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GLOBE YEAR 8 EVALUATION

Adapting Implementation to Diverse Contexts

Prepared for:

The GLOBE Program
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CONTENTS

TABLES

FIGURES

1. Introduction

SRI International (SRI) prepared this evaluation research report for the GLOBE Program. This is the first report submitted under a new grant to SRI for the GLOBE evaluation and the eighth in a series of annual evaluation reports SRI has provided to the GLOBE Program since its inception. The Year 8 evaluation report focuses on how GLOBE's United States partners and teachers adapt GLOBE to fit their local contexts. Adaptation is a hallmark of GLOBE, as it is for all educational innovations. In the process of translating a program design into a classroom reality, program staff, partners, and teachers each place different levels of emphasis on particular program goals and activities. Adaptation is also necessary because different states and regions have unique configurations of educational goals and policies, as well as different concerns that could be the focus of inquiry into Earth systems. GLOBE's partners make choices about how to organize training sessions and use precious resources for follow-up. Teachers adapt GLOBE to help meet myriad demands on them related to curriculum, assessment, and classroom management. GLOBE Program staff have periodically reorganized training of trainers in response to partners' and teachers' observed needs. SRI's Year 8 report highlights issues related to the adaptation of GLOBE to diverse local educational and environmental contexts.

We studied two aspects of adaptation of GLOBE this year (2002-03). First, we examined how partners have adapted training and follow-up support to meet teacher needs. Second, we analyzed GLOBE implementation in a subset of schools in which at least 80% of students come from communities of color that are underrepresented in science (e.g., African Americans, Hispanics, Native Americans). Together, these data help to tell a story about the ways partners and teachers have been resourceful in the face of challenges posed by their local policy contexts and by limitations on financial resources.

Program Description

From its inception in 1994 until summer 2003, the GLOBE Program was headquartered in Washington, D.C. The Program received support from several United

States Government agencies: The National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), the Environmental Protection Agency (EPA), and the Departments of Education and State. Until 2002, the National Oceanic and Atmospheric Administration (NOAA) was an integral partner to the Program. Then, NASA took over primary responsibility for administrative oversight of the GLOBE Program. As of July 2003, more than 20,000 teachers from 12,000 schools have completed GLOBE training, and students have submitted more than 10 million measurements to the GLOBE Web site as of October 2003. The Program has reached 102 countries, such that nearly every biome on Earth is represented in GLOBE.

GLOBE is both an environmental science and an education program. GLOBE scientists seek to enhance their understanding of the Earth by conducting research in four major investigation areas: Atmosphere, Hydrology, Soils, and Land Cover. They also conduct research on interactions among phenomena in each of these investigation areas to construct models of Earth as a system. More recently, GLOBE protocols have expanded to include observations of living organisms whose migration patterns can be used as indicators of environmental change (Hilton, 2002). By collecting GLOBE data, K-12 students contribute to scientists' research and gain valuable experience in carrying out data collection and analysis activities as part of their study of environmental science. As an education program, GLOBE prepares teachers with training, materials, and follow-up support to implement data collection protocols and learning activities with students designed to enhance their environmental science achievement. Table 1.1 shows the protocols and investigation areas teachers and students can explore in GLOBE.

Table 1.1
GLOBE Data Collection Protocols

Atmosphere/Climate	Soil
Air Temperature	Soil Characterization
Clouds	Gravimetric Soil Moisture
Precipitation	Soil Temperature
Aerosols	Particle Density
Water Vapor	Soil Particle Size Distribution
Surface Ozone	Soil pH
Relative Humidity	Soil Fertility
Barometric Pressure	Soil Moisture Sensor
Surface Temperature	Water Infiltration
Davis Automated Weather Station	Automated Air and Soil Temperature Monitoring
Automated Air and Soil Temperature Monitoring	Digital Multi-Day Max/Min Soil and Air Temperatures
Digital Multi-Day Max/Min/Current Air and Soil Temperatures	Digital Multi-Day Soil Temperatures
AWS WeatherNet	

Hydrology	Land Cover/Biology
Water Transparency	Land Cover Sample Site
Water Temperature	Biometry
Dissolved Oxygen	Manual Land Cover Mapping
pH	Computerized MultiSpec Land Cover Mapping
Electrical Conductivity	Land Cover Change Detection
Salinity	
Alkalinity	
Nitrate	

General Information	Phenology
GPS	Budburst
	Green-up
	Green-down
	Ruby-throated Hummingbird
	Phenological Gardens
	Lilac Phenology

GLOBE provides schools with a scientific framework for data collection and with educational training and materials that teachers can adapt to their own classroom situations. The goals of GLOBE in having students follow these protocols to collect, report, and analyze data are:

- To enhance the environmental awareness of individuals throughout the world;
- To contribute to scientific understanding of the Earth; and
- To help all student reach higher levels of achievement in science and mathematics.

The GLOBE Program is representative of a class of science reform initiatives structured around the principle of engaging students in real science investigations, rather than reading about the products of science investigations or watching or mimicking demonstrations. Some of these programs that seek to engage students in authentic inquiry are designed as year-long curricula for teachers to use with students (see Ba, Admon, & Anderson, 2002 [JASON Project]); still others are designed to scaffold students' developing explanations of phenomena that result from their inquiry into particular scientific controversies (Linn, Bell, & Hsi, 1998). A third class of programs are quite similar to GLOBE, in that they seek to use technology to link students from different regions in common environmental monitoring and reporting activities (Feldman, Konold, & Coulter, 2000; Songer & Lee, 2003). GLOBE, like the programs that most closely resemble it, is concerned to some degree with both fidelity of implementation *and* teacher choice in the use of particular materials (Penuel & Means, 2004). On one hand, GLOBE is concerned that classrooms adhere to the scientific protocols for data collection and expects that schools will report student-collected data. Fidelity to these elements of the GLOBE design is critical to meeting the Program's scientific mission. At the same time, the Program's philosophy has always been one of providing resources and leaving decisions concerning curriculum and pedagogy to teachers. Teachers' adaptations shape GLOBE's potential to promote student learning in fundamental ways, depending on their goals, choice of protocols, and use of GLOBE learning activities.

Transitioning the Administration and Leadership of GLOBE

This year marks an important transition in the history of the GLOBE Program. In fall 2002, the Office of Earth Science at NASA issued a Cooperative Agreement Notice (CAN) indicating it was seeking applicants to administer the GLOBE Program. No longer would the GLOBE office be an official part of the United States government. Rather, NASA sought proposals from independent organizations to manage GLOBE in the United States and internationally. NASA's stated objective in putting forth the CAN was "to continue, enhance, and expand on the legacy of the GLOBE Program in both of these areas [Worldwide and the United States] and to further NASA's objectives in education."

The enhancements sought by NASA were in both the educational and scientific aspects of GLOBE. Education in GLOBE was to align with NASA's other new initiatives in science education. In addition, the CAN goals for GLOBE included a focus on teacher professional development and use of the Internet to connect students to NASA's wide array of educational resources. With respect to its scientific efforts, the CAN stated its expectation that GLOBE would become an active member of the Earth Science Research, Education and Applications Solutions Network (REASoN), a distributed network of data and information providers, as part of an effort to facilitate greater use of GLOBE data in the advancement of science. Additional pressure would be placed on GLOBE's scientists to publish the results of their work using student-collected data to advance understanding of Earth.

The CAN also outlined some specific 5-year program implementation goals for expanding the reach of GLOBE. These goals include increasing the number and activity of United States partners, greater alignment of GLOBE with state-level curriculum standards, and incorporation of GLOBE into preservice education. As Figure 1.1 shows, these goals also include evaluation.

Figure 1.1
The CAN's Expectations for GLOBE Implementation Enhancement

- Support for increasing number and activity of US partners
- Alignment of GLOBE to standards of learning in at least 10 states
- Five more statewide adoptions of GLOBE for incorporation in classroom plans
- Incorporation of GLOBE in pre-service teacher education programs in at least 5 more states
- Pre-test/post-test assessment of GLOBE's effects on at least 1000 students in at least 3 grades
- Establishing GLOBE ties to all appropriate NASA Earth science missions through their respective education and outreach efforts
- Expanded use of GLOBE data to include data integration into scientific modeling, additional research investigations, overall observational systems, and decision support tools
- Expanded use of GLOBE data by schools and students to include use in inquiry based student investigations

In addition to these implementation expectations, the CAN also called for further development of GLOBE's educational materials, including the completion of two textbooks incorporating GLOBE content.

There were also specific numerical targets for a set of "outputs" that the organization selected to manage GLOBE would be expected to attain. Table 1.2 lists these outputs, the targets the GLOBE CAN set out, and the current levels for each of the outputs for United States schools (the focus of SRI's evaluation effort).

Table 1.2
Expected Outputs for GLOBE in the Next 5 Years (U.S. Schools)

Output	Expected Level	Current Level
Schools reporting data per year (defined as August 1 – July 31)	3000	1893[1]
Atmosphere sites (temperature, relative humidity, precipitation, and cloud protocols) reporting each weekday (on average)	800	141.1[2]
Students on Honor Rolls achieved each year by GLOBE schools[3]	3000	86
U.S. student journal reports per year	>100	Not available
Metric defined and determined of the effect of GLOBE on U.S. teacher retention and professional growth	1	0
Pretest/posttest assessment of GLOBE's effects on U.S. students in 1 to 3 grades	1000	294

[1]Reported data between September 1, 2002 and August 31, 2003.
[2]Calculated from one sample week in November, 2003.
[3]Schools are put on the Honor Rolls to recognize data reporting achievement in a number of areas.

To accomplish these targets, NASA planned to select one or two organizations to take responsibility for GLOBE Program implementation, including support for meeting the U.S. government’s commitments under agreements with international partners. The total funding available for the CAN was to be $5 million per year for 5 years, with the option of an additional 5-year renewal. Two things are important to note with respect to funding: (1) the funding available for managing GLOBE through the CAN represents a decrease of 20% to 30%, depending on whether the Program’s current office space costs are counted; and (2) the explicit expectation in the CAN was that GLOBE would become self-sufficient in 10 years and no longer need federal funding.

NASA selected one partnership to manage both areas outlined in the CAN and signed a cooperative agreement with this partnership in June 2003. The University Corporation for Atmospheric Research (UCAR) and Colorado State University (CSU) were selected as the partnership to manage the GLOBE Program. UCAR is a nonprofit corporation established 45 years ago as a support for individual universities to conduct and participate in a broad range of atmospheric and related science and education programs. Headquartered in Boulder, Colorado, UCAR helps support the work of more than 100 universities. CSU is a major public United States university, founded in 1870. CSU's more than 24,000 resident students pursue degrees from within one or more of eight colleges (Agricultural Sciences, Applied Human Sciences, Business, Engineering, Liberal Arts, Natural Resources, Natural Sciences, and Veterinary Medicine and Biomedical Sciences). In fall 2003, the GLOBE Headquarters moved to Colorado, but GLOBE will maintain a presence in Washington, D.C., with at least one staff member located there.

Neither UCAR nor CSU is new to GLOBE. UCAR's Joint Office for Science Support has handled logistics for GLOBE training sessions and conferences for many years. CSU is also not new to GLOBE; its Cooperative Institute for Research in the Atmosphere (CIRA) is the current GLOBE Systems group responsible for the GLOBE Web site, GLOBE Data Archive, and all related functions since the Program's inception. Two science PIs in the Atmosphere investigation area also come from CSU.

