.	**Still some problems here.** Much attention has gone into proper staffing during the past year - in releasing inadequate staff members, delegating authority to unit heads to hire staff, and hiring new staff members. Many well-qualified staff now present; but efforts are not always integrated; new hires were provided little orientation to TAMS. Science Director position still vacant. Formal plans and proposals provide little discussion of staffing needed for expansion, nor for their orientation and training. Short term funding conflicts with lead time needed for hiring.	Program delivery consistent with TAMS' mission and philosophies may suffer when staff are not explicitly integrated into TAMS programs; requires longer lead time for staffing needs. Proposals for expansion may be unrealistic, if plans not included for how to staff the expansion properly.
d. Staff members' skills are effectively utilized and rewarded, both financially and via feedback from supervisors and co-workers.	**Generally yes.** Staff have opportunities for creatively using their skills; few complaints about salaries or other benefits. Some staff would like more opportunities and support for their own professional development and for a pension/retirement plan.	Staff feel rewarded by the important work, which keeps up motivation in spite of difficulties. Continued attention needed to TAMS internal staff development.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
10. Administrative Processes		
a. Normal operating routines and procedures are established, but are not used as rigid rules.	**Under development.** Policies and procedures are being explicitly developed (e.g., in policies manual, in review meetings, for recruitment of schools) but not yet firmly established; some questions arose over interpretation. No problem with excessive rigidity.	Operations likely to go more smoothly, if procedures continue to be more "normalized," with less of a crisis atmosphere. This would allow expansion to go ahead more smoothly.
b. Modern procedures are established for support functions, such as financial management, personnel recruitment and administration, purchasing supplies and equipment, and operating and maintaining equipment, such as computers.	**Under development.** Much work has gone into development of proper accounting procedures, but further adjustments may be needed. Other administrative systems are being addressed for purchasing, inventory management, space allocation, etc.	As support functions become more regularized, will reduce crisis atmosphere and contribute to focus on program development and delivery.
c. Procedures for trouble-shooting and problem solving are built into the organization's operating culture and expectations.	**Yes, part of intended culture.** TAMS work with the Learning Leadership Teams and semi-annual review meetings are mechanisms for problem solving.	TAMS is working on this; but major problems to be solved stem from instability of funding.
11. Communications		
a. Good internal communication channels are established to foster both formal and informal communications, both vertically and horizontally.	**Only Partially.** Many staff members mentioned problems with communications - e.g., they don't know what other units are doing; they do not feel they have a voice in some decisions which affect them; all-staff meetings are infrequent and dominated by "speeches from above." But TAMS leadership is aware of these problems, and is trying to address them. More staff meetings may be needed for short periods more frequently; or more meetings among unit heads, to provide informational channels for their staff.	Better communication channels would pull together TAMS' operations with its mission and underlying philosophy. It is also likely to reinforce the motivation of staff members to continuing working in a difficult situation, and to work together collaboratively. Continuing fragmentation of efforts will make it difficult to bring in new staff members and integrate them into TAMS strategies.

Components of Effective New Organizations	Current Status of TAMS? (Spring, 1994)	Likely Consequences
b. Administrators actively support and work with staff members in developing and delivering the program components, while utilizing the contributions of each staff member in their areas of expertise.	**Needs work.** Top administrators seem primarily focused on external matters: funding, professional and political communications, larger system change, as well as initial development of programs. Seldom visit on-going workshops or staff members in schools. While staff have great respect for the administrators, many staff members do not *feel* strong support from the administrators in their day-to-day work.	Better balance would provide more support for TAMS staff, to ensure focus on high quality delivery and would provide first-hand channels of communication to staff members. Morale suffers without this support.
c. The sub-divisions of the unit maintain good communications with each other, as the organization grows.	**Not yet.** The internal units of TAMS have not fully overcome the isolation developed during the prior period. Some rivalry exists. Efforts are underway to develop better inter-unit communications, but take time away from program delivery and are not always seen by staff members as productive uses of time.	Integration of program components may suffer. Time needed for delivery of program components with teachers may conflict with time needed for developing internal communications.

