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ABSTRACT

This evaluation of mini-conferences conducted for Alabama teachers who completed training in the 1996 Summer Space Orientation for Professional Educators (SOPE) examines the effectiveness of follow-up sessions for teachers (N=69) and provides baseline data on teachers' knowledge of and attitudes toward teaching science. Conclusions about the 1996 summer SOPE program, reached through collaboration between the evaluation team and project personnel, provided the impetus for initiation of the follow-up mini-conferences for Alabama teachers in the Huntsville, Birmingham, and Montgomery areas of the state. (Contains 18 tables.) (DDR)

SPACE ORIENTATION FOR PROFESSIONAL EDUCATORS: PROGRAM EVALUATION AND EFFECTIVENESS

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EXECUTIVE SUMMARY

OVERVIEW

This evaluation of mini-conferences conducted for Alabama teachers who completed training in the 1996 Summer Space Orientation for Professional Educators (SOPE) examines the effectiveness of follow-up sessions for 69 teachers, and provides baseline data regarding teachers' knowledge of and attitude toward teaching science. Traditional 'satisfaction' scales in previous SOPE training consistently demonstrate high satisfaction with the SOPE training and popularity of the program has been exceptional. However, no formal baseline data has been collected for use in making formative decisions related to identification and refinement of instructional units and activities to be used in training of teachers. Recognition of the lack of a formal monitoring procedure of the program necessitated the initiation of additional evaluation measures.

Conclusions about the 1996 summer SOPE program reached through collaboration of the evaluation team and project personnel provided the impetus for initiation of the follow-up mini-conferences targeted toward Alabama teachers in three areas of the state: Huntsville, Birmingham, and Montgomery. Informal observations and field notes from program debriefings about summer SOPE training and teacher need assessments instructed the evaluation team and program personnel in development of session topics. These observations included:

> The summer SOPE training increased teachers' understanding and awareness of inquiry-based science; however, informal observations of teachers during summer sessions showed this awareness was largely unrelated to practice.
>
> For the most part, SOPE summer training sessions employed a distinctively more constructivist style of teaching. Convenience interviews with teachers demonstrated that many teachers were aware of the need for more student-centered classroom hands-on activities suggestive of inquiry science within a constructivist epistemology. It was noted that more intensive training efforts were needed for this new approach.

Subsequently, Alabama teachers were queried to determine perceived additional instructional needs and possible dates for scheduling of follow-up sessions.

EVALUATION PROCEDURES

In evaluating the training component of the mini-conference sessions, the evaluation team administered a survey to teachers after the training sessions and collected "self report" measures often used in evaluation of professional development activities. Teachers provided demographic information and communicated their current understanding of basic scientific concepts and attitudes toward the teaching of science concepts. Teachers also communicated their level of satisfaction with the use of content presented and delivery of that content. Their comprehension of inquiry-based science, interdisciplinary connections of science, portfolio assessment, and integration of computers into classroom curriculum was substantiated by their responses on open-ended question.

SPECIFIC FINDINGS

Findings in this section are divided into the following categories: teacher background, basic concepts of science, constructed response items, and satisfaction with SOPE follow-up sessions.

Teacher Background

The majority of the Alabama teachers attending the SOPE follow-up sessions were Pre-kindergarten through Elementary Level Grade 5, while the second largest group was comprised of Middle Level teachers in grades 6-8. As might be expected, most teachers at the lower grade levels teach all subject areas while middle level and secondary teachers are more subject specific. Teachers demonstrated a wide variance in experience in general teaching and in teaching science. The majority of Alabama SOPE teachers were Caucasian and were female. Most teachers taught in public schools in either a predominately rural setting (42%) or suburban setting (38%) with student enrollments in excess of 500 students. Student populations were very diverse with the largest categories constituted by special education and remedial students. The average estimate of minority students was around 32 percent and teachers reported a female population close to 45 percent.

Most teachers reported a positive experience with teaching science. Teachers did not perceive themselves prepared to use the inquiry approach to teaching, implementation of science standards, and integration of computer technology into the curriculum. Mixed results about textbook use in science teaching was noted.

Basic Concepts of Science

This portion of evaluation examined teacher knowledge of basic concepts inherent in inquiry-based science intended to facilitate development of problem-solving skills, independent thinking, and learning. All items measured were indicative of the constructivist epistemology and instructional strategies and assessments supportive of that approach. Due to the formative nature of baseline data collection, only mean scores and standard deviation from the mean were reported. Of special note is the option given to teachers to respond "Don't Know" to items in each domain being measured. A large group of teachers exercised that option and that fact in itself is indicative of the need for additional instruction and support.

Teachers expressed overall agreement with the philosophy and basic premises of constructivism and process-based science instruction. However, the overall low concept mean in the Constructivist Approach domain indicated teachers possessed a confused understanding of the philosophy of constructivism. Although teachers varied in their prior knowledge regarding the Development of Concepts, most teachers expressed agreement with items in this category. Teachers showed moderate agreement with items comprising the domain of Inquiry in Science with low variance among teachers. Teachers showed a mixed level of knowledge and understanding about the Nature of Science while those same teachers generally showed a moderate level of prior knowledge and understanding about Interdisciplinary Connections and Assessments. As a group, teachers were aware of the new standards in science, but possessed a low level of prior knowledge about items measuring this domain.

Constructed Response Understanding

Teachers' high mean concept scores related to interdisciplinary connections and assessment, and inquiry in science suggest teachers can plan and implement activities incorporating these concepts into their curriculum. However, the results in this sample cannot be applied to a total group of Alabama teachers due to a miscommunication among project personnel which resulted in only 34 teachers responding to this item. Teachers generally demonstrated a fairly clear understanding of concepts indicative of student-centered instruction. Activities reported under the integration of computer technologies into the curriculum tended to be teacher driven. Teachers demonstrated a limited understanding of portfolio use and that use tended to be teacher centered as opposed to student centered. Review of teachers' written responses to portfolio use clearly demonstrated that teachers do not include portfolios among their assessments.

Satisfaction with SOPE Follow-up Sessions

Teachers indicated overall high satisfaction ratings for all aspects of the follow-up sessions. Trainer-related ratings were generally higher than application of ideas and teacher confidence to implement instruction reflective of content provided. Teachers' written responses indicated they generally were very pleased with all the sessions and activities they engaged in during sessions and with presenters' enthusiasm, preparation, knowledge, and willingness to accept teachers' ideas, questions, and comments. Several worthwhile suggestions for improvement were made and suggestions from earlier sessions were incorporated into subsequent mini-conferences. Teachers indicated great satisfaction with resources provided related to new developments in space science, overall usefulness, and future benefit to students and the school.

IMPLICATIONS

The SOPE mini-conference sessions successfully demonstrated the need to provide additional instruction and support activities to Alabama teachers as they strive to integrate space science activities into the classroom curriculum. This extension of the summer SOPE training proved very effective and teachers expressed great satisfaction with all aspects of the program. The initiation of a systematic approach to monitoring the attitudes, knowledge, and understanding of science concepts proved very beneficial in the identification of challenges for future research and practice associated with future SOPE summer programs and possible follow-up sessions. These challenges include:

To what degree can future SOPE training effectiveness be maintained and/or changed to incorporate basic premises of inquiry-based science and a constructivist epistemology congruent with national standards?