Both organizations bring additional resources to support Earth and space science education. CSU's Center for Science, Mathematics, and Technology Education (CSMATE) houses the Digital Library for Earth Science Education (DLESE), a major online curriculum resource for educators. UCAR also maintains a large library of educational materials online as part of its Office of Education and Outreach. Both these resources will be available to GLOBE schools.

The UCAR/CSU partnership has committed to maintaining program stability and to adding new elements of focus. The GLOBE Web site, Help Desk, and partnership structure will be maintained, although the Web site will likely soon have a new address. One important new focus is on fundraising: the partnership plans to undertake an aggressive campaign to expand the total funding now available for GLOBE and to chart a course toward program self-sufficiency. A second area of new focus will be on the creation of GLOBE Learning Communities (GLCs). New GLCs will build on the work of current countries, partners, and schools, and they will be composed not only of educators and scientists but also of other local community members and informal learning centers.

Importantly, the GLCs will be designed to make learning and science relevant to the local and regional environment.

Although NASA had planned to retain Dr. Dixon Butler, the current Director of GLOBE, through the transition period and into a NASA oversight role for the Program, Butler announced his decision to leave GLOBE in summer 2003. His departure is yet another aspect of the transition in leadership and administration that is significant for the GLOBE Program. He and those who will not continue to work with the Program will be missed by all in the GLOBE community.

It is important to note that although this report includes findings from studies conducted since the new partnership has taken responsibility for managing GLOBE, the findings cannot be attributed to their work. The research plans were set by SRI in collaboration with the former GLOBE Headquarters in Washington, DC, in summer 2003. The UCAR/CSU partnership did not have any input into these designs. The responses of teachers and partners to the benefits and challenges of GLOBE, moreover, reflect the work of the 8 years of the Washington, D.C.-based management team and its partners. It will take some time before teachers and students experience the impact of the changes in GLOBE’s management.

Other Significant Developments in GLOBE in 2002-03

Two other developments in GLOBE are worth noting for their influence on helping build United States schools’ capacity for student research and inquiry in particular. First, ongoing refinements to the training program have helped to sharpen the focus on student inquiry and research. Second, the third GLOBE Learning Expedition provided schools with an opportunity to submit student research papers for a summer 2003 conference in Croatia.

Refinements to the GLOBE Training Model. Over the past 2 years, under the leadership of GLOBE Education Director Dr. Carol Conroy, significant changes have been made to the way United States partners are encouraged to prepare teachers to implement GLOBE. She has encouraged Program staff and partners to view this preparation not as “training,” as it has been conceived in the past, but as “education” (Conroy, 2001). The distinction is significant for GLOBE, because in the past little emphasis has been placed on the *process* by which teachers might best learn how to teach with GLOBE. Rather, the emphasis has been largely on direct instruction and practice using the protocols, with little emphasis on implementation or on developing teachers' conceptual understanding of Earth science topics that are part of GLOBE.

In the past 2 years, the Train the Trainer (TTT) model promoted by GLOBE has included much more emphasis on student inquiry and on how teachers learn. The model emphasizes that the structure of training should mirror or follow a cycle of inquiry, beginning with observation and question formulation, proceeding with data collection and analysis, and then communicating results. Partners have been encouraged to go beyond simply presenting the protocols and to incorporate local environmental topics into their training, to help make inquiry more relevant to teacher participants in training and, ultimately, to students.

In addition, a new "Partner Implementation" training session has been developed. The implementation session focuses much more on how to teach with GLOBE and is designed for United States partners. Ideas for curriculum integration, standards alignment, and follow-up support to teachers are all discussed. This session is intended to supplement the TTT model, which is more protocol focused, without taking away time needed to learn protocols.

The GLOBE Learning Expedition (GLE). The 2003 GLOBE Learning Expedition was held in late June in Šibenik, Croatia. At the GLE, roughly 400 students from 23 countries presented original research projects that used Earth science data. Students also conducted fieldwork at Krka National Park and on the island of Obonjan, side by side with selected GLOBE scientists. The GLE was cosponsored by the United States GLOBE Program and the Croatian Ministry of Education and Sports.

The GLE gave incentives and supports to students in the United States and other countries an opportunity to conduct their own investigations. A subset of student projects that were submitted were selected for presentation by students at the conference in Croatia, an important incentive for student researchers. Partners also competed for spots at the conference; this incentive was important to them because it helped motivate their support for student research and inquiry. To guide decision-makers in selecting projects, GLOBE staff developed a rubric for judging the quality of the research. They made this rubric public to give GLOBE partners and teachers a concrete idea about what was expected as a product of conducting student research and inquiry.

Studying the Adaptation of GLOBE in Local Contexts

All educational innovations are enacted within what has been called "embedded contexts" (McLaughlin & Talbert, 2001). The form that an innovation takes in a particular place and time is affected by a complex policy context, physical and social school structures, available curricular frameworks and resources, and classroom environments. For Earth science education innovations, the local ecological context is also significant, because the dynamics of that context will form the basis for student inquiry and investigation (Barstow & Geary, 2002). The influences of these contexts on one another are not straightforward or always coherent.

It is the individual human actors in these contexts who must try to make sense of how the indirect and sometimes inchoate demands on them will influence their decisions about how to implement a particular educational innovation. Various reform intermediaries (e.g., GLOBE's partners) play an important role in preparing teachers to adopt the innovation with their decisions about what to emphasize and what to leave out, what they think teachers need to know, and how to provide support to teachers. For their part, teachers draw on their own understandings, beliefs, and practices, and on the resources provided by the school and other supporting organizations in enacting new practices (Cohen & Hill, 1998; Knapp, 1997; McLaughlin & Talbert, 1993; Spillane, 1999).

Because of their dependency on individual actors, innovations are necessarily fragile, especially so when it comes to innovations like GLOBE that emphasize student inquiry in science. Enactment of inquiry-based approaches to science teaching requires much of teachers. Teachers need a deep understanding the subject matter content that they are teaching (Cohen & Hill, 2001). They also need an understanding of the challenges students typically face in learning that content and knowledge of strategies for addressing those challenges (Shulman, 1987; van Driel, Verloop, & de Vos, 1998). To address student questions, science teachers need to be able to draw from students' everyday sense-making strategies and build toward scientific practices (Krajcik, Marx, Blumenfeld, Soloway, & Fishman, 2000; Snively & Corsiglia, 1998; Warren et al., 2001). Along similar lines, to foster science learning among students from diverse racial and ethnic backgrounds, science instruction teachers need to be able to draw from students' everyday sense-making strategies and build toward scientific practices (e.g., Bureau of Indian Affairs, 1998; Snively & Corsiglia, 1998; Warren, Ballenger, Ogonowski, Rosebery, & Hudicourt-Barnes, 2001).

Enacting inquiry-based science also requires much of people who are charged with preparing teachers to facilitate student-led investigations. They need to design and provide teachers with opportunities to practice inquiry in the context of their preservice and in-service training (NRC, 2000). They need to ensure that teacher professional development has a strong subject matter focus (Cohen & Hill, 1998). They also need to ensure that this professional development is experienced by teachers as part of a coherent strategy of science education reform (Garet et al., 2001). In addition to the type and content of professional development, the *amount* of professional development that teachers receive has been found to correlate significantly with inquiry-based teaching practice and "investigative classroom culture" (Supovitz & Turner, 2000).

In Year 8's GLOBE evaluation report, we focus on how GLOBE is adapted to diverse contexts. We analyze adaptation from the inside, as partners see it and as a select group of teachers working in schools with high percentages of students from underrepresented minority groups see it. From the partner perspective, we explore how partners' goals and their strategies for recruiting and supporting teachers shape GLOBE's adaptation, as well as how adaptation is influenced by local policy and funding contexts. From the teacher perspective, we examine what distinguishes teachers working in schools with essentially similar characteristics (from the outside view) who report data to GLOBE at widely different levels. We hope this analysis will help underscore ways GLOBE can continue to expand to reach those students who are least likely to pursue careers in mathematics, engineering, or science.

2. Program Growth

The GLOBE Program completed its 8th year during the 2002-03 school year. SRI's tracking of two program growth indicators, the number of teachers trained and the number of data reports, shows that the growth of GLOBE, which was steady in the early years of the Program, has reached a plateau in the last few years. Nonetheless, GLOBE is widely implemented, and there are some areas of program growth in this year.

Data Sources for Growth Indicators

Two main sources of data are used in this chapter: the number of GLOBE teachers trained and the level of data reporting to the GLOBE Data Archive. The number of teachers trained to implement GLOBE represents the number of GLOBE teachers generally. Teachers who have been trained, however, may choose not to implement GLOBE for a variety of reasons. At the same time, GLOBE materials are available on the Internet, and there may be teachers who have not been GLOBE-trained who implement protocols or learning activities with their students. Therefore, the number of teachers trained is an indicator that is imprecise in predicting growth in data reporting.

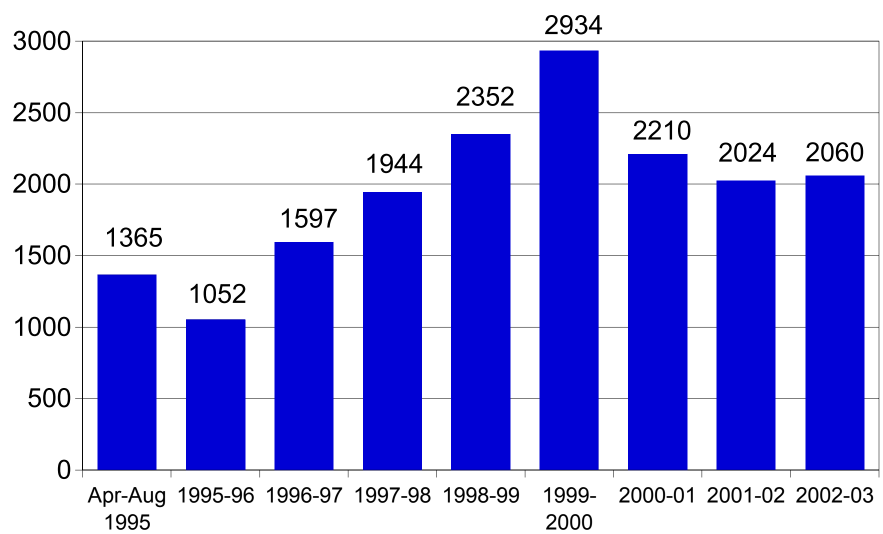
Data reporting trends similarly provide evidence of the growth of GLOBE but are not comprehensive indicators of GLOBE activity. One of the limitations of data reporting as an indicator is that reporting as an activity often lags behind training and data collection; recently trained teachers may immediately do GLOBE activities with their students and then let the data collected accumulate before entering it into the GLOBE Data Archive. Teacher surveys have also shown that many teachers collect data but do not report them for various reasons (Means et al., 2000; Penuel et al., 2003). Therefore, data reporting provides an accessible but incomplete picture of GLOBE implementation. (For a discussion of an alternative model for measuring implementation, see Penuel, 2003.)

Given the limitations of these two sources of data, inferences to explain observed patterns cannot be made with confidence in most cases. It is possible, however, to consider data for the number of teachers trained and for reporting to the GLOBE Data Archive in concert with other sources of data, from surveys, for example. In this way, imprecise and incomplete data sources can help to paint a clearer picture of the Program than would be possible if we ignored data reporting and teacher training altogether.