APPENDIX 6

**A TEMPLATE FOR MATHEMATICS AND SCIENCE
STAFF DEVELOPMENT PROGRAMS IN A SYSTEMIC CONTEXT**
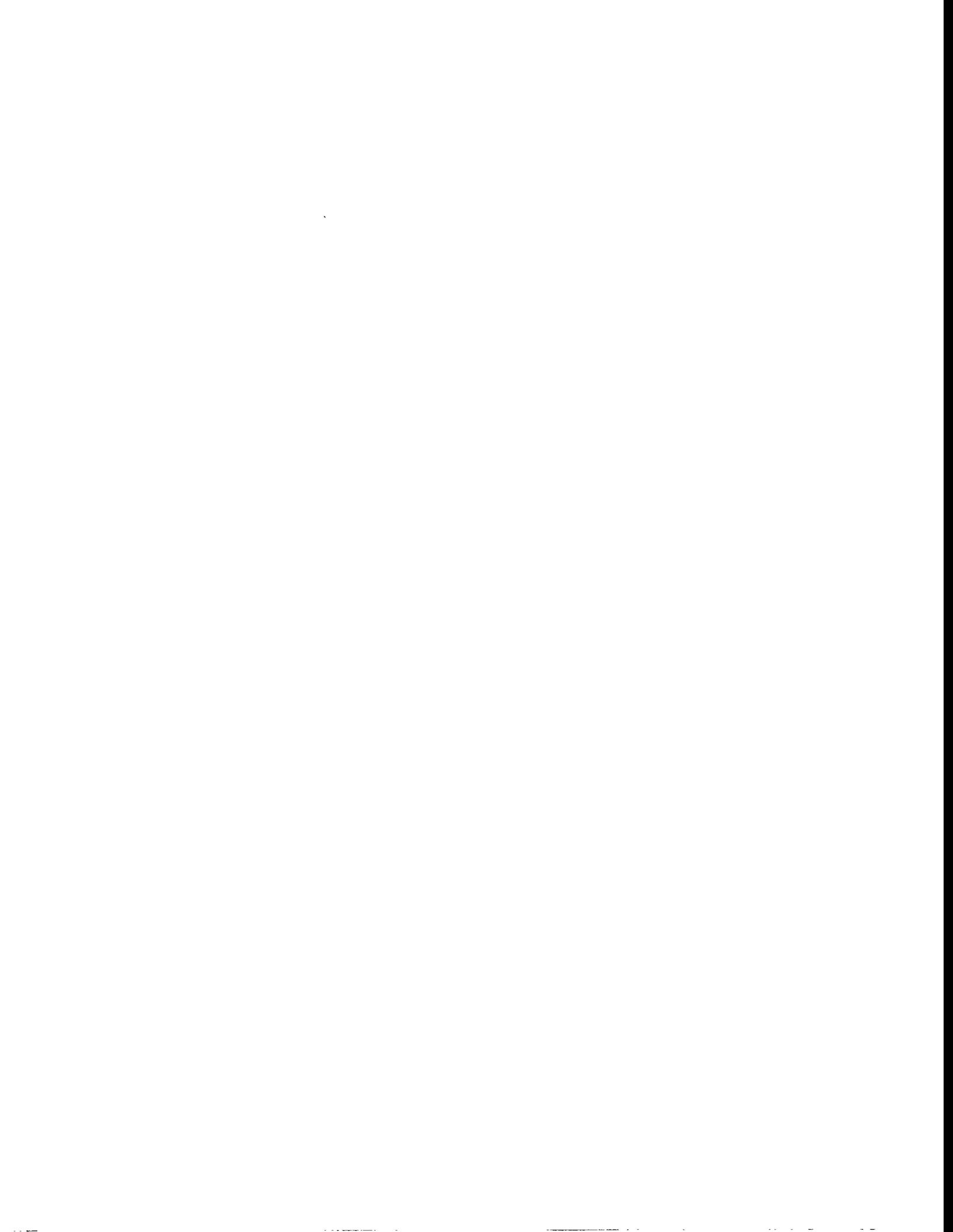
A TEMPLATE FOR MATHEMATICS AND SCIENCE STAFF DEVELOPMENT PROGRAMS IN A SYSTEMIC CONTEXT[*]
(to be used in conjunction with a template for the components of building effective organizations)

Components of Effective Practice	Intended	Actual
1. Vision of the Program		
a. Developed through a collaborative, consensus process by all relevant stakeholders (e.g. teachers; school leaders; community, college, university, and state board of education representatives, and scientists/mathematicians.)	Original group working on Grecian Urn document intended that a variety of stakeholders be included in planning and governance.	Original planning group included a variety of stakeholders, including university presidents, professors, scientists, CPS representatives, state representatives, city government officials, and other stakeholders in the Chicago community. The board still has large representation from a variety of areas. Until recently, relations with CPS have been strained. At first, Board concerned with program direction. Now serves more in advisory capacity. Program committee of board plays more active function, setting overall policy. Parents not originally included in design of parents piece; problem later rectified. Staff not involved in original decision to use MathTools® and TIMS®. Math Department directions have evolved through external consultants and one person's strong leadership rather than through a collaborative process involving TAMS' internal staff. Science Department is in process of developing new program, through assistance from consultant (BSCS) and work in teams by staff members of department.
b. Shared and articulated by all relevant stakeholders.	Strategic plan asserts that TAMS will work in partnership with school communities and seek feedback from customers and suppliers, and strive to be a learning organization where staff can contribute to development of TAMS programs and services.	All stakeholders do not buy into overall model completely, but by and large strong sharing of key elements of the vision. Teaching staff seem to like it especially. Some disagreement about what science content should look like. Pyramid model not emphasized in favor of themes.

[*] Focus is on school as the unit of change.

