DOCUMENT RESUME

ED 220 336 SE 039 098

TITLE Preparing People for USMES. An Implementation Resource Book.

INSTITUTION Education Development Center, Inc., Newton, Mass.; Unified Science and Mathematics for Elementary Schools, Newton, Mass.

SPONS AGENCY National Science Foundation, Washington, D.C.
PUB DATE Jun 75
NOTE 80p.; For related documents see SE 039 060-097 and ED 142 362.
AVAILABLE FROM ERIC Clearinghouse for Science, Mathematics, and Environmental Education, 1200 Chambers Rd., 3rd Floor, Columbus, OH 43212 ($3.25).

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Elementary Education; *Elementary School Mathematics; *Elementary School Science; Interdisciplinary Approach; Language Arts; Mathematics Education; *Problem Solving; Process Education; Program Descriptions; *Program Implementation; *Resource Materials; Science Course Improvement Projects; Science Education; Social Studies; *Unified Studies Curriculum; Workshops
IDENTIFIERS National Science Foundation; *Unified Science Mathematics for Elementary Schools

ABSTRACT

This volume is divided into three sections, each focusing on an activity associated with dissemination and implementation programs for the Unified Sciences and Mathematics for Elementary Schools (USMES). Section I focuses on techniques for conducting USMES informational meetings to introduce administrators/teachers/parents to USMES. It is designed to provide them with information they need to decide whether they want to involve themselves and their students in the program. Section II describes in detail strategies for conducting USMES workshops for teachers. These workshops provide teachers with experiences they need to successfully work on USMES units with their students. Section III deals with methods of training Design Lab managers. The training session gives paraprofessionals, parent volunteers, and high school or college students the background they need to work in Design Labs with students and teachers as they design and construct the things they need to carry out work on USMES challenges. The first section is preceeded by a short discussion of ways USMES differs from other curricula, emphasizing what is unique about the program and providing a focus for the sections that follow. (Author/JN)

PREPARING PEOPLE for USMES

An Implementation Resource Book

June 1975

Education Development Center

Unified Science and Mathematics for Elementary Schools

PREPARING PEOPLE for USMES

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Education Development Center
55 Chapel Street
Newton, Massachusetts 02160

CONTRIBUTORS

USMES Central Staff

Earle Lomon, Director
Betty Beck, Associate Director for Development
Thomas Brown, Associate Director for Implementation
Quinton Baker, Associate Director for Administration
Carolyn Clinton Arbetter, Coordinator for Evaluation Programs and Implementation Resources
Charles Donahoe, Coordinator for Design Lab and Information Services
Jeannette Bolt, Assistant Editor
Phyllis Dorfman, Sue Sampson, Administrative Staff

We are deeply indebted to a large number of people whose assistance and advice have contributed to the development and refinement of the ideas presented in this book. Our thanks to the university content and curriculum specialists and experienced USMES teachers who have staffed the workshops run by the project during the past several years, to the personnel in Lansing, Michigan and Chicago, Illinois who participated in district implementation experiments, to USMES resource team members who have conducted local dissemination and implementation programs throughout the nation, to other members of our central staff who have helped run our workshops, and to the many teachers, administrators, and children who have participated in project-run workshops. Special thanks also to David H. Ost for his efforts as Associate Director for Implementation and Christopher Hale for his work as Project Manager during the development of this book.

USMES is supported by grants from the National Science Foundation. Any opinions, findings, conclusions, or recommendations expressed are those of the authors and do not necessarily reflect the views of NSF.

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PREFACE

The Unified Science and Mathematics for Elementary Schools (USMES) project was formed in response to the recommendations of the 1967 Cambridge Conference on the Correlation of Science and Mathematics in the Schools.* Since its inception in 1970, USMES has been funded by the National Science Foundation to develop and carry out implementation trials of 32 interdisciplinary units centered on long-range investigations of real and practical problems taken from the local school/community environment. School planners can use these units to design a flexible curriculum for grades one through eight in which real problem solving plays an important role.

The development and trial implementation work is carried on by classroom teachers with the assistance of university specialists at workshops and at occasional meetings during the year. This work is coordinated by a staff at Education Development Center in Newton, Massachusetts. In addition, the staff at EDC coordinates a widespread implementation program involving districts and colleges which are carrying out local USMES implementation programs for teachers and schools in their area.

The following units are currently available for widespread implementation:

Protecting Property (Burglar Alarm Design)
Pedestrian Crossings
Lunch Lines
Play Area Design and Use
Describing People
Designing for Human Proportions
Dice Design
Weather Predictions
Getting There
Classroom Management
Growing Plants
Orientation
Traffic Flow
Consumer Research
Soft Drink Design
Manufacturing
Advertising
Classroom Design
Ways to Learn/Teach
School Zoo
Bicycle Transportation

Since all activities in USMES units are initiated by the students in response to a long-range challenge, the students and teachers often have need of resource materials; USMES materials provide some of these resources. The Design Lab or its classroom equivalent is a resource for students;

*See Goals for the Correlation of Elementary Science and Mathematics, Houghton Mifflin Co., Boston, 1969.

using the tools and supplies available children can follow through on their ideas by constructing measuring tools, testing apparatus, models, etc. The "How To" Cards are another resource for students. Each set of cards gives information about a specific problem which arises in the context of the overall problem. The students use a set only when they want help on that particular problem.

Several types of resources are available for teachers: the USMES Guide, a Teacher Resource Book for each challenge, Background Papers, and a Design Lab Manual. A complete set of all these written materials comprise what is called the USMES library. In addition, the Curriculum Correlation Guide is presently being developed and preliminary sections are available.

These materials are described in brief in the USMES brochure, which can be used by teachers and administrators to disseminate information about the project to the local community. A variety of other dissemination and implementation resources are also available for individuals and groups involved in local implementation programs. They include the USMES slide/tape show, videotapes of classroom activities, a general report on evaluation results, a map of implementation locations, a list of experienced USMES teachers and university consultants, and newspaper and magazine articles.

About Preparing People for USMES: An Implementation Resource Book

This volume is divided into three sections, each concerned with an activity which is an important part of any USMES dissemination and implementation program. Section One focuses on techniques for conducting USMES informational meetings. This dissemination activity introduces administrators, teachers, and parents to USMES. It is designed to provide them with the information they need to make decisions about whether they want to involve themselves and their students in the program. Section Two describes in detail strategies for conducting USMES workshops for teachers. The workshop provides the teachers with the experiences they need to successfully work on USMES units with their students. Section Three deals with methods for training Design Lab managers. The training session gives paraprofessionals, parent volunteers, and high school or college students the background they need to work in Design Labs with students and teachers as they design and construct the things they need to carry out their work on USMES challenges.

The first section is preceded by a short discussion of the ways in which USMES differs from other curricula. In emphasizing what is unique about the program, it provides an important focus for the sections that follow.

WAYS IN WHICH USMES DIFFERS FROM OTHER CURRICULA

The Unified Science and Mathematics for Elementary Schools (USMES) project has as its goal the development and implementation of real problem solving as an important new style of education. Real problem solving develops the problem-solving ability of students and does it in a way that leads to a full (learning-by-doing) understanding of the process. In addition, students learn many skills and concepts as the need for them arises. This method of learning skills and concepts is especially effective because the students not only immediately apply them in a practical situation but also get a great deal of practice with any operations involved. The necessity for some teacher preparation may be seen by looking at the ways in which real problem solving differs from other learning modes. Some teachers may have been introduced by other projects to several of the following new developments in education, but few teachers have integrated them all into the new style of teaching and learning that real problem solving involves.

1. New Area of Learning - Real Problem solving is a new area of learning, not just a new approach or a new content within an already-defined subject area. Many subject matter curricula include something called problem solving. However, much of this problem solving involves made-up problems or fragments of a whole situation and does not require the cognitive skills needed for the investigation of real and practical problems. Learning the cognitive strategy required for real problem solving is different from other kinds of learning.

2. Interdisciplinary Education - Real problem solving integrates the disciplines in a natural way; there is no need to impose a multi-disciplinary structure. Solving real and practical problems requires the application of skills, concepts, and processes from many disciplines. The number and range of disciplines are unrestricted and the importance of each is demonstrated in working toward the solution of practical problems.

3. Student Planning - To learn the process of problem solving, the students themselves, not the teacher, must analyze the problem, choose the variables that should be investigated, search out the facts, and judge the correctness of the hypotheses and conclusions. The teacher acts

as coordinator and collaborator, not authoritative answer giver or mastermind, in real problem-solving activities.

4. Learning-By-Doing - Learning-by-doing, or discovery learning as it is sometimes called, comes about naturally in real problem solving since the problems tackled by each class have unique aspects; for example, different lunchrooms or pedestrian crossings have different problems associated with them and, consequently, unique solutions. The challenge, as defined in each situation, provides the focus for the children's hands-on learning experiences, such as collecting real data; constructing measuring instruments, scale models, test equipment, etc.; trying their suggested improvements; and (in some units) preparing reports and presentations of their findings for the proper authorities.

5. Learning Skills and Concepts as Needed - Skills and concepts are learned in real problem solving as the need for them arises in the context of the work being done, rather than having a situation imposed by the teacher or the textbook being used. Teachers may direct this learning when the need for it arises, or students may search out information themselves from resources provided.

6. Group Work - Progress toward a solution to a real problem usually requires the efforts of groups of students, not just individual students working alone. Although some work may be done individually, the total group effort provides good opportunities for division of labor and exchange of ideas among the groups and individuals. The grouping is flexible and changing in order to meet the needs of the different stages of investigation.

7. Student Choice - Real problem solving offers classes the opportunity to work on problems that are real to them, not just to the adults who prepare the curriculum. In addition, students may choose to investigate particular aspects of the problem according to their interest. The variety of activities ensuing from the challenge allows each student to make some contribution towards the solution of the problem according to his or her ability and to learn specific skills at a time when he or she is ready for that particular intellectual structure.

CONDUCTING USMES INFORMATIONAL MEETINGS

Section One

CONDUCTING USMES INFORMATIONAL MEETINGS

In order to implement any new program in a school system, it is usually necessary to engage in some dissemination activities. This is particularly important when USMES is being implemented, because of the critical ways in which USMES differs from other curriculum programs. Key personnel in the district and in target schools need to be informed of what USMES is all about, what it has to offer, what kind of support is needed, and so on. Informal discussions and distribution of some of the project's written materials are good beginning points. In addition, an informational meeting for all those who are interested is an extremely valuable, if not vital, next step.

Based on reports we have received from people across the nation who have conducted such meetings we have compiled a list of "Key Elements in USMES Informational Meetings" which is reproduced on the next page. The list represents what have been found to be the most important items to be covered and some of the strategies for covering them. The audience, the specific purpose of the meeting, and the amount of time allotted will all influence the tone, depth, and order of the presentation. The suggested times included on the list for each of the key elements are based on meetings conducted during the past several years.

The key elements are described in more detail on pages 7 to 10. Possible strategies for presenting each element are described and the best sources for further information on the different topics are listed. Some of the elements are also discussed in Section Two on Conducting USMES Workshops which can be referred to for other suggestions. A brief report on an informational meeting is reproduced on pages 11 to 12. The report documents how the key elements were covered during a half-day meeting for district administrative personnel.

KEY ELEMENTS IN AN USMES INFORMATIONAL MEETING

Introduction to USMES philosophy and units (30-60 minutes)

- slide/tape show
- videotape(s) of classroom activities
- question and answer session
- information brochures

Experiencing real problem solving by working on an USMES unit challenge at adult level (45-90 minutes)

- discussion of challenge
- tasks and priorities defined
- observation
- data collection
- construction work as needed
- data representation and analysis
- action on challenge
- group discussions on any aspect of process

Discussion of real problem solving and its place in the total school program (10-20 minutes)

Discussion of USMES resource materials (20-30 minutes)

- Design Lab (types, inventory, cost, scheduling, staffing, safety)
- "How To" Cards
- USMES Guide
- Teacher Resource Books
- Background Papers for teachers
- Design Lab Manual
- Curriculum Correlation Guide

Discussion of classroom strategy and teacher's role in USMES (5-10 minutes)

Discussion of skills and concepts in USMES units (5-10 minutes)

- Listing of skills/concepts covered in hands-on activity carried out during session.
- Review of skills charts in USMES Guide and Teacher Resource Books

Discussion of USMES evaluation and documentation program and data (5-10 minutes)

Discussion of USMES implementation program (5-10 minutes)

- Map showing extent of implementation
- Magazine articles and newspaper clippings

DISCUSSION OF THE KEY ELEMENTS IN USMES INFORMATIONAL MEETINGS

Introduction to USMES Philosophy and Units

Experience has shown that the initial discussion on USMES should be short. An in-depth discussion can take place later in the meeting after participants have spent at least a short period of time engaged in hands-on activities in response to a challenge. The first discussion should give participants a basic understanding of what the real problem solving mode of teaching and learning is and what kinds of activities and discussions are scheduled for the rest of the meeting.