Number of Teachers Trained

The number of teachers trained by partners in the United States remained stable in 2002-03 (Figure 2.1), rising slightly higher than in 2001-02 but remaining lower than in 2000-01. U.S. partners trained the most teachers in 1999-2000, perhaps reflecting that 1999-2000 was the last time that partners placed the highest priority on training teachers. Partner survey data from the Year 8 survey indicate that support to trained teachers is the current priority for United States partners.

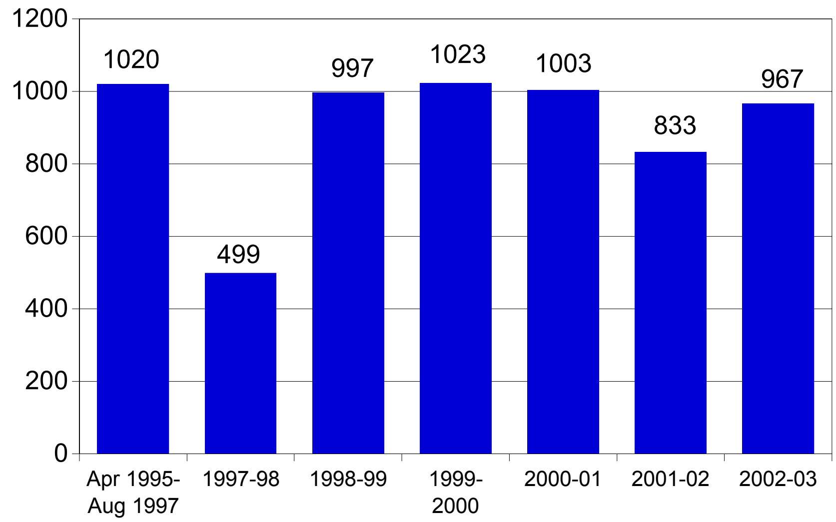
Figure 2.1
Number of Teachers Trained in the United States, by Year*



* Bars depict 12-month (September-August) training totals, except as noted in 1995.

The number of teachers trained internationally increased in 2002-03, approaching the numbers trained in 1998-99, 1999-2000, and 2000-01 (Figure 2.2). For international partners, there has not been a peak in training similar to U.S. partners, but training totals were lowest in 1997-98, with a noticeable decline in 2001-02.

Figure 2.2
Number of Teachers Trained Internationally, by Year*



* Bars depict 12-month (September-August) training totals, except as noted in 1995-97.

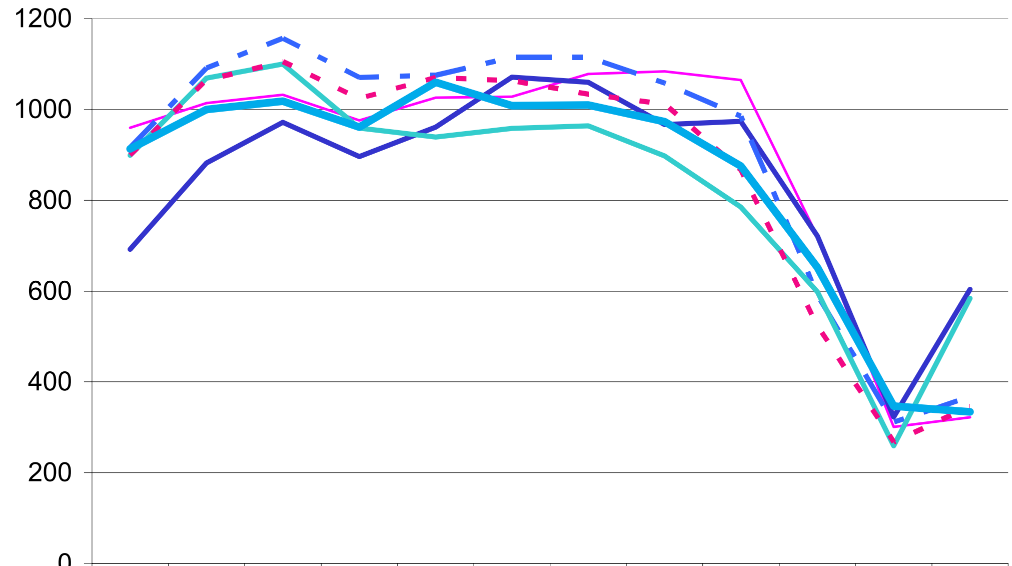
The number of teacher training sessions decreased in 2002-03, but the number of teachers attending each session continued to increase. In Year 8, U.S. partners held 140 training sessions (compared with 193 in 2001-02 and 180 in 2000-01), which were attended by an average of 15 teachers each (10 in 2001-02 and 8 in 2000-01).

Trends in GLOBE Data Reporting

There was a slight increase once again in the total number of schools reporting data: 1,893 in 2002-03, compared with 1,848 in 2001-02 and 1,810 in 2000-01. This slight increase indicates that the number of newly-trained teachers does not result in a comparable increase in the number of schools reporting data. Because data reported is tracked by school rather than by teacher, it is not possible to know for schools with more than one teacher who has ever been GLOBE-trained which teachers are or are not reporting data. It is evident from persistence in reporting data that the Program attrition rate is about 40% (see Figure 2.5), suggesting that trained teachers are discontinuing their GLOBE activities as newly-trained teachers are beginning theirs.

The number of schools that reported GLOBE data by month continued to follow the pattern seen in previous years (Figure 2.3). Data reporting rises in the fall and maintains a relatively stable level through the spring, then begins a steep decline in May as the school year comes to an end.

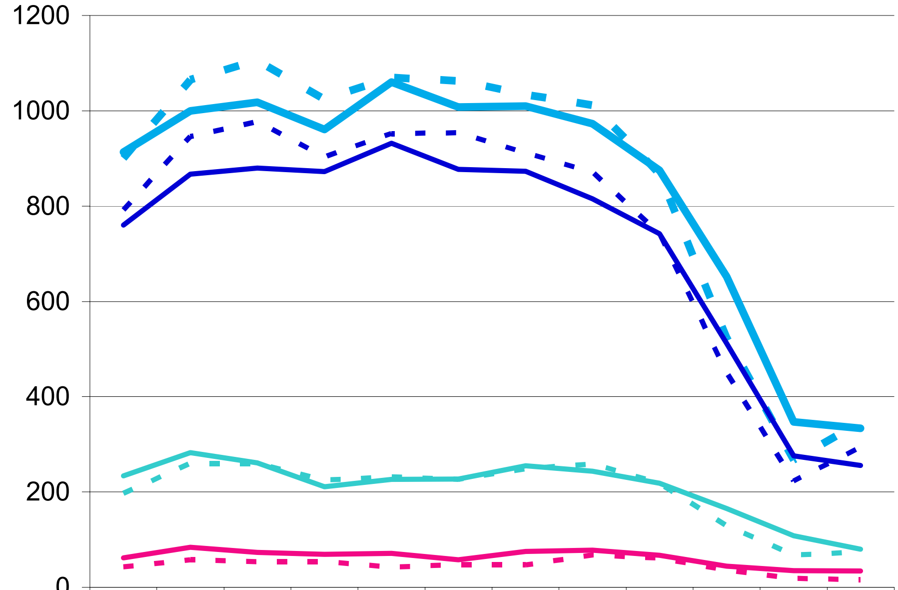
Figure 2.3
Number of Schools Reporting Data Overall, by Month and Year



	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1997-98	960	1014	1032	976	1026	1028	1078	1084	1065	720	301	322
1998-99	692	882	972	896	961	1071	1060	967	974	721	323	604
99-2000	916	1091	1156	1070	1075	1115	1115	1058	985	591	311	367
2000-01	899	1069	1100	959	939	958	964	898	785	598	259	584
2001-02	900	1065	1105	1024	1070	1063	1034	1012	867	523	267	346
2002-03	913	1000	1018	961	1060	1008	1010	973	875	652	347	334

The investigation area with the highest rate of data reporting continued to be Atmosphere, followed by Hydrology (Figure 2.4). Reporting in three investigation areas, Atmosphere, Hydrology, and Soil, has remained stable during 2001-02 and 2002-03. The number of schools reporting Atmosphere measurements exceeded 700 in each month except June, July, and August. The number of schools reporting Hydrology measurements was higher than 200 except for the same months as Atmosphere. There was an increase in the number of schools reporting soil measurements.

Figure 2.4
Number of Schools Reporting Data in Years 7 and 8, by Investigation Area

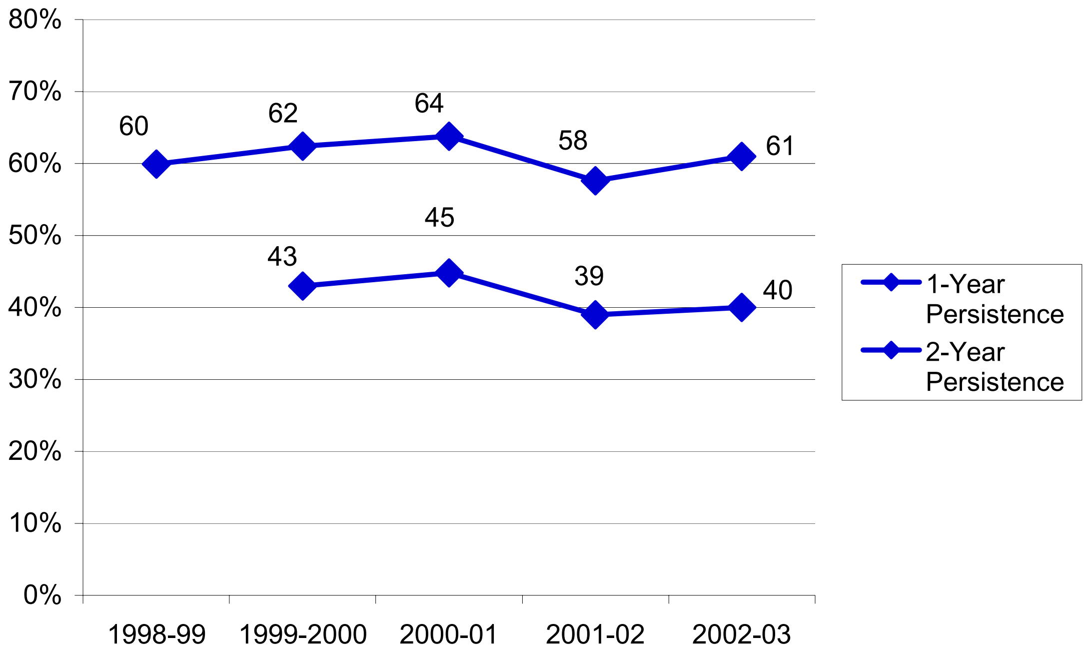


	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
All reports 2001-02	900	1065	1105	1024	1070	1063	1034	1012	867	523	267	346
All reports 2002-03	913	1000	1018	961	1060	1008	1010	973	875	652	347	334
Atmos 2001-02	792	946	978	903	952	954	911	871	743	450	223	294
Atmos 2002-03	760	867	880	872	932	877	873	815	742	512	276	256
Hydro 2001-02	197	260	260	225	232	226	249	259	218	129	68	74
Hydro 2002-03	234	283	261	211	226	227	255	244	218	165	108	80
Soil 2001-02	43	58	54	54	42	48	47	68	61	36	19	16
Soil 2002-03	62	84	73	69	71	58	75	78	67	44	35	34

