DOCUMENT RESUME

ED 385 448 SE 056 795

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TITLE The Impact of Reform-Based Partnerships on Attitudes toward Environmental Science and Partnering and on Classroom Instruction. Draft Copy.

PUB DATE Apr 95

NOTE 29p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Francisco, CA, April 18-22, 1995).

PUB TYPE Reports - Evaluative/Feasibility (142) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC02 Plus Postage.

DESCRIPTORS *Educational Change; Elementary Education; *Elementary School Teachers; *Environmental Education; Inservice Teacher Education; Instructional Improvement; *Partnerships in Education; Professional Development; *Professional Personnel; Rural Areas; Science Education; Teacher Attitudes; *Teacher Education Programs

ABSTRACT

Partnering for Elementary Environmental Science, a professional development program developed to enhance teachers' skills and content knowledge in science education, pairs classroom teachers with resource professionals for 1 year of collaborative instruction. The purpose of this study was to examine the impact of reform-based partnerships among teachers and resource professionals on instructional practices, teacher attitudes, and student attitudes and learning in 11 rural elementary schools in a midwestern state. In the first phase of the program, an in-depth 4-day institute was held in the summer. The second phase of the project enabled partnership teams to implement their collaborative teaching projects throughout the following academic year. A follow-up implementation phase included two mini-conferences. This paper reports part of the evaluation and research related to the program and is delimited to reporting participants' changes in attitudes and instructional approach. Though the mean for both groups improved, the teachers' levels of confidence in reform-based partnering showed significant improvement after the program. Approximately three-quarters of teachers expressed that their instructional approach had changed, often towards more hands-on approaches. The questionnaire is appended. Contains 10 references. (LZ)

ED 385 448

The Impact of Reform-based Partnerships on Attitudes toward Environmental Science and Partnering and on Classroom Instruction

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Support for this project, Partnering for Elementary Environmental Science, is provided by a grant under the federally funded Dwight D. Eisenhower Mathematics and Science Education Act, administered by the Ohio Board of Regents.

Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA, April 18-22, 1995.

SE056795

ABSTRACT

Partnering for Elementary Environmental Science, a professional development program developed to enhance teachers' skills and content knowledge in science education, pairs classroom teachers with resource professionals for one year of collaborative instruction. This paper reports part of the evaluation and research related to the program. Specifically it examines changes in teachers' and resource professionals' attitudes toward environmental science and partnering, and changes in instruction.

The Impact of Reform-based Partnerships on Attitudes toward Environmental Science and Partnering and on Classroom Instruction

Although partnerships between schools and businesses or other agencies have been advocated as a vehicle for professional development and education reform for the past decade, most partnerships themselves have lacked formal evaluation designs or mechanisms. As a result, their impact on instruction and student learning can only be surmised. The purpose of this study was to examine the effects of reform-based partnerships among teachers and resource professionals on instructional practices, teacher attitudes, and student attitudes and learning in rural elementary schools. This report is delimited to reporting participants' changes in attitudes and instructional approach.

Background

Students are most motivated and receptive to learn about things that are closest to them, preferably in their own backyards. Further, they learn best when they are actively involved in the learning experience. It seems, then, that by studying environmental science utilizing a hands-on approach that is facilitated by partnerships with local resource professionals, student learning will be enhanced and a strategy for reform in science education will be modeled.

A deluge of reports and research has documented that American students are not scientifically literate and that this is directly related to several issues, including classroom time spent on science, types of instructional strategies, and teacher characteristics.

Time spent on science at the elementary grades surfaces as one of the major concerns. Teachers of grades K-3 reported spending 18 minutes per day on science instruction while teachers of grades 4-6 reported 29 minutes (Weiss, Nelson, Boyd & Hudson, 1989). This lack of quantity of instruction is compounded by a lack of quality. While lecture, discussion, and textbook reading characterize science lessons, the majority of science teachers agreed that laboratory-based science classes are more effective than non-laboratory classes (Weiss et al., 1989). This view is supported by the NAEP assessment which indicates that a positive association exists between participatory classroom activities and science proficiency (Mullis & Jenkins, 1988). What happens in the science classroom depends in large part on the teacher. Relatively few elementary teachers perceive themselves as very well qualified to teach science. When asked what assistance they needed, teachers most frequently indicated "learning basic concepts" and "learning about instructional materials." However, this assistance is not reaching the majority of teachers. Half of the K-6 teachers had no inservice education related to science education in the last year and had taken no college credit courses in science or science education in the last 10 years (Weiss et al., 1989).

Teachers' qualifications and perceived abilities to teach science are related to the quantity and quality of instructional time. While many other barriers exist (e.g., lack of science facilities and equipment, curricular mandates, administrative support), addressing the need for quality teacher preparation is critical in improving elementary science education. The key word, of course, is quality. The National Science Teachers Association (1986) proposes standards for preparation of elementary science teachers. It suggests that teachers: 1) have a broad science content background; 2) have instructional skills that promote teaching of science process skills, content, and attitudes especially through hands-on activities; 3) be aware of innovations in methods and materials and how to apply them; and 4) be competent in assessing student performance.