The USMES slide/tape presentation gives an overview of the USMES program and a brief description of some of the units. The project's origins, the USMES mode of teaching and learning and some of the evaluation results are discussed. The taped narrative might be paraphrased by one of the individuals conducting the information meeting if a more lively, informal approach seems desirable.

Videotapes on classroom use of various units are available on a purchase or loan basis and might also be utilized to provide a more in-depth look at how children work on USMES challenges. The USMES brochure presents USMES in a nutshell. It is available in quantity and is a good "hand-out" for meeting participants to take away with them.

The best resource to use to prepare for this sort of introductory discussion and any questions that may come up during it is the USMES Guide. The project, the USMES mode of teaching and learning, the units, the resources for teachers and students are all described in detail. The paper "Real Problem Solving in USMES: Interdisciplinary Education and Much More" covers much of the same material from a slightly different perspective.

Experiencing Real Problem Solving by Working on an USMES Unit Challenge on an Adult Level

Experience has shown that in order to really understand what USMES is all about, meeting participants should engage in some hands-on activities related to one of the unit challenges. One cannot fully appreciate the learning that can take place by working toward a solution to a real problem without this experience. The investigations are, of course, limited by the time constraints of an informational meeting and in this respect differ from the kind of experience described in the section on USMES workshops. Even within a limited amount of time, however, meeting participants can make

a good stab at the problem and in so doing get invaluable insight into the real problem solving mode of education.

Discussion of Real Problem Solving and Its Place in the Total School and Class Program

In addition to general discussions of what real problem solving is, meeting participants are often concerned about the ways in which it can be worked into the school schedule. Why it should be and how it can be are discussed in the USMES Guide, in the paper "Real Problem Solving in USMES: Interdisciplinary Education and Much More," the Curriculum Correlation Guide, and the section on USMES workshops in this volume.

The main points to be covered in this discussion are: 1) USMES provides experience in the process of solving real problems which is an important skill to be learned, and 2) many skills and concepts can be learned quickly and effectively during work on real problems. Therefore, substantial time can be devoted to real problem solving while maintaining skill and concept learning at the same level, or at an even more effective level of understanding.

The charts and list in the unit Teacher Resource Books which list the specific skills and concepts that might arise during student work on the challenges can be used by teachers and administrators in planning the most effective way to include real problem solving in a particular school's or district's program. The individuals conducting the informational meeting may want to discuss how USMES might be worked into the existing programs at the schools involved.

Discussion of USMES Resource Materials for Teachers and Students

Resources for USMES work fall into three categories. The first includes all the resources of the school and community--people, books, places, etc.--that are relevant and can be accessed by the children. In addition, USMES recommends that general tools, materials, and measuring instruments be made available as a Design Lab so that students can carry out hands-on work on the unit challenges. The third category consists of the USMES written resources for students and teachers. The Design Lab and the written resources are described in the USMES Guide and the section of this volume on conducting USMES workshops. In addition, the Design Lab Manual and Supplement provides detailed information on the ways in which Design Lab work can be carried on in a classroom, in a separate Design Lab room, or by using a portable Design Lab. The Design Lab inventory, cost, space requirements,

staffing, and safety considerations are also covered in depth. The Design Lab brochure covers many of the same points in brief.

It is extremely useful to have a complete set of the written materials available for meeting participants to peruse. The set includes the "How To" Cards for students, the USMES Guide, Teacher Resource Books for each unit, Background Papers and Design Lab Manual. The price list for written materials is included in the brochure. A workshop experience is recommended for introducing teacher to the USMES style of teaching and learning and to the first unit or two they will use with their students. The teacher's resource materials are designed to enable teachers with such experience to build upon it and to move on to other units.

Discussion of Classroom Strategy and Teacher's Role in USMES

The teacher's role and responsibilities are detailed in the unit resource books, the USMES Guide, and in the workshop section of this volume. In brief, the teacher acts as the coordinator in introducing the challenge, providing resources when needed, including help on specific problems, scheduling frequent sessions for hands-on work and for student exchange of ideas, and stimulating new directions in the students' thinking and investigations. Many of the videotapes of class work on different challenges show USMES teachers in this role and might be used to stimulate discussion on the topic.

Discussion of Skills and Concepts in USMES Units

Listing the skills and concepts that come up during the participants' hands-on work on the adult challenge is a useful strategy for pointing up the kinds of learning that have gone on during real problem solving. Meeting participants are often surprised to realize what a wide range of skills and concepts from the different disciplines have been touched on. It is also often useful to review the charts in the USMES Guide and Teacher Resource Books. The charts in the Guide compare the implementation units in terms of their strengths in different subject areas and specific skills, concepts, and processes that usually take place in the different units. The charts in each Teacher Resource Book relate possible unit activities to broad subject area objectives, correlate categories of skills and concepts with the possible unit activities, and list specific skills and concepts that are used in the possible unit activities.

Discussion of USMES Evaluation and Documentation Program

The program includes the documentation of development and implementation activities across the nation via interviews and reports from teachers using USMES in their classrooms,

from local observers visiting classrooms, and from resource teams conducting local dissemination and implementation programs. In addition, specific instruments are administered to a sample of the classes using USMES and some non-USMES classes in order to assess the effect of working with USMES on student problem-solving abilities, on basic skill development, and on classroom organization and student interactions and activities.

The evaluation and documentation program and results to date are summarized in the USMES Guide. A general report on evaluation outlines the results of specific aspects of the evaluation program in more detail. Technical reports are also available.

Discussion of USMES Implementation Program

The USMES widespread implementation program is reviewed in the USMES Guide. In addition, a map showing the implementation locations is available. A packet of magazine and newspaper articles on USMES also gives a selected look at what kinds of USMES activity have gone on in different communities. These resources enable those conducting the informational meeting to give the participants a good idea of the geographic scope of the project's activities.

REPORT OF USMES INFORMATIONAL MEETING
12:30 - 4:00 P.M.
December 11, 1973
Wexford School, Lansing, Michigan

On December 11, 1973, a three and a half hour informational meeting was held in Lansing, Michigan, for the principals of the elementary schools in the district, the helping teachers, and the subject area consultants. Approximately thirty people took part. The meeting was conducted by a group of people in Lansing who have been involved in the USMES program over the past several years. The group included several USMES teachers and observer/coordinators, a principal, and a Michigan State University faculty member.

The meeting began with a thirty-minute slide presentation on USMES units being implemented in Lansing and other districts across the nation. This was followed by a short (ten-minute) talk on real problem solving and the nature of USMES challenges. The participants then divided into four small groups to work on an USMES unit challenge. Each group worked on one challenge for approximately fifty minutes and then switched to another challenge for another fifty-minute session. The four units offered were Describing People, Soft Drink Design, Dice Design, and Consumer Research.

In response to the challenge to "find out what is the best information to put in a description so that a person can be quickly and easily identified," the Describing People groups worked on a description of one of the district administrators. After drawing up a detailed description, they identified the most important characteristics. Other possible activities relating to the challenge were described.

The groups working on the Soft Drink Design unit were presented with the challenge to "invent a new soft drink that would be popular and produced at low cost." During their fifty minute sessions they focused on taste preferences. They participated in a blindfold test using three popular cola drinks. They were given samples of the three drinks and asked to identify them. They made a "confusion matrix" of how often the different drinks were confused and then analyzed the results. The sessions concluded with a discussion of how the unit had evolved in different classrooms.

The Dice Design groups were challenged to "construct practical shapes which can be used as dice to make a fair decision between two or among three, four,...choices." The participants did some preliminary work with coin tossing. They then moved on to constructing polyhedra from die-cut shapes. They

grouped the shapes according to whether they were regular or irregular and discussed how to test them for fairness.

The Consumer Research groups were presented with the challenge to "determine which brand of a product is the best buy for a certain purpose." During each session, half of the participants tested ballpoint pens and the other half tested cellophane tapes. In both cases, they first established criteria for judging, then designed and conducted tests, and finally analyzed their results to choose the best buy.

When the whole group reconvened, one of the Lansing principals who had implemented USMES in his building last year and one of his teachers who had taught USMES in her classroom discussed working USMES into the school and class program. They outlined the resources available within the district for the inservice training of teachers. The group spent about twenty minutes discussing these topics, including a question and answer period.

This was followed by a ten-minute presentation on the Design Lab or its classroom equivalent. The tools and materials already in the district schools were mentioned and scrounging strategies outlined.

The meeting closed with a discussion of the evaluation program and results to date, followed by a general question and answer session.

CONDUCTING USMES WORKSHOPS

Section Two

CONDUCTING USMES WORKSHOPS

When teachers try out a new curriculum for the first time, they usually spend some time becoming familiar with it. The amount of preparation necessary varies according to the difference between the teaching style and content of the curriculum currently being used. The real problem-solving type of learning found in USMES is different in many respects from the learning modes utilized by other curricula. Therefore, the amount of preparation required may be extensive in some cases (for example, when a teacher has been using a teacher-centered curriculum over a period of years). In other cases (for instance, when a teacher has been utilizing a style of teaching similar to that required in USMES), the time required for familiarization is considerably reduced.

The purpose of this section is to provide information on the types of workshop activities that have been found to be helpful in preparing teachers not only to use the teaching style required but also to deal adequately with the variety of content that may arise when their students are engaged in real problem solving. The major categories of work carried out at an USMES workshop are stated in the outline "Key Elements at an USMES Workshop" that is found on the next two pages. A possible agenda for a five-day workshop follows, indicating how the key elements fit into a daily schedule. The overall strategy for workshops is outlined next, followed by a detailed discussion of the various key elements in a workshop and then suggestions for planning a workshop, running a workshop Design Lab, and evaluating a workshop. The section concludes with lists of major activities carried out by adults and children in a sample of workshop unit groups.

KEY ELEMENTS IN AN USMES WORKSHOP

	Percentage of Time 5-day workshop
Experiencing real problem solving by working on an adult challenge	40%
. discussion of challenge . tasks and priorities defined . observation . data collection . data representation and analysis . Design Lab work . group discussions, refinement of procedures . action on challenge	
Exploring skills/concepts in units	(Time included in other categories)
. skills sessions as needed for unit group activities . listing of skills/concepts covered during day . optional skills sessions . skills chart in Teacher Resource Book	
Preparing for USMES work in classroom	30%
. working with children on challenge . videotapes of classroom activities . discussing possible unit activities with teachers who have taught unit	
Familiarization with USMES resources	10%
Design Lab . brief introduction . Design Lab slide/tape show . skills sessions and demonstrations	
USMES written materials . Teacher Resource Book . "How To" Cards . Background Papers . USMES Guide . Design Lab Manual . Curriculum Correlation Guide	5%
Understanding USMES philosophy	5%
. introductory talk . slide/tape show . unit group discussions of teaching style . question and answer periods	

Place of USMES in the total school program	5%
Introduction to other unit challenges	5%

. miniworkshops by unit groups for other participants
. display boards
. slides

POSSIBLE AGENDA - 5-DAY WORKSHOP
(to be preceded by pre-workshop staff meeting)
(to be followed by inservice training periods)

- 1ST DAY

9:00 - 9:45 Plenary Session
- . Introduction of workshop staff and participants
- . Brief introduction of USMES and the purpose of real problem solving
- . Review of workshop objectives
- . Brief description of participant's role at workshop
- . Review of workshop agenda
- . 5 minute descriptions of unit challenges being offered

9:45 - 4:00 (with lunch and coffee breaks) Work in Unit Groups
- . Brief introduction of unit
- . Discussion of adult challenge
- . Setting of priorities for tasks; groups formed to work on various aspects
- . Hands-on work as needed in classroom
- . Discussion of day's activities

4:00 - 4:30 Staff Meeting

- 2ND DAY

9:00 - 4:00 (with lunch and coffee breaks) Work in Unit Groups
- . Continuation of work on adult challenge
- . Hands-on work as needed
- . Skills session as needed
- . Sessions on written resource materials and Design Lab today or tomorrow

4:00 - 4:30 Staff Meeting

- 3RD DAY

9:00 - 9:30 Work in Unit Groups
- . Preparation for work with children

9:30 - 10:30 Work in Unit Groups with Children
- . Introduction of challenge by staff teacher
- . Children develop strategies for handling challenge
- . Children begin hands-on work with participants working with small groups of children on specific tasks
- . Dismissal of children with understanding that they will return the next day