Reporting Persistence and Schools Reporting for the First Time

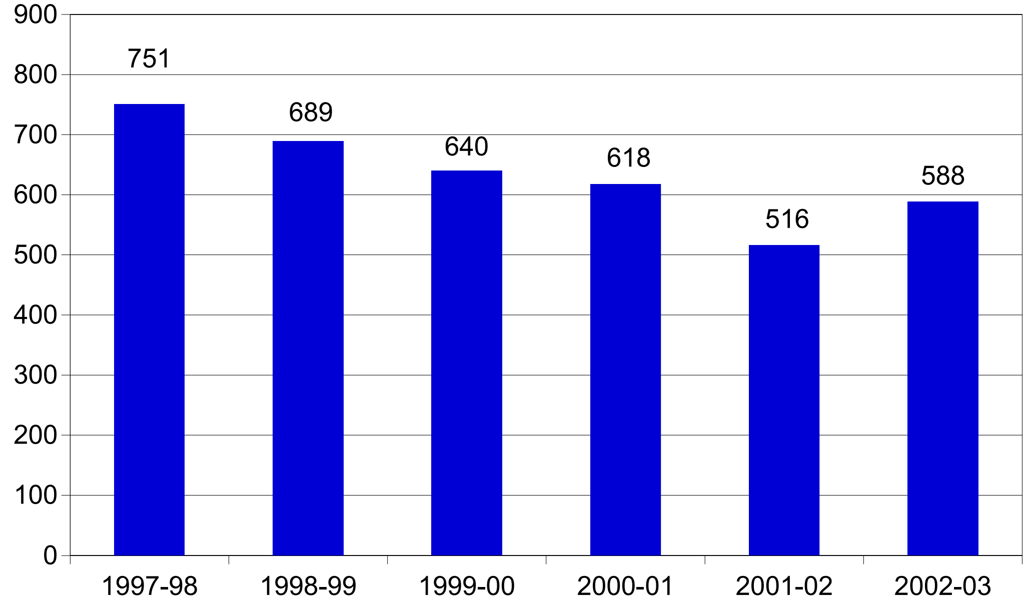
Persistence in data reporting from year to year by GLOBE schools is necessary if data collected are to be used in exploring variation in Earth systems. Therefore, SRI began calculating persistence in data reporting in 2000-01. Initially, the rate of persistence in data reporting increased slightly each year (Figure 2.5) for both schools that report 2 years in a row (1-year persistence) and those that report 3 years in a row (2-year persistence). In Year 7 (2001-02), the persistence rates decreased. In Year 8 (2002-03), both the 1- and 2-year persistence rates increased, but the increase for 2-year persistence was very small (0.6%).

Figure 2.5
Percentage of Schools Reporting Data Persistently, by Year



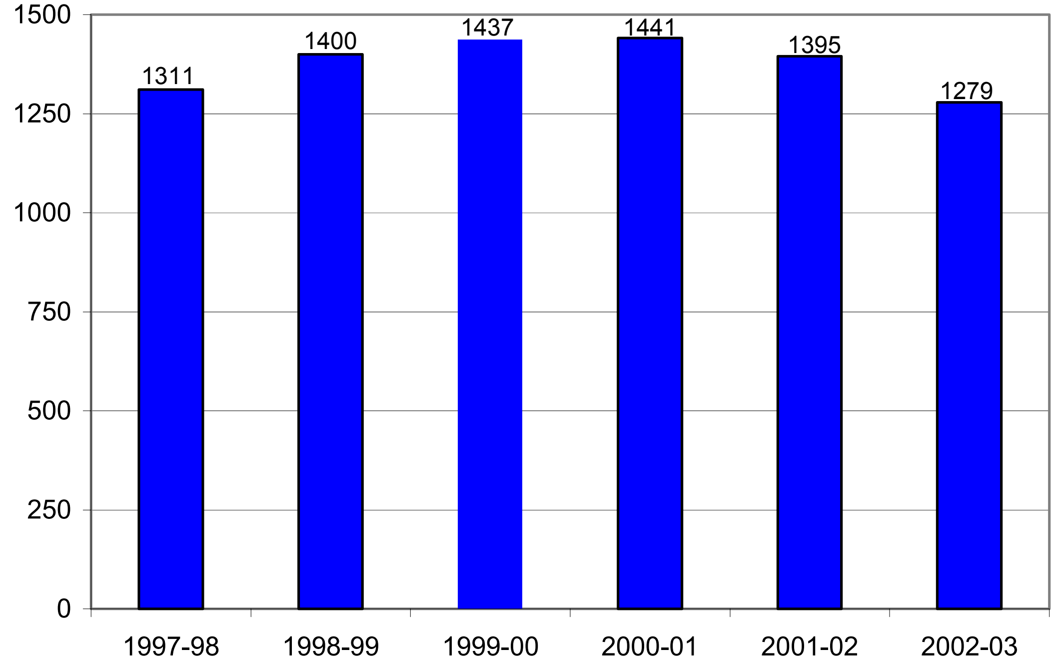
The downward trend in the number of new schools reporting data that has been seen since Year 3 was reversed in Year 8 (Figure 2.6). Almost 600 schools reported data for the first time in 2002-03, compared with just over 500 schools in 2001-02. This increase does not appear to be accounted for solely by the number of teachers trained in 2002-03 (36 more teachers than during 2001-02).

Figure 2.6
Number of Schools Reporting Data for the First Time, by Year



The number of schools who have reported data in the past year and in any other previous year is another indication of persistence in GLOBE (Figure 2.7); it captures both schools that may have lapsed in their implementation of GLOBE and schools that have reported data continuously. This number is just under 1,300 schools, but it declined last year by 8.3%. This figure should be watched carefully, because it may serve as another indicator of program attrition.

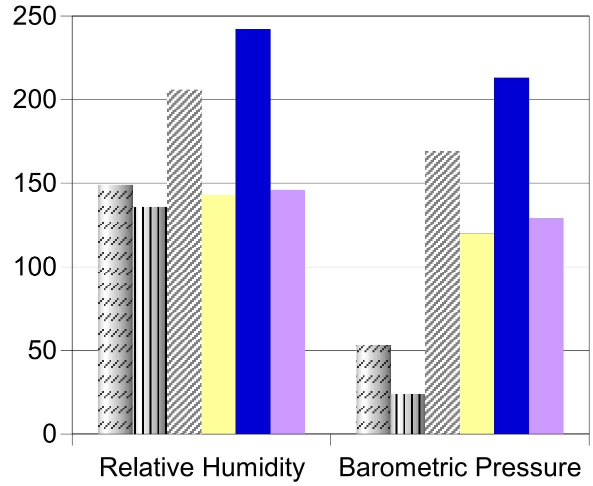
Figure 2.7
Schools Reporting During Both Designated School Year and Any Previous Year



Reporting Patterns for Frequently Measured GLOBE Data Types

As discussed above, data reporting for the Atmosphere investigation area overall remained stable. For newer Atmosphere protocols, there were some increases in rates of data reporting in 2002-03. The number of schools that reported Ozone data increased to 41 from 27 in 2001-02; however, the number of schools that reported Aerosols data decreased slightly, to 16 from 18. Reporting for Relative Humidity and Barometric Pressure protocols continued to increase, for both U.S. and international schools (Figure 2.8).

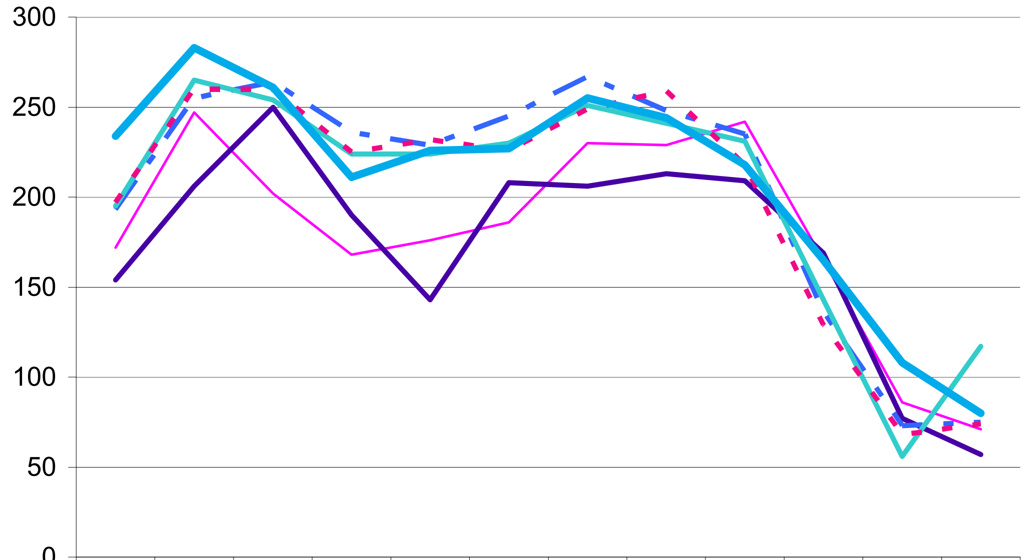
Figure 2.8
Number of International and United States Schools Reporting Relative Humidity and Barometric Pressure Data, by Year



	Relative Humidity	Barometric Pressure
Int'l 2000-01	149	53
U.S. 2000-01	136	24
Int'l 2001-02	206	169
U.S. 2001-02	143	120
Int'l 2002-03	242	213
U.S. 2002-03	146	129

There was an increase in the number of schools reporting Hydrology data in 2002-03 (542) compared with 2001-02 (503). The monthly pattern of data reporting for Hydrology remained the same in Year 8, with September and October levels reaching their highest ever in 2002-03 (Figure 2.9). The winter decline in reporting followed the pattern of other years, with a similar springtime increase in March and April.

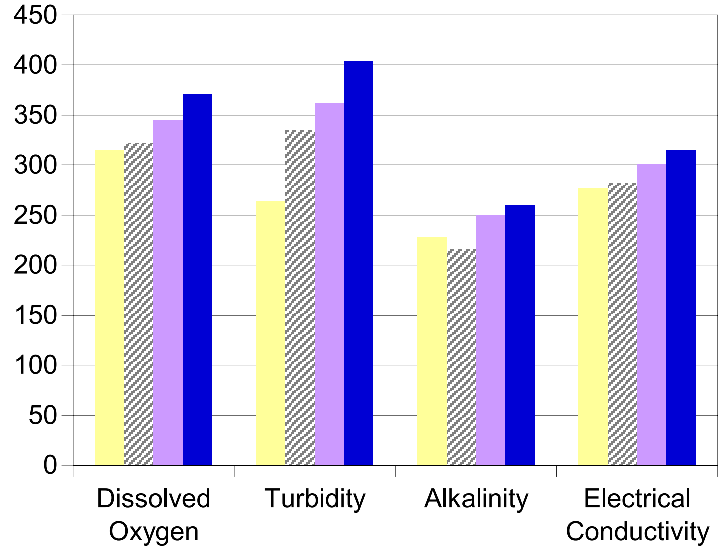
Figure 2.9
Number of Schools Reporting Hydrology Data, by Month and Year



	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1997-98	172	247	202	168	176	186	230	229	242	165	86	71
1998-99	154	206	250	190	143	208	206	213	209	169	77	57
99-2000	193	255	264	236	229	245	267	248	235	136	73	75
2000-01	195	265	254	224	224	230	251	241	231	143	56	117
2001-02	197	260	260	225	232	226	249	259	218	129	68	74
2002-03	234	283	261	211	226	227	255	244	218	165	108	80

Reporting of water quality measurements increased in 2002-03, compared with 2001-02 (Figure 2.10). For each of the four protocols, Dissolved Oxygen, Turbidity, Alkalinity, and Electrical Conductivity, the number of schools reporting data increased slightly in Year 8. The number of schools submitting Turbidity measurements has increased significantly since 1999-2000, climbing from 264 to 404.