Do teachers trained in the SOPE summer program maintain and refine their practice of inquiry-based science and strategies when they return to their schools where minimal support is all they receive? Can a systematic program of observation and evaluation of classroom implementation be established?

To what extent do teachers trained in the one-week SOPE summer program and follow-up sessions actually integrate the new science concepts into their curriculum? Do teachers' practices, habits, and styles of instruction complement or conflict with their newly attained knowledge and understanding of inquiry-based methods on science?

What types of systemic conditions facilitate or constrain trained teachers' use of the new space science concepts -- teacher reassignments; computer technology; scheduling difficulties; teacher mobility; administrative training and/or awareness of the new approaches to teaching science; etc.?

Do students from SOPE trained teachers' classrooms outscore other students on performance assessment tasks and on standardized tests?

SECTION 1: INTRODUCTION AND BACKGROUND

Space Orientation for Professional Educators (SOPE) is the first of three levels of programs within a larger project funded in part by the Alabama Commission on Higher Education (ACHE) and the Alabama State Department of Education. The Capital-Area Space Orientation (CASO) in Washington, DC and the International Aerospace Education: Russian Space Science Program are the two additional program levels available for professional teacher educators. (*A major portion of this section is composed of excerpts from a program description found in program promotion brochures and project proposals available from the project director and the Office of Continuing Education at the University of Alabama in Huntsville.*) SOPE (Level 1) is a graduate-level course offered by the University of Alabama in Huntsville (UAH), in conjunction with the U.S. Space and Rocket Center, NASA's Marshall Space Flight Center, and various corporate participants. The course is designed to assist educators in development and improvement of science, mathematics, and social studies curricula in our nation's elementary and secondary schools.

SOPE introduces the educator to a variety of space-related subjects, including a first-hand look at state-of-the-art technology that can be used in the classroom. Participants engage in a curriculum designed to reflect current research and technological development in a hands-on experience through the assistance of faculty on the cutting edge of space science research and engineering and NASA's Marshall Space Flight Center experts working on various dimensions of the U. S. space effort such as the International Space Station and the Hubble Space Telescope. Participants engage in activities directed by NASA's official Visitor Information Center, home to the U. S. Space and Rocket Center (the world's largest nonprofit space education facility and home to SPACE CAMP). Teachers train in Space Shuttle simulations and professional astronaut training devices in preparation for a two-hour simulation of a Space Shuttle mission.

TEACHER TRAINING

The SOPE Level 1 program provided approximately 45 hours of intensive classroom, laboratory, and training time. The program included a number of experiments which can be duplicated in the classroom. Teachers were required to attend at least four of the following workshops/activities: Science in Space, National Science and Technology Week, History of Flight, Microsoft in the Classroom, Mission to Planet Earth, and Rocketry. Approximately 60 teachers divided into four teams for each of the 6 SOPE sessions throughout the summer program period rotated through the various workshop sessions. Samples of operational schedules and workshop topics for each SOPE session have been delineated in the final technical report (Harwell, 1997).

In addition to required participation, teachers were encouraged to engage in inquiry learning. Participants were asked to keep track of questions, discuss those questions with each other and with workshop leaders and experts, and to identify questions they personally wanted to pursue in future explorations. These questions were identified prior to graduation. Teachers collaborated in the development of grade-level appropriate lesson plans using information and knowledge gained throughout the week. After teachers returned home, they were required to individually develop an interdisciplinary activity for use in their classroom. Two options were made available. Option 1 consisted of the development of an interdisciplinary activity with a minimum of at least one week of instruction and based on one of the 'questions for further inquiry' identified during the intensive summer SOPE workshop. Option 2 allowed teachers to write a four-page reflection paper on what they had learned during their SOPE experience and outline how they planned to apply that learning in an interdisciplinary manner within their classrooms.

SECTION 2: TEACHER EVALUATION

An integral component of the SOPE program revolved around the continuous formative and summative evaluation of each of the (six) 6 SOPE training sessions. Members of the evaluation team attended each SOPE team's debriefing session and wrote a summative evaluation which was used to inform program changes and adjustments in the following SOPE sessions. Observations useful in planning the next year's program were also compiled and presented to the project directors. Of special note to this report is the finding that SOPE participants desired follow-up professional development related to a variety of topics.

The SOPE evaluation team and project directors met on September 4, 1996 to determine program format for possible follow-up sessions and to discuss appropriate evaluation measures in determining the effectiveness of the mini-conferences. At that time it was determined that an effort should be made to not only determine teacher satisfaction with the sessions, but to collect baseline data regarding teachers' knowledge of and attitude toward teaching science in general. Up until this time no concerted effort had been made to determine teachers' knowledge, understanding, and beliefs about science. It was believed that this knowledge would be useful in planning future summer SOPE program content areas. To this end, the evaluation team researched science teacher education evaluation programs and decided upon selected portions of an evaluation instrument used in a National Science Foundation (NSF) exemplary science education program in place in the Montgomery County Public School (MCPS) in Rockville, Maryland (Saab & Larson, 1996). Verbal approval to use selected items with adaptation was obtained from Mr. John Larson after completion of a workshop under his leadership at the National Evaluation Conference held in Bethesda, MD in July 1996. Additionally, several demographic items were selected from the evaluation conducted for the Capitol-Area Space Orientation (CASO) program conducted by Dr. HelenMarie Hoffman of Gettysburg College, a SOPE external evaluator. This approach to selection of items to use in program evaluation allowed some comparisons to other programs. Evaluation forms used in mini-conference sessions are available from the author (Harwell, 1997).

Evaluative data collected during debriefing sessions conducted at the conclusion of each of the SOPE Summer Institutes directed program personnel in identification of several themes teachers expressed weaknesses and/or a need for additional information. Subsequently, all Alabama teachers were mailed a questionnaire asking them to check topics they would be interested in gaining additional knowledge. They were also asked to give preferred choices for dates to schedule mini-conference sessions. This data provided the rationale for conducting follow-up sessions in Huntsville on November 8, Birmingham on November 15, and Montgomery on November 22, 1996.

Mini-conference sessions included the following:

Science as Inquiry

This session emphasized the importance of conducting scientific investigations using the inquiry approach as defined in the National Science Standards and introduced teachers to the National Standards.

Bit-by-Bit: Putting It Together

This session emphasized the use of student portfolios as an integral component of authentic assessment and the documentation of interdisciplinary connections of space science with other topics. Development of a portfolio and the concept of using rubrics as an integral part of both instruction and assessment were emphasized. Teacher portfolios were briefly introduced.

Crawling Through the WWWeb

This session emphasized the integration of computer technology into the science curriculum and more specifically the use of the Internet as an inquiry tool in the classroom.

Resources for the 21st Century

This session emphasized new resources available for teachers to use in integration of space science into their curriculum. Teachers browsed through resources, explored CD-ROM's, and previewed computer software technologies.

Sharing Session

This session emphasized the sharing of a one-page lesson plan of a space-related topic each teacher designed as a result of their summer SOPE experience. Also, a general discussion related to the effectiveness of the mini-conference, follow-up session was conducted.