For practicing teachers, quality inservice programs address these needs. The literature, in general, however, does not support the use of short, one-shot workshops provided on an irregular basis. Characteristics of effective professional development programs include: 1) the development of a coherent plan, 2) in-depth and long-term programs such as intensive courses of institutes, 3) substantial follow-up as teachers return to the classroom, 4) critical mass of teachers and/or administrators from one building or district to build internal support structures, and 5) use of teachers in training and support roles (Loucks-Horsley, 1989).

Beyond these generalizations, professional development for the 1990s utilizes three powerful ideas that are "altering the face of professional development in this decade" (Sparks, 1994, p. 2). The first is the notion of results-driven professional development which judges the success of the professional development program not by how many teachers and administrators participate or by how satisfied they are with the program, but by whether the program alters instruction in ways that benefit students. Honig (1994) points out that a problem with education reform is that it is not typically organized around improving teachers' knowledge of content or enhancing their ability to collaborate to improve instruction.

The second guiding notion is systems thinking, which recognizes the complex, interdependent interrelationships among various parts of the educational system. This suggests that collective, not individual, efforts which involve a critical mass of staff committed to improving student performance and making necessary instructional changes are needed to initiate systemic reform in science education.

A third notion driving professional development programs is constructivism. Constructivist professional development involves multiple forms of job embedded learning. It depends on successful networking among education professionals that focuses attention on instruction and learning, provides nurturing to schools, and brings schools together to broaden perspectives and offer needed collegial support.

A promising mechanism for carrying these powerful ideas into professional development for the '90s is partnerships. In the early 1980s, the federal government began to recognize the need to integrate school and business entities. By 1989, the Department of Education estimated that over 140,000 school-business partnerships existed nationwide (Rigden, 1991). Initially, most businesses avoided getting involved in decisions which impacted curricula and educational systems. The partnerships, mostly confined to urban and suburban areas, took on a variety of forms ranging from providing equipment or financial support to the school with no direct involvement with teachers or students, to "popping in and doing a few 'gee whiz' things" (Sills, Barron & Heath, 1993). It is uncertain, however, that these partnerships resulted in fundamental changes in instruction or student learning. Miron and Wimpelberg (1989), for example, found that only eight of the 450 local school-business partnerships they investigated led to instructional

instructional process, and 3) the impact of partnerships on student attitudes and learning. This report is delimited to a discussion of the effects of the program on participants' perceptions and on changes in the instructional process.

Program Description

The project, Partnering for Elementary Environmental Science, is specifically designed to improve elementary science education at the local level through partnerships aimed at providing inservice teacher education and professional development which addresses national standards for science education and reflects characteristics of effective professional development. The project is being sponsored collaboratively by The Ohio State University at Mansfield (OSU), the Ohio Department of Natural Resources (ODNR), and The Science and Mathematics Network of Central Ohio (Network), a part of the Central Ohio Regional Teacher Training Center. The overall goals of the project are to:

1) provide an in-depth, extended inservice program for elementary teachers and ODNR resource professionals focusing on a hands-on inquiry approach to environmental science;

2) develop knowledge, skills and attitudes which will result in a commitment to teaching environmental science through a hands-on inquiry approach;

3) foster long-term partnerships between local teachers and ODNR resource professionals which mutually enhance the teaching of environmental science through inquiry;

4) introduce teachers and ODNR resource professionals to and provide experience with a wide variety of curriculum materials and instructional strategies which they can integrate into their own curriculum and programs; and

5) involve teachers and ODNR resource professionals from the counties in a follow-up program which will build a support system as well as a base for future collaboration between the partners and among educators from those counties.

More specifically, it was anticipated that the project would provide three outcomes:

1) Professional development opportunities for elementary teachers. The program models a hands-on, inquiry approach to environmental science and provides teachers as well as resource

professionals with the opportunity to practice with activities and techniques that are applicable to their specific curriculum and programming. Participants are introduced to a wide variety of elementary science and environmental education programs and materials and have the opportunity to incorporate components of these materials into their existing curriculum and programs.

2) Improved instruction of elementary science. Through the inservice and follow-up activities, teachers and resource professionals gain knowledge, skills and attitudes which will increase their expertise and build confidence in an inquiry approach. For teachers, especially primary level, this may represent a radically different method for teaching science while for others it may represent a retraining or polishing. For resource professionals, it provides much needed professional development in the areas of classroom instruction and teacher inservice. Because of their content expertise, resource professionals are often invited into classrooms and inservice programs with little formal preparation in the education field. By identifying and addressing barriers to teaching activity-based environmental science and providing both partners with the opportunity to practice modeled instruction, participants are prepared to transfer their professional development experience to their educational settings.

3) Increased collaboration about effective environmental science teaching within the partnerships and among the partnerships and collaborators. Building on the common experiences from an intensive four-day resident professional development summer institute, teachers and resource professionals participate in follow-up activities aimed at developing a support system between the partners as well as among the participants. They share materials, instructional techniques, and content information that contributed to improved instruction and programs as well as provide insights into what works for them and why. Experience in other projects has shown this peer interaction to be a powerful mode of professional development, resulting in increased motivation and excitement for science teaching.