189

Components of Effective Practice	Intended	Actual
2. Program Design and Delivery		
a. Within the program, curriculum and materials, instructional strategies, and assessment are aligned with— • the vision • each other • best practices for teaching students in mathematics/science and for teaching adults • district, state, and national standards • school infrastructure issues • community support	Early incarnations of the vision did not address alignment, but the notion of four parallel strands (intensive teacher enhancement, school improvement, school/community partnerships, and resource network) is consistent throughout later documents. Strands address the alignment of these factors and are linked into the vision. Math-Science Program Policy Guidelines (MSSPPG) states that all components must support restructuring of the educational environment of the school. Strategic plan addresses need to seek continuous feedback from experts and integrate current research, best practices, and standards into all aspects of the staff development model. Understanding of standards by TAMS staff is emphasized in plan.	All four strands are now operational, to varying degrees. School improvement unit is newest and is just beginning readiness work. Within math and science programs, attention is paid to alignment of own curriculum and instructional strategies. Each program has begun work in helping teachers deal with own curriculum issues and assessment. SIU assistance stresses help with principals in changing infrastructure. Active principal's group meets quarterly, with formal program. School/community staff work with parents. Weakness of program is that components are aligned with each other in ideas but not in practice. Staff almost universally agree that they do not communicate or work with other units closely, except for SIU. Work on strategic plan brought some together; communications still weak and mainly informal. Resource Center did coordinate workshops for Math Department, based on needs. School Assessment meetings have opened up some channels; staff appear to like these. Math and science programs largely unaware of each others' activities, especially the new math staff. Staff of both departments have an interest in improving communications. Lack of planned time together is a problem.
b. The program emphasizes development among teachers of higher order skills, a common core of content, and judgment about how to make decisions regarding curriculum.	TAMS programs are based on a staff development model, which encourages development of skills, allows time for reflection, gives the opportunity to plan and implement their own learning experiences, and guides teachers in developing their own curricula. The intent of the math program, which is based closely on the work of the University of Chicago School Mathematics Project's Teacher Development Program is to build a common content core of knowledge in mathematics. The ultimate intent of the science program is to introduce a core of content.	Observation of instructors in both mathematics and science provided good evidence of emphasis of development of higher order thinking skills. Some instructors were less patient than others in allowing some of this thinking to take place, but overall a realized goal. Math classes revolved around developing both content and process skills in mathematics. Science classes were very process oriented in terms of science. With the help of BSCS, science staff are working on a revised program with greater emphasis on content for the coming academic year. Both math and science programs have built in time for teachers to work on curriculum development, both within grade levels and across grade levels in their own schools. Informal interactions in class often point to ways of thinking about the curricula.

190

Components of Effective Practice	Intended	Actual
c. Learning activities are spread out over time.	The current model for both the mathematics and science programs allows for a year and a half of each. Programs follow slightly different ways of distributing time between instruction and in class follow-up.	The model is generally carried out as stated. Originally, schools could only receive mathematics or science, thus the staff development cycle was somewhat shorter. Now schools receive both mathematics and science and all levels.
d. The school is the unit for program delivery (e.g. teachers may not participate as individuals but only as part of a school team).	TAMS documents have clearly stated since its inception that the school is the unit of delivery for the program and that the teachers are the agent of change. Recruitment is by school not individual teacher, and the principal and teachers must buy in as a school. The entire School Improvement Process is designed on a school by school basis.	Science sometimes delivers all instruction and follow-up in individual schools. In other cases, schools are combined for the instructional side, but implementation happens on a frequent basis in the individual school. In mathematics, schools are always combined for the instructional side (except in some planning sessions), but schools receive their own followup implementation. The School Improvement Unit also works with individual schools. The Resource Center has a few workshop programs where individual teachers may attend.
e. A majority of teachers in each school unit agree to participate in the staff development program.	75% of teachers in each intensive school are required to agree to participating before TAMS commits to that school. Program guidelines for both mathematics and science indicate that all teachers involved in the program are expected to actively participate. In science, teachers are given an extra incentive of a materials allowance of $500 for showing up to 85% of all sessions.	Percent of teachers agreeing to participate seems to be enforced. However, in actuality teachers do not show up consistently to all sessions. Instructors described different levels of participation among teachers, whether instruction was held on site or in the schools. Some suggest that lack of commitment may be due to lack of readiness, and the SIU is now gearing up to address the readiness issue by developing a self-assessment tool to use with schools in the recruitment process. In addition, some teachers are more welcoming of follow-up help in their classrooms than others (primary more than intermediate grades), but most implementers said they were able to win around the majority eventually. Implementers had different philosophies about how much to "force" themselves on reluctant teachers, and how much to let teachers take the initiative in seeking them out.

Appendix 6: Staff Development Programs in a Systemic Context

Components of Effective Practice	Intended	Actual
f. Schools engage in collaborative needs assessment and program planning with the staff development program to take into account individual needs.	The program policy guidelines note that options will be made available for establishing schedules other than during school time. The mathematics and science programs appear to take a somewhat different approach to scheduling. Mathematics has a pull-out, TAMS based program for K-3 for its intensive phase; at the 4-8 level the math dept appears to offer a pull-out or after school model. The Math Department offers three different levels of programs, with the most intensive and the content workshop series being based on needs assessment. It is unclear how flexible the science program intends to be in relation to its program offerings in the future; currently, it is a fixed curriculum. The latest TAMS model calls for each participating school taking the math and then the science program at all grade levels–i.e. a fixed program. The SIU has plans to institute a readiness procedure so that it can work with schools in varying stages of receptivity to change.	Unclear to what extent school needs are considered other than for scheduling purposes. By instructing individual schools rather than groups of schools, most science instructors have some room for flexibility as it relates to a school's needs for scheduling. More often, schools (both in math, but especially in science) have had to be responsive to the needs of the TAMS staff because of frequent required meetings during this past year. All programs have to take into consideration issues relating to the overall school calendar (e.g. IGAP and ITBS test schedules) The readiness process, including needs assessment, to be undertaken with the schools is not yet in place. The mathematics model with its three different levels is somewhat new; unclear how it is working with readiness not quite in place. Both mathematics and science programs have their own somewhat predetermined curricula, but what occurs in schools occurs through a joint planning process with each school and to some degree each teacher.
3. Attention to Equity Specific strategies address equity issues (e.g. gender, race, ethnicity) issues, including:		
a. Equitable recruitment and selection of schools	The original intention of TAMS was to reach all schools; specifically, the concern was with the mathematics and science learning of girls and minorities. A more recent document states that school participation shall be open to all schools in the CPS. Equity of school selection is not addressed formally in TAMS' documents. However, most Chicago public schools serve a large number of low SES students, and many schools serve a majority of students from African-American and Hispanic backgrounds.	TAMS still hopes to reach as many schools as it can although it is more realistic about the time frame now. Equity does not seem to be an issue in recruitment. Recruitment of schools is currently based on interest. However, lack of attention to this issue has not appeared to create any imbalance in the kinds of schools served.
b. Sensitivity by program instructors and implementers in choice of instructional strategies and practices used with participating teachers and with children in relation to different cultures, languages, learning styles and gender.	TAMS subscribes to the value that all human beings can and will learn and that all learners are entitled to a quality education in which curricular and instructional strategies reflect learner growth and development. Program policy guidelines state that TAMS must help teachers to conspicuously create a classroom culture that reflects the diversity of students so that all students have a chance to succeed and that staff development should be sensitive to the many cultures of students and should allow alternative instructional strategies.	The science and mathematics staff have discussed gender issues in teaching. Observational opportunities did not point out any major problems in lack of sensitivity to issues of difference. Majority of participating teachers were women; the few men did not receive more attention than they deserved.