All teachers attending each mini-conference site participated in **Science as Inquiry**, **Resources for the 21st Century**, and **Sharing Session** as a total group. Teachers divided into two groups and rotated through two options: **Bit-by-Bit: Putting It Together** and **Crawling Through the WWWeb.** Slight variations and program adjustments were made in each of the mini-conferences due to program personnel changes (Harwell, 1997).

Evaluation Procedure

Each teacher received an evaluation as she/he entered the conference room for the Registration/Orientation session. Teachers completed the evaluations as they enjoyed coffee, juice, and doughnuts. Teachers were asked to record the last four digits of their social security number on the evaluation form and to use the same number on all other evaluations they completed throughout the remainder of the conference. Program evaluation followed the responsive model first advocated by Stake (Worthen et al., 1997; Denzin & Lincoln, 1998). The central focus of this model resides in addressing the "concerns and issues of a stakeholder audience" in an effort to "improve and focus" directly upon program activities rather than program interests (Worthen et al., 1997, p. 159). The program evaluation design, implementation, and report writing were based upon standard program evaluation techniques (Joint Committee on Standards for Educational Evaluation, 1994).

SOPE Evaluation Forms

Evaluation Form 1: The first section of this evaluation consisted of items related to the teachers' academic and professional background and their prior experience and attitude toward science. The second section captured teachers' attitudes towards the philosophy and assumptions underlying appropriate science teaching pedagogy (five statements). The remaining six sections included 25 items with each set of four (one section consisted of five items) representative of the main objectives of the mini-conference sessions. Some items were adapted from the Montgomery County Public Schools project in Maryland, (Saab & Larson, 1996), and others were developed after extensive collaboration with project staff. All items are consistent with exemplary science teaching practices (National Research Council, 1996).

Evaluation Form 2: This assessment presented teachers with a possible classroom situation asking them to describe instructional techniques they would use should they encounter that situation. These evaluations were presented at the conclusion of each of the mini-sessions.

Evaluation Form 3: This evaluation form included items eliciting teachers' attitudes toward the information presented and their perceptions of the presenter's skills in presentation of session information. Finally, two-opened questions asked teachers to record what they thought worked effectively during the mini-conference and what they thought could be improved. This evaluation was conducted at the end of the mini-conference session. For additional clarification consult Harwell (1997).

Assessment Scoring and Analyses

All istruments were scored by this researcher and all data was entered into a statistical program, SYSTAT, which was used to calculate all ststistical analyses (Gay, 1996; Wilkerson et al., 1992). Since 13 of the 30 items in the instrument measuring basic concepts about science were constructed as negative items, that is, a 'strongly disagree' response reflects a 'correct' response, and a 'strongly agree' response, reflects an 'incorrect' response, those items were reverse coded. The data that appears in the tables is now uni-directional for all items: '4' and '3' represent correct responses, and '1' and '2' represent incorrect responses even though the actual items in the table displaying data continue to be phrased negatively as they appear on the evaluation form completed by teachers.

TEACHER BACKGROUND

Grade Level and Teaching Assignments

Table 1 compares the distribution of grade level assignments, subject area assignments, and percentage of teachers at each grade level who participated in the SOPE mini-conference sessions. Of the 69 teachers who participated, the largest percentage (53.7%) constituted the combined groups representative of Pre-kindergarten through Elementary Level Grade 5. The Middle Level Grades 6-8 comprised the second highest percenage (35.8%). Only 8 teachers (11.6%) were assigned to the Secondary Level 9-12.

As might be expected, the majority of Pre-kindergarten through Elementary Grade Level 5 teachers (81%) taught all subjects as an integral part of their teaching assignment. Fifteen of the 24 Middle Level teachers reported teaching science more than 75% of their teaching assignment. Seven of the eight Secondary Level teachers reported teaching either science or math for more than 75% of their teaching assignment.

Academic and Professional Background

Attendees of the SOPE mini-conference sessions reported varying credentials in both their professional and academic preparation. Table 2 demonstrates that the mean number of years of general teaching experience is 11.15 with a high of 31 years of experience and a low of one-half year, while the median number of years of general teaching is 8 years. Science teaching experience also showed a similar variance, although the mean number of years was 8.20. Again, the highest number of years of science teaching experience was 31 and the lowest was no experience. The median science teaching experience was 5 years. The high standard deviation scores in both categories of experience suggest a wide range of experience.

Table 3 displays the descriptive statistics regarding the number of methods and content courses completed prior to SOPE participation. Mean scores (2.30) indicate that teachers have completed between 2 and 3 science methods courses prior to SOPE participation. A small standard deviation of 2.41 suggests most of the teachers clustered around the mean. The mean score for content courses (5.14) indicates teachers had completed between 5 and 6 content courses with some completing as many as 30 and some none.

Table 1
Grade Level and Teaching Assignments for SOPE Follow-up Teachers
(N = 69)

Assignment	Number of Respondents	Percent of Teachers
Pre K - 2 Level		
All subjects	15	21.75
Special Education	0	0
Other subjects	2	2.90
Comprehensive K - 6 Level		
All subjects	1	1.45
Math (more than 75%)	1	1.45
Science (more than 75%)	0	0
Other subjects	1	1.45
Elementary Level 3 - 5		
All subjects	13	18.84
Science (more than 75%)	1	1.45
Learning Resources/Remediation & Special Education	2	2.90
Other subjects	1	1.45
Middle Level 6 - 8		
All subjects	4	5.80
Math (more than 75%)	3	4.35
Science (more than 75%)	15	21.74
Other subjects	2	2.90
Seconday Level 9 - 12		
Science (more than 75%)	4	5.80
Math (more than 75%)	3	4.35
Other subjects	1	1.45

Note: Percentages may not total 100 due to rounding errors.

Table 2
Years of Teaching Experience for SOPE Participants
(N = 69)

Experience Area	Mean	SD	Median	High	Low
General Teaching Experience	11.15	8.51	8.00	31	0.5
Science Teaching Experience	8.20	8.39	5.00	31	0.0

Table 3
Number of Methods and Content Courses Completed Prior to SOPE Participation
(N = 66)

	Mean	SD	Median	High	Low
Methods	2.30	2.41	2.00	12.00	0.00
Content	5.14	5.95	3.50	30.00	0.00

Ways Participants Learned About SOPE

The majority of SOPE participants (n=26; 37.7%) in the mini-conferences reported they learned about the summer SOPE program through the flier/brochure that had been distributed during the previous academic school year (Table 4). Another sizable group of teachers discovered the SOPE program from former SOPE participants (n=20; 29%).

Table 4
Ways Participants Learned About SOPE Program
(N = 69)

Medium	Number	Percentage
Flier/Brochure	26	37.68
Publication	5	7. 25
NSTA ad	0	0
Former SOPE Participant	20	28.99
Other	2	2.90
Combination of above	2	2.90

Note: Percentages may not total 100 due to rounding errors.

Ethnic and Gender Background of SOPE Participants

Table 5 reports that 89.9 percent (n=62) of the SOPE participants were Caucasian. Three teachers were of African-American heritage and one teacher reported Native American/Eskimo/Aleutian ethnic background. Ten SOPE participants opted to provide no response when queried about their gender. However, the majority of the total teachers (n=59) who chose to respond were female (84.1%).