The project, Partnering for Elementary Environmental Science, attempted to meet these goals through a year-long sequence of courses and seminars that focus on planning, implementation and assessment of a hands-on approach to environmental science based on a partnership model. Liaisons from the eleven participating counties worked with the project collaborators to analyze the science graded courses of study and curriculum materials in use by the districts. Common environmental science topics were identified and seminar sessions designed to enhance instruction in these curriculum areas.

In the first phase of the program, an in-depth four day institute (30 contact hours) for three graduate credits was held in the summer. During the institute, instructors presented theory and research about topics related to hands-on inquiry approach, including its effectiveness compared to other approaches, barriers to implementation, indoor and outdoor classroom management, collaborative learning, questioning strategies and assessment. Most importantly, instructors modeled environmental science activities which apply this theory to practice, provide opportunities for the teachers and resource professionals to practice within the institute setting, and allow adequate time for participants to explore resources as well as to interact with each other and resource people. Hands-on activities used during the institute were drawn from a wide variety of environmental science curricula including GEMS, AIMS, Project WILD, Project Learning Tree, Super Saver Investigator, OBIS, NatureScope, Earth Education, OEAGLS, and Project Wet. Environmental and natural resources content were integrated throughout the institute.

An important component of the institute was the development of a collaborative teaching project by partnership teams of teachers and resource professionals. Each team formulated an action plan and associated curriculum materials aimed at improving instruction in elementary environmental science. Action plan projects involved the development of thematic units, utilization of school sites or other natural areas, or school wide projects.

The second phase of the project enabled partnership teams to implement their collaborative teaching projects throughout the following academic year. Participants field tested their ideas and materials, assessed their success, and made appropriate revisions. Through their collaborative teams, they provided the support base needed to implement a hands-on approach and to have the opportunity to reflect about their practice. This follow-up or implementation phase included two mini-conferences, held in the fall and in the spring, at which partnership teams presented their projects and the progress they had made. The challenges and benefits of partnering and teaching utilizing a hands-on inquiry approach were discussed within and among partnership teams.

At the end of the academic year, partnership teams were encouraged to reflect on and to assess their partnering relationship, to make concrete plans for continuation into a second year of involvement (without grant funding), and to explore ways to scale up their partnership to include an expanded network of teachers and resource persons.

Methods

Sample. This study examined the impact of reform-based partnerships among teachers and natural resource professionals in 11 predominantly rural counties in a Midwestern state. The elementary teachers represented kindergarten through grade six and special education classrooms. Resource professionals represented divisions of forestry, geological survey, natural areas and preserves, parks and recreation, real estate and land management, reclamation, recycling and litter prevention, soil and water, public information and education, water, and wildlife from the state Department of Natural Resources, as well as the state university's cooperative extension service, county soil and water conservation districts, and the U.S. Army Corps of Engineers.

Participants included teachers and natural resource professionals working collaboratively in partnership teams formed over the first two years of the program. During the first year, 23 partnerships were formed in five counties among 44 elementary teachers, 1 curriculum specialist, and 27 resource professionals, involving 23 schools. While the effectiveness and structure of the Institute were evaluated during the first year, measures to evaluate the impact of the program on teacher attitudes and instruction were merely piloted. The instruments and procedures were subsequently polished and restructured for use during the second Summer Institute. Thus the results reported below reflect responses of participants during the second year of the program. During the second year, 39 teachers, 1 principal, and 24 resource professionals formed 18 partnerships in six counties, involving 20 schools.

During the application process, teachers were asked to state their familiarity with 11 prominent science and environmental education curriculum materials (Table 1). Curricular knowledge of resource professionals was not assessed.

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Table 1

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Procedure. The measures and interviews given to the teachers, resource professionals, and school principals are detailed below.

1) Summer Institute Questionnaire (Pre and Post forms) (Appendix A) were administered to all participants. Both forms of the questionnaire contained identical scaled, closed, and open-ended items designed to capture participants' perceptions toward environmental science instruction and partnering. The Post form contained additional questions examining the effectiveness and impact of the Institute. The sample (N = 63) consisted of those individuals who completed both forms of the questionnaire. Data was analyzed using SAS (Statistical Analysis System). Analysis of Variance (One-Between, One-Within ANOVA) was used for scaled items. Simple descriptive statistics were used for closed items, and responses to open-ended items were analyzed using content analysis.

2) A focus group technique was employed to develop a more in-depth review of the effectiveness and impact of the Institute. Members of the focus group consisted of six Institute participants: four teachers and two environmental resource professionals. Members were selected by the Institute instructors. Criteria for selection included: a) representatives from teacher and resource professional groups, and b) demonstrated articulation of thought-provoking, critical views and opinions in either large or small group settings. The focus group interview occurred on the final day of the Institute, and lasted for approximately one hour. The interview was audio-recorded subsequent to obtaining permission from all participants. Assurances of anonymity and confidentiality were provided by the evaluators. The recording was transcribed verbatim; analysis was performed via content and cluster analysis techniques.