10:30 - 12:00 Work in Unit Groups
- Critique of work with children
- Discussion of ways to introduce challenge to children
- Discussion of next day's work with children
- Viewing of videotapes of class activities
- Continuation of work on adult challenge with hands-on work and skills sessions as needed

(lunch break)

1:00 - 3:00 Work in Unit Groups
- Continuation of work on adult challenge with Design Lab work and skills sessions as needed
- Sessions on written resource materials and Design Lab if not already covered

3:00 - 4:00 Discussion Sessions on Special Topics
- Design Lab issues
- Use of USMES in the primary grades
- Use of USMES in middle schools
- Use of USMES by resource or specialist teachers

4:00 - 4:30 Staff Meeting

4TH DAY

9:00 - 9:30 Work in Unit Groups
- Preparation for work with children

9:30 - 10:30 Work in Unit Groups with Children
- Discussion with children of challenge and previous day's work
- Continuation of children's work on challenge; participants work with small groups of children
- Dismissal of children with understanding that they will return the next day

10:30 - 12:00 Work in Unit Groups
- Critique of work with children
- Discussion of classroom management issues
- Viewing of videotapes of class activities

(lunch break)

1:00 - 4:00 Work in Unit Groups
- Continuation of work on adult challenge with Design Lab work and skills sessions as needed

4:00 - 4:30 Staff Meeting

- 5TH DAY

9:00 - 9:30 Work in Unit Groups
. Preparation for work with children

9:30 - 10:30 Work in Unit Groups with Children
. Discussion with children of challenge and previous day's work
. Continuation of children's work on challenge; participants work with small groups of children
. Dismissal of children with arrangements made for children to come to inservice sessions later in year or work in classrooms on problem

10:30 - 12:00 Work in Unit Groups
. Critique of work with children
. Review of progress on adult challenge
. Continuation of work on adult challenge

1:00 - 3:00 Work in Unit Groups
. Completion of work on adult challenge with Design Lab work and skills sessions as needed
. Discussion of further work that could be done
. Critique of week's work

3:00 - 4:00 Plenary Session
. Discussion of USMES in the total school program
. Review of workshop activities
. Evaluation of workshop
. Discussion of plans for follow-up inservice sessions

Follow-up Staff Meetings

. Evaluation of workshop
. Planning follow-up activities

Follow-up Inservice Sessions for Participants

. Reports on children's class work
. Skills sessions using data collected in classes
. Continuation of work on adult challenge--rerun of experiments, surveys, etc.
. Hands-on work as needed in relation to class work or work on adult challenge

THE OVERALL STRATEGY AT USMES WORKSHOPS

The overall strategy at USMES workshops is to (1) provide teachers with a learning-by-doing experience with real problem solving and (2) to facilitate the transfer of the learning gained in the workshop situation to an understanding of the teacher's role during the classroom application of the real problem-solving process.

Since experience in real problem solving must come first, teachers spend the first part of a workshop working on a challenge at an adult level. During this time, however, some insight into the teacher's role is also gained from observing the way in which the workshop staff provides the leadership in this problem-solving effort. By using the same approach that has been found to be effective in class work with students, the leaders are effectively modelling the teacher's role in an USMES class. This process of modelling includes making sure that the Design Lab work is not required until a need arises in the course of working on the adult challenge. Initial hands-on work is usually done in the classroom; this models the situation, which arises frequently, where student work on a challenge is started before Design Lab tools and materials are available or a school Design Lab is ready for use. Another important aspect of the workshop modelling is that math skills and other skills are covered when the need for them arises during specific investigations carried out by the participants.

In order to make this modelling effective, any shift from work on the adult challenge to work on another element of the workshop should be clearly indicated. Experience has shown that teachers understand these shifts of emphasis most easily if the list "Key Elements at an USMES Workshop" is made available and both the list and the participant's role are discussed at the beginning of the workshop.

The teacher's role in the classroom is emphasized more directly later in the workshop. It is important that this role be not only discussed but also practiced. Participants should work with children as much as possible at a workshop in order to see that children are truly interested in a problem that is relevant to them and that they do have many good ideas about what has to be done in order to find a solution to the problem. The teaching style required for effective open-ended class work is made clear through several cycles of observation, discussion, and working directly with children.

If the workshop is short, most of the time should be spent in the above two types of activities. Very little time

should be taken up with an initial discussion of the USMES philosophy; participants will gradually become aware of its various aspects as they become engaged in its practical application. Often the most meaningful discussion of the philosophy takes place while the participants are engaged in hands-on activities.

Experience has shown that a total of 8 to 10 days of workshop time is usually necessary for a teacher to feel secure in this new style of teaching and learning. However, this time can be spread out over a period of weeks. In fact, there is some advantage to having periodic inservice training sessions during the time when teachers are introducing the challenge to their classes and working with the students as they carry out the first tasks. In addition, periodic meetings during the school year afford teachers the opportunity to discuss class successes and problems and thereby gain a deeper understanding of the whole process of learning through real problem solving.

Since different teachers may need different amount of preparation time, the agenda for a 5-day workshop presented on the preceding pages is intended only to be a starting point from which a more specialized agenda can be built. A longer workshop not only allows more time for a personal experience on one challenge and more time to practice the new style of teaching with children but also allows time for an introduction to a second unit challenge, possibly one that might stem from the first one. In addition, there is time at a longer workshop for more skills sessions, more Design Lab work, and discussions in special interest groups.

The number of staff needed at workshops depends on the number of units being introduced to the teachers. Experience has shown that two staff members can provide effective leadership for one unit group of about twenty participants. At least one of the staff for each unit should be able to refer to personal experiences working with children on the unit challenge. Most workshops should offer participants at least 3 or 4 units to choose from. This choice is essential in order to allow teachers to select one that particularly interests them and to provide students in different classes with a variety of real problem-solving experiences. Each year the number of challenges being worked on within a school can be increased until it is possible for a student to work on a total of about 16 challenges (2 per year) which focus on a wide variety of problems and involve learning a wide range of skills and concepts.

In addition to staff needed for unit groups, staff is required for overall direction and coordination of the workshop and for Design Lab activities. In general, one Design Lab staff member is needed for every 25 to 30 participants at a workshop.

Experienced USMES teachers and university content and curriculum specialists are located throughout the country and can serve as consultants to help with the planning and staffing of USMES workshops. They include development teachers and university personnel who have worked with the project for a number of years developing units and staffing project-run workshops as well as resource team members who have been trained in implementation strategies and are carrying out teacher-training programs in their own areas. A list of these experienced USMES teachers, administrators, and university personnel is available from the USMES central office.

It is very important that staff members come together for a pre-workshop staff meeting to review the workshop agenda and the roles and responsibilities of the staff. The key elements of an USMES workshop should be reviewed and the ways in which they will be implemented discussed. The importance of modelling the USMES style of teaching and learning during unit group work should be emphasized. The staff for each unit group should also spend some time planning their introductory session with participants. The staff can then share their ideas and offer suggestions to one another on ways to optimize the experience of learning about USMES and about particular units for the participants. This process of sharing ideas and evaluating the workshop experience is also an important part of the daily staff meetings held throughout the workshop.

DISCUSSION OF THE KEY ELEMENTS IN AN USMES WORKSHOP

Experiencing Real Problem Solving By Working On An Adult Challenge

In order to experience first-hand the learning that can be achieved by working toward a solution to a real problem, teachers spend at least 40% of their time at a workshop working on an aspect of the unit challenge that is real to them as adults. All real problems, including the ones stated in USMES challenges, can be looked at from an adult's point of view as well as from a student's vantage point. For example, adults may become involved in the Designing for Human Proportions challenge by designing and constructing a prototype table that is the right height to work at while standing up or by designing a backpack suitable for carrying around books and other supplies. Adults working on the Play Area Design and Use challenge might observe children's use of a play area and then design a "better" one or they might design a recreational program for the workshop participants or a school staff. Participants in the Classroom Design unit can look for ways to improve the teachers' lounge, the school office, or the auditorium. The adult challenge in units like Manufacturing or Advertising may arise in the course of working on other adult challenges. See the lists of major activities beginning on page 48 for documentation of other adult challenges workshop participants have tackled.

The advantages in having participants spend a considerable amount of time working on an adult challenge are evident when the spin-offs from this experience are considered. Some possible consequences are listed below.

1. Participants become aware of the importance of the challenge in providing motivation and focus for all activities.

2. Participants understand fully the process involved in real problem solving. They experience many of the same problems that students have in:

   a) defining the problem
   b) setting priorities for tasks that need to be carried out
   c) making accurate and relevant observations
   d) collecting accurate and relevant data
   e) analyzing the data
   f) redefining the problem and establishing new approaches
   g) redoing the measurements

h) drawing conclusions; making recommendations
i) working in groups
j) reporting to others

3. Participants identify some of the skills and concepts that may arise as students work on a similar challenge.

4. Participants learn to work with Design Lab tools and supplies, just as students do, when the need arises.

5. Participants are exposed to a model of an USMES class as the workshop staff works with them in a nondirective way.

Experience at USMES-run workshops has indicated that initial discussions about the adult challenge should include the consideration of the amount of time available at the workshop for working on the challenge. However, it should be pointed out that time is a factor only because of the limitation imposed by the workshop and does not apply to work by students in the classroom. Each USMES challenge is a statement of a problem that applies to a real situation with all the variables and complexities of real situations and ideally the time required to find some solution cannot be limited.

Exploring Skills and Concepts in Units

As mentioned above, many of the skills and concepts that may arise as students work on the unit challenge will come up as participants work on the adult challenge. This establishes the model of learning in context; namely, learning specific information or skills when they are needed to help work toward the solution of the challenge. Participants learn new skills in the context of work on the adult challenge in three ways: 1) by participants trying out their own ideas, 2) by participants using relevant "How To" cards and background papers, and 3) in skills sessions led by the staff at the times when more information on specific skills is needed.

Work on many of the adult challenges leads to skills sessions which cover skills such as graphing techniques, ways to choose samples and conduct surveys, the construction of of triangle diagrams to compare ratios, and methods for using pegboard graphs to represent and analyze data. In certain units the sessions may cover specialized topics such as basic concepts in electricity, determining density and volume, constructing confusion matrices and drink difference maps, using climatology data to make weather forecasts, determining

regularity and irregularity in polyhedra, and using Venn diagrams to check accuracy of descriptions.

Real data that has been collected at the workshop by the participants is used in these skills sessions. As in the classroom situation, there is no substitute for the use of real data in making the learning of skills relevant. In the Weather Predictions unit some skills sessions and subsequent work by participants are based on weather data gathered from newspapers prior to the workshop. Since weather forecasting is based on accumulated data, it is important that the staff make sure that this information is available at the workshops. In classes, students can collect the information for themselves and gradually build up the necessary store of information, or they can go to the library and collect past data. In other units, the workshop participants can easily gather their own data within the time allotted for unit group work.

The content of most of these skills sessions is covered in Background Papers and workshop staff can base their sessions on this material. The chart on page 46 of this book lists possible skills sessions and sources of information for conducting each session.

Teachers at USMES-run workshops have often indicated that they would like more skills sessions than come up in group work on the challenge. During long workshops some time can be devoted near the end of the workshp to extra skills sessions. These sessions afford the opportunity for participants to learn about skills that often arise in units other than the one(s) they are working on.

In addition to participating in skills sessions while they work on the adult challenge, participants spend a short time at the end of each day in listing all the skills and concepts that came up during the day's work. Experience has shown that this is an effective way of illustrating the range of learning that takes place in the course of real problem solving. The list is expanded and methods for teaching skills and concepts are further explored when the group begins to focus on how children respond to the challenge -- the children they work with at the workshop, the children they see in videotapes of class activities, and the children they read about in the edited logs found in the resource books.

Participants also discuss the chart and list of skills and concepts found at the back of the resource books. Possible uses for the chart are discussed either in the unit groups or in a special session on the written resources. For example, the chart has been used for documenting both class experiences and individual student experiences in various USMES units. Sample copies of a blank Class

Experience Chart and Student Experience Chart which have been used by USMES teachers are available from the central office.

Preparing For USMES Work In The Classroom

Sometime near the middle of the workshop the emphasis shifts from work on an adult challenge to preparation for classroom work on the unit, although some time is still spent on the adult challenge throughout the balance of the workshop. The teacher's role when students are involved in real problem-solving work is considerably different from his or her role when other learning activities are going on. The teacher has certain responsibilities that must be carried out to ensure that students derive the maximum benefit from their real problem-solving work. The resource books spell out these responsibilities by stating that the teacher should:

1. Introduce the challenge in a meaningful way that not only allows the children to relate it to their particular situation but also opens up general avenues of approach.