Table 5
Ethnic and Gender Background of SOPE Participants
(N = 69)

	Number	Percentage
Ethnic Background		
Hispanic	0	0
Asian	0	0
African-American	3	4.35
Caucasian	62	89.86
Native American/Eskimo/Aleutian	1	1.45
Pacific Islander	0	0
Asian	0	0
Other	0	0
No Response	3	4.35
Gender		
Female	58	84.06
Male	1	1.45
No Response	10	14.49

Note: Percentages may not total 100 due to rounding errors.

Type of School

Table 6 indicates that 92.8 percent (n=64) of the 69 SOPE teachers taught in a public school. Two teachers (2.9%) taught in private schools while three teachers (4.4%) ttaught in parochial schools.

Table 6
Type of Schools Where SOPE Participants Teach
(N = 69)

School Type	Number	Percentage
Public	64	92.75
Private	2	2.90
Parochial	3	4.35
DoD/DoS Dependent School	0	0
Bureau of Indian affairs	0	0
Other	0	0

Note: Percentages may not total 100 due to rounding errors.

School Location and Student Enrollment

A majority of the teachers (n=29; 42%) came from schools located in a rural setting while 37.7 percent (n=26) categorized their schools as suburban. The smallest portion of teachers (n=13; 18.8%) were from urban schools. Clearly, the largest percentage of SOPE teachers (59.4.%) taught in schools with a student population in excess of 500 students. The second largest group taught in schools with a population between 300 and 499 students. (See Table 7.)

Table 7
School Location and Student Enrollment for SOPE Teachers
(N = 65)

	Number	Percentage
Location		
Rural	29	42.03
Suburban	26	37.68
Urban	13	18.84
No Response	1	1.45
Student Enrollment		
0 - 99	0	0
100 - 299	8	11.59
300 - 499	20	28.99
500 +	41	59.42

Note: Percentages may not total 100 due to rounding errors.

Student Population

Table 8 reports student population taught by SOPE participants and breaks that population into five categories. Teachers were allowed to check multiple responses to more nearly portray their student population. The largest category of responses (59.4%) constituted the special education group of students. The remedial category comprised the second highest group of students with the honors/college preparatory a close third group. The underrepresented minority category was represented with 39.1 percent of the total responses.

Table 8
Student Population Taught by SOPE Participants

Category	Number	Percentage
Honors/College Prep.	30	43.48
Underrepresented Minority	27	39.13
Special Education	41	59.42
Remedial	33	47.83
Other	20	28.99

Table 9 displays data regarding SOPE participants' estimates of percentage of minority and female students they taught. The average percentage of minority students estimated by 66 SOPE teachers was 31.74 percent with a high of 100 percent and a low of no students. The mean percentage of female students reported by all 69 SOPE teachers was 45.36 percent. The highest estimate was 70 percent while the lowest estimate was 10 percent.

Table 9
SOPE Participants' Estimates of Minority and Female Students Taught

Category	N	Mean	Low	High	Median
Minority Students	66	31.74	0.00	100.00	25.00
Female Students	69	45.36	10.00	70.00	50.00

Personal Experience with Teaching Space Science

Most teachers reported a positive personal experience with teaching science. Mean scores above 3.0 were recorded on all items except four and indicated an agreement response with those items (Range of responses: Strongly Agree = 4 to Strongly Disagree = 1). Items showing mean scores less than 3.0 indicated some disagreement related to use of textbooks as an important part of the science program, knowledge about and implementation of current national science standards, and use of the inquiry approach to teaching to maximize computer technology. Teachers did not perceive themselves prepared to use the inquiry approach to teaching science, although they reported textbooks were not an important part of their science program which is considered an important move in the direction of inquiry. Table 10 provides a summary of teachers' personal experiences with teaching space science.

Table 10: SOPE Teachers' Personal Experiences with Teaching Space Science

Response Item	Mean	SD	Responses	N/A
1. I enjoyed teaching space science activities.	3.69	0.46	62	7
2. I integrated space science with other subject areas.	3.5	0.5	60	9
3. Textbooks were an important part of my science program.	2.38	0.89	55	14
4. I had access to enough space science materials to provide my students with hands-on experience.	3.1	0.76	62	7
5. Most students in my class would choose science as one one of their favorite subjects.	3.25	0.69	64	5
6. I am willing to accept the "noise" that comes with an active, inquiry-based classroom.	3.54	0.51	68	1
7. I am knowledgeable about the current national standards in science.	2.95	0.72	61	8
8. I feel well-prepared to implement instruction reflective of current national standards in science.	2.86	0.67	62	7
9. I am well-prepared to use the inquiry approach to teaching to maximize computer technologies.	2.52	0.79	67	2
Range of Responses: Strongly Agree=4; Agree=3; Disagree=2; Strongly Disagree=1; Not applicable=N/A				

ANALYSIS OF BASIC CONCEPTS OF SCIENCE

This section of the report examines teacher knowledge of basic concepts underlying inquiry-based science. The concepts identified are inherent in a process-based approach to science instruction intended to facilitate the development of problem-solving skills while encouraging independent thinking and learning. The notion that science is more than a collection of facts, concepts, and theories provides the basic premise of this approach. Science is a distinctive way of seeing and understanding the world. Therefore, exemplary instruction should provide students with extensive opportunities to learn and practice authentic scientific behaviors. These premises necessarily mean the introduction of manipulatives, instruments, and laboratory-type materials and activities into the curriculum suggestive of the constructivist epistemology and instructional practices in inquiry-based science. Instructional strategies appropriate for implementation of this type of curriculum include positive management strategies, assessment of prior knowledge, wait-time, asking for supportive evidence, non-judgmental teacher response, and student involvement in decision-making.

Due to the formative nature of the data collected, only mean scores and standard deviation from the mean are reported. Teachers were given the option of recording 'Don't Know' if they did not know how to respond. The largest number of 'Don't Know' responses occurred in the domains of Nature of Science (n=35) and Science Standards (n=36). Table 11 presents a summary of the data by item and the concept average mean score and standard deviation from the mean in the shaded area of the table. Teacher responses ranged from Strongly Agree = 4 to Strongly Disagree = 1.

Concept mean scores below 3.0 indicate areas where teachers could benefit from additional training and support. These concept areas include the constructivist approach, the nature of science, and science standards. Although these three science concepts showed low overall average mean scores, the item mean scores within several other concept areas showed low mean scores. In fact, some concept areas in which high mean scores were reported showed a few items with low mean scores within that area.

Attitude Toward Science

Though not a specific content area, the five items that comprise this category reflect the philosophy and the basic premises of constructivism and process-based science instruction. Even though teachers' average concept mean score of 3.29 and a range of item mean scores between 2.84 and 3.73 indicated overall agreement with the philosophy, the item relating to science content over science processes showed some disagreement among teachers.

The Constructivist Approach

Teachers demonstrated varied levels of understanding in this domain as reflected in the range of item mean scores: 1.94 - 3.02. The overall concept average mean of 2.42 indicated teachers have a somewhat confused understanding of the philosophy of constructivism and could benefit from additional instruction and support in this domain.