3) Reflection questions or writing prompts were given to all participants four times during the Institute. During the first years' Institute and throughout the year of involvement with the

program, all participants were provided with and instructed to keep journals about the Institute and subsequent implementation and partnering activities. Journals were reviewed three times during the year and feedback was provided to writers. This approach was not popular with program participants and was largely ineffective in securing detailed information about teachers' attitudes and instructional changes. As a result, open-ended reflection questions were developed and used to obtain more specific data during the second Institute. Participants were given 20-30 minutes to respond to each question, and were encouraged to write a one to two page response. One reflective question asked participants to describe their teaching or presentation style in detail: "Think back over the past year to the times you taught or made presentations to students. In as much detail as possible, describe your presentation/teaching approach or style. What methods do you most frequently use? How long are your science lessons/presentations? How do students generally respond? If you are a teacher, how much time per week do you spend doing science? Paint us a picture of yourself as a teacher/presenter."

4) Individual and team interim evaluations were completed by all participants and all partnership teams in November at the mini-conference. Both evaluations consisted of open-ended items designed to gather specific information on the implementation of the action plan and to parallel the reflective questions presented during the Summer Institute. Specifically, questions aimed to ascertain the number of students, teachers, and resource persons involved in the implementation of the action plan; the perceived benefits of the program for the teachers, resource persons, and the school and community; what excited them the most and least about partnering; the greatest benefits and challenges to partnering; and anecdotal accounts of class or students' involvement with the program. One item on the individual interim report paralleled the teaching style question from the Summer Institute: "List and describe some ways that your professional life is different because of partnering. For example, in what ways is your teaching/presentation style different? What changes have you made in the classroom? Do you think differently about planning, presenting to groups, or learning? Please be as specific as possible." Data from interim reports was transcribed by question and content analyzed.

5) Individual and team final evaluation reports contain scaled, closed, and open-ended

items designed to capture participants' perceptions toward environmental science instruction and partnering identical to the items on the pre- and post-Institute questionnaire. Some open-ended questions paralleled questions to the interim reports about the specific benefits and challenges of the partnership and action plan. Team evaluations also asked the team to discuss extending their partnering activities into a second year and, if they desired to continue, to begin planning for the continuation. Data was analyzed using SAS, using Analysis of Variance for scaled items to see longitudinal changes in attitudes toward environmental science instruction and partnering. Responses to open-ended questions were analyzed using content analysis.

6) Telephone interviews with building principals were conducted after partnership teams had been active for 10 and 22 months in the program. Interview questions sought to determine if the principal was aware of the teachers' involvement with the program; if the partnership was active; the sorts of activities the partnerships were engaged in; the perceived benefits of the partnering program for the teacher, students, school, and community; and challenges of which the principal was aware. Descriptive statistics and content analysis were used, where appropriate, after interview data was transcribed.

7) Telephone interviews with team leaders were conducted after 22 months of potential involvement in the program to ascertain the level of activity of the partnership (very active and dynamic, active and on schedule, limited activity, or disbanded); changes in the participants of the partnership; perceptions of why the partnership endured or disbanded; and impacts of the partnering program on teaching style, curriculum, students, and the way the teachers thought about teaching and learning. Descriptive statistics and content analysis were used, when appropriate, after interview data was analyzed.

Results and Discussion

Results will be presented as responses to three questions driving one aspect of this research.

Was there a change in the participants' attitudes toward environmental science?

In both the pre and post forms of the Summer Institute Questionnaires, participants were asked to: a) consider one-word descriptors for environmental science, and b) indicate the degree to which they agreed with the term as an appropriate descriptor. Responses ranged from 5 (strongly agree) to 1(strongly disagree). See Table 2 for means and standard deviations. Analysis of Variance was performed on responses to determine changes by group (A) from pre to post (B). (Groups are teachers and resource professionals). Table 3 shows an F-value for each of three sources by variable. The three primary sources are: 1) main effects of Group (Teacher or Resource Professional) (A), 2) main effects of Pre-Post scores (B), and 3) the interaction of Group and Pre-Post (AB). Significant differences (P<.05) in F-Values are noted with a single asterisk. Significant changes at the end of the Institute included that both teachers and resource professionals expressed that they found environmental science more "exciting" and more "interesting." Perceptions of other environmental science variables (active, unfamiliar, intimidating, difficult) shows no significant change across the Institute.

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Tables 2 and 3

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Participants were also asked to rate their levels of confidence with regard to teaching environmental science. See Tables 6 and 7 for results. For all items in this section, there was a significant change ($p < .05$) in participants' levels of confidence from pre to post: all participants indicated a higher degree of confidence from pre to post. Interaction effects in a) teaching process skills and b) adapting what you are teaching to a specific age group, and c) your own level of knowledge about environmental science were significant for these items. In two of the items, a) teaching process skills and b) adapting what you are teaching to a specific age group, teachers began with higher confidence and also showed a greater increase than resource professionals. Concerning their level of knowledge about environmental science, although teachers began significantly lower than resource professionals, on posttest measures they showed no significant difference to the resource professionals with regard to confidence in their knowledge of environmental science.