2. Act as a coordinator and collaborator. Assist, not direct individuals or groups of students as they investigate different aspects of the problem.

3. Hold USMES sessions at least two or three times a week so that the children have a chance to become involved in the challenge and carry out in in-depth investigations.

4. Provide the tools and supplies necessary for hands-on work in the classroom or make arrangements for the children to work in the Design Lab.

5. Be patient in letting the children make their own mistakes and find their own way. Offer assistance or point out sources of help for specific information, such as the "How To" cards, only when a child reaches the point of frustration in his approach to the problem.

6. Provide frequent opportunities for group reports and student exchanges of ideas in class discussions. In most cases, students will, through their own critical

examination, improve on their procedures or set new directions in their investigations.

7. If necessary, ask appropriate questions to stimulate the student's thinking so that he or she will increase the depth of the investigations or the analysis of the data.

The workshop provides participants with the opportunity to not only discuss, but also practice this new role. Participants should work directly with children if at all possible. A staff member who has worked with the unit usually takes the lead the first day in introducing the challenge to the children. However, participants are urged to work with groups of children on certain aspects of the problem, or at the very least on their own unit investigations in the same room with the children. Experience has shown that participants also learn a great deal by watching children work in the Design Lab on various construction activities.

Working with children at a workshop is admittedly artificial in some ways. However, the advantages outweigh the artificiality of the situation. The more practice participants have at the workshop in discussing a real problem with children and in working with them on possible solutions, the easier it is for them to take on the same role in the classroom. The biggest problem in working with children at a workshop is that there is seldom enough time for the children to follow through on all of their ideas. It would be ideal for students involved in the workshop if their classes could begin work on the challenge immediately following the workshop.

After each session with children the group critiques the session; this often stimulates a discussion of the teacher's role and problems of classroom managements. Occasionally participants hesitate to criticize the efforts of others in the group. Therefore it is helpful to watch and critique videotapes of activities in trial classes, especially those videotapes which show class discussions and teachers working with several small groups of children. Talking with the staff teachers who have worked with USMES in their own classrooms is another way for participants to gain insight into ways to solve problems that may arise in the classroom situation.

In many cases the fears of participants gradually vanish as they work with children at the workshop and subsequently in the classroom. Most report that the interest and persistence of their children in working out a solution to the problem have overcome many of the discipline and management problems they had anticipated.

Familiarization With USMES Resources

USMES resources for classroom work fall into two categories: 1) tools and materials for certain hands-on activities, and 2) written resources for both students and teachers. In some schools, tools and equipment are kept in a room called the Design Lab. Design Lab tools and supplies are also kept in a corner of a classroom, or on a cart that moves from room to room and serves as a portable Design Lab.

USMES students use the Design Lab tools and materials to construct measuring instruments, test equipment, gadgets, scale models, etc., as the need for them arises. Thus working in a Design Lab is an important part of a teacher's preparation for classroom work on real problem solving. In general, workshop participants learn about the Design Lab concept by:

1. working with Design Lab tools and materials as the need arises in the course of their work on the adult challenge;

2. working in the Design Lab with children as they become engaged in construction work as part of their investigations of the challenge

3. attending a short introduction to the Design Lab;

4. participating in sessions focused on the use of specific tools;

5. participating in special sessions for persons responsible for Design Lab operation and maintenance.

Details on the above are found later in this section under "Running a Design Lab at an USMES Workshop" (pages 39-41).

USMES written resources are distributed to participants at workshops after they have worked for a day or two on the adult challenge. This slight delay emphasizes the effectiveness of learning by doing before learning by reading. The purpose and the content of the various resources -- the USMES Guide, Teacher Resource Books for the various units, "How To" Cards, Background Papers and the Design Lab Manual -- are thoroughly explored at the workshop. Special sessions may be scheduled for this purpose, with further discussions in unit groups as the need arises for a specific resource. The descriptions of the USMES Guide, "How To" Cards, and Background Papers found in the Preface of each Teacher Resource Book are adequate for use in these sessions. However, some points

that should be covered in a discussion about Resource Books follow:

1. The first section includes a description of the overall USMES philosophy with particular emphasis on the nature of real problem solving and the classroom strategy which is effective in promoting good problem solving work by the students.

2. The second section includes general papers on the specific unit. If a teacher has already taught another USMES unit, he or she need to read only this section before introducing the challenge to the class. The papers include:

   a) An overview of possible unit work plus details on prerequisite skills, if any, needed by students before starting the unit.

   b) Information on work that primary children can accomplish in searching for a solution to the challenge.

   c) A description of the classroom strategy which includes documentation from classes which have encountered certain pitfalls in working on the unit.

   d) A flow chart and composite log showing one way in which in-depth investigations can take place.

3. The third section is the documentation section. Edited logs of the work in a variety of age-level classes are included. For easy reference, each log is preceded by a brief abstract of the class work on the challenge.

4. The fourth section contains lists of "How To" Cards and Background Papers relevant to the unit; an annotated bibliography of other resources is also included.

5. For quick reference during the year, the skills and concepts charts are included at the end of the resource books as an Appendix.

Understanding USMES Philosophy

Only about five percent of the time at a 5-day workshop is spent in sessions devoted exclusively to the USMES philosophy. Much of the rationale for real problem solving as a viable mode of learning is examined in the context of other activities --working on the adult challenge, working with children, discussing USMES resources, and discussing the place of USMES in the total school program.

A brief description of real problem solving is given in the opening session of the workshop so that the participants will be able to put the workshop activities in context; the slide/tape show may be used for this purpose. Further discussions of the importance of the challenge and the teacher's role in USMES work take place in unit groups. If a more formal dissertation on USMES philosophy is desired, videotapes are available of speeches and panel discussions on the purpose and effectiveness of real problem solving in the classroom. Question and answer periods often follow the viewing of these videotapes and are also scheduled at other times during the workshops. If a question and answer period is scheduled fairly early in the workshop (but after participants have had some experience working on the adult challenge and working with children) the staff may gain insight into the particular aspects of USMES and the workshop that may be bothering the participants. For example, obtaining administrative support for the program was the overriding concern at one workshop. A subsequent invitation to the principals of the schools involved to attend some of the workshop sessions helped alleviate this concern.

Place Of USMES In The Total School Program

In short workshops some time should be spent on discussing the ways in which real problem solving can be worked into the school schedule; various aspects of the problem may come up in special sessions on written resources or during unit group discussions. It can be pointed out at these times that:

1. Children can learn many new skills and concepts quickly in the course of their work on real problems. A great deal of practice on these skills and others will also take place. This practice is especially effective in the context of real problem solving because children are using the skills in a practical way.

2. By planning the school day around work that is undertaken in response to an USMES challenge children can learn a great variety of

things and still utilize the most effective method for learning each specific thing. For example, children may learn certain skills best while involved in real problem solving, while other skills may be learned best in other learning modes. Since all activities in USMES are student-initiated in response to a challenge, planning for teaching skills and concepts must be flexible. Each unit resource book contains charts which identify the skills and concepts that may arise during work on that unit. Teachers can use these charts to plan their teaching program, postponing until the end of the year the teaching of skills that may come up in real problem solving. At that time, skills that have not already been learned during the time spent on the USMES challenge(s) may be taught in a more traditional way.

3. A further integration of learning activities can take place when activities which may lead into, supplement, or utilize USMES work are scheduled at the most appropriate time (preceding, concurrent with, or following the USMES activities). A volume called the Curriculum Correlation Guide is currently being compiled by the USMES staff which will identify ways in which activities that are included in standard textbooks and other curriculum materials may be effectively intertwined with work on the various challenges.

At the workshop some time can be spent in becoming familiar with the content of the Curriculum Correlation Guide and finding ways to apply the information contained in the guide to the curriculum being utilized in the schools.

Teachers and administrators at several schools are currently documenting the intensive use of USMES by the majority of the teachers and students in their buildings. These USMES model program schools are working on correlating USMES with other subject areas and dealing with management issues such as scheduling, financing, student assessment, and training and use of school and community personnel. The documentation will provide the basis for new resource materials which directly address the question of working USMES into the total school program.

Introduction To Other Unit Challenges

If the workshop runs for 8 to 10 days, participants can usually work with two unit challenges. This is especially desirable since some challenges, like the Manufacturing or Advertising ones, may come up during the course of adult or student work on another unit. However, if work on two units is scheduled during the workshop, about 5 days should be spent on the first challenge so that in-depth investigations in response to the adult challenge and several sessions with children can take place. After this experience, a second unit can be adequately covered in a shorter period of time. If possible when working on the second adult challenge individual participants should carry out a different type of investigation from the one attempted during work on the first challenge. For example, conducting a second survey would not help a participant learn new skills as much as carrying out another type of investigation.

At shorter workshops, participants can be introduced to other unit challenges by the participants working on these units. The different unit groups can run miniworkshops of 1½ to 2 hours duration sometime near the end of the workshop. Experience has shown that the planning for these miniworkshops provides a good opportunity for the participants to review their work and reinforce their learning. As the word miniworkshop implies, the units are introduced by having participants engage in hands-on work on the challenge presented, in addition to any general discussion of the unit that may take place. If there is not sufficient time for miniworkshops to take place, participants in the unit groups can present their findings to the others at a plenary session.

Display boards and slide shows are other methods that can be utilized to convey information on a variety of challenges to the participants. In addition, specific skills that may arise in "other" units may be covered during general skills sessions near the end of longer workshops.

PLANNING USMES WORKSHOPS: A CHECKLIST FOR WORKSHOP COORDINATORS

The information contained in this section is intended to assist you in setting up your workshop. It is our belief that if these things are done before the workshop date you will have a smooth operation.

Workshop Location

Determine at least three weeks before the workshop date where the training will take place. Set up the area just as you would during the actual workshop; and if you have time, do a "dry-run" of workshop activities in order to determine what else is needed. It seems we never miss things like sinks, waste receptacles, electrical outlets, etc., until we need them.

Workshop Staff

Identify your workshop staff early, and, if it is possible, please let your staff know where they will be working by going over the physical plant with them. This is necessary in order to prevent the "last minute demands" from staff which result from lack of familiarity with the work space.

Have each staff member give you a list of supplies he/she anticipates needing, a general outline of the kinds of unit activities that will take place each day, and a signed agreement which includes the hours of work, the amount of pay they will receive for the work (including report writing, attendance at staff meetings, etc.) and any information needed to process payment (address, social security number, etc.).

Workshop Coordinating Committee

Select a group of people whom you can count on to help you coordinate the workshop. This group should be in on every detail of the workshop planning and should meet frequently before and during the workshop in order to plan for each and every possible workshop situation. This group should consist of three to five people, plus yourself.

Staff Meetings

Be sure that each staff member understands that his/her attendance is expected at each staff meeting--before, during and after the workshop date. Let each member have a list of the staff meeting times prior to his/her signing an employment agreement with you.

Arrange a meeting place at or as nearby the workshop site as possible. It is awfully important that the staff not travel too far away from the workshop site to staff meetings. There is a mental lassitude that accompanies the physical latitude. Therefore, it is important to try to keep the staff near the workshop site--in one of the unit rooms, if possible.

Runner for Workshop

The person selected to go for immediate purchases should not be a member of the workshop staff--and definitely not part of the administrative staff, because these people will have enough to do. This person should be someone who knows the area, has access to a car, and is reliable. We have had success with teenagers. Since this person will have to be paid, you should make allowances for this in your budget.

Secretarial Assistance for the Workshop

Secretarial assistance is vitally important in running a workshop. Get someone committed to the job early; this person can make or break a good workshop. You need him/her for answering the phone, typing news notes and reports, copying, etc. The lack of a good secretary can really hinder you.

Children for the Workshop

Having children for participants to work with on USMES units is essential to a good workshop. Try to contract with a day school or a local public school for children. Maybe one of the workshop participants could encourage his/her class to attend.

Select someone who will have the responsibility for meeting and dismissing the children each day they are present. Once this person has been selected, you might also assign him or her the responsibility for purchasing and distributing the treats for the children (e.g., candy bars, fruit, popsicles).

Have each unit group give you the name of the staff teacher who will be responsible for picking up and returning the children to the person who is taking overall responsibility for the students.

Date of Workshop

Let everyone involved know the workshop dates as soon as they are fixed. The sooner they are fixed the sooner people--both staff and participants will start to arrange their personal calendars to accommodate this time block. And once the dates

have been publicly announced, please do not allow them to be changed. Change the workshop site, staff, unit presentations, etc., but do not change the dates. People are often more committed to dates than they are to people and things--especially when we are talking about time frame commitments that are to be made by large numbers of people.