Figure 2.10
Number of Schools Reporting Water Quality Data, by Year



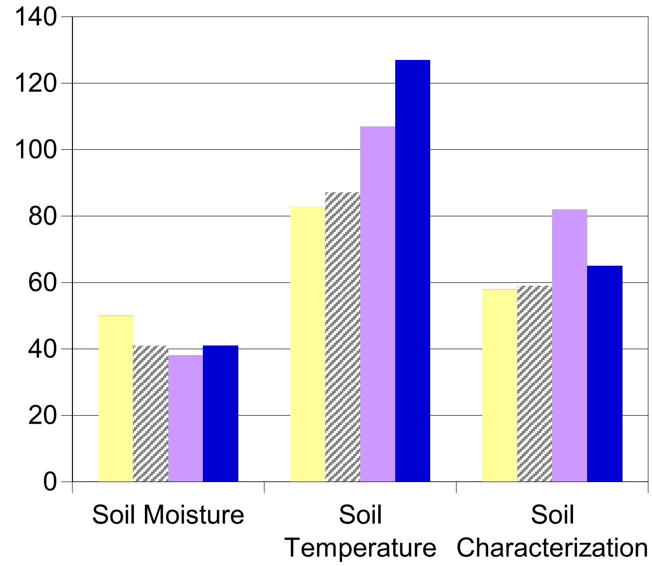
	Dissolved Oxygen	Turbidity	Alkalinity	Electrical Conductivity
1999-2000	315	264	228	277
2000-01	322	335	216	282
2001-02	345	362	250	301
2002-03	371	404	260	315

Reporting Patterns for Less Frequently Measured GLOBE Data Types

There are two investigation areas—Soil and Land Cover—that do not require schools to collect data as frequently as for Atmosphere and Hydrology. Soil and Land Cover protocols are also implemented less often by GLOBE teachers.

The pattern of data reporting for soil measurements was less consistent than those seen for Hydrology and Water Quality in Year 8. Of the three Soil protocols presented in Figure 2.11, one showed an increase (Soil Temperature) in 2002-03, one showed a decrease (Soil Characterization), and one remained stable (Soil Moisture). The number of schools reporting Soil Temperature measurements reached 127, continuing a steady rise since 1999-2000. Soil Characterization measurements declined from 82 schools reporting in 2001-02 to 65 in 2002-03. Soil Moisture measurements reported were similar to those seen since 1999-2000.

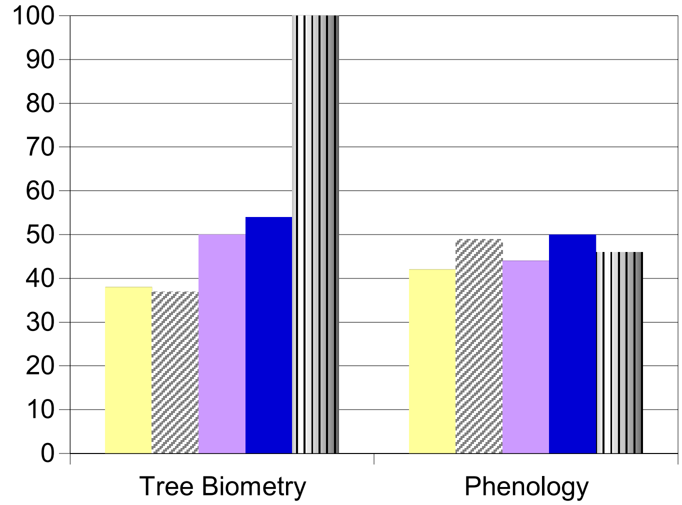
Figure 2.11
Number of Schools Reporting Soil Data, by Year



	Soil Moisture	Soil Temperature	Soil Characterization
1999-2000	50	83	58
2000-01	41	87	59
2001-02	38	107	82
2002-03	41	127	65

The number of schools reporting Tree Biometry and Phenology data increased slightly (Figure 2.12). For the Green-up/Green-down measurement, 52 schools reported data, compared with 32 schools in 2001-02. Five schools reported observations of the ruby-throated hummingbird in the Phenology investigation area.

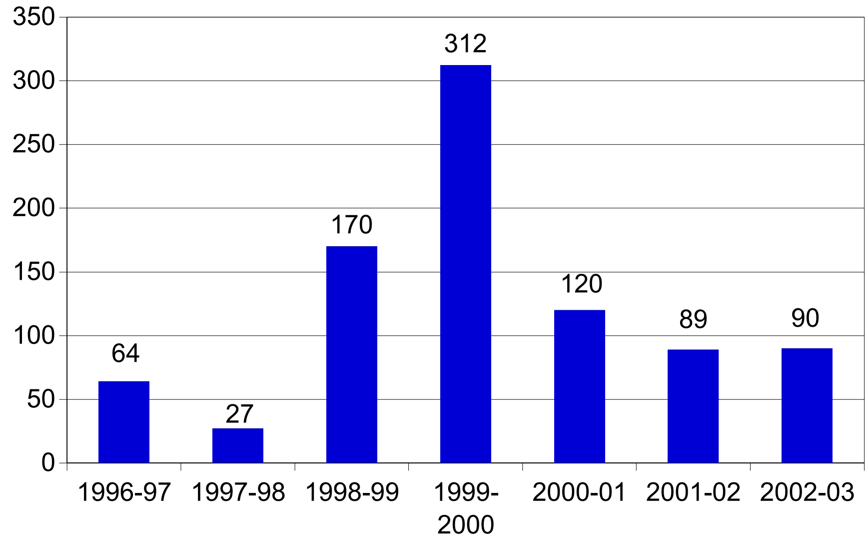
Figure 2.12
Schools Reporting Quantitative Tree/Biometry and Phenology Reports, by Year



	Tree Biometry	Phenology
1999-2000	38	42
2000-01	37	49
2001-02	50	44
2002-03	54	50
1998-99	100	46

The number of schools reporting Qualitative Land Cover (MUC) data has been relatively stable since 2000-01, compared with earlier years (Figure 2.13). A peak in reporting occurred in 1999-2000, due to wide participation in a MUC-a-thon held that year.

Figure 2.13
Number of Schools Reporting Qualitative Land Cover (MUC) Data, by Year



Discussion

Data reporting patterns continue to reflect a stabilizing of the overall number of teachers implementing GLOBE. On the one hand, roughly 2000 new teachers continue to be trained each year in the protocols, a figure that has held relatively steady over the past six years. If only a small percentage of these teachers went on to report data, the number of schools reporting data on a monthly basis would increase. However, only three in five teachers who report data in any given year tend to report data in the next year; the 2 year attrition rate from data reporting is even larger. So as new teachers join the program, many are leaving it. This pattern is not unusual for inquiry science programs (C. Joyce, personal communication, August 2001), and some teachers may even leave and come back to the program. The spike this year in first-time data reporters is certainly encouraging in this regard.

Atmosphere remains the investigation area for which most schools that implement GLOBE report data. Both its popularity with teachers and the frequency with which data are expected to be collected pose some challenges for the evaluation, however. The monthly reports, for example, overshadow the other investigation areas. We have chosen to create separate graphs to depict trends in data reporting for these other areas, but it makes it difficult for us to compare data reporting patterns across investigation areas. Therefore in future years, we will explore using the honor roll criteria as the basis for reporting on trends in data reporting. These criteria have been developed for each investigation area and reflect scientists' thinking about the requirements for data collection specific to their protocols.

The increase in Hydrology data reporting for water quality measures is encouraging, however, and suggests that this investigation area may be growing in importance for teachers. The data reporting numbers cannot themselves tell the story of why these data are becoming important. We do see, however, from our case study visits that this topic is one that appears in many state standards and is therefore viewed as particularly well-integrated with teachers' existing curriculum.

A continuous concern with data reporting is in assessing the impact of partners' decisions about the relative focus they may be placing on recruitment, training, and support. Importantly, the change in focus that U.S. partners have made from training new teachers toward supporting existing GLOBE teachers has not resulted in any decline in the overall numbers of schools reporting data. Partners have become more efficient with training, including more teachers per session than in previous years. Moreover, their efforts at providing posttraining support may be beginning to pay off, if the number of first-time reporting schools is a good indicator.

3. GLOBE's Reach to Students from Underrepresented Groups

A goal of many science education programs, especially those funded at least in part by the National Science Foundation (NSF), has been to do a better job of reaching students who come from communities of color. The National Science Foundation has as a core part of its mission to extend the pipeline of learning opportunities for traditionally underrepresented groups, such as women and minorities, in science and mathematics careers. GLOBE, for its part, has always sought to include schools from diverse communities, and it has made special efforts to reach out to Historically Black Colleges and Universities (HBCUs) and Tribal Colleges to increase the numbers of schools that serve African-American and Native American students. As part of the GLOBE evaluation in Year 8, SRI undertook an examination of the supports and barriers to implementing GLOBE in schools with high percentages of students from underrepresented groups, including African Americans, Hispanic Americans, and Native Americans.

Among schools with GLOBE-trained teachers, 17% have a student body that includes more than 80% students of color. This percentage is consistent with national 2002 figures from the National Center for Education Statistics (NCES), which showed that about 18% of American schools have a student body of more than 80% students of color. Throughout this chapter, we will refer to these schools as "high-minority schools."[1] These schools differ from the general population of GLOBE schools in several key ways. They tend to be in more urban areas than the majority of GLOBE schools. For example, 78% of high-minority schools are in urban areas, while lower-minority schools are more evenly distributed between urban and rural areas (57% and 43%, respectively). Geographically, high-minority schools cluster in the West and South of the United States. The students participating in GLOBE who attend high-minority schools tend to be American Indian/Alaska Native (38%), African American (38%), and Hispanic (21%). These high-minority schools also tend to have students who come from lower-income families, with 70% of high-minority schools listed as Title I schools, compared with only

[1] Many students who are classified as "minorities" in a school may come from cultural or ethnic groups that make up a majority of the people in their communities. Other terms for describing these schools might be more accurate, but to make it easier for readers to follow, we have opted for the shorthand "high-minority schools."

48% of lower-minority schools. In addition, a somewhat smaller proportion of these schools (11%) report data to the GLOBE Data Archive than the general population of GLOBE schools in the United States (15%). These data are based on an examination of a subset of 6,084 GLOBE schools matched with socioeconomic data from the National Center for Education Statistics (NCES).

As part of our evaluation in Year 8, we decided to take a closer look at how implementation and adaptation of the GLOBE Program are influenced by high-minority school contexts by talking to teachers in the Program who were currently implementing and reporting data and those who either were not reporting data or had reported only limited data in the past 2 years. We were particularly interested in understanding what teachers might reveal about their decision-making that could inform the Program as to how best to support high-minority schools. By supporting high-minority schools more effectively, we argue on the basis of research presented here, GLOBE may have much greater success in reaching underrepresented groups.