The Development of Concepts

Different teachers brought varying levels of prior knowledge to this concept area. Item mean scores ranged from 2.85 to 3.21. The overall concept average of 3.05 demonstrated agreement with the items included in this category.

Inquiry in Science Education

Teachers scored high in this concept domain with an overall concept average mean score of 3.32. Item mean scores ranged from a low of 3.11 to a high of 3.55 and teachers showed moderate agreement with this concept.

Nature of Science

Teachers showed a mixed level of knowledge and understanding in this domain. Item mean scores ranged from a low of 2.25 to a high of 3.49. Overall concept mean average score was 2.91 indicating that teachers could benefit from additional training and support regarding the nature of science.

Interdisciplinary Connections and Assessments

Teachers generally showed a moderate level of prior knowledge and understanding in this domain. Item mean scores ranged from 2.84 to 3.30 while the concept average mean score was calculated as 3.19 and indicative of teacher agreement with the items representative of this concept.

Science Standards

Many teachers, apparently, were aware of the new science standards, but possessed a low level of prior knowledge on this domain. Item mean scores ranged from a low of 2.69 to a high of 2.91 and an overall concept average mean score of 2.76. These scores indicate teachers need additional knowledge and support in understanding and implementing the science standards.

Insert Table 11 here.

SATISFACTION WITH SOPE FOLLOW-UP CONTENT AND PRESENTATION

Teachers rated their satisfaction with the various content mini-sessions by rating them on various aspects: helpfulness, application of ideas presented, new information, appropriateness of selected materials, clarity of presentation, trainers being well-informed and engaging, confidence in using inquiry approach, portfolios, computer technologies, etc. Mean scores for each aspect and each mini-session are presented in Table 12. All items were positively phrased so '4' or 'Strongly Agree' represents the greatest satisfaction and '1' or 'Strongly Disagree' represents the least satisfaction with any aspect of the sessions.

Item mean scores ranged from a low of 3.29 to a high of 3.71 and were indicative of overall high ratings, although some items were rated higher than others. From the results in Table 12, we can see that teachers were satisfied with all aspects of the follow-up sessions. Teacher ratings for the *trainers being well-informed* and *engaging* received the highest ratings (3.71 and 3.66, respectively), while items relating to *application of ideas in the classroom* and *confidence in ability to implement instruction reflective of current national science standards,* though high (3.29 for both items) were lower than trainer-related ratings.

Table 12: Satisfaction with SOPE Follow-up Content and Presentation			
Aspect of Satisfaction	**Mean**	**SD**	**Responses**
1. Information presented during these follow-up sessions was helpful to me.	3.59	0.53	56
2. I can apply most of the ideas presented in my classroom.	3.29	0.56	56
3. I gained new information during these follow-up sessions.	3.57	0.54	56
4. Session materials were appropriately selected.	3.57	0.49	56
5. Information was presented clearly.	3.54	0.54	56
6. The session facilitators were well informed.	3.71	0.46	56
7. The session facilitators were engaging.	3.66	0.52	55
8. I am more confident about using the inquiry approach to teaching science to maximize computer technologies.	3.39	0.56	56
9. I am more confident in my ability to implement instruction reflective of current national standards in science.	3.29	0.57	55
10. I have a more meaningful understanding of how portfolios can be used effectively in assessment of learning.	3.45	0.57	56
Range of Responses: Strongly Agree=4; Agree=3; Disagree=2; Strongly Disagree=1			

Teachers' Written Responses

Teachers were asked to tell us what went well or was most effective during the follow-up sessions and what they thought could be improved. Teachers were generally very pleased with all the sessions and activities they engaged in during the mini-conference sessions and with presenters' enthusiasm, preparation, and willingness to accept SOPE participants' ideas, questions, and comments. On the other hand, teachers made suggestions for improvement that were incorporated by project staff throughout subsequent mini-conferences.

Tables 13, 14, and 15 present representative responses of SOPE teachers regarding most effective activities and suggested improvements placed in categories. Identified categories include: Sharing of common SOPE Experiences, Portfolio Development and Assessment, Integration of Computer Technology into Curriculum, Science as Inquiry and National Science Standards, Resources, and General Overall Comments. Table 13 corresponds to the Huntsville mini-conference, Table 14 represents the Birmingham conference, and Table 15 corresponds to the Montgomery mini-conference.

Insert Tables 13, 14, and 15

ANALYSIS OF CONSTRUCTED RESPONSES

All teachers who responded to the evaluation at the conclusion of each mini-session were asked to write a paragraph describing strategies they would use should a hypothetical situation occur in his/her classroom. Some open-ended questions simply asked teachers how they were using or planned to use portfolios and/or computers within their classroom. Responses to these open-ended questions represented basic concepts addressed during the mini-session, however, the same situations used in the sessions were not used. A new situation was presented. It was anticipated that teacher responses would reflect their ability to apply the theoretical knowledge in a "real life" situation. Methods appropriate for this portion of the evaluation followed the principles advocated by Bogdan and Biklen (1992). Rubrics for each of the questions were developed through consultations with project staff and are delineated in the final evaluation technical report (Harwell, 1997).

Situations for Teacher Constructed Responses

Interdisciplinary Connections and Assessment

You have just completed an investigation with your class. Describe two strategies you would use to help students effectively communicate their understandings.

Inquiry in Science Instruction

Your students have been studying evaporation and are unsure of how temperature affects the rate at which a puddle disappears. Describe two strategies you would use to help them come to a conclusion.

Prior Use of Portfolios to Document Student Growth in Space Science Knowledge

Describe how you have used or plan to use portfolios to document student growth in knowledge about space in your classroom learning environment.

Projected Future Use of Portfolios to Document Integration of Space Concepts

Describe how you as a teacher have used or plan to use portfolios to document integration of space concepts in your classroom instruction.

Integration of Computer Technology into Curriculum

Describe two strategies you have utilized (or plan to use in the future) which use the inquiry approach to maximize computer technologies as you teach space science topics.

Table 16 presents mean scores on constructed response items for SOPE teachers as well as number and percentage of responses placed in four categories. Mean scores were generally high for the concept related to Interdisciplinary Connections and Assessments (M=3.5; n=34), and for Inquiry in Science Instruction (M=3.24; n=34). It must be pointed out that only 34 teachers responded to these two constructed response items due to a miscommunication among project personnel. Overall mean scores indicated a fairly clear understanding of the construct and that understanding tended to be student centered. The mean score for Integration of Computer Technologies into the Curriculum was 2.77 with 61 teachers responding. Activities tended to be teacher driven. This could be due to the fact that a large group of teachers had no access to computers in the classroom and at the best only one computer per classroom.

Insert Table 16

Mean scores for the concept related to Prior Use of Portfolios to Document Student Growth in Space Science Knowledge (M=2.0; n=54) and the concept related to Projected Future Use of Portfolios to Document Integration of Space Concepts in the Curriculum (M=2.02; n=54) showed that teachers demonstrated a limited understanding of portfolio use which tended to be teacher centered as opposed to student centered. Convenience interviews and conversations with participants during mini-sessions showed that very few teachers use portfolios as one form of authentic assessment. In reviewing teachers' written comments to portfolio use, it became very clear that teachers do not include portfolios among their assessments. Additional training and support is needed in the areas of portfolio assessment and integration of computer technology into the instructional curriculum.