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Tables 6 and 7

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In most cases with the exception of managing materials, there was a significant difference ($p < .05$) in responses between the teachers and resource professionals. Therefore teachers, in general, indicated a higher level of confidence in behaviors related to teaching environmental science. As noted above, on the item concerning the level of knowledge about environmental science, teachers' confidence began significantly lower than resource professionals.

Long-range changes in participants' attitudes toward environmental science will be assessed after 10 and 22 months involvement in partnership teams.

Was there a change in the participants' attitudes toward reform-based partnering?

As with the environmental science variable, on both the pre and post forms of the Summer Institute Questionnaires, participants were asked to: a) consider one-word descriptors for partnering, and b) indicate the degree to which they agreed with the term as an appropriate descriptor. Responses ranged from 5 (strongly agree) to 1(strongly disagree). See Table 4 for means and standard deviations. Analysis of Variance was performed on responses to determine changes by group (A) from pre to post (B). (Groups are teachers and resource professionals). Table 5 shows an F-value for each of three sources by variable. The three primary sources are: 1) main effects of Group (Teacher or Resource Professional) (A), 2) main effects of Pre-Post scores (B), and 3) the interaction of Group and Pre-Post (AB). Significant differences ($P < .05$) in F-Values are noted with a single asterisk. Examination of the data indicate that, at the end of the Institute, teachers perceived partnering to be less "unfamiliar". Further, at the end of the Institute resource professionals perceived partnering to be more "intimidating" than at the beginning, and teachers expressed less intimidation at the end of the Institute than at the beginning. While neither group's change in attitude was statistically significant, the two groups moved in opposite directions concerning the variable "intimidating." Both groups found partnering more "meaningful," more "helpful," and more "exciting" at the end of the Institute. Teachers expressed greater change in the extent to which they thought it was "helpful," and resource professionals expressed greater change in the extent to which they thought it was more "meaningful" and "exciting."

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Tables 4 and 5

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Also with regard to partnering, participants were asked to indicate their level of confidence by selecting the statement that most accurately reflected their feeling about partnering. Options for this item were: 1-Very confident, 2-Let's just say, "confident" and leave it at that, 3-Somewhat guarded confidence, or 4-I'd prefer to "wait and see." As can be seen in Table 8, only the teachers indicated a significant change ($p<.05$) in level of confidence toward partnering from pre to post. Though the mean for both groups improved from pre to post, the teachers' levels of confidence showed significant change (ie., improvement). The mean response for both groups at the end of the Institute was "very confident."

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Table 8

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Long-range changes in participants' attitudes toward partnering will be assessed after 10 and 22 months of involvement in the partnership program.

What is the impact of partnering on instruction?

To begin to determine changes in classroom instruction as a result of the partnership effort, the following open-ended responses were content analyzed: 1) teacher descriptions of their instructional approach when teaching science from the Institute reflection question; 2) teacher responses to the individual interim report question asking how their instruction had changed, and 3) team responses to the interim and final evaluation questions soliciting anecdotal stories about how the project had benefited students.

Approximately three-quarters of teachers shared that their instructional approach had changed, sometimes radically. Most of these teachers described their approach as "less traditional", and noted that they were using more "hands-on approaches", and "cooperative groups

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Table 1

Teacher Experience with Science and Environmental Education Curriculum Materials

Program	Have Used (%)			Have Heard of but Never Used (%)			Never Heard of It (%)		
	1st	2nd	X	1st	2nd	X	1st	2nd	X
GEMS	4	3	3.5	14	20	17.0	83	77	80.0
Earth Education (Acclimatization)	3	0	1.5	15	3	9.0	82	97	89.5
NatureScope	22	17	19.5	28	18	23.0	50	65	57.5
OBIS	24	0	12.0	19	17	18.0	77	83	80.0
OEAGLS (Sea Grant)	24	2	13.0	14	14	14.0	82	84	83.0
PortaParKit	27	0	13.5	8	11	9.5	85	89	87.0
AIMS	29	38	33.5	32	38	36.0	39	24	31.5
Project Learning Tree	27	18	22.5	38	47	42.5	35	35	35.0
Project WILD	45	44	44.5	41	43	42.0	14	13	13.5
Sharing Nature with Children	19	11	15.0	17	15	16.0	64	74	69.0
Super Saver Investigator	15	12	13.5	20	17	18.5	65	71	68.0

Table 2

Environmental Science: Means and Standard Deviations for Pre (#1) and Post (#2)