Research suggests some important ways that a high concentration of underrepresented minorities in the school context can shape educational practices and outcomes. Orfield (1996) found that schools with large percentages of ethnic minority students tend to be grouped together in low-socioeconomic-status (SES), often urban, communities. Lower test scores are correlated with low SES, high-minority communities and also characterize the profiles of these schools (Orfield, 1996; Ault, Behtz, Meskimen, & Norman, 2001). As a consequence, teachers and students in these schools may be more affected by current policy-driven pressures to improve scores on standardized tests. In addition, teachers of low-SES students are often doubtful of their students' abilities and believe that they need "basic skills," direct instruction, and controlling teaching, not challenging, independent, and creative work (Solomon & Battistich, 1996; Haberman, 1991). Haberman (1991) dubbed this approach the "pedagogy of poverty." Many of these students are frequently judged as having lower academic abilities and tracked into remedial courses or special education programs (Oakes, 1992).

Further, the lack of resources in these school communities often presents insurmountable obstacles to innovative science inquiry. Such limitations include inadequate space, equipment, and materials; inadequate teacher preparation time to plan and reflect on a new program; low levels of science content or computer knowledge and training among teachers; large class sizes; high amounts of teacher and student mobility; limited instructional freedom and/or a lack of administrative support; and unreliable Internet connectivity (Huinker, 1996; Ingersoll & Rossi, 1995; Ingersoll & Gruber, 1996; Ingersoll, 1999; Songer, Lee, & Kam, 2002).

Our literature review led us to expect differences between high-minority GLOBE schools that were and were not implementing GLOBE, as measured by data-reporting activity. On the basis of this literature review, one might reasonably expect a program like GLOBE not to take hold at such schools to any great extent. These schools frequently lack reliable Internet connectivity and other material resources that permit engagement in science inquiry. These schools frequently expect only "the basics" from their students in the face of standardized testing pressures and resist experimenting with student-driven forms of instruction that rely on inquiry. Additionally, teachers rarely stay at such schools. Finally, the administration is under pressure to improve in math and language arts, not science, so the systemic support would be weak for a science course.

However, against these odds, some teachers have managed to implement GLOBE. Some of the reasons teachers decide to implement GLOBE may be associated with teaching in a particular context. For example, although teachers' decisions to report GLOBE data may have little to do with the size of the school in which they teach or the socioeconomic status of their students, being in a rural area does seem to be associated with higher percentages of data reporting (Table 3.1).

Table 3.1
School-Level Characteristics of High-Minority GLOBE Schools

	Limited/Nonreporting Schools* (892≤n≤990)	Data-Reporting Schools (59≤n≤84)
Average number of students	896	775
Average number of faculty (FTE)	50.2	44.9
Average percentage free or reduced-price lunch	62.6%	65.7%
Percentage in communities with population >250,000	14.6%	7.1%
Percentage in communities with population <20,000	11.9%	29.8%

* Limited-reporting schools are those with 1 to 29 data reports in the past 2 years.

Some differences in reporting also were observed across level of schooling among high-minority schools. Reporting high-minority schools were slightly more likely to be high schools and slightly less likely to be middle or elementary schools than limited- and nonreporting schools.

We undertook an interview study of selected implementing and limited-implementation schools because we anticipated that school characteristics alone did not determine teachers' decisions to implement GLOBE. We wanted to investigate the extent to which teachers' perceived context and their individual characteristics might influence these decisions. Understanding teachers' own interpretations of the context in which they work and the role their experiences play in decision-making might better help the Program target its efforts to reach out to high-minority schools.

Sample Selection and Characteristics

To carry out our design, we constructed a sample of GLOBE schools with 80% or greater concentrations of minority students. To gather demographic information on the schools, we cross-referenced the GLOBE database with the NCES database and matched a total of 1,079 schools that were high-minority. (Two-thirds of the entire population of

United States GLOBE schools was able to be matched with this procedure.) We split the sample between those that had entered 30 or more data points to the GLOBE Data Archive during last two school years (GLOBE implementing schools) and those with fewer than 30 data points (GLOBE schools with limited implementation). We selected this cut point because we reasoned that high minority schools might be implementing GLOBE activities and reporting only small amounts of data, particularly schools in low-income, urban areas where equipment theft is a problem and it is sometimes challenging to find a data collection site meeting GLOBE specifications. We found during interviews that this cut point turned out to be a relatively solid indicator for initial screening of whether GLOBE was being implemented. Only in two cases did it appear that a high-implementing teacher and a low-implementing teacher needed to be switched to the other group. After constructing the sample, we used a random-number generator to sample from the high-minority GLOBE school populations of implementing and limited-implementation schools for comparison.

Approach to Recruiting Teachers for the Study

We took three separate random samples from the high-minority school population, for a total of 70 implementing schools and 163 limited-implementation schools. Many teachers could not be reached because teacher attrition was not reflected in the GLOBE database. After accounting for attrition, the samples were significantly reduced. The random sample of implementing schools fell by 33% to 47 schools, and the random sample of limited-implementation schools fell by 47% to 87 schools.

We attempted contact with each teacher through phone calls, e-mails, and faxes. To increase response rate, we set up a toll-free number for the teachers' use. After follow-up, we obtained a response rate of 45% (21 teachers) from implementing schools and just 12% (10 teachers) from limited-implementation schools. These low response rates mean that our findings should be interpreted with great caution because the sample is skewed in favor of teachers who were willing to return our phone calls. These teachers would tend to be more motivated and positive about GLOBE than perhaps those who were unwilling to return our phonecalls, for example. We interviewed eight elementary school teachers (two limited-implementation, six implementing), nine middle school teachers (four limited-implementation, five implementing), seven high school teachers (three limited-implementation, four implementing), and seven teachers who work in schools with other grade breakdowns, such as K-12 (one limited-implementation, six implementing).

Differences between the Sample and the Population of High-Minority GLOBE Schools

Because of the low response rate, we needed to test how typical our sample might be. To test whether our high-minority sample was representative of the larger population of high-minority GLOBE schools, we ran demographic characterization analyses on the groups. Although overall the sample looks much like the high-minority population, there are some small differences.

Locale. The sample is more rural than the overall high-minority population of GLOBE schools matched to the NCES database (35% versus 18%). In our recruiting, we had difficulties obtaining responses from high-minority GLOBE schools in urban areas and so we have a slightly higher representation of rural high-minority GLOBE schools. It is important to emphasize that we did interview some urban teachers, just not the number that we would have preferred. The primary contributor to this problem was teachers not responding to multiple telephone calls, faxes, and emails.

Title I Status. A greater proportion of schools in the sample receive Title I aid than schools in the overall high-minority population of GLOBE schools (77% versus 70%).

Region. The sample is slightly more western than the overall high-minority population of GLOBE schools (32% versus 23%). Nonwestern and nonsouthern regions of the country are slightly underrepresented in the sample, compared with the overall high-minority population of GLOBE schools (19% for both regions combined versus 34% overall.).

Dominant Ethnic Group. Hispanic-dominated schools are underrepresented in the sample (29% versus 40% in the population) and American Indian/Alaska Native-dominated schools are overrepresented (19% in the sample versus 6% in the population).

Procedure

To explore differences between implementing and limited-implementation high-minority schools, we designed an interview protocol. We sought teacher self-reports about the context of support that exists for GLOBE, the teachers' background in science and education, the details of their implementation of the Program, and their views of their administration, their students, and their surrounding communities. We also sought information about general strategies teachers used to implement GLOBE and overall impressions about why they could or could not implement the Program successfully in their schools. We carried out all interviews by phone from February to March 2003.

Findings from the Interview Study

After reviewing the interview responses that were recorded during the phone conversations, we found a number of themes that tell the story of how GLOBE is and is not effectively reaching underrepresented groups in science. We found that teachers' ability to find issues of local relevance, their autonomy to make curricular decisions, and support from GLOBE partners and other organizations are critical aspects of teachers' decisions about GLOBE implementation. In addition, implementing teachers tended to have more experience and more advanced educational training than limited-implementation teachers.

Making GLOBE Relevant to Local Issues

Implementing teachers tended to express concrete goals for their students' GLOBE work that were related to local issues, while teachers from schools with limited implementation had only general conceptions of how GLOBE tied to local issues. When asked about their goals for GLOBE in the classroom when they were first trained in the Program, nearly every teacher we interviewed responded that they wanted their students to have the chance to do "hands-on" science. But 15 of 21 implementing teachers interviewed had identified more specific ways that GLOBE could support investigation into local issues, compared with just 1 of the 11 teachers from limited-implementation schools. One implementing teacher noted that people in her community are particularly attuned to weather because of hurricanes and the local crawfish industry; she finds GLOBE to be a way to introduce students to thinking about weather from a scientific vantage point. Another teacher indicated that her students were investigating local Department of Transportation images of their town using GLOBE concepts. Another teacher engaged her students by having them compare the data they collected with weather reports on television and in the local newspaper. Still another built on his school's participation in the draining of an "urban lake" in which students' findings that oxygen levels had dropped led local park officials to discover that the lake had faulty pumps. Finally, a teacher in Alaska had local Alaska Native elders talk to the students about climate changes that were relevant to GLOBE work. According to this teacher, "Elders talk about the old sweat lodges and their predictions for great changes in the climate. Now this makes sense to the kids."

These differences suggest that localization of the Program is particularly important to teachers who choose to implement GLOBE. In other words, teachers work to make GLOBE relevant by tying students' experiences in the Program to some environmental issue that is locally important. It is unlikely that communities where teachers are not implementing GLOBE face no important issues that could be studied by students; however, they may need assistance in identifying connections that their students could explore.

Administrative Support and Teacher Autonomy

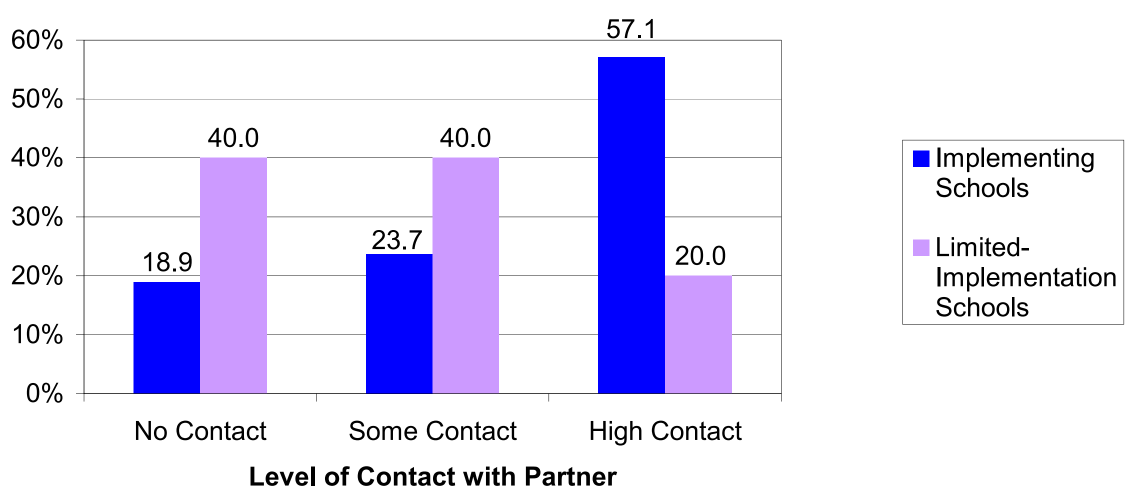
The level of administrative support available for GLOBE did not appear to strongly influence teachers' decisions to implement or not implement GLOBE. Roughly two-thirds of the teachers from implementing and limited-implementation schools reported that their local school administration supported their GLOBE participation. Some of the limited-implementation schools even have a strong emphasis on science; one teacher reported that her principal had a strong interest in environmental science in particular. By contrast, some of the implementing teachers faced quite difficult situations in their own schools with respect to administrative support. One implementing teacher commented that her school was "scared of science"; another commented that at her school, science had been relegated to being a side activity in the curriculum.