RESOURCES FOR THE 21st CENTURY

In addition to specific training in the areas delineated in previous sections of this report, project personnel provided a resource materials room for teachers to browse and to make selections for future use. Teachers were provided several free books and other supplies supportive of the concepts explored during the mini-sessions. Three statements assessed teachers' satisfaction with resources provided. All statements were phrased positively and response options ranged from excellent (5) to poor (1). Table 17 presents data supportive of great satisfaction with the resources provided related to new developments in space science, overall usefulness of resources, and future benefit to students and the school. Item mean scores ranged from a low of 4.41 to a high mean score of 4.70 with 59 teachers responding. Teachers listed numerous and sundry ideas/activities they planned to initiate with their students as a direct result of exploration of new resources presented in the mini-conference. Teachers reported a combination of local resources available for their professional development. These resources include: subject specialists, in-service workshops, and local/regional/national conferences. (See Table 18.)

Table 17
Satisfaction with Resources in SOPE Follow-up Sessions

Category	Mean	SD	Responses
New developments in space science	4.70	.57	59
Overall usefulness of resources	4.63	.58	59
Future benefit to students and school	4.41	.72	59

Note: Range of responses: 5 = excellent, 4. 3, 2, and 1 = poor.

Table 18
Categories of Local Resources Available to SOPE Participants
(N = 59)

Category	Number	Percent
a. Resources Centers	1	1.7
b. Subject Specialists	1	1.7
c. In-service Workshops	7	11.9
d. Local/Regional/National Conferences	0	0.0
e. Other	6	10.2
f. Combination of any two categories	15	25.4
g. Combination of any three categories	12	20.3
h. Combination of categories a, b, c, d, e.	17	28.8

Note: Percentages may not total 100 due to rounding errors.

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Table 11: Space Orientation for Professional Educators Teacher Evaluation				
Attitude Towards Science	**Mean**	**SD**	**Responses**	**Don't Know**
#1. Good science teaching emphasizes science content over science processes.	2.84	0.78	61	8
#2. Good science teaching depends on good science textbooks.	3.06	0.72	67	2
3. Students learn science best when they experience and conduct scientific investigations.	3.7	0.46	69	0
4. Students learn science best when teachers relate the science lesson to everyday situations.	3.73	0.45	69	0
#5. Having students learn science concepts is more important than their becoming independent investigators.	3.08	0.59	65	4
Concept Average	**3.29**	**0.71**	**331**	**14**
The Constructivist Approach	**Mean**	**SD**	**Responses**	**Don't Know**
6. Students' prior beliefs and knowledge are as important a factor in learning as the concepts being taught.	3.02	0.62	66	3
#7. Teachers can transfer science knowledge by clearly presenting information to students.	2.21	0.73	66	3
#8. A successful student adopts the mental representation of a science concept as presented by the teacher.	2.5	0.72	62	7
9. Learning is made more difficult when a student has to work with other students who have different ideas/approaches.	1.94	0.68	65	4
Concept Average	**2.42**	**0.8**	**259**	**17**
The Development of Concepts	**Mean**	**SD**	**Responses**	**Don't Know**
#10. There is a specific set of teaching strategies that should be used by teachers to promote science learning.	2.85	0.69	65	4
11. Assessing prior knowledge is a necessary first step in inquiry-based instruction.	3.12	0.59	68	1
12. Communicating findings for others to understand is an important component of inquiry-based science.	3.21	0.51	63	6
13. Students must quantify data to enable others to replicate their investigations.	3.02	0.72	53	16
Concept Average	**3.05**	**0.64**	**248**	**28**
Inquiry in Science Education	**Mean**	**SD**	**Responses**	**Don't Know**
14. A goal of science instruction is to encourage students to learn to conduct their own investigations.	3.55	0.5	66	3
15. Students will learn more using data sheets that they developed than by using teacher-prepared data sheets.	3.11	0.73	66	3
16. Students should begin participating in identification & control for variables in investigations as early as first grade.	3.37	0.49	60	9
#17. Students who have been taught science using an inquiry-based approach will be weak in science content.	3.25	0.77	65	4
Concept Average	**3.32**	**0.65**	**257**	**19**
# This negatively worded item has been recoded so a mean score approaching 4 reflects a correct response.				
Range of Responses: Strongly Agree=4; Agree=3; Disagree=2; Strongly Disagree=1; Don't Know=D/K				

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Table 11: Space Orientation for Professional Educators Evaluation (Cont'd)				
Nature of Science	**Mean**	**SD**	**Responses**	**Don't Know**
18. Children are involved in the nature of science when they are asking questions.	3.49	0.53	66	3
#19. Effective science instruction depends on the teacher being able to answer most of the students' questions.	2.86	0.58	65	4
#20. When teaching about microgravity, a good way to explain the concept is to say it is "weightlessness."	2.96	0.85	54	15
#21. Most scientists follow the same sequence of steps in search of scientific knowledge.	2.25	0.72	56	13
Concept Average	**2.91**	**0.8**	**241**	**35**
Interdisciplinary Connections and Assessment	**Mean**	**SD**	**Responses**	**Don't Know**
#22. Science units designed to teach language arts, math, & social studies as well as science end up teaching students very little about science.	3.22	0.73	63	6
23. Writing helps students clarify personal understanding of scientific concepts.	3.27	0.62	66	3
24. Performance assessments can be used by teachers to promote learning as well as to assess student achievement.	3.26	0.44	66	3
25. Providing students with scoring criteria and rubrics is an important part of effective science instruction.	2.84	0.73	57	12
26. When students are responsible for deciding what to include in a portfolio, they are forced to examine their work from new perspectives.	3.3	0.53	64	5
Concept Average	**3.19**	**0.63**	**316**	**29**
Science Standards	**Mean**	**SD**	**Responses**	**Don't Know**
#27. We know that science learning has taken place when students can state important scientific facts.	2.69	0.72	62	7
#28. Science subject matter standards specify the full range of what students in a particular local school should know and be able to do.	2.69	0.69	62	7
29. Science subject matter standards identify a limited number of important concepts, principles, facts, laws, and theories that provide a foundation for understanding and applying science.	2.91	0.61	57	12
30. Science standards define the level of understanding all students regardless of background, future aspirations, or interest in science, should develop.	2.75	0.8	59	10
Concept Average	**2.76**	**0.71**	**240**	**36**
# This negatively worded item has been recoded so a mean score approaching 4 reflects a correct response.				
Range of Responses: Strongly Agree=4; Agree=3; Disagree=2; Strongly Disagree=1; Don't Know=D/K				

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TABLE 13

Categories of SOPE Teachers' Responses Concerning MOST EFFECTIVE Activities During Follow-up Sessions and Teachers' Suggested Activities to IMPROVE Follow-up Sessions (HUNTSVILLE SESSION)

Category	Most Effective Activities (Representative Responses)	Suggested Improvements (Representative Responses)
1. Sharing of Common SOPE Experiences	"teachers sharing ideas" and "lesson plans which will be used when appropriate" "The reinforcement that lets me know I am on the right track."	"It would be nice to be able to collect lesson plans on one grade level." "More selections (options) to fit our grade level and curriculum."
2. Portfolio Development and Assessment	"Portfolio presentation, but needed more time to view portfolios." "Using portfolios as assesment tools." "Explanation of portfolio" Several general comments: "Information on portfolios" "Learning about portfolios" and "requirements of porftolios"	"We need ideas and to see more samples." "more examples needed for portfolios compiled by actual teachers." "more hands-on with potfolios"
3. Integration of Computer Technology into Curriculum	"Use of computers" Several general comments about: "Computer Internet session" "Accessing the <u>net</u>."	"more computer time" "more time on www."
4. Science as Inquiry and National Science Standards	"Encouragement to use inquiry approach to teach science/math." "Video on Inquiry based education was helpful."	"We need more time to follow through with the activities and really gain from them."