Pre-Workshop Information for Staff and Participants

Send each staff and each participant a copy of the tentative agenda (including dates, times and location) as soon as it is possible in order that each will know what to expect. Also, invite the staff and participants to suggest changes to improve the agenda. By doing this, each person is encouraged to participate in the productive effort of the workshop. NEVER prepare an iron-clad agenda; it will surely blow up in your face.

Send each staff a copy of the resource book for the unit he or she will be teaching. If possible, send along a copy of Preparing People for USMES: An Implementation Resource Book as well, or at least copies of the sections on key elements in USMES workshops and strategies for covering them.

Travel Arrangements and Accommodations for Out-of-Town Workshop Staff and/or Participants

If your workshop staff and participants are local, the matter of travel and accommodations becomes a moot point. However, if you plan to have some out-of-towners participate in this workshop it will become necessary that you arrange lodging for them that is central for after-workshop entertainment. It is also necessary that you arrange to have these people picked up and delivered to and from the workshop site. (Don't try to do this yourself, because you will have enough to do just trying to keep on top of all of those things you were not able to plan for.)

Check with out-of-town participants and staff also to be sure that their travel arrangements to and from the airports, train stations, etc., are being cared for. This is not your responsibility; it is just a courtesy.

Petty Cash

You should have some money to purchase consumable materials for the Design Lab and the units that you plan to run. A good rule-of-thumb to use is $.50 per day per participant. Let the staff know before they meet with the participants just how much money they have to spend. This way, the problems resulting from needing cash are the participants' and staff's as well as the administration's (yours).

It might be a good idea to give the petty cash to someone else and not try to keep it yourself.

Materials for Workshop Participants

The supplies for the Design Lab and the unit resource materials should be on hand on the first day of the workshop. How and when these materials are distributed is, of course, left up to the staff, but have them there for them when they are needed.

All of the workshop participants should have one copy of the following:

1. Workshop Agenda
2. Participant List
3. Unit Room List
4. Diagram of the Workshop Area (map)
5. Workshop Questionnaire (when appropriate)
6. List of USMES Resource Personnel in the Area
*7. USMES Brochure
*8. Design Lab Brochure
**9. USMES Guide
**10. Teacher Resource Book of their unit
**11. "How To" Cards
**12. Background Papers
**13. Design Lab Manual
*14. USMES Newsletter
*15. Reprints of recent USMES news articles

*Available free of charge from USMES Central Office
**To be ordered from USMES Central Office; optional as to who will purchase these -- participants or schools or district

Other items which may be of interest to participants include Evaluations of USMES: A General Report, the preliminary edition of the Curriculum Correlation Guide, and the map and list of schools, districts, educational institutions, and personnel throughout the nation involved in USMES. Contact the USMES Central Office concerning the availability of these materials.

Workshop phones, typewriters, etc.

You should have access to a phone to make the necessary workshop business calls, typewriters to do the necessary clerical services, and a VTR to do videotaping and playback, if desired.

Participant List and Information Sheets

Assign someone to be responsible for collecting participant lists from unit groups and distributing and collecting participant information sheets which include name, address, school, grade level and any other information needed.

Sessions for Principals

Although you may not have a formal and detailed agenda for the principals, it is imperative that you set aside some time during the workshop for them to visit and talk with their teachers. In this way, the teachers will be able to directly ask their principals those questions which will surely arise as a result of teacher training sessions like these; it will also give the principals an opportunity to see what is going on.

Staff-Participant Social

A time should be proposed to the staff and participants to hold a social where they can spend some informal time together. The sooner, the better. Say, second or third evening.

Publicity for the Workshop

Call the district's public information officer to report the impending workshop including a description of USMES and the USMES program in your area. You might follow this up with other materials and articles on USMES.

Creature Comforts at Workshop

Please plan for the creature comforts for the participants.

- Will the toilet facilities be adequate and clean?
- Will there be coffee and rolls? Who will make the coffee and purchase the rolls? Will the coffee be made in time?
- What lunch facilities will be required?
- Will smoking be allowed? Where?
- Will the participants have access to telephones? Where?
- Will the participants have access to office machines and will there be enough supplies (i.e., ditto paper and masters, etc.)?

A Final Word

Delegate as much of this work as possible--especially during the workshop--because you will have all you can handle just trying to keep on top of all of those things for which you can never plan.

RUNNING A DESIGN LAB AT AN USMES WORKSHOP

The following several pages describe the key elements involved in operating a Design Lab at an USMES workshop for teachers. USMES Design Labs are usually staffed with one Design Lab staff member for every 25 to 30 participants. Additional staff may be required if Design Lab managers are to be trained at the same workshop; one or two staff for this purpose is usually sufficient. See the section on training Design Lab managers (pages 61 to 76) for more information on conducting manager training workshops.

Setting Up a Workshop Design Lab

1. All material ordered for the workshop should be delivered at least 3 days prior to the beginning of the workshop.

2. Tri-Wall should be ordered at least a month in advance.

3. A workshop lab should be large enough to accommodate at least a third of the workshop participants at one time. (A 24' x 40' or 30' x 60' room is a good size.)

4. When a large room is not available, two smaller rooms should be used.

5. Ideally, there should be four double plug electrical outlets in a lab.

6. When possible, old tables or workbenches should be used in a lab due to the possible rough usage.

7. A "runner" or "go-for" (a high school student, etc.) with a car, is often useful for gathering needed supplies for the Design Lab and unit groups.

Design Lab Introduction Sessions

Design Lab staff often introduce the lab by showing the Design Lab slide/tape show. The presentation takes about ten minutes and covers many of the important elements of the USMES Design Lab concept.

When the Design Lab slide/tape show is not available or when a more personal approach is desired, a short introductory session might be held in the lab or Design Lab staff might make presentations to individual unit groups in their own rooms.

The Design Lab brochure can be handed out to participants during either type of introductory session. The brochure gives participants a handy reference to the Design Lab that they can take away with them.

In addition to a brief review of the major aspects of the Design Lab concept that are covered in the Design Lab slide/tape show and brochure, the following key points should be included in any introductory session:

1. The importance of children using the lab when the need arises in the course of their unit work. Design Lab work is not required until a need for it has been identified.

2. The importance of a continual emphasis on safety. Mention should be made of Design Lab safety record. There has never been a serious accident in a Design Lab for as long as USMES has been in existence.

3. The importance of not feeling you have to be an expert with tools.

4. The importance of soliciting help from lab managers, teachers, and children in scrounging tools and materials.

The Design Lab Manual and Supplement are the most complete source of information on USMES Design Labs and should be referred to for assistance.

Design Lab Skills Sessions

Skills sessions focus on descriptions of how to use the tools in the Design Lab. There are two ways that this has been done at various USMES workshops. Both methods can make use of the Design Lab "How To" Cards to familiarize the participants with ways that adults and children can learn about the tools and materials in the lab.

One method for doing skills sessions might be called a lecture/demonstration. This type of skills session is usually done by one person who explains the use and gives a demonstration of many or all of the tools in the Design Lab.

The second method is less formal but requires more than one person to explain and demonstrate the various tools. In this method, which might be called the stations approach, the tools are divided up among some number of areas or tables. Participants move between the tables or areas as they wish. This method because of its informality allows far more opportunity for participants to ask questions and to handle the tools or try a few simple procedures themselves.

It is highly recommended that either of these methods or some variation for skills sessions be done "live." However, when it is not possible to conduct live skills sessions on tool use, videotapes are available which cover the use of most tools.

Helping Participants in the Design Lab

A. Encouragement and assistance

1. Those participants who are unfamiliar with tools will need a good deal of encouragement and assistance in the lab. The Design Lab "How To" Cards can be used to help participants feel more comfortable working with tools.

2. Having three or four children assigned to the lab and working on various constructions will help participants see what children can do.

3. When unit groups bring children to the lab, the adult members of the group should be helped with any technical problems that arise as they work with children and they should be encouraged to follow USMES philosophy for working with children.

B. Safety - Design Lab staff needs to be constantly alert for misuse of equipment. Both eyes and ears can detect problems. A first aid kit should be handy. Attention should be paid particularly to:

1. Keeping aisles clear of scraps and extension cords.

2. Preventing the lab from becoming so crowded that participants cannot work safely.

Follow-up to Workshop

Additional skills sessions are often helpful. These sessions may be run by Design Lab staff at schools where teachers feel a need for additional help with tools. These sessions may be held after school, on half days, etc. Design Lab staff should be available by phone or in person to answer questions on Design Lab issues or technical problems that may arise.

EVALUATING AN USMES WORKSHOP

The staff continually evaluates the workshop throughout its duration. The questions raised by participants in unit group meetings, question and answer periods, or any of the other workshop sessions provide valuable information on the effectiveness of the workshop in meeting the participants' needs. Comments and suggestions on this particular point can also be solicited at various times throughout the workshop. Experience has shown that short staff meetings every day or two provide a good opportunity for sharing observations of the strengths and weaknesses of the specific workshop format being utilized. Additional meetings or sessions on different topics may be scheduled in response to the expressed or perceived needs.

Participants are also usually asked to fill out a questionnaire at the end of the workshop. The questionnaire provides the teachers with an opportunity to comment on their experiences at the workshop, their plans for using USMES in their classrooms, and their preferences on items to be covered in follow-up inservice sessions. A sample questionnaire is included on the next several pages.

SAMPLE
USMES WORKSHOP QUESTIONNAIRE

Dear Workshop Participant:

We need your reactions and preferences in order to better evaluate this five-day workshop and to plan future ones. Please fill in your responses and return to the office before the end of the workshop. Thank you!

1. Which unit did you work with?

2. When do you plan to introduce the unit challenge to your class?

3. Do you feel the workshop prepared you adequately to introduce the challenge to your class?

_____ Yes _____ No

4. What problems, if any, do you expect to encounter doing the unit with your class?

5. Was the total amount of time spent in the workshop activities listed below too much, too little, or just about the right amount? If you feel that no time should be spent on a particular activity, please check the first column.

	No time necessary	Too much	Too little	Just about right
a. Working on the challenge at an adult level.				
b. Working in Design Lab on adult challenge.				
c. Skills sessions in unit groups				
d. Working with children on challenge.				
e. Viewing videotapes on unit activities				
f. Design Lab introduction.				
g. Discussion of written resource materials.				
h. Discussion of USMES philosophy.				

6. Would you like to attend another workshop as a follow-up to this one?

_____ Yes _____ No

7. What activities would you like to see covered in another workshop?

____ a. Work on unit challenge at the adult level.
____ b. Work with children on challenge.
____ c. Viewing videotapes on unit activities.
____ d. Math or science skills sessions.
____ e. Design Lab skills sessions.
____ f. Discussion of written resource materials.
____ g. Discussion of USMES philosophy.
____ h. Discussion of ongoing USMES work in classrooms.
____ i. Other (please specify) _____

8. Other comments and suggestions:

POSSIBLE SKILLS SESSIONS FOR WORKSHOPS

TOPICS	REFERENCES
Techniques of Surveying	
- Design of questions, sample size, sample composition, analysis, reliability	See Background Paper PS4
Analyzing Data	
- Finding and using the median	See "How To" Cards, PS4, 5
- Comparing ratios by analyzing triangle diagrams	See "How To" Card R1; Background Papers R1, R2
- Making bar graphs, histograms, line graphs, scatter graphs	See "How To" Cards GR1-6; Background Papers GR4, 6, 7
- Rounding off	("How To" Cards being written)
- Comparing sets of data	See "How To" Card GR7; Background Papers GR4, PS1, 5
- Making 3-dimensional pegboard graphs	See Background Paper GR5
Drawing Maps	
- Making scale drawings	See "How To" Cards R2, 3; Background Paper R3
- Mapping large areas	(Background Paper being written)
Measuring	
- Deciding which instrument to use	See "How To" Cards M1-16, G3
- Converting measurements from one unit to another	See "How To" Cards M9, 10

Making Electrical Circuits	
- Series and parallel	See "How To" Cards EC10; Background Papers EC1,3
- Troubleshooting	See "How To" Cards EC2,7,9; Background Paper EC2
- Connections	See "How To" Cards EC3
Analyzing Taste Tests	
- Making confusion matrices and drink difference maps	See Background Paper DP3
Simulation	
- Rope circles and Venn diagrams	See Background Paper SA2
Design Lab Skills	
- Tool use	See Design Lab "How To" Cards
Classification and Categorization	
- Keying and identification of plants and animals	See Background Paper B3

MAJOR ACTIVITIES FOR A SAMPLE OF WORKSHOP UNIT GROUPS

The lists on the following pages indicate major activities carried out by adults and children in a sample of workshop unit groups:

- Advertising
- Bicycle Transportation
- Classroom Design
- Consumer Research
- Describing People
- Manufacturing
- Pedestrian Crossings/ Traffic Flow
- Play Area Design and Use
- Protecting Property/ (Burglar Alarm Design)
- Soft Drink Design

The particular unit group activities described took place at the USMES Resource Team Workshop held at University of California at Santa Cruz, June 24-July 5, 1974. Participants spent four days working on a unit, including two one-and-a half hour sessions with children. The lists include activities related to two key elements: (1) experiencing real problem solving by working on an adult challenge and (2) preparing for USMES work in the classroom by working with children. The other key elements were covered in much the same way for all unit groups so they are not included in the lists.