National Center for Improving Science Education

192

Components of Effective Practice	Intended	Actual
c. Sensitivity in materials and program content in relation to different cultures, languages, learning styles, and gender.	TIMS® and MathTools® materials appear to be sensitive to showing balance in pictures of male/female figures and children of other races. Multi-cultural mathematics materials are in instructors' notebooks as well as materials on women in mathematics.	As indicated. Instructors appeared to avoid sexist use of language. Math materials, including one TAMS mathematics class observed used examples of number systems from other cultures. A key speaker in their science literacy conference supported by the state spoke on the multicultural roots of science.
d. Equitable allocation of resources among schools and teachers.	Resources are intended to be given out equitably both on a school by school and individual basis. Science and math have slightly different policies. Science provides stipends for teachers who are not on a pull-out model and $500 in materials for all who participate in 85% of workshops. Math provides materials and notebooks for all teachers.	Stipends and resources appear to be given out as stated. Teachers in science receive curriculum materials as they are handed out in class, or as instructors may provide them in schools. It is unclear whether some instructors are more lavish with additional materials than others, but it would not appear to be so.
4. Vision of the Classroom Emphasizes		
a. A belief that all children can learn challenging material in mathematics and science.	The belief that all human beings can and will learn is fundamental to TAMS philosophy. Mention is not made of challenging material	There was no obvious evidence that this philosophy is not being carried out.
b. Deep understanding by students of major science/math concepts or principles, development of skills, and scientific habits of mind.	The program policy guidelines state that programs focus on helping teach for conceptual understanding of key principles of math and science. Other documents discuss various other higher order skills. The TIMS® curriculum promotes understanding of a few key variables used in science, the scientific process, and scientific habits. The emerging new staff development program concentrates on themes in science, such as cause and effect. MathTools® is also geared around deep conceptual understanding.	The programs are generally carried out as intended. Most instructors talked about and modeled learning for deep understanding; some talked more than they modelled it, not always pushing participants to think.
c. A hands-on, minds-on instructional approach that includes student investigations, discovery, and application.	TAMS subscribes to NCISE's framework of hands-on, minds-on. Both TIMS® and MathTools® are geared towards hands-on instruction.	All science classes observed were heavily hands on, some allowing deeper investigation than other. TIMS® experiments can be somewhat prescriptive, unless the instructor allows participants to take them in a new direction. Some instructors were more skilled at guiding this than others. MathTools® contains many hands-on activities, but also relies somewhat more on presentation and discussion. When hands-on was used, it generated good discussions among participants.

Components of Effective Practice	Intended	Actual
d. Depth of study (fewer concepts) in classroom instruction.	TAMS documents advocate depth versus breadth of interventions. In its grant application to NSF, TAMS states that science instruction will focus on a relatively few, fundamental principles based on the benchmarks of AAAS Project 2061 and selected in collaboration with professional scientists. The TIMS© curriculum focuses on a relatively small number of variables: length, area, volume, mass and density, and works with these in a variety of ways. MathTools© covers a larger number of topics.	It is unclear how the new TAMS science curriculum is going to address the issue of less is more. Each age level team is currently at work on its new curriculum, which will have more of a thematic focus, potentially allowing for depth, while illustrating key principles in science, across disciplines. Currently, the curriculum and the instructional sessions are quite focused, sticking to one experiment per class. The math program seems to cover a lot of ground, with several topics being introduced in each session. However, topics are revisited and built upon in later sessions.
e. Balance between content and process in classroom instruction of science and mathematics.	Documents mention both the importance of content and process in the science and math programs. Math is focused around a core of content to which problem solving, mathematical communication, exploration of relations, and reasoning must be applied. Science content is not to be taught in isolation, but will also include the processes and principles of scientific inquiry and will address the issues of values, attitudes and ethics (NSF Proposal).	Instructional sessions attended in math paid attention to both content and process. Instructors typically took content in a number of different directions that emphasized skills such as hypothesizing and reasoning. The TIMS© curriculum is much narrower in relation to content and process. Instructors were generally skilled enough to bring in a variety of thinking skills.
f. Use of real world problems.	The founders of TAMS intended that subject matter should be more closely connected with applications relevant to the students' home environments and career options.	Real world applications in TIMS© included lots of graphing about things related to children's interests (such as birthdays and pets) and measuring activities in the child's world. Activities on volume seemed less applicable. Math classes on a variety of topics included use of and reference to real world problems and objects; e.g. in math class on geometry, teachers went on a scavenger hunt for objects which they then had to describe in terms of shape. The Resource Center has a resource room which is set up to show real world applications of science (e.g. what forms of transportation do you see out this window?). It is unclear how much this center is used by teachers.