Variable	Group	Pre M	Pre SD	Post M	Post SD
Environmental Science					
Active	Teacher	4.65	0.62	4.80	0.40
	Resource	4.57	0.51	4.74	0.45
	Total	4.62	0.58	4.78	0.42
Unfamiliar	Teacher	2.63	1.25	2.00	1.19
	Resource	2.05	1.05	2.17	1.30
	Total	2.42	1.21	2.06	1.23
Intimidating	Teacher	2.38	1.29	1.82	0.97
	Resource	2.00	1.04	2.04	1.15
	Total	2.24	1.21	1.90	1.04
Exciting	Teacher	4.63	0.63	4.80	0.41
	Resource	4.43	0.73	4.68	0.72
	Total	4.56	0.67	4.76	0.53
Interesting	Teacher	4.70	0.46	4.88	0.33
	Resource	4.52	0.73	4.74	0.45
	Total	4.63	0.58	4.83	0.38
Difficult	Teacher	2.60	1.08	2.03	1.05
	Resource	2.65	1.15	2.57	1.21
	Total	2.62	1.10	2.23	1.10

Table 3

One-Between- One Within ANOVA by Environmental Science Variable and Pretest (#1) -Posttest(#2)

Variable	Source		df	MS	F
Active	Between Ss -	Groups (A)	1	.1548	0.51
		Subjects (S)	61	.3014	
	Within Ss -	Pre-Post (B)	1	.7661	3.54
		Groups * Pre-Post (AB)	1	.0041	0.02
		Error (SB/A)	61	.2164	
Unfamiliar	Between Ss -	Groups (A)	1	.9725	0.59
		Subjects (S)	61	1.6394	
	Within Ss -	Pre-Post (B)	1	1.9777	1.54
		Groups * Pre-Post (AB)	1	4.5351	3.54
		Error (SB/A)	61	1.2818	
Intimidating	Between Ss -	Groups (A)	1	.0813	0.06
		Subjects (S)	61	1.3413	
	Within Ss -	Pre-Post (B)	1	2.0540	1.73
		Groups * Pre-Post (AB)	1	2.7754	2.34
		Error (SB/A)	61	1.1883	
Exciting	Between Ss -	Groups (A)	1	1.2463	2.23
		Subjects (S)	61	.5576	
	Within Ss -	Pre-Post (B)	1	.6880	*4.05
		Groups * Pre-Post (AB)	1	.0105	0.06
		Error (SB/A)	61	.1697	
Interesting	Between Ss -	Groups (A)	1	.7205	2.19
		Subjects (S)	61	.3295	
	Within Ss -	Pre-Post (B)	1	1.1242	*7.75
		Groups * Pre-Post (AB)	1	.0131	0.09
		Error (SB/A)	61	.1449	
Difficult	Between Ss -	Groups (A)	1	1.9177	1.35
		Subjects (S)	61	1.4226	
	Within Ss -	Pre-Post (B)	1	2.4681	2.57
		Groups * Pre-Post (AB)	1	1.2222	1.27
		Error (SB/A)	61	.9603	

Note. *$p<.05$.

Table 4

Partnering: Means and Standard Deviations for Pre (#1) and Post (#2)

Variable	Group	Pre M	Pre SD	Post M	Post SD
Partnering					
Meaningful	Teacher	4.72	0.60	4.88	0.33
	Resource	4.35	0.88	4.68	0.72
	Total	4.58	0.74	4.81	0.51
Unfamiliar	Teacher	3.05	1.38	1.97	1.27
	Resource	2.48	1.20	2.39	1.27
	Total	2.84	1.33	2.13	1.27
Complicated	Teacher	2.18	0.95	2.46	1.17
	Resource	2.48	0.95	2.91	1.27
	Total	2.30	0.95	2.62	1.21
Helpful	Teacher	4.72	0.46	4.95	0.22
	Resource	4.52	0.73	4.59	0.73
	Total	4.65	0.58	4.82	0.50
Confining	Teacher	1.79	0.81	1.82	1.12
	Resource	1.96	0.93	1.96	0.93
	Total	1.85	0.85	1.87	1.05
Intimidating	Teacher	2.23	1.16	1.72	1.07
	Resource	1.83	0.83	2.17	1.07
	Total	2.08	1.06	1.89	1.09
Exciting	Teacher	4.69	0.47	4.98	0.16
	Resource	4.17	0.83	4.68	0.71
	Total	4.50	0.67	4.87	0.46

Table 5

One-Between- One Within ANOVA by Partnering Variable and Pretest (#1) -Posttest(#2)