Advertising

Experiencing real problem solving by working on an adult challenge

Challenge: Find the best way to advertise a product or an idea you want to promote.

- discussed unit challenge
- listed possible products or services needing advertising (e.g., USMES workshops, 4th of July barbecue, work of other unit groups, improving book store hours or getting participants to mix more in evening)
- divided up into three groups
- first group went to work with Play Area Design participants on advertising their recreational activities
- second group went to work with Manufacturing participants on advertising "How To" Card holders
- third group worked on ideas for testing ways to advertise a new product
- first and second groups examined needs, then joined forces to advertise Play Area Design group's recreational activities, designed advertising strategies and distribution mode
- third group went to Banana Joe's to work on advertising for a new product; designed advertising campaign for cantaloupe a la mode which Banana Joe's served as a special item
- discussion of advertising strategies (posters on walls, patios, and walkways, distribution of balloons with written messages, additions to daily news notes, etc.)

Preparing for USMES work in the classroom by working with children

Challenge: Design advertising campaign for school or community events coming up that could be promoted so that more people would attend.

- discussed unit challenge with children
- listed coming events on the board (4th of July fireworks show, Tuesday field trips to Creative Candle Factory, Staff of Life bread factory, stained glass window factory, train trip to Fremont, Oakland Museum, school fair, school barbecue picnic)
- divided up into groups of interest and brainstormed ways to advertise events by means of notes, invitations, flyers, models, posters, billboards, radio, videotape, word-of-mouth, announcements in classes
- group went to Design Lab for tools and materials (paper, pencils, tagboard, rulers, felt pens, scissors, glue) to design advertisements
- group worked on a variety of promotional materials and strategies (posters made of Tri-Wall*, ditto flyers, bullhorn for announcements, skits, individual tags with name and date, poster with a flashlight bulb on front and battery holder and bell taped on back, cassette tape with train sound effect and announcement overlaid
- discussed and decided on best ways to advertise, best places to advertise, and why
- follow up discussion/planning occurred among adult participants on classroom and Design Lab management, questioned what strategies to use.

*Because Tri-Wall was the most readily available brand of three-layered cardboard at the time the project began, USMES has used it at workshops and in schools; consequently, references to Tri-Wall can be found throughout USMES materials. There are several other brands of three-layered cardboard available and the addresses of the companies that supply three-layered cardboard can be found in the Design Lab Manual.

Bicycle Transportation

Experiencing real problem solving by working on an adult challenge

Challenge: How can bicycle transportation be used to enable USMES participants to enjoy Santa Cruz?

- discussed unit challenge
- designed questionnaire, surveyed participants for bike ownership, use, and preferences for a bike tour (how long and what time)
- acquired bicycling guide for Santa Cruz County
- discussed bike rental plans
- investigated bike rental possibilities and various bike paths
- analyzed rental plans and decided to rent bikes from Flying Bicycle Shops
- analyzed possible tours and chose Cliff Drive for the five mile bike tour
- organized and carried out tour for workshop participants
- analyzed survey data on bike ownership and bike use
- critiqued tour and discussed extension of the unit

Preparing for USMES in the classroom by working with children

Challenge: Plan and set up a bicycle course at the West Lake School.

- discussed unit challenge with children
- divided up into two groups
- first group worked on planning, sketching, and designing bike course
- second group went to Design Lab to work on constructing stop signs, traffic lights, ramps, "slow" and "sharp curve" signs
- bikes and signs were taken to the course, discussed what should be watched for: speed; general safety; stopping safely; stopping for signals, signs, and pedestrians; giving hand signals; how to turn on sand; how to ride tight, narrow, circular paths; how to ride over ramps
- critiqued activity, student comments were bikes needing maintenance, most riders making several mistakes; decided worst mistakes were forgetting hand signals and stopping, sliding on sand
- worked on rules for riding: use hand signals, stop for people, slow down on curves, and keep your eyes on the road
- discussed follow-up; students expressed interest in doing unit with their regular teachers, saw the possibility of getting assistance from the police

Classroom Design

Challenge: Make this room a better place to meet this week.

Experiencing real problem solving by working on an adult challenge

- group leaders moved all furniture out of the classroom
- participants sat on floor, discussed what might be needed during week in the classroom: group meeting area, storage space, supply area, tables, chairs, carpet, pillows, Design Lab corner, decorations, coffee area, audiovisual materials
- challenge issued, suggested the following areas: quiet corner, coffee corner, Design Lab work and supply area, and a large group discussion corner
- drew diagram of room on board, determined size of areas by pacing and using length of foot measurements, checked dimensions given on wall chart
- discussed measurements and scale drawings
- discussed location of each area, what each area needed, safety issues
- broke up into interest groups, went to Design Lab to begin work on their projects (tables, chairs, bookshelves, and an acoustic room divider) for different areas
- two participants designed a bean bag chair, discussed and identified major characteristics, and constructed prototype
- organized and equipped areas with existing and specially constructed furnishings
- discussed likes and dislikes of each area, and skills learned and utilized

Preparing for USMES work in the classroom by working with children

- asked children how they would make the room a better place to be in
- students suggested decorating, carpet, couch, record player, kitchen with food, television, and pictures
- discussed unit challenge with children, items suggested, and which could be worked on
- broke up into groups
- one group designed mobiles
- "garden" group collected flowers and rocks for room, discussed location of a garden
- "picture" group created posters for walls, discussed location of pictures
- groups came together to discuss seating arrangements
- discussed other possible changes and how they help make the room a better place; focused on using television, kitchen area, animal area, relaxing area
- adults viewed videotape of classroom activities

Consumer Research

Experiencing real problem solving by working on an adult challenge

Challenge: Determine which brand of a product is the best buy for a certain purpose.

- discussed unit challenge
- divided up into three groups (plastic wraps, mouth wash, and potato chips)
- plastic wrap group: investigated four brands of plastic wraps (Glad, Saran, Stretch and Seal, and Kitchen Craft) to determine which was the best buy for maintaining freshness; designed apparatus to test strength, all but Saran Wrap were equal in strength (Saran Wrap weaker); design apparatus to test adhesive properties, results showed all had same adhesive properties; results of tests compiled, data presented graphically; conducted survey to determine which brand consumers preferred before and after learning test results, survey results showed others preferred before, Stretch and Seal preferred after; analyzed results of survey & graphed findings; stored wrapped foods 48 hours, found all wraps maintained freshness
- potato chip group: acquired samples of brands of chips; compared cost and weight of large and small bags; charted information; set up surveys to find out preferred brands using these criteria: appearance, smell, taste, uniformity of size, and greasiness; graphed survey results on line and bar graphs; discussed findings; designed and built instruments in Design Lab for testing chips for strength; graphed strength test results
- mouth wash group: selected five brands of mouth wash (Scope, Listerine, Micrin, Lavoris, and Cepacol); set up survey to determine number from random sample who chose mouth wash for aroma, appearance, and taste; tested mouth wash for best buy, most popular; taste tested mouth wash for effectiveness; results tallied, analyzed, and presented graphically; results showed Scope highest in price, most popular and Listerine least expensive, least popular

Preparing for USMES work in the classroom by working with children

Challenge: Determine which brand of squirt gun is the best buy.

- discussed unit challenge with the children
- children discussed items they purchased for themselves; decided to investigate squirt guns
- discussed price, quantity of water held, distance water travelled, size, and convenience
- conducted "squirt tests" to compare length of stream of water; measured distances with tape measure
- noted differences between squirt guns of different sizes and guns of the same size
- discussed findings, different reasons given as to which gun was the best

Describing People

Challenge: Find the best information to put in a description so that a person can be quickly and easily identified.

Experiencing real problem solving by working on an adult challenge

- discussed unit challenge
- listed characteristics of group leader present for beginning of session only; compared descriptions with leader when he returned
- listed and discussed characteristics
- divided into four groups to list most important characteristics discussed
- completed and listed characteristics common to all four lists; discussed remaining characteristics and agreed on a final list (sex, race, height, weight, body build, hair, noticeable characteristics, and age)
- divided into groups and surveyed workshop participants on different characteristics
- one group interviewed 25 males, 20 females asking for height and weight, classifying build on scale of 1 to 5 (thin, average, stocky, plump, obese), analyzed data; results showed no correlation between height and weight or height and build and some correlation between weight and build in specific individuals in relation to height
- another group surveyed 20 people to find out their choice of most important characteristics; extended survey to large sample and found hair, build, facial characteristics, and height most often chosen*

Preparing for USMES work in the classroom by working with children

- discussed unit challenge with children
- listed characteristics of one of the group leaders
- discussed most important parts of a person to describe such as hair, clothes, eyes, and size
- played sit-down game
- group leader from another unit came in and grabbed some candy; children were asked to describe the "robber"
- divided up into four groups and made a list of characteristics, came together and compared lists and agreed upon one description
- students began to search for candy robber who had changed clothes and gone to Design Lab
- found two suspects; went through agreed-upon description to see which one best fit
- picked out most important characteristics in description and identified robber*
- students got together into pairs and traced each other on large white paper, colored in hair, eyes, mouth and clothing; discussed similarities and differences
- adults discussed working with various age levels; made suggestions for doing unit with very young children

*Note: Adults and children might try to determine which three characteristics were most effective in describing a person. They might also determine the number of characteristics needed for identification in most cases.

Manufacturing

Experience real problem solving by working on an adult challenge

Challenge: Produce in quantity an item that is needed.

- discussed unit challenge
- broke up into groups to brainstorm possibilities, decided to manufacture "How To" Card holders
- discussed how to make card holders (design, materials, size)
- sketched designs for building prototypes
- adjourned to Design Lab to build prototypes out of Tri-Wall and heavy wire
- shared ideas on prototypes and showed models
- discussed division of labor, management, marketing
- began production of "How To" Card holders in Design Lab, completed cutting of Tri-Wall
- completed assembling "How To" Card holders
- skills sessions held on marketing prices, marketing process, and production process

Preparing for USMES in the classroom by working with children

Challenge: Find the best way to make a quantity of bike safety flags.

- discussed unit challenge with children
- discussed parts of bike safety flag (flag, pole, and fasteners)
- suggested materials for flag (plastic, cloth), for fastening flag to pole (tape, glue, sewing, staples), for pole (wooden sticks, plastic rods, fishing pole), for fastening pole to bike (tape, screws, C-clamp)
- discussed size, shape, dimension of flag, and length of pole
- drew sketches of safety flag, with three general shapes emerging
- reached a compromise on design for flag and pole
- discussed how to manufacture in quantity for students in group; suggested assembly line with different people doing different tasks such as: measuring and cutting flags, assembly or attachment of flag to pole, fixing or making clamps for pole, individuals making designs on flag
- suggested making a pattern for the flag so that each flag would be the same
- went to Design Lab to see what materials were available, found ¼" doweling but only in 4' lengths
- checked various bikes and found 4' length was sufficient on only a few bikes, most bikes needed longer pole
- divided up into four groups to work on producing flags
- "pattern" group worked on cutting out model, placing model on material and tracing the pattern
- "fastening flag to pole" group worked on a variety of methods, using glue, staples, tape, needle and thread
- "attaching two short poles together" group worked on many different methods: using tape, putting dowels into plastic tubes, drilling a hole in end of each dowel and using a nail to fasten them followed by a plastic tube, using last method but applying hot glue before plastic tube
- "attaching pole to bike" group worked on clamping pole to bike using a set of clamps and screws
- groups came together to share reports on their activities

Pedestrian Crossings/Traffic Flow

Experiencing real problem solving by working on an adult challenge

Challenge: Investigate pedestrian and vehicular traffic patterns at an intersection and crossing and make recommendations for alternatives.