TABLE 13 (Cont'd)

Categories of SOPE Teachers' Responses Concerning MOST EFFECTIVE Activities During Follow-up Sessions and Teachers' Suggested Activities to IMPROVE Follow-up Sessions (HUNTSVILLE SESSION)

Category	Most Effective Activities (Representative Responses)	Suggested Improvements (Representative Responses)
5. Resources	"Resources. Resources. Resources. Thank you!" "Viewing resources"; "Availability for viewing" "Resource lab and books given to us." Several general comments simply stating "Resources".	No suggestions
6. General Overall Comments	"web-search-portfolio session-resource room-Wonderful hand-outs!" "Good timing! It has been a difficult year for me because of family illness, so this was a <u>motivator</u> and a time to <u>refocus</u>." "I think all were so effective that I could not choose one."	"Nothing - This was great!" "Nothing! excellent! Great Resources!" "It was so good - how could it be better/" "It was great! Thank you!"

TABLE 14

Categories of SOPE Teachers' Responses Concerning MOST EFFECTIVE Activities During Follow-up Sessions and Teachers' Suggested Activities to IMPROVE Follow-up Sessions (BIRMINGHAM SESSION)

Category	Most Effective Activities (Representative Responses)	Suggested Improvements (Representative Responses)
1. Sharing of Common SOPE Experiences	"Meeting friends and reflecting on what new things we learned this summer." "Seeing Mark and Sharon again!"	"More sharing among teachers on what they've done on space." "I would have liked to get into small groups of same grade teachers and share ideas on teaching space units. I got a few ideas just in short conversations."
2. Portfolio Development and Assessment	"The portfolio session was good. I needed that!" Several responses to the effect that the "Explanation of portfolio construction was very helpful." Several general responses: "Enjoyed the portfolio session," and "How to put portfolio together." "Understanding what the portfolio is." "Good examples of potfolios to be reviewed." "Portfolios -- What to include and how to use it as a 'grade'." Several general responses indicating "mini session on portfolios" and 'portfolio assessment."	"Samples of student portfolios." "Examples of teacher portfolios of space rather than student teachers." "Handouts to follow rather than the overhead would have been great." "Paticularly needed written materials about portfolios."
3. Integration of Computer Technology into Curriculum	""Finding computer programs I can use." "I really enjoyed the 'surfing the internet' time." "Inernet sights [sites] to use with my kids (ifwe get access.) "I really enjoyed the computer session. I have not had much experience and learned a lot during the short time with the hands-on time available." "crawling through the science wwweb." Several general comments: "computer time"and "network."	"Have a follow-up dealing with technology to keep us up on new technology." "offer more indepth computer orientation." "Add a little more time to the computer session."

TABLE 14 (Cont'd)
Categories of SOPE Teachers' Responses Concerning MOST EFFECTIVE Activities During Follow-up Sessions and Teachers' Suggested Activities to IMPROVE Follow-up Sessions (BIRMINGHAM SESSION)

Category	Most Effective Activities (Representative Responses)	Suggested Improvements (Representative Responses)
4. Science as Inquiry and National Science	"More understanding of Inquiry and the Standards." "The Frisbee."	No Suggestions.
5. Resources	"The use of the resource room to have access to viewing different CD-Roms/Videos/Laser Discs." "Access/information to resources." "Resources on display." "Resources will be very helpful take home materials." Several general comments: "Resources" and "Enjoyed the availability of maerials."	"more information about how to qualify for Washington, DC (criteria for qualifying)." "Allow a little more time to the resource room."
6. General Overall Comments	"Great to summarize." "There was great variety." "Question/answer periods." "Availability of resource personnel."	"I would like to see more math related topics. Kids are always asking 'When am I ever going to use this?' I desperately need more ideas to integrate space related activities in the math classroom." "I don't know. I enjoyed. It provided additional useful materials and information. Thank you!" "Nothing! Food was terrific!"; Great job! Enjoyed!" "It was great! I know you will think of other ideas. But I understand it has improved much from the passed [past]" and "Time! (What else) more time!" "Send evaluatons home to be completed and maled back."; "Narrow down evaluation forms to one." "I enjoyed it very much! Great like it was. <u>I have no idea</u>!" One time response: "Start a little earlier."

TABLE 15

Categories of SOPE Teachers' Responses Concerning MOST EFFECTIVE Activities During Follow-up Sessions and Teachers' Suggested Activities to IMPROVE Follow-up Sessions (MONTGOMERY SESSION)

Category	Most Effective Activities (Representative Responses)	Suggested Improvements (Representative Responses)
1. Sharing of Common SOPE Experiences	"Sharing experiences with other teachers." "Shared lesson plans"; "meeting teachers from other areas." "Sharing ideas with each other was one of the most effective things about the conference." Several general reponses such as "sharing" and "encouragement."	"More time sharing what others did in DC/Russia." "More time sharing what activities teachers have used with changes and improvements."
2. Portfolio Development and Assessment	Several general responses related to "Learning more about portfolios," "Using portfolios," and "Information about portfolios."	"Learning more about portfolios." "less time on portfolio."
3. Integration of Computer Technology into Curriculum	"Surfing the Net!" "Searching the Internet for science information." "Learning how to use Netscape on the computer" and "Understanding how to use the Internet." Several short responses such as "Using the Internet," "www." and "computer time."	"More time in the computer lab."
4. Science as Inquiry and National Science Standards	"How to start a lesson so students will be coming up with the questions." "Reinforcement of inquiry learning and strategy ways to implement them and be able to stay with State course of study." "National Science Standards."	No suggestions.

TABLE 15 (Cont'd)

Categories of SOPE Teachers' Responses Concerning MOST EFFECTIVE Activities During Follow-up Sessions and Teachers' Suggested Activities to IMPROVE Follow-up Sessions (MONTGOMERY SESSION)

Category	Most Effective Activities (Representative Responses)	Suggested Improvements (Representative Responses)
5. Resources	"Previewing available resources was helpful." "Availablity of the resource room." Several general responses simply stating "Resource Room."	"More on NASA and space; give us space updates." "Cooperation with AEA Aerospace Week and AATA."
6. General Overall Comments	"The sessions were great!" "All sessons were effective." "I gained new knowledge that I can incorporate into my subject area. However, the session on portfolios was very effective." "I gained new and better ideas about including space science in my classroom."	"Good the way it is!" "Session on hands-on activities that we can use in our classrooms." "Add more things directly related to space in the elementary classroom." "I expected it to be more science oriented." "More information on space science." Several suggestions regarding time: "Start just a bit earlier." "Start session earlier so that it could end earlier."