Variable	Source		df	MS	F
Meaningful	Between Ss -	Groups (A)	1	2.1793	*4.43
		Subjects (S)	61	.4918	
	Within Ss -	Pre-Post (B)	1	1.7418	*6.32
		Groups * Pre-Post (AB)	1	.1352	0.49
		Error (SB/A)	61	.2755	
Unfamiliar	Between Ss -	Groups (A)	1	.0463	0.02
		Subjects (S)	61	1.9571	
	Within Ss -	Pre-Post (B)	1	10.1827	*7.44
		Groups * Pre-Post (AB)	1	7.4286	*5.43
		Error (SB/A)	61	1.3678	
Complicated	Between Ss -	Groups (A)	1	4.1229	3.41
		Subjects (S)	61	1.2074	
	Within Ss -	Pre-Post (B)	1	3.1837	2.78
		Groups * Pre-Post (AB)	1	.1329	0.12
		Error (SB/A)	61	1.1457	
Helpful	Between Ss -	Groups (A)	1	2.3682	*5.57
		Subjects (S)	61	.4248	
	Within Ss -	Pre-Post (B)	1	.5365	*4.65
		Groups * Pre-Post (AB)	1	.2415	2.05
		Error (SB/A)	61	.1176	
Confining	Between Ss -	Groups (A)	1	.6034	0.46
		Subjects (S)	61	1.3083	
	Within Ss -	Pre-Post (B)	1	.1295	0.25
		Groups * Pre-Post (AB)	1	.1295	0.25
		Error (SB/A)	61	.5200	
Intimidating	Between Ss -	Groups (A)	1	.0717	0.05
		Subjects (S)	61	1.4439	
	Within Ss -	Pre-Post (B)	1	.2282	0.28
		Groups * Pre-Post (AB)	1	5.4741	*6.82
		Error (SB/A)	61		
Exciting	Between Ss -	Groups (A)	1	4.7302	*10.82
		Subjects (S)	61	.4370	
	Within Ss -	Pre-Post (B)	1	4.3012	*29.17
		Groups * Pre-Post (AB)	1	.3340	2.27
		Error (SB/A)	61		

Note. *$p < .05$.

Table 6

Levels of Confidence in Teaching Environmental Science: Means and Standard Deviations for Pre (#9) and Post (#5)

Variable	Group	Pre M	Pre SD	Post M	Post SD
Using a variety of teaching approaches	Teacher	4.18	0.68	4.68	0.53
	Resource	3.39	1.12	3.70	0.70
	Total	3.89	0.94	4.32	0.76
Teaching process skills	Teacher	3.38	0.81	4.23	0.58
	Resource	2.77	1.07	3.17	0.78
	Total	3.16	0.94	3.84	0.83
Adapting what you are teaching to a specific age group	Teacher	4.03	0.66	4.65	0.53
	Resource	3.48	1.08	3.65	0.83
	Total	3.83	0.87	4.29	0.81
Managing students	Teacher	4.40	0.74	4.68	0.53
	Resource	3.56	0.86	3.78	0.74
	Total	4.10	0.88	4.35	0.74
Managing materials	Teacher	3.78	0.86	4.33	0.73
	Resource	3.82	0.73	4.04	0.56
	Total	3.79	0.81	4.22	0.68
Asking effective questions	Teacher	3.65	0.70	4.23	0.70
	Resource	3.45	0.74	3.64	0.66
	Total	3.58	0.71	4.02	0.74
Measuring student learning using methods other than traditional tests or worksheets	Teacher	3.43	0.90	4.30	0.69
	Resource	3.00	1.02	3.57	0.84
	Total	3.27	0.96	4.03	0.82
Your own level of knowledge about environmental science	Teacher	2.85	0.81	3.93	0.62
	Resource	3.73	0.63	4.22	0.80
	Total	3.16	0.86	4.03	0.69

Table 7

One-Between- One Within ANOVA by Environmental Science Variable and Pre (#1) -Post(#2)

Variable	Source		df	MS	F
Using a variety of approaches	Between Ss -	Groups (A)	1	22.6957	*29.80
		Subjects (S)	61	.7617	
	Within Ss -	Pre-Post (B)	1	4.7239	*14.10
		Groups * Pre-Post (AB)	1	.2795	0.83
		Error (SB/A)	61	.3350	
Teaching Process Skills	Between Ss -	Groups (A)	1	18.5286	*20.39
		Subjects (S)	61	.9086	
	Within Ss -	Pre-Post (B)	1	10.4529	*31.21
		Groups * Pre-Post (AB)	1	1.6787	*5.01
		Error (SB/A)	61	.3350	
Adapting what you are teaching to a specific age group	Between Ss -	Groups (A)	1	17.4193	*22.28
		Subjects (S)	61	.7818	
	Within Ss -	Pre-Post (B)	1	4.6603	*13.32
		Groups * Pre-Post (AB)	1	1.4857	*4.25
		Error (SB/A)	61	.3498	
Managing students	Between Ss -	Groups (A)	1	22.5489	*30.18
		Subjects (S)	61	.7471	
	Within Ss -	Pre-Post (B)	1	2.1291	*9.02
		Groups * Pre-Post (AB)	1	.0000	0.00
		Error (SB/A)	61	.2362	
Managing materials	Between Ss -	Groups (A)	1	.5796	0.71
		Subjects (S)	61	.8172	
	Within Ss -	Pre-Post (B)	1	4.8037	*15.90
		Groups * Pre-Post (AB)	1	.5456	1.81
		Error (SB/A)	61	.3022	
Asking effective questions	Between Ss -	Groups (A)	1	3.8360	*5.43
		Subjects (S)	61	.7068	
	Within Ss -	Pre-Post (B)	1	4.0344	*15.35
		Groups * Pre-Post (AB)	1	1.0180	3.87
		Error (SB/A)	61	.2628	
Measuring student learning using methods other than traditional tests or worksheets	Between Ss -	Groups (A)	1	8.5025	*9.12
		Subjects (S)	61	.9326	
	Within Ss -	Pre-Post (B)	1	13.4173	*26.02
		Groups * Pre-Post (AB)	1	.9980	1.94
		Error (SB/A)	61	.5156	
Your own level of knowledge about environmental science	Between Ss -	Groups (A)	1	9.9148	*12.71
		Subjects (S)	61	.7801	
	Within Ss -	Pre-Post (B)	1	18.0617	*73.27
		Groups * Pre-Post (AB)	1	2.5535	*10.36
		Error (SB/A)	61	.2465	

Note. *$p < .05$.