Components of Effective Practice	Intended	Actual
g. Ongoing, authentic assessment of important learning outcomes for students.	Program policy guidelines indicate that teachers will be exposed to current forms of student assessment. Other literature notes that TAMS guides teachers to develop a repertoire of assessment practices.	One staff member has specialized in assessment and given workshops on it, and one SIU staff member is in charge of this area. In addition, TAMS organized a three day workshop for intensive schools on assessment practices and invited teams of teachers and the principal from each school. In the session attended by NCISE staff, quality of the program was high, and teachers were engaged in a meaningful and enthusiastic way. In instructional sessions attended, there was infrequent mention of assessment techniques; one instructor gave her teachers an assessment activity, and they seemed puzzled, but more assessment activities may follow.
h. Integration of mathematics and science, and with other areas of study.	Mentions are made in several key TAMS documents about content being taught in an "integrated, interdisciplinary fashion." Program policy guidelines state that all efforts will be taken to integrate math and science across disciplines and across grade levels. The TIMS⊕ curriculum is an integrated math and science program, although there seems to be disagreement about which is its strongest suit. However, structure of the program with quite separate math and science divisions and programs does not necessarily follow the philosophy of integration. TAMS' position on this topic is that teachers need a much stronger foundation in math and science before focusing on total integration of the two content areas.	Mathematics concepts and processes are a key part of the TIMS⊕ curriculum, and science instructors frequently mentioned connections with mathematics. The concept of integration has clearly made its way to some schools--one school has combined its math and science instruction in the upper grades. Some science instructors at TAMS brought in other disciplines, such as geography and language arts (e.g. books that were related to TIMS⊕ topics). The math program at TAMS uses materials that suggest applications of math to science. More problematical is that the Math and Science Departments don't communicate with each other; there is much overlap in the content of their respective programs, without an attempt to address the overlap. Teachers notice this, and do not understand the lack of coordination. When the science program includes more science content, the overlap problem may be reduced, but lack of integration may actually get worse unless addressed. The science staff at TAMS seem more interested in integration and communication than does the math staff. However, the staff development instructional schedule does not easily allow integration.
i. Active use of learning resources within the community (e.g. museums).	The Resource Network has been set up to provide additional linkages through partnerships with museums, universities, science labs, and libraries.	The math program schedules field trips to the science museum and planetarium to show how these environments can be used for teaching math. In addition to advertising programs at these other environments, the Resource Center reports that it uses museums in several different ways, including museum based workshops, museum professionals presenting in TAMS' workshops, and a new summer program of museum-school partnerships.

195

Components of Effective Practice	Intended	Actual
5. Teacher Development Program Activities		
a. Are appropriately designed for adult learners: • focus on growth rather than defects • relevant and practical • focus on teachers' interests and concerns • link teachers to resources and support • build on teachers' current knowledge and experience	TAMS subscribes to a staff development philosophy which specifically addresses the needs of the adult learner. The model is set up to provide experiential learning, with guided practice.	By and large, TAMS instructional staff are tuned into the needs of adult learners, even though at times the teachers wanted to behave like children (e.g. need for excessive talk in classes about matter extraneous to learning)! A particular emphasis is placed on responding to their concerns and issues in class. The model is followed quite closely.
b. Model teaching principles and strategies that can be transferred to the classroom.	Modeling is mentioned as a key ingredient in a variety of TAMS documents, especially modeling of pedagogy.	TAMS instructors do an effective job of modeling instruction, showing good questioning techniques and demonstrating the idea of teacher as facilitator.
c. Allow teachers to actively construct knowledge through hands-on activities.	TAMS' philosophy of teaching is centered on "hands-on, minds-on constructivist learning theory and student-directed learning" (NSF proposal)	The science program uses a model developed by BSCS, which starts with an engaging activity that allows participants to explore the new concept before being directed to pursue more specific ends. Most of the science instruction up to this point has been hands-on. The math program uses a more mixed approach, a with a greater proportion of each class presentation and discussion. However, it, too, makes regular use of manipulatives designed to foster learning.
d. Include the use of tools, methods, and processes of scientists and mathematicians.	Both the math and science programs are built around using appropriate tools and processes, including the use of technology and calculators.	Tools and processes are kept at somewhat of a simple level since expensive equipment would not be appropriate if teachers have no further access to it. All teachers get training in the use of computers as a tool for teaching and managing their teaching, as well as exposure to the computer as a vehicle for communication.
e. Include actual or simulated problems or challenges of "real world" science or math.	Although relevance of content is addressed (see Vision of the Classroom), explicit reference is not made to tackling simulated problems of math and science.	Content is geared to the grade school level; problems for discovery are usually kept fairly simple.
f. Are designed so teachers learn cooperatively in small groups.	Program policy guidelines state the programs will offer both opportunities for self-study and to learn in cooperation with others (note: it just says math here). Cooperative learning is named as a concept that TAMS wants teachers to understand.	The science program staff mostly made use of cooperative learning techniques in their experiments. Some did not use this approach where it might have been appropriate. In the station activities, math program participants also used cooperative learning. Even when not told to do so, groups naturally worked together collaboratively.