TABLE 16
Scores on Constructed Response Items for SOPE Teachers in Follow-up Sessions

Concept	No Relevant Response *Score = 1*		Limited Understanding (Teacher Centered) *Score = 2*		Some Understanding (Teacher Driven) *Score = 3*		Clear Understanding (Student Centered) *Score = 4*		Mean Score	No. of Responses
	N	%	N	%	N	%	N	%		
Integration of Computer Technology into Curriculum	1	1.6	3	4.9	24	39.3	19	31.2	2.77	61
Interdisciplinary Connections and Assessments	0	0.0	4	11.8	9	26.5	21	61.8	3.50	34*
Inquiry in Science Instruction	0	0.0	2	5.9	22	64.7	10	29.4	3.24	34*
Prior Use of Portfolios to Document Stud-dent Growth in Space Science Knowledge	18	33.3	21	38.9	12	22.2	3	5.6	2.00	54
Projected Future Use of Portfolio to Document Integration of Space Concepts	16	29.6	24	44.4	11	20.4	3	5.6	2.02	54

* Note: Due to a miscommunication Huntsville participants did not complete these constructed response items.

RUBRICS FOR CONSTRUCTED RESPONSES

Rubrics used to score constructed responses were patterned after the generic rubric used in the evaluation study of the Montgomery County Public Schools. This generic pattern was followed; however, adaptations were made to accommodate individual constructed situations relevant to material and activities presented in the mini-conference sessions.

Explanation of Scores

Possible scores range from a high of four to a low of 1 and followed this pattern:

Score = 4 -- Response indicates that teacher clearly understood main points presented in the mini-session that seems relevant to the question and can make applications to individual classroom situation.

Score = 3 -- Response shows some or limited understanding and application of practices and/or orientation toward material presented in the mini-session.

Score = 2 -- Response indicates that the question was generally understood, but response incorporated no application or orientation toward materials presented in the mini-session.

Score = 1 -- No response or a response showing no relevance to material presented.

Description of Scoring

Each of the values listed above required a phrase or statement focusing on the major premise required for that score. Brief descriptions of what teachers did was important in placement of a response within a category.

Explanation of Special Situations

Many teachers provided scant responses with incomplete sentences and/or teachers gave only one situation but that situation demonstrated that they understood the point of the mini-session. Teachers may not have viewed the survey as a "test" situation in which they had to convince another person of their knowledge and ability to apply that knowledge. It should be noted that most teachers' responses to the Integration of Computer Technology into the Curriculum situation was influenced by the fact many teachers did not have internet access and many have access to only one computer in the classroom. Also, the fact that many teachers do not presently use portfolios in their classroom, influenced responses to those questions related to portfolio use.

Since this evaluation exercise was considered a "pilot" effort at using constructed responses, no attempt was made at this juncture in time to use more than one evaluator to categorize responses. Therefore, no interrater reliability was established. However, in the event this evaluator became unable to clearly assign a response to a category, consultation with colleagues in the education department helped the evaluator to make that assignment. As a rule, the actual score assigned was one agreed upon by both.

Inquiry in Science

Situation: Your students have been studying evaporation and are unsure of how temperature affects the rate at which a puddle disappears. Describe two strategies you would use to help them come to a conclusion.

Score = **4** -- One student centered activity which incorporates student discussion, predictions, evaluations, independent investigations, or reference to strategies of cooperative learning, hands-on experiences, or specific programs using these strategies.

Score = **3** -- Teacher controlled or teacher driven approach. Teacher sets up activity or activities, no mention of student discussions, evaluation, or other student centered activities. No references made to strategies of cooperative learning or hands-on experiences conducted by students.

Score = **2** -- Teacher controlled instruction where teacher explains, tells, or says that I will answer it later. Activities are non-process oriented.

Score = **1** -- No (relevant) response written or space is left blank

Interdisciplinary Connections and Assessments

Situation: You have just completed an investigation with your class. Describe two strategies you would use to help students effectively communicate their understanding.

Score = **4** -- Student centered approach. Teachers provide at least one situation describing how students help themselves and each other to communicate their understanding. Students write about observations and experiences, explain to each other, engage in group discussion, critique each other's work, draw pictures, keep journals/logs. Teachers use techniques specific to scientific investigation and engage in concrete experiences and investigations.

Score = **3** -- Teacher driven approach
Teacher prepares activities and environment. Limited student involvement.

Score = **2** -- Teacher centered approach
Teacher critiques student products and investigation results. No student input on evaluation.

Score = **1** -- No relevant response written or space is blank

Integration of Computer Technology into Curriculum

Situation: Describe two strategies you have utilized (or plan to use in the future) which use the inquiry approach to maximize computer technologies as you teach space science.

Score = **4** -- Student centered approach
Teacher provides one situation in which students help themselves or others in using computer technology. Situations are created that encourage participation and student use of computers to research topics about space science. Techniques specific to inquiry instruction are used.

Score = **3** -- Teacher driven approach
Teacher plans and sets up activity with no mention of student discussion and/or evaluative input from students. Limited understanding of inquiry approach.

Score = **2** -- Teacher centered approach
Teacher critiques student products and investigation results. Activities are non-process oriented and for teacher use only.

Score = **1** -- Nothing relevant written or no computer use/access, nothing relevant to inquiry instruction. No specific plans for use.

Portfolio Use to Document Student Growth in Space Science Knowledge

Situation: Describe how you have used or plan to use portfolios to document student growth in knowledge about space in your classroom learning environment.

Score = **4** -- Clear understanding of portfolio development and use as an authentic Assessment of student growth in knowledge of space related topics. Valid reasons for portfolio assessment and development of rubrics for scoring based on content and activities presented in mini-session.

Score = **3** -- Some understanding of portfolio development and use as authentic assessment. Inadequate reasons for portfolio assessment and little or no knowledge of rubrics.

Score = **2** -- No use of portfolios as assessment of student growth in knowledge in space related topics. Response indicates question was understood; however, limited understanding of how portfolios can be incorporated into current practice abounds.

Score = **1** -- No response

Portfolio Use to Document Integration of Space Science Concepts into Curriculum

Situation: Describe how you as a teacher have used or plan to use portfolios to document integration of space concepts into your classroom.

Score = **4** -- Clear understanding of portfolio development and use as authentic assessment of ways teacher integrated space science concepts into classroom curriculum. Valid reasons for using portfolios as assessment presented. Good working knowledge of rubrics. Good understanding of portfolio assessment based on content and activities presented in mini-session.

Score = **3** -- Some understanding of portfolio development and use as authentic assessment. Inadequate reasons for portfolio assessment and little or no knowledge of rubrics.

Score = **2** -- No use of portfolio assessment as documentation of integration of space science concepts into curriculum. Response indicates question was understood, but response indicates limited understanding of how portfolios could be used as documentation of classroom activities.

Score = **1** -- No response.

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