- discussed unit challenge
- broke up into groups, and investigated two sites: intersections near West Lake School and in downtown Santa Cruz near pier
- West Lake group: interviewed residents as to problems; tallied cars that failed to come to a full stop at intersection; interviewed children for awareness of problems; and made sketch of area
- pier group: interviewed pedestrians as to problems; took pedestrian crossing times; tallied pedestrian and vehicular traffic
- groups came together and presented findings; decide to work together on West Lake School intersection
- worked at intersection: made observations (cars did not come to full stop at intersection, children had to walk on poor sidewalks, had to cross a major intersection, had difficulty in getting to side of street school was located on); collected measurement data at intersection (distance from curb to curb); sketched intersection for mapping; interviewed teachers as to the number of accidents in the area, problems observed at intersection, children's awareness of problems in the area; and timed and tallied stopping patterns of cars
- formed subgroups and made measuring instruments in the Design Lab (trundle wheel), scale maps, and refined interview techniques and questions
- skills session given on scale drawing and mapping
- analyzed data, graphed findings on number of cars stopping at intersection

Preparing for USMES work in the classroom by working with children

Challenge: Find ways to make the intersection at High and Bay Streets (near West Lake School) safer for pedestrians.

- discussed unit challenge with children
- decided to interview residents about the problems, sketch area, count cars that failed to stop at signs, measure distances, and measure crossing times for pedestrians
- divided up into 4 groups
- interviewing group: discussed how to go about gathering necessary data from residents (questioning techniques, reporting sheets, describing sample by sex, age number of children in family), conducted interviews, revised questionnaire adding more objective questions, interviewed more residents
- first timing group: timed cars passing through intersection using stop watches, tallied number of cars and made observations, examined data, retimed and re-tallied intervals between cars
- second timing group: worked on how to determine amount of time it took cars to stop at signs using stop watches, tape measures, and sketches, took measurements using bicycle wheel with clicker attached as a trundle wheel
- mapping group: made sketches of area, took measurements for scale map
- groups met together to discuss problems: need for more information on the area more time to gather data, interviews with more residents, more raw data on vehicular traffic, more data on timing of cars
- continued work in groups to correct problems
- adults and children compared data, recommended that stop light be installed; enlist help of local police; brief children, parents, teacher, and principal on problem
- adults viewed videotapes of classes working on Pedestrian Crossings and Traffic Flow

Experiencing real problem solving by working on an adult challenge

Challenge: Improve the "workshop play area" in the Fireside Lounge/Crown Dining Hall quad; design recreation program for workshop participants

- discussed unit challenge
- investigated available recreational facilities and supplies
- surveyed recreational activities desired by the participants
- analyzed survey questionnaire, weighting each response and computing a mean value for each activity
- identified most popular activities from survey: volleyball, sing-along, table tennis, records and/or dancing
- organized most popular activities for workshop participants plus an evening of games and races in quad
- enlisted help of Advertising group to advertise activities

Preparing for USMES in the classroom by working with children

Challenge: Recommend and try to have changes made which would improve the design or use of your school's play area.

- discussed unit challenge with children
- divided up into groups worked on equipment and games
- went to Design Lab and worked on model of slide equipment
- worked on measurements and approximations using tape measure, rulers
- interviewed other children about play area problems and needs

Protecting Property (Burglar Alarm Design)

Challenge: Design and construct a container which is burglar-proof.

Experiencing real problem solving by working on an adult challenge

- discussed unit challenge
- divided into groups
- discussed designs and listed materials to be utilized (Tri-Wall, saber saw, square, springs, outdoor masking tape, screws, glue gun, metal rod, batteries, and bell)
- worked in Design Lab constructing containers out of Tri-Wall
- cut and glued Tri-Wall to form a rectangular shaped box and added lid
- worked on two alarm systems: first system had a metal rod suspended within a spring inside the container and both were connected to a bell and battery, so that when the container was tilted the rod touched the spring and the alarm went off; the second system had a spring attached to the lid and the interior rear wall of the container so that when the lid was opened the spring stretched and touched a contact point making the alarm go off

Preparing for USMES work in the classroom by working with children

- discussed unit challenge with children
- divided up into groups to design model containers
- skills sessions given on Design Lab materials and tools
- first group: made a sketch of a bell and battery circuit system
- second group: cut out Tri-Wall containers
- discussed wiring containers
- incorporated alarm systems into containers

Soft Drink Design

Experiencing real problem solving by working on an adult challenge

Challenge: Make a soft drink which would be popular and produced at a low cost.

- discussed unit challenge
- began making sample soft drinks
- planned taste test; discussed number and amount of soft drinks to be made for initial test
- discussed how final testing would be done; decided to bring in five other participants to rank each finalist drink on a point scale
- conducted taste tests and identified preferred drink
- analyzed data to identify taste factors, worked on scatter graph to find data on sugar amounts preferred
- worked on predicting outcome of discrimination test for Coke, Pepsi, Diet Pepsi, Shasta and Root Beer; completed discrimination test
- identified constants and variables
- made confusion matrices based on data
- reissued challenge with modification "Make a new soft drink that will be popular and can be made at a reasonable cost to be served at the barbecue"
- worked on developing oral survey poll on preferences for carbonated or uncarbonated; citrus, grape, pineapple or berry; sherbert or non-sherbert; wine or no wine
- administered survey
- discussed results and how to make the drink
- divided up into task forces (mixing, recipe, publicity, set up and decoration groups)
- made drinks for barbecue
- discussed and carried out preparation for serving drinks

Preparing for USMES work in the classroom by working with children

Challenge: Make a new soft drink and differentiate between Pepsi and Coca Cola.

- discussed unit challenge with children
- divided up into two groups
- first group worked on making a new soft drink using Kool-Aide, water and sugar; taste tested drinks
- second group worked on taste testing difference between Pepsi and Coca Cola
- adults discussed working with children, acceptance of challenge by students, circumstance of involving students in new environment with strangers, what students did, time constraints, and need for more students

TRAINING DESIGN LAB MANAGERS

Section Three

TRAINING DESIGN LAB MANAGERS

The training of Design Lab managers for individual schools can best take place during a workshop for teachers learning about USMES. The workshop environment provides not only an understanding of how to work in a Design Lab but also, time permitting, a chance to be part of a unit group. The experience of working with a unit group gives the lab manager a greater understanding of what happens in the classroom when USMES units are being worked on. Even when this unit training is not possible, the general workshop atmosphere provides for a better understanding of USMES.

Design Lab manager training has been carried out at a number of USMES workshops. Two-day training sessions for Design Lab managers have also been held in the fall following district implementation workshops for teachers. Reports on two such training sessions may be found in the Design Lab Supplement; one of these reports is also included at the end of this section.

The training of Design Lab managers at USMES-run summer workshops has been restricted because of the difficulty of identifying potential managers before the school year begins. It is especially difficult because managers are often paraprofessionals who staff Design Labs part-time and for minimal wages. School districts implementating USMES should not have this difficulty because their workshops can be carried on during the school year, after managers have been located. The big problem will still probably be finding people to staff the labs. The staffing and scheduling sections in the Design Lab Manual may be helpful with this problem.

A problem may still exist, however, even with manager training being held during the school year, if managers cannot be found for all schools. It may be necessary, therefore, to follow the example set at USMES workshops and train USMES teachers as Design Lab managers. These teachers agree to take the responsibility for setting up the lab and handling such things as scheduling, ordering, etc. It is not expected that teachers will run the lab for other classes unless some special release time is made available. These teachers can, however, train managers in their schools when they are located.

The key elements for Design Lab manager training sessions are outline on page 63. Following this are agendas for two-day and four-day Design Lab manager training sessions; the agendas are based on USMES workshops that included manager

training and separate two-day manager training workshops mentioned above. A four-day manager training workshop is required for adequate training. A two-day workshop may be utilized when time is limited at a workshop or when Design Lab managers or teacher/managers have only limited time at a workshop for manager training.

Manager training sessions will vary in many ways and these agendas should not be considered the only good format; rather they contain pieces (the key elements) to be juggled and put together by the personnel responsible for manager training in the way that is most beneficial for their training purposes.

Following the agendas are discussions of the key elements and strategies for covering them, an outline for a session on Design Lab problems, and the report of a two-day training session held for managers and manager/teachers.

KEY ELEMENTS IN DESIGN LAB MANAGER TRAINING

	Percentage of Time	
	2-day workshop	4-day workshop
Introduction to USMES philosophy and units	5%	5%
. USMES general slide/tape show		
Introduction to USMES Design Lab concept	5%	5%
. Design Lab slide/tape show		
Design Lab skills session	15%	10%
. Lecture/Demonstration approach . Stations approach		
Hands-on experience with tools	50%	30%
Learning about Design Lab written resources	5%	5%
. Design Lab Manual . Design Lab "How To" Cards . Non-USMES materials		
Discussion of Design Lab management problems	5%	5%
. See outline of points to cover		
Setting up and running a Design Lab	5% (discussion only)	20%
. Discussion of setting up and running a lab . Set up a workshop lab . Set up school labs		
Working with children in workshops or school lab	10%	20%

TWO-DAY TRAINING SESSION FOR DESIGN LAB MANAGERS

- 1ST DAY

9:00 - 9:30 Philosophy of USMES and Teaching of Units

. USMES general slide/tape show
. Stress should be put on importance of managers knowing what is happening with units in the classrooms.
. Particular attention can be paid to slides showing the use of the lab for different units.

9:30 - 10:10 The USMES Design Lab

. Design Lab slide/tape show
. In-depth discussion on types of labs (See Design Lab Manual for more information on types of labs.)
  1. Design Lab as a separate room
  2. Portable Design Lab (where space is a problem)
  3. Design Lab as part of regular classroom (where space is a problem or only one or two teachers in a school are doing USMES)
. Discussion of some important elements
  1. Tools and materials available for use by children
  2. A resource available to whole school
  3. "How To" Cards available to help children

10:10 - 10:30 Discussion of Design Lab Written Resources

. Design Lab Manual and Supplement
. Design Lab "How To" Cards
. Non-USMES reference books

10:30 - 12:00 Skills Session

. Lecture/demonstration
. Stations approach
. (Note: Live skills sessions are better than videotapes but there are skills tapes for those who would like to review or for actual use at a workshop.)
. Participants should realize that scheduled skills sessions are not required for children. Children should learn about tools as the need arises.
. Time should be made available for participants to handle and try the tools.

1:00 - 4:00 Hands-On Experience with Tools and Materials

- Participants decide something they would like to make. Suggestions from USMES units may be given such as chairs, tables, trundle wheels, electric circuits, bookcases, greenhouses, etc.
- Participants should be encouraged to use as many tools as possible.

2ND DAY

9:00 - 11:00 Hands-On Experience with Tools and Materials Continues

11:00 - 12:00 Discussion of Setting Up Lab

- Setting up the Design Lab Room (See chapter on the Design Lab Room in Design Lab Manual.)
- Portable Design Lab (See Portable Design Lab section in Design Lab Manual.)
- The In-Class Design Lab (see Design Lab Manual section on In-Class Design Lab.)

1:00 - 2:00 Discussion of Design Lab Problems

- (See page 72 for outline of talk on Design Lab management problems. Topics should be discussed briefly because of time limitations.)

2:00 - 3:00 Working with Children in the Lab

- A group of children (from USMES classes or concurrent teacher training workshop if possible) with a need to use lab are brought to workshop lab.
- Participants work with children and are helped by Design Lab staff. Both participants and staff use Design Lab philosophy of "hands-on" for children, "hands-off" for adults until children need help with specific problem.

3:00 - 4:00 Discussion of Working with Children and Final Discussion

- Discussion of problems associated with working with children in the lab
- Review by staff of accomplishments of two days
- Remainder of time spent in question and answer period

Follow-Up to Workshop Training

- Follow-up by Design Lab staff should be done as soon as possible after workshop.
- Additional training may be necessary for participants with only two days of experience.
- Design Lab staff should be available to district school managers when problems arise.

FOUR-DAY TRAINING SESSION FOR DESIGN LAB MANAGERS

1ST DAY

9:00 - 9:30 Philosophy of USMES and USMES Units

- USMES general slide/tape show
- The importance of managers knowing what is happening with units in the classroom should be discussed.
- Particular attention should be paid to slides depicting use of the lab for different units.
- The importance of children using the lab as the need arises should be discussed.

9:30 - 10:10 The USMES Design Lab

- Design Lab slide/tape show
- Discussion of types of labs
  1. Design Lab as a separate room
  2. Portable Design Lab (where space is a problem)
  3. Design Lab as part of regular classroom (where space is a problem or only one or two teachers in a school are doing USMES)
- Discussion of some important elements
  1. Tools and materials available for children to build constructions of their own design
  2. A resource available to non-USMES as well as USMES classes
  3. "How To" Cards available to help children

10:10 - 10:30 Discussion of Design Lab Written Resources

- Design Lab Manual and Supplement
- Design Lab "How To" Cards
- Non-USMES reference books

10:30 - 12:00 Skills Session

- Lecture/demonstration
- Stations approach
- Skills sessions, it should be stressed, are done to help participants quickly gain some understanding of many tools in the lab.
- Children should learn about tools when the need arises.
- Participants should have some chance to handle tools either during the skills session or at the end of the session.
- Live skills sessions are better than videotapes but there are skills tapes available for those who would like to review or would prefer the tapes to a live session.