Components of Effective Practice	Intended	Actual
g. Include opportunities to practice and discuss new classroom behaviors or strategies.	In the staff development model which TAMS follows, opportunities to try out new learnings in the classroom are advocated. TAMS model allows for immediate follow-up in the classroom.	TAMS instructors frequently make reference to classroom teaching strategies that are germane to that day's lesson. The model of follow-up seems to be carried out as described, with instructors modeling, co-teaching, and assisting teachers in carrying out the new practices in their classrooms.
h. Include opportunities for teachers to plan together (at their own grade level and with others from their own schools) for use of new knowledge and skills in their own classrooms, with their own curricula.	The model includes strategic planning and content review sessions so that teachers can develop year long curriculum plans.	This process was only just beginning for teachers in this phase of instruction. Math staff felt that some of their valuable planning time was being taken up with the technology training.
6. Follow-Up Support for Teachers		
a. Follow-up is provided over time to create sustained change in teacher classroom behaviors.	The TAMS model is science allows for ongoing implementation during instruction followed by another half year of in-class followup. The math model allows for some ongoing implementation during the year of instruction followed by a half year of in-class follow-up.	The follow-up component was the most praised of all the features of the TAMS model-- by teachers, principals, and TAMS instructional staff. TAMS staff admitted that even longer followup--three to five years might be useful for some schools, but that most felt some reasonable change could be expected in the time allowed. Some were worried about sustainability.
b. Follow-up focuses specifically on the use of new knowledge and skills in the classroom.	The goal of follow-up is to help teachers integrate into their curriculum the concepts, content, and ideas covered during the workshops and to work with students and teachers in their classrooms.	Implementation staff described a variety of ways in which they worked with teachers. Teachers in schools we visited were unanimous in their praise the kinds of assistance they received. Staff talked about varying degrees of success with teachers; their goal was to move their teachers towards independence, and not relying on them or trying to please them.

Components of Effective Practice	Intended	Actual
c. Follow-up takes a variety of forms, including additional training (e.g. direct instruction, modeling, co-teaching, coaching), problem-solving or sharing meetings, on-site or telephone conversations, networking through newsletters or telecommunications, training and support of local resource teachers or others to provide ongoing assistance.	In addition to in-classroom help, such as modeling, co-teaching and coaching, the model calls for staff to help organize regular departmental or grade level meetings so that teachers can continue to plan and explore selected topics, ideas, and strategies in greater depth; to do demonstrations; to schedule additional workshops as needed. It also calls for networks that focus on the ongoing need of teachers to keep learning, to interact with each other, and to identify resources to help them enrich the curriculum, through the Resource Center.	Staff and teachers described the additional assistance received through regular workshops provided on site. Teachers noted the importance of this help in clarifying what they had learned previously. Each school has an official liaison, whose role is to attend monthly meetings at TAMS and log in regularly to the computer network to find out salient events. From 10/93 through 4/94, approximately 50% attended monthly meetings, which covered a range of topics including assessment, problem solving in math and science, relating curriculum to outcomes, and the IGAP. Only one TAMS' school never sent a representative during this time. From 10/93 to 3/94 458 logins by TAMS' schools were recorded, representing 30 schools. (Almost 1/2 the logins were from four individuals.) TAMS is in the process of setting up Resource Centers in six schools—these are to be made available to teachers from other schools.
d. Long-term commitment from program staff includes material, moral, logistical, technical, and symbolic support from the teacher enhancement program staff, or as a result of arrangements made by the program from the school or community.	TAMS intention is to provide the long term linkage through the Resource Network of its intensive schools. Once a school is no longer in the intensive program, it can continue to receive additional assistance in the form of technical assistance or workshops, from the Resource Center at low cost.	TAMS has not been in existence long enough to test out how long term its commitment to a school might be. However, anecdotal evidence from schools with earlier involvement with TAMS indicate that commitment from TAMS is ongoing. Older schools are given opportunities to take advantage of new programs, such as summer institute on restructuring, principals' group, and assessment workshops.
7. Teachers' Leadership Responsibility		
a. Some teachers take on leadership responsibilities in aspects such as program development, delivery, implementation, follow-up and spread to other colleagues.	TAMS currently has plans to create a "cadre" of lead teachers at the 4-8 level, with the goal of strengthening their content background and their staff development skills. One proposed scenario is graduate level courses and internships leading to a masters degree through the TAMS program.	A simple lead teacher model, without adequate training and support, has not proven to be all that successful in creating change in other settings. TAMS model, in which the lead teachers will be trained from schools that already have had the intensive program, shows promise, but it still needs to be funded and up and running.
b. Teachers have input and/or involvement in decisions about the content, process, implementation, and/or evaluation of their learning experiences.	The program policy guidelines state that all teachers in a school are involved in a needs assessment process before joining the Academy; TAMS is to respond to the school's needs with a plan jointly prepared with the school. Teachers do provide evaluations of their experiences.	Without concrete data from teachers, it is difficult to know exactly how much input teachers have.