Table 8

Correlation Analysis for Level of Confidence in Partnering Pre (#13) and Post (#8)

Group	Pre		Post		Spearman Coefficient
	M	SD	M	SD	
Teachers	1.85	0.78	1.11	0.39	0.24
Resource Professionals	2.22	1.04	1.36	0.58	0.44*
Total Group	1.98	0.90	1.20	0.48	0.37*

Note: $p < .05$.

APPENDIX A

Please check one | Pre

_____ Teacher

_____ Resource Professional | Name: ______________________________

Summer Institute Questionnaire

1. The following words can be used to describe environmental science and partnering relationships. Please circle the appropriate number which best reflects your feelings toward the word as a descriptor.

	Strongly Agree		Strongly Disagree	
ENVIRONMENTAL SCIENCE				
active	5	4	2	1
unfamiliar	5	4	2	1
intimidating	5	4	2	1
exciting	5	4	2	1
interesting	5	4	2	1
difficult	5	4	2	1
PARTNERING				
meaningful	5	4	2	1
unfamiliar	5	4	2	1
complicated	5	4	2	1
helpful	5	4	2	1
confining	5	4	2	1
intimidating	5	4	2	1
exciting	5	4	2	1

2. Which type of instructional materials do you use most often in teaching/presenting about environmental science? (check one)

_____ textbook, workbook and supplementary materials
_____ audio visuals
_____ activities taken from programs such as GEMS, AIMS, Project WILD, etc.
_____ materials developed by yourself
_____ other ______________________________

3. Which approach do you tend to use the most when teaching/presenting about environmental science? (check one)

_____ lecture and/or audio visual
_____ lecture with discussion
_____ demonstration
_____ experiential, hands-on activities involving students

4. The following statements reflect possible goals of environmental science instruction. In your opinion, what are the most and least important goals? Please rank the list from 1 to 6 with 1 being the most important and 6 being the least important.

_____ Aid students in developing positive attitudes toward environmental science

_____ Develop knowledge base of concepts, facts, and theories of environmental science

_____ Develop skills in the process of scientific inquiry

_____ Help students develop skills in the proper use of instruments and techniques of environmental science

_____ Help students see the role of science and technology in identifying and addressing environmental issues and concerns

_____ Help students gain expertise in taking responsible action on environmental issues

5. When you work with elementary students on environmental science, do you feel that you are successful in achieving your top three rated goals? Why or why not?

6. In general when you work with elementary students on environmental science, what percent of that time is spent doing hands-on activities?

A._____ 0 percent
B._____ 1 - 20 percent
C._____ 21 - 40 percent
D._____ 41 - 50 percent
E._____ 51 - 60 percent
F._____ 61 - 80 percent
G._____ 81 -100 percent

7. In general what percent of time would you like to spend doing hands-on activities?

A._____ 0 percent
B._____ 1 - 20 percent
C._____ 21 - 40 percent
D._____ 41 - 50 percent
E._____ 51 - 60 percent
F._____ 61 - 80 percent
G._____ 81 -100 percent

8. If responses to questions 6 and 7 are different, what factors do you think cause the difference?

9. For each of the following items please circle the number that best indicates how confident you feel about:

	Level of Confidence				
	High				Low
Using a variety of teaching approaches	5	4	3	2	1
Teaching process skills	5	4	3	2	1
Adapting what you are teaching to a specific age group	5	4	3	2	1
Managing students	5	4	3	2	1
Managing materials	5	4	3	2	1
Asking effective questions	5	4	3	2	1
Measuring student learning using methods other than traditional tests or worksheets	5	4	3	2	1
Your own level of knowledge about environmental science	5	4	3	2	1

10. Describe how you feel about teaching/presenting environmental science to elementary students.

11. Briefly describe what you see as the 2 greatest challenges to a successful partnering relationship.

Challenge 1:

Challenge 2:

12. Briefly describe what you see as the 2 greatest benefits of a successful partnering relationship.

Benefit 1:

Benefit 2:

13. Which statement best reflects your present level of <u>confidence in your ability to contribute to the success of the partnering relationship?</u>

_____ Very confident!
_____ Let's just say, "confident" and leave it at that.
_____ Somewhat guarded confidence.
_____ I'd prefer to "what and see."

14. Have you been involved in a partnership? If yes, describe your experience.

Pre