On the basis of these data, it is difficult to conclude that administrative support has a strong effect on data reporting. Instead, it appears that when support is absent, as it is in about one-third of the schools in which we interviewed teachers, it is teachers' relative autonomy within the school that makes the biggest difference in their decision to implement GLOBE. Implementing teachers asserted their own autonomy and power in deciding to implement GLOBE. One teacher in Alaska reported that she "ignores" the fact that she is not supposed to teach GLOBE because it does not align with the science standards. Another described himself as "the science department," responsible for decision-making about the science curriculum in his school. By contrast, teachers from schools with limited implementation reported that they had limited autonomy. The perceived lack of alignment with her state's standards has caused one teacher's interest in GLOBE to wane. Another commented that a change in her school's emphasis on science gave her no choice but to discontinue GLOBE.

Partner Support

Partner support appears to help GLOBE succeed in high-minority schools, as it does in other GLOBE schools. There exist large differences between implementing and limited-implementation schools in this regard. Some 57% of implementing teachers reported high levels of contact with their local GLOBE partner, while only 20% of teachers from schools with limited implementation reported high levels of contact (Figure 3.1). In addition, only 19% of implementing teachers reported that they had not been in touch with their local GLOBE partner at all since their training, while 40% of teachers from schools with limited implementation reported no contact with the local GLOBE partner since completing their initial training. The latter group of teachers yearn for contact; one reported that she "would probably engage in GLOBE if the partners were in touch" with her.

Figure 3.1
Level of Partner Contact among High-Minority Sample, Percent Reporting

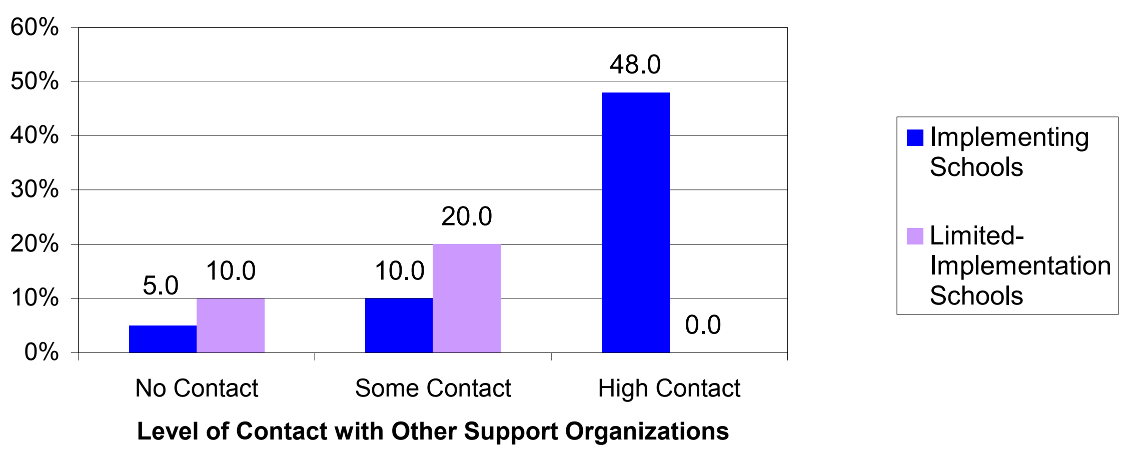


Our data do not speak to the issue of which party initiated the contact; perhaps more implementing teachers than limited-implementation teachers were persistent in obtaining contact with their local GLOBE partner. Perhaps some of these implementing teachers benefited from a particularly proactive GLOBE partner. We cannot determine the social dynamics of these affiliations.

Connections to Related Support Organizations

The implementing teachers also found support for GLOBE from other, non-school-related organizations. As can be seen in Figure 3.2, a greater proportion of implementing teachers than of limited-implementation teachers have contact with groups that either help them with GLOBE directly or are aligned in focus. One Louisiana teacher, when asked to list any partnerships with other organizations in the area, said that there were far too many to mention. An Alaska teacher whose partner could not provide a severe-weather thermometer was able to contact a supplier to get the equipment sponsored. In another example, an implementing teacher from Los Angeles found that GLOBE did not always work in the "urban jungle." Instead of letting the environment stop his GLOBE endeavors, this teacher is working with UCLA with the goal of writing aerosol and smog protocols that better match what urban schools need and can do. These data suggest that these teachers have a talent for building, maintaining, and tapping into social networks. The data support the idea that an extended support network is correlated with higher levels of GLOBE work in high-minority schools.

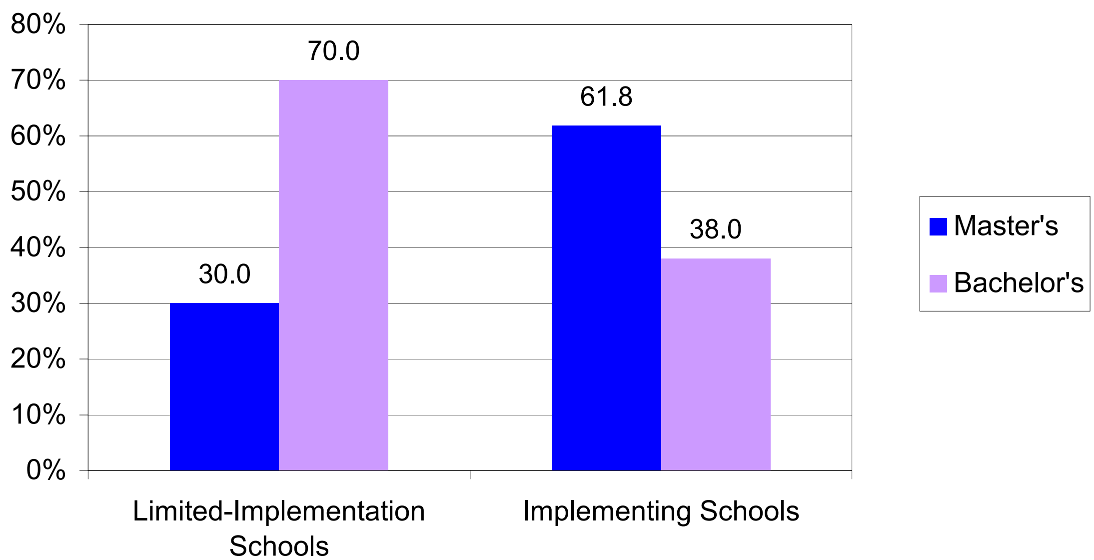
Figure 3.2
Level of Contact with Other Support Organizations among High-Minority Sample, Percent Reporting



Differences in Professional Preparation and Experience of Teachers

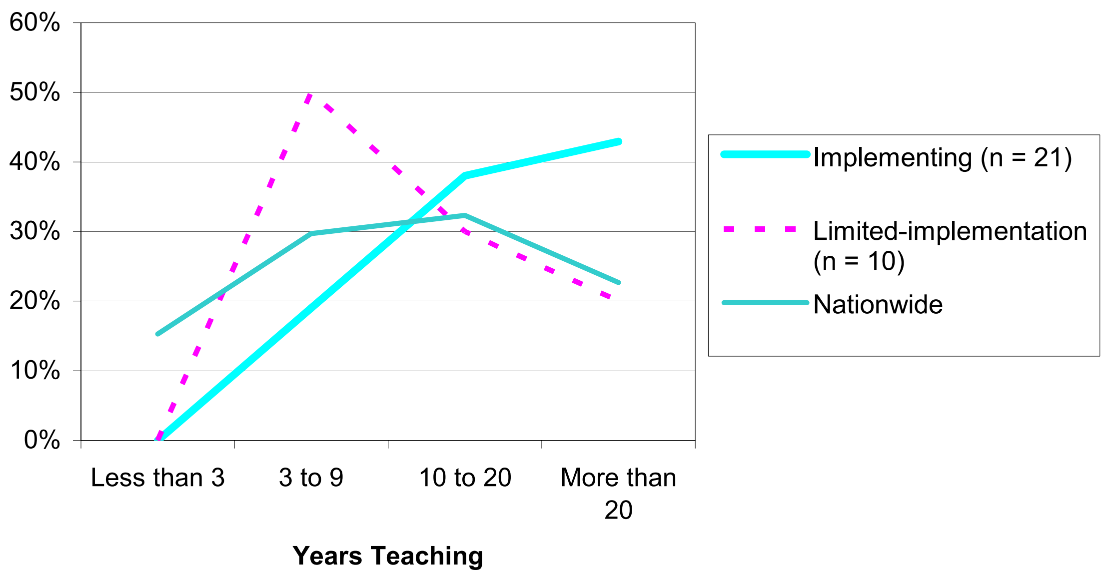
Teachers from both groups had similar levels of preparation in science, but implementing teachers tended to have more advanced degrees than did teachers from limited-implementation schools. Approximately 50% of teachers from both groups had a degree in some sort of science (biology, chemistry, natural resources, environmental science, etc.). However, implementing teachers were more likely to have master's degrees (Figure 3.3). With the exception of one teacher, all of the master's degrees earned by the teachers we interviewed were in education.

Figure 3.3
Highest Level of Degree Obtained by Teachers in High-Minority Sample, Percent Reporting



Implementing teachers also had more classroom experience than teachers from limited-implementation schools. More than 80% of implementing teachers had been teaching for 10 years or more, while only 50% of limited-implementation teachers had been teaching for as long (the other half had been in the classroom for only 3 to 9 years). Our sample of implementing teachers also had more experience than the country's teaching population in general, with a greater proportion of teachers with 10 or more years of experience in the implementing GLOBE high-minority sample than the nationwide population (Figure 3.4).

Figure 3.4
T eaching Experience among High-Minority Sample, Percent Reporting



Source for nationwide data: U.S. Department of Education.

Taken together, these data demonstrate that teacher experience can shape the decision to implement GLOBE. It may be that teachers with greater confidence in science teaching, earned through professional preparation and years in the classroom, are more willing to take on the challenge of implementing a new program like GLOBE. Further investigation of the role of experience in deciding to implement GLOBE is necessary to test this hypothesis, however.

Points of Commonality: Accountability Pressures and Teacher Isolation

Pressure to improve test scores is felt by both groups of teachers. We had anticipated that teachers from limited-implementation schools would report greater testing pressure than teachers from implementing schools, but we did not find this pattern. Pressure was high across the board, with teachers from both groups using terms like “tremendous” and “constant” when describing the pressure to increase test scores. The large majority of teachers from both groups feel that this pressure has taken away from science instruction. One implementing teacher stated, “I have to figure out a way to bring science in a 10-minute window in my language arts period.” In a few cases, the test pressure is perceived as having a positive impact on science instruction. Some teachers reported that their schools are specifically focusing on increasing science test scores or that the focus on science is expected to increase when across-the-board science testing begins in fall 2007 in accordance with the federal No Child Left Behind (NCLB) Act.

There appeared to be very little collaboration among any of the GLOBE teachers we interviewed, even when teachers came from within the same schools. Both implementing and limited-implementation teachers tended to be the only GLOBE teacher at their schools. Implementing teachers seemed to cope well with this isolation, while limited-implementation teachers reported the need for a collaborator. Some limited-implementation teachers were especially vocal about the need for other teachers to make GLOBE work: "The other trained teacher left, which totally broke down GLOBE at the school." "I need a team to do it." But in schools where there were other GLOBE teachers, the level of collaboration did not necessarily increase. Both groups of teachers reported that even if there were other GLOBE-trained teachers at the school, they did not work together. Teachers indicated that they rarely collaborated with fellow teachers in any of their work and so it did not occur to them to do so with GLOBE. Some said they did not have time or that it was difficult to arrange time to meet.