Components of Effective Practice	Intended	Actual
c. Teachers are given support by the teacher enhancement program for leadership and networking with people outside the program, such as teacher colleagues and professional associations.	The role of the Resource Center is to promote partnerships with universities, museums, science labs, and businesses. The model also calls for teachers to be introduced to professional networking opportunities, such as scientific organizations, journals, meetings, on-line services, and other teachers.	During the period of 3/93 to 11/93, 17 science related institutions/programs and universities did use TAMS electronic network. Adequate data are not available to show how well these networking services are working. See 4i (actual) for more details on partnerships.
8. Building the Capacity of the School as a System. The staff development program and the participating teachers and principal pay attention to:		
a. Showing commitment to change by creating and institutionalizing an infrastructure for change and renewal, including commitment of: • time • money • personnel • other resources • creation of appropriate learning environment	The TAMS model requires that schools commit both time and personnel to change, and expects that schools will also commit financially to support long term implementation (a sliding fee scale per student applies). Some resources are supplied through the program; schools must arrange use of other resource money at their disposal. The SIU works with school leadership to help plan for use of resources towards change and build an effective support system at each school site to ensure implementation and sustainability.	Anecdotal information with successful schools suggests that part of their success has been focusing their efforts on change in math and science education by allocating available resources and going after new ones (e.g. grants). The SIU is new this year, so it may be early to tell how successful it is assisting schools this way. SIU staff are responsible for 8-9 schools each, in addition to specific subject areas, thus making it difficult to work closely with each school. SIU staff reported spending as much time helping with problems as they could, usually over the phone. Changing the infrastructure is a hard goal to meet, given limitations of time and money, and lack of creative solutions.
b. Developing collaboration skills among teachers.	One of the "key values" of TAMS is that team work is necessary and should be rewarded.	Teachers are encouraged to collaborate both in the science and math programs in developing curriculum together, both in same grade level across schools (where possible) and across levels at the same school. Some time is provided for this activity. The reality in the schools we visited is that no time is provided for collaboration in planning outside of the time allotted by TAMS. A number of teachers commented on more informal planning time together since they have been involved with TAMS.

Components of Effective Practice	Intended	Actual
c. Developing leadership and change agent skills and attitudes among teachers and the principal.	The Strategic Plan calls for implementing a readiness phase and building an effective support system at each school that will ensure effective implementation and sustainability. The model calls specifically for the creation and training of leadership teams in schools and assistance in building the internal capacity of schools to think, do, evaluate, and reflect about changes they are making in mathematics and science. Principal and administrator support is recognized as important to the school improvement process. Principals are expected to participate in staff development. Quarterly principal meetings with agendas have been set up. TAMS also plans for a summer institute for 12 teams on school change and school restructuring, and workshops on the quality review process and the state's School Improvement Plan.	Some mechanisms for creating leadership are already in place, such as the quarterly Principal's leadership symposium for the principals from the intensive schools. x percent of principals in intensive schools show up to each meeting. Principals set up the schedule and the agenda to meet their needs. One principal described it as an invaluable opportunity to meet with colleagues. Evaluations suggest that these have been favorably received. Many other mechanisms, such as the summer institute for restructuring are in the planning stage, and their success remains to be seen. Not clear how many principals actually attend staff development sessions.
d. Developing an understanding of and use of systems thinking concepts, disciplines, and tools (including an understanding of how all parts of the system align).	TAMS literature notes that schools are dynamic, complex systems, and that teachers are only one of the variables that affect learning. It is not clear how explicitly systems thinking will be shared, except through the aforementioned summer institute.	Both Math and Science Department heads reported that issues of systemic change are discussed in class, especially as they relate to aligning curriculum and standards and assessment.
e. Active networking among participants and with other change efforts (e.g. state and district policies).	The Resource Center Network calls for several elements, including a teacher network that serves those in pre-service, teachers in the intensive schools, and others.	The Resource Center has a coordinated electronic network that allows teachers to communicate with other science and math teachers with similar interests. The electronic network has about 100 school members--more than half are not TAMS' teachers. In a seven month period between 3/93 and 11/93, 44 teachers from almost as many schools logged on at least once, with some schools clocking as much as several hours in a given month (see 6c, actual, for more information on computer logins.) It also has published a listing of museums, universities, and other institutions that periodically offer science and mathematics workshops. It is not clear in what ways teachers are using this network or this information.

Components of Effective Practice	Intended	Actual
f. Development of parental support for and understanding of changes	Parents and community are considered to be partners in math and science education. All TAMS planning documents call for different ways to involve parents. The central goals appears to be the empowerment of a group of parents and community leaders who will maintain this parent involvement. The plans call for parent facilitator meetings once a month; family math and science leadership training four times a year, and additional family math and science workshops. TAMS has a school/community partnership department.	TAMS school/community partnership department has not been able to operate fully until this year although its two chief staff members have put on a variety of activities over time. As of Fall, 1993, the department was fully functional. TAMS paid for three summer workshops for families in 1993 (the third one was booked because the demand was high) The goal of the workshops were to help families see the everyday math and science around them. As of Spring 1994, five schools were actively participating in the parent facilitator meetings, sending two facilitators each. Systemic thinking, change information as well as family math and science are the key topics. The job of this group of facilitators is to meet with ten other parents/community people; two schools have this activity in place.
g. Integrating all the components.	The model calls for focused school improvement intervention that uses science and math as vehicles to address organizational development issues through team building and decision making that impact the total quality of the instructional program, including standards, alignment to local, state, and national processes, curriculum, instructional outcomes, alternative assessment, and use of educational technologies, as well as the ongoing learning needs of the organization.	Through the intensive instructional program, teachers learn to think about how curriculum, instruction, and assessment can align with each other and with national standards. These all appear to be addressed in instruction. Technology training also occurs through the mathematics program-it is not clear how much this is linked with other goals. Part of the goal of the SIU is to help schools think about integrating these parts. With the other demands on their time, it is not clear how much attention the staff can give to these issues. The regular School Assessment Meetings do help each unit think about how it is contributing to the school's success, and most staff find these useful in gaining the whole picture of their schools.