1:00 - 4:00 Hands-On Experience with Tools and Materials

. Participants decide on something they would like to make for their own use or use in the lab or school. Suggestions from USMES units may be given such as chairs, tables, trundle wheels, electric circuits, bookcases, greenhouses, etc.
. Participants should be encouraged to use as many tools as possible.

- 2ND DAY

9:00 - 12:00 Hands-On Experience with Tools and Materials Continues

1:00 - 2:00 Discussion of Setting Up Lab (Discuss those sections that are appropriate)

. Setting up the Design Lab Room (See the Design Lab Room section in the Design Lab Manual.)
. The Portable Design Lab (See Portable Design Lab section in the Design Lab Manual.)
. The In-Class Design Lab (See the In-Class Design Lab section in the Design Lab Manual.)

2:00 - 4:00 Setting Up a Design Lab

. Labs set up in schools of managers involved.
. When the above is not possible, participants set up a lab at a workshop.
. Design Lab staff assists in either situation.

- 3RD DAY

9:00 - 10:00 Discussion of Lab Problems (See page 72 for outline of talk on Design Lab management problems.)

10:00 - 3:00 Practicing Staffing the Workshop or School Lab

(12:00 - 1:00 Lunch)

. Participants run workshop or school lab(s) for whole day with assistance of Design Lab staff.
. Manager trainees are encouraged and helped to work with participants in the open way that has been discussed previously.
. When manager training session is not part of larger workshop, manager trainees should begin work with children if possible.

3:00 - 4:00 Discussion of Running Lab

. Discussion of problems that arose in running lab(s)
. Importance of letting children build their own constructions emphasized

- 4TH DAY

9:00 - 2:30 Working with Children in Workshop or School Lab

. Participants run workshop lab for children with no help from Design Lab staff.

(12:00 -1:00 Lunch)

. Participants run their own labs for children instead of above if possible. Whenever possible, children should be brought from USMES classes.

. Design Lab staff visits each lab during course of day.

2:30 - 4:00 Discussion of Work with Children and Final Discussion

. Discussion of problems in working with children in the lab

. Review by staff of points covered in four-day workshop

. Remainder of time spent in question and answer period.

Follow-Up to Workshop Training

. Follow-up by Design Lab staff should be done about a month after the workshop.

. Design Lab staff should be available to district school managers when problems arise.

DISCUSSION OF THE KEY ELEMENTS IN DESIGN LAB MANAGER TRAINING

Introduction to USMES Philosophy and Units

The quickest and surest way of covering the basic USMES philosophy is to use the USMES slide/tape show. The slide/tape presentation gives Design Lab managers the overview of USMES and its units that is essential if a manager is to function successfully as a member of the USMES school program.

The USMES brochure can also be given to each Design Lab manager as a very short and handy description of the basic philosophy of USMES that can be referred to.

The USMES Guide can be reviewed by the staff for a "refresher course" before this opening session is held. Another useful piece of refresher material is the paper "Real Problem Solving in USMES: Interdisciplinary Education and Much More."

Introduction to USMES Design Lab Concept

A good way of beginning a discussion of the Design Lab is to use the Design Lab slide/tape show. This slide/tape show is very helpful in providing a visual understanding of many important aspects of the lab.

The Design Lab brochure, like the USMES brochure, is a good summary of the philosophy of the lab that participants can take with them for future reference.

Design Lab Skills Sessions

A session that explains the use of the various tools to be found in a Design Lab is very helpful. Such sessions have been done in one of two ways.

One way is to have the tools arranged on a table and have each explained to the participants as they sit and watch. This can be done by one person as a sort of lecture/demonstration.

Another possibility, called the station approach, is to set up a few tools on some number of tables scattered throughout a room. Participants can move from table to table learning about tools and handling them at the same time. This approach requires enough knowledgeable people to staff each table or station.

Hands-On Experiences with Tools

It is important to give each participant in a Design Lab manager training workshop a chance to use the tools (as many as possible) to construct something for his or her own use or for use in the school or lab. This gives participants unfamiliar with the use of these tools the opportunity to better understand the tools and to feel more relaxed about having children use them.

Learning About Design Lab Written Resources

A short session should be given explaining the written resources available for the Design Lab. Included in this session should be the Design Lab Manual, Design Lab Supplement, Design Lab "How To" Cards, and other available reference books such as the Reader's Digest Complete Do-It-Yourself Manual and the Workshop for Learning Things book--The Further Adventures of Cardboard Carpentry.

Discussion of Design Lab Management Problems

This session should cover such topics as Design Lab scheduling and use, scrounging, discipline and safety, storage and layout, and relationship between the manager and other school personnel. An outline of points to include in this discussion can be found on pages 72-73.

Setting Up and Running a Design Lab

Experience in setting up a workshop Design Lab similar to the actual Design Lab a manager will be working in can be a very valuable experience. If the Design Lab at a workshop is set up and running when the manager training begins, explore the possibilities of dismantling the lab and having the managers set it up again. Give the managers the full range of problems to deal with, i.e., setting up and running the lab, evaluation of success, liaison with teachers, report writing, etc.

Working with Children in Workshops or School Labs

Managers can gain a great deal from the experience of working with children in either the workshop or school labs. The most important aspect of this type of experience is the chance it gives the staff to correct any misunderstandings on the part of managers in putting the USMES philosophy in practice with children. The staff should not hesitate to make corrections because failure to do so will create many problems with the functioning of the Design Lab within a school's USMES program.

Safety should be stressed continually throughout the training sessions. Improper use of tools should be pointed out as it happens. It is important to make safety an important element, but in a positive way, not a negative one.

Follow-Up to Workshop Training

The follow-up to workshop training is one of the most critical elements in training a manager. An occasional visit to observe a Design Lab manager and discuss the functioning of the lab may mean the difference between the success or failure of the manager and the lab.

In addition, an occasional short meeting might also be held with all the district or area managers. This might be done two or three times during the school year to discuss concerns relating to the running of Design Labs.

DESIGN LAB MANAGEMENT PROBLEMS

(Points to be covered in session on management problems.)

1. Responsibilities in Taking Care of the Lab
   a. Locking and unlocking
   b. Cleaning
   c. Ordering supplies

2. Scheduling Systems
   a. Sign-up sheet in classroom
   b. Sign-up sheet in office
   c. Sheet sent around in morning
   d. Sheet brought around before school

3 Design Lab Use (USMES vs. non-USMES)
   a. Design Lab mainly for use by USMES classes
   b. Non-USMES use during other times

4. Scrounging
   a. Need for getting free or almost free supplies
   b. Places to look for scrounged materials
      1. Yellow Pages
      2. People's Yellow Pages
      3. Friends and their places of employment
      4. Places like the Boston Children's Museum Recycling Center

5. Manager/Teacher Relationship
   a. Importance of not interfering with teachers who are using USMES
   b. May have a hand in helping to develop units

6. Management
   a. Discipline in the lab
      1. Importance of USMES philosophy of openness
      2. Importance of rules -- particularly concerning use of power tools
   b. Administration
      1. Importance of explaining philosophy of USMES to principal and others as it pertains to Design Lab
      2. Noise problem -- ask about potential problem and possible solutions

7. Safety
   a. Special care needed for power tools, soldering irons, etc.
   b. Importance of knowing how to use all tools correctly

8. Space Layout
   a. Keep power tools near plugs
   b. Keep caustic materials near sink, if available
   c. Keep sawing table away from main walkways

9. Storage
   a. Importance of storing tools and materials not in use
   b. Ways of storing equipment

Note: Design Lab videotapes are available on setting up and running a Design Lab:

An Interview with Bernie Walsh; principal and Design Lab coordinator of Hardy School, Arlington, Massachusetts.

An Interview with Joe Joyce; principal and Design Lab coordinator of Winthrop School, Dorchester, Massachusetts.

REPORT OF TWO-DAY DESIGN LAB MANAGER TRAINING SESSION

October 22-23, 1973
Horace Mann School
Chicago, Illinois

A two-day workshop was held on October 22-23 at the Horace Mann School to train Design Lab managers or teacher/managers for thirteen schools which were in the process of receiving Design Lab equipment and materials. Many of the participants at this workshop had also attended the two-week workshop for teachers held in August at the Dyett School. It was possible, for this reason, to spend more time in detailed discussions of Design Lab problems, in setting up two of the school labs (one at the Mann School and one at the O'Keeffe School), and in working with children in the labs.

The first morning began with a brief discussion of the USMES philosophy and the way in which the philosophy works in the Design Lab. This was followed by a short discussion on the problems that various schools were facing at this time. Participants asked questions, such as "What stage of ordering has the Board of Education reached?" and "How can we have a Design Lab when no room is available?"

An informal Design Lab skills session was then held during which participants were asked to try various tools with which they were not familiar. Unfortunately, not all the tools were available which meant some tools had to be described, with the help of the "How To" Cards, instead of being introduced via the usual hands-on experience. The two Design Lab staff members circulated among the participants during this session, helping as the need arose.

Following the skills session, an in-depth discussion was held on the various aspects of setting up and running a Design Lab. This discussion covered the following areas: scheduling, scrounging, space and layout, teacher orientation, USMES vs. non-USMES use, cleanup, staffing, safety, and storage. Individual school problems in these areas were part of the discussion and there was a great deal of interaction among participants on how they had handled or planned to handle certain problems.

Activity then switched from discussions to actual hands-on experience. The participants broke up into two groups. One group stayed at the Horace Mann, while the other group moved to the O'Keeffe School. Both groups had the task of setting up the Design Lab for that school and having it ready by the end of the day for use with groups of children the next morning.

After the two groups had been established, one of the Design Lab staff talked with those participants who were not at the August workshop. The discussion with this group focused on the philosophy of USMES both in the class and in the lab. These people felt they had a good idea of how USMES worked from talking with USMES teachers. It was suggested that reading a few Teacher Resource Books and, if possible, observing some USMES unit work in the classroom might be very valuable.

The afternoon was spent in setting up the labs. Sketches were made and discussions were held on where the best and safest places to set things up were, where things should be stored, etc. Finding a secure place for keeping materials and tools was an acute problem at O'Keeffe. It was decided to solve this problem by using a portable cart and after some brainstorming by the group, a plan developed for enclosing the cart with pegboard to hang tools from and making compartments to store other materials. These plans were not implemented during this two-day session, but were done at a later date by the Design Lab manager at O'Keeffe. It was also decided that the cart would be stored in the school vault for safekeeping. The Mann School, with its Design Lab located in two small rooms, had to deal in a more critical way with good utilization of space. The placement of work tables and designation of areas for various types of activity such as painting, soldering, etc., was more crucial in the Mann's small lab than in the large lab found at the O'Keeffe School. By the end of the first day of the workshop, the two rooms were beginning to look like USMES Design Labs.

The second day of the workshop began at the Horace Mann School with a discussion of the setting up of the two labs and how this experience could be applied in each of the other eleven schools' lab rooms. The feeling the participants expressed was that this experience had been useful and had given them insights into how to go about setting up their own labs.

The discussion then switched from the setting up of the lab to the real reason for the lab's existence--its use by children. The non-directive USMES approach was stressed throughout this session. The importance of children using the lab for some purpose was also discussed, as was the importance of giving varied kinds of assistance to groups working in the lab. It was stressed that this assistance should not only be in building techniques, but also in other areas, such as the math and science skills and concepts that come up in the lab. A videotape of student activities was shown to help emphasize this point. The nondirective, yet questioning approach used by the teacher on the tape was pointed to as an example of the type of teaching that can go on in a Design Lab.

After a discussion of the tape, the participants again broke up into two groups, one at the Mann and the other at the O'Keeffe. Fifteen children were assigned to each lab. Unfortunately, none of the children was currently using the lab in relation to work on USMES units. During the session, both groups of children were given suggestions for making things such as games, puzzles, boxes, etc., that they could use in their classrooms. The results were very encouraging. The children were very excited about their work in the lab and the participants appeared to have a good feel for assisting, yet not directing, the children. Interesting discussions took place with the children. Help was given in measuring, sketching, cutting, and other specific skills. Due to the amount of time available, it was not possible for the children to finish their projects, but they all planned to return to the lab the next day to do so.

The second afternoon session centered around the viewing of the videotape that had been made in the morning when the children were in the lab. Some of the problems encountered in working with children were discussed. A final discussion was held on remaining problems the participants could foresee in the setting up and running of their own lab. The participants were then asked to fill out a short report describing their plans for setting up their own school lab.