Components of Effective Practice	Intended	Actual
h. The teacher enhancement program models behaviors and strategies of collaboration, risk-taking, continuous reflection, and quality.	This goal is not explicitly stated in TAMS literature.	TAMS administrators and staff are often seeking ways to collaborate—whether with local colleges or with each other as co-teachers. Unfortunately, this happens less across departments than it does within departments where collaboration is high, or with outside bodies, which administrators eagerly pursue. Risk-taking behavior also characterizes the organization as a whole for anyone who has followed its history—the whole venture is one exercise in risk taking. Through the strategic planning process, the various grant proposals, the instituting of the Learning Leadership Teams, and the ongoing work and consultation with BSCS to revise the science curriculum, there is evidence of continuous reflection. Staff do not always feel heard, however. Although quality is not even throughout the organization, it has grown over time, and its most obvious service—direct instruction and assistance with schools and teachers—reflects a high standard overall. One person connected with one of the programs in use said that he would not hesitate to hire TAMS staff for his own staff development workshops. Quality is also reflected in its very public forums—the conferences it sponsors.
9. Program Evaluation		
a. Monitoring of participant satisfaction during the program and follow-up activities identifies needed changes which are made as soon as appropriate and feasible.	The Resource Center Network calls for evaluation of the impact of the Network on teachers at different stages of their involvement with the Academy. The goal is to allow the RC to improve their system. Other formal TAMS documents do not indicate plans to collect these type of data.	The different units collect survey information after workshops and meetings to gauge how the event went. These are largely informal tools, and information from them is compiled and analyzed by the units collecting them. Department heads report that results help to shape future activities.
b. Ongoing formative and summative evaluation of important program outcomes involves data collection from a variety of sources, with resulting changes in program design.	The Evaluation Plan calls for a variety of formative evaluation activities. No systematic summative evaluation is planned for, although piecemeal activities, such as journal analysis, post-tests, and classroom observations are outlined.	Teachers keep journals or notebooks, and the evaluation unit is in the process of analyzing 25 journals from the Math Department. Both departments indicate they have given some specific directions to teachers as to how to maintain these journals but also give them latitude in completing them. Pre- and post-tests in TIMS® do not allow for comparison with any other group.

Components of Effective Practice	Intended	Actual
10. Public Support		
a. Specific strategies are used to mobilize public support for change.	The Strategic Plan calls for leveraging of support and brokering of resources from the CPS, the Chicago Teachers' Union, the Illinois State Board of Education, advocacy groups, policy groups, and businesses, to advance math and science education. It also calls for increasing the level of expectations about CPS students by translating key research and TAMS beliefs to the public, educating the media, becoming an active voice in relevant public conversations; assisting parents in leadership, and creating mechanisms for schools to share successes.	TAMS' chief administrators and founding Board member, Leon Lederman, are frequent spokespersons in support of change. Some of TAMS' plans for mobilizing public support are underway (such as working with parent cadres and coordinating a state conference); others have not yet occurred. There is no question that TAMS' administrators are positioning themselves to be key players in math and science educational reform. TAMS' leaders are actively targeting the groups identified in their strategic plan.
b. Specific communication and engagement strategies are used to involve non-collaborating stakeholders (e.g. legislators, special interest groups) in the effort.	The Strategic Plan calls for creating and implementing a plan for identifying and influencing key decision-makers. The plan includes identifying relevant policy issues and partners with similar positions, and working with the constituency and practitioners to make sure policies are in the best interest of constituents. Elsewhere, TAMS discusses a growing relationship with pre-service education to assist in the restructuring of teacher preparation.	TAMS has ben establishing working parameters with state policy leaders including state legislators, state superintendent of education, president of the Chicago School Board, chair of Chicago Public Schools (CPS), and chancellor of Chicago City Colleges. In addition, Op Ed article by Executive Director in Chicago Tribune identifies professional development as a key policy issue to be addressed. Upcoming plans to meet with the Association of Deans of Education to establish working relationships. Designing Masters Program to influence direction of university offerings.
c. The teacher enhancement program examines and is involved with state and local policy making that has an impact on school and classroom practices and allocation of resources (e.g. assessment, standards)	TAMS states that as a neutral alliance it is uniquely positioned to participate in policy formulation and leverage the resources of a variety of stakeholders needed to support change processes at the school level and the retooling of the teachers with new knowledge and materials.	TAMS recently held a state supported conference on science literacy called "Science Matters." The focus of the conference was on the state standards and how to operationalize these in the schools. The conference was geared towards educational leaders and was attended by 300. TAMS is also involved in the quality review process for schools and had planned to work with 13 schools to prepare them for this review. (As of 6/94, plans had shifted to more broadly encompass the school improvement process.)

Developed by the National Center for Improving Science Education, 1994.