Discussion

Just as finding the relevance of GLOBE to issues of local concern helps to motivate student inquiry in the Program, relevance appears to play a role in how teachers in high minority schools who implement GLOBE think about the Program. These teachers more readily pointed out connections of GLOBE to environmental issues in their community than did teachers from schools with limited implementation. These connections may have been made post-hoc; they may have been influential in teachers' decisions to implement GLOBE in the first place. While our study doesn't permit us to say when teachers made these connections, teachers' sense of the local relevance of GLOBE activities figures strongly in their thinking about the potential benefits of GLOBE for students.

It is possible for partners and other environmental science organizations to support teachers in understanding the local relevance of GLOBE. In Alaska, Native elders have played such a role in communities, helping students to see the links between Native ways of observing the environment and scientific forms of observation. These connections are also made in local standards documents, which emphasize the importance of culturally responsive science curricula for Alaska Native youth (Alaska Native Knowledge Network, 2003). GLOBE scientists in that state, too, have emphasized opportunities youth have to study global warming firsthand by observing changes in the dates of green-up and green-down for certain plant species. Together, this web of support makes it possible for teachers to see connections between GLOBE and being a member of a Native community, between cultural and scientific forms of observation, and between local data collection activities and inquiry into global environmental issues.

Our sample was limited to those teachers who were most motivated to return our telephone calls and was somewhat more skewed toward those in rural areas than the overall high minority population of GLOBE schools, and so this focus on surrounding environmental issues may represent an effective incentive for the most motivated teachers in rural areas. We did have two teachers from Los Angeles who were motivated in similar ways. One teacher's class was collecting data on water quality as an urban lake was drained, for example, while the other collected data on air quality. The students found that dissolved oxygen levels were dropping and reported it to local park officials and the Fish and Game Department, leading the county to discover that the pumps were dysfunctional. Other issues particular to urban areas are being explored through the NSF-funded "GLOBE in the City" program, which is engaging students in collecting, reporting, and analyzing air quality data in different parts of the Los Angeles basin. Based on the general feedback from our sample and the two cases of the Los Angeles teachers, we think it is fair to conclude that one effective way to involve teachers in high minority schools in GLOBE is to help them identify issues of local ecology that they can investigate with students in GLOBE.

A third opportunity for GLOBE is to develop ways for teachers with limited experience in teaching or preparation in science to dive more deeply into issues relating to leading GLOBE activities successfully. Helping students learn from GLOBE will necessarily depend on teachers' knowledge of the content of GLOBE activities, but it will also likely depend on their pedagogical content knowledge, a topic we have discussed as part of earlier evaluations. Even in our sample, we had a mix of experienced and inexperienced teachers. Higher implementation of GLOBE was associated with higher levels of classroom experience, and lower implementation of GLOBE was associated with lower levels of classroom experience. GLOBE already provides rich content to teachers; however, prospective GLOBE teachers may need to be introduced to that content in different ways, depending on their own science background and teaching experiences. Such supports may be particularly important in bringing GLOBE to high-minority, urban schools where there are generally higher concentrations of newer teachers.

4. GLOBE's U.S. Partners: Current Goals, Strategies, and Challenges

Introduction

The GLOBE Program's U.S. partners were surveyed in spring 2003. The survey questions addressed a number of areas: partners' goals and institutional contexts, approach to GLOBE training, use of GLOBE materials, strategies for recruiting and posttraining support, and partner needs and challenges (see Appendix B). This chapter includes a description of the methodology used in conducting the survey, as well as a report on its results.[2] Following the methods section, there is a brief characterization of GLOBE partners in terms of the types of organizations in which they are housed, their mission and goals, the activities that are most important to them, their sources of funding, and the benefits they see in GLOBE participation. The fourth section of this chapter summarizes the approach to teacher training used by partners at their most recent training sessions. A new area of research, teacher use of GLOBE materials, is reviewed in the fifth section. The final sections of this chapter summarize typical partner practices and their greatest needs and challenges.

Method

Determining the Survey Sample

The initial download of partner contact information from the database yielded 471 contact records. Duplication occurred for partners with both coordinators and trainers listed. After the trainers were removed to yield one contact per partner, 267 contacts remained. Finally, inactive partners as identified by the GLOBE office were removed, yielding 155 active partners for the survey sample.

Conducting the Survey

In early 2003, partner coordinators were notified by e-mail message that they would be receiving a survey in coming weeks. The survey was delivered in an e-mail message sent on March 7 to each partner coordinator individually. The message included a URL link to a personal copy of the survey, with ID number and partner organization

[2] Percentages in some tables do not total 100 because of missing data.

information completed. These first two messages identified invalid e-mail addresses for 15 partner coordinators. Paper copies of the survey were mailed to this group. On March 21, a reminder to complete the survey was sent to partner coordinators with valid e-mail addresses who had not submitted an online version of the survey. The reminder was sent by regular mail with a paper copy of the survey in order to offer partners the option to complete the survey in the format most convenient for them. An e-mail reminder was sent to partner coordinators with valid e-mail addresses on April 4. For partner coordinators without valid e-mail addresses, a reminder with a second paper copy of the survey was sent by regular mail on April 11. On May 5, the GLOBE office sent an e-mail reminder with URL link asking for remaining surveys to be submitted. SRI then sent paper copies of the survey to nonrespondents by regular mail. The survey was closed on June 2. Table 4.1 presents response rate data.

Table 4.1
Partner Survey Response Rate

	Online		Paper	Total
Number of surveys initially sent	140		15	155*
	Online	Paper		
Number of completed surveys received	30	43	5	78*
Number of blank surveys received	1	1		2
Number of late surveys received		3		3
Number of surveys included in analysis (N)	**29**	**39**	**5**	**73**

* Response rate = 50.3%.

Coding of Open-Ended Responses

Researchers reviewed responses to determine a set of codes for each open-ended question (questions 2, 17, 21-24; see Appendix B). Reliability of these codes was tested by three researchers by scoring a sample of 10 answers per open-ended question. Interrater reliability for all questions except question 24 exceeded 75% (question 24:

73%; all others: 77% to 90%). Codes for question 24 were rewritten, yielding reliability of 76%. Coding was then completed for all responses to open-ended questions. Where applicable, responses to open-ended questions were coded with all codes that applied. For example, partners tend to have more than one funding source, and sources stated in the response were each coded (e.g., one code for "federal funds," one code for "other grants"). Therefore, the sum of the percentages reported in tables presented below may exceed 100.

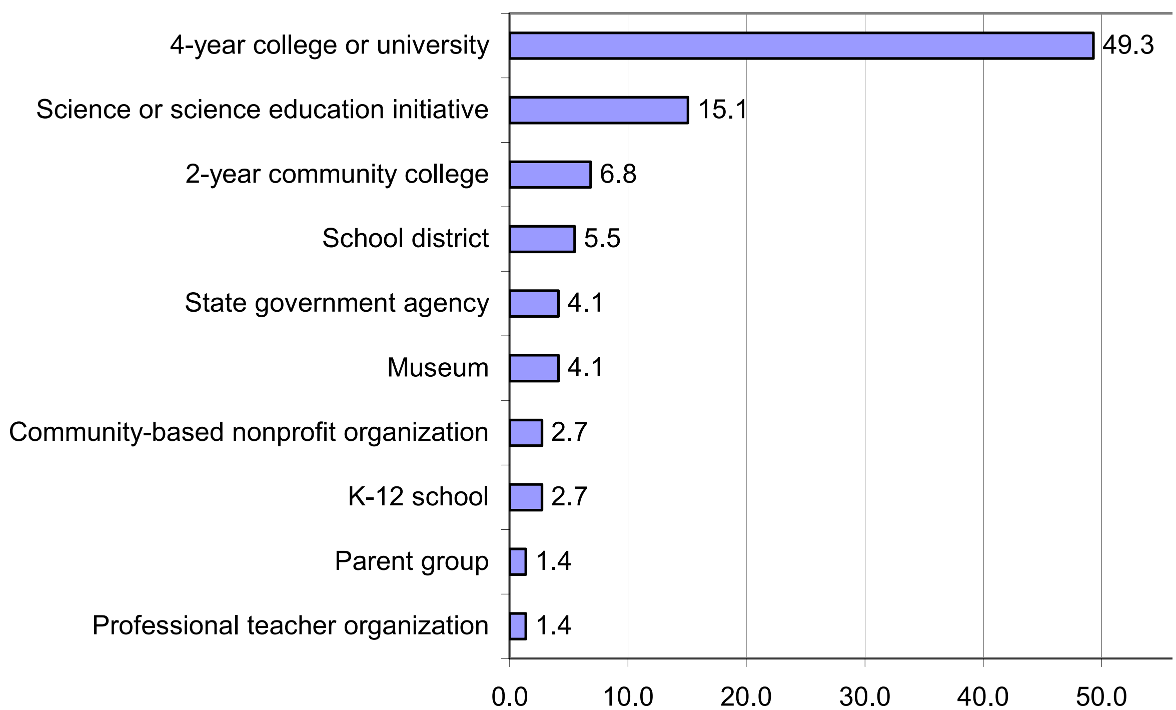
Partner Description

A number of survey questions provided information that characterizes the partners in terms of their home organizations, their goals, and their views about the benefits of participating in GLOBE.

Types of Partner Organizations

Figure 4.1 shows that almost half of partners (49%) are housed in 4-year colleges. The rest of the partners are distributed among several organization types, with only one other substantial grouping: 15% of partners are housed within science or science education initiatives. This diversity may reflect the alignment of GLOBE with the outreach and education goals of a variety of organizations.

Figure 4.1
Partner Organization Type, Percent Reporting



N = 68

Primary Mission of GLOBE Partners

The survey asked about the primary mission of GLOBE partners. Responses were coded twice; the first code identified the target (teachers, students, organizations) of the partner's efforts, and the second code noted whether promotion of student inquiry in science was explicitly mentioned as part of the partner's mission. The number of codes applied to the responses (87) exceeded the number of responses (66) because some partners named more than one target for their efforts. More than twice as many partners (82%) named teachers to be targets of their efforts as named students (36%). Fourteen percent of partners named organizations, such as school districts, as targets of their efforts.

The following excerpts provide examples of teacher, student, and organization targets.

> *Train teachers to collect data using GLOBE protocols; increase teachers' science content understanding; provide support to teachers who are implementing GLOBE.*
>
> *Increase students' research skills while enhancing their critical thinking and problem-solving skills.*
>
> *Create synergy among GLOBE partnerships in the area; work with state [environmental education] leaders to show GLOBE's value across the curriculum.*

Only 6% of respondents explicitly stated that inquiry in science was part of their mission. This finding is not surprising since the GLOBE Program's emphasis on student investigations and research is relatively recent. It may also be that partners are reluctant to emphasize inquiry because the current accountability pressures emphasize teaching a broad set of concepts in science that extended investigations might preclude teachers from covering in the time they have allotted for science teaching. Still, some partners have embraced an emphasis on inquiry, as the following excerpts illustrate:

> *Our primary mission is to train educators in the GLOBE protocols and to have those educators implement GLOBE with their students. We want the educators to report data and stress student inquiry. We will provide the necessary support to achieve our mission.*
>
> *We promote inquiry-based and problem-solving programs for teaching students.*
>
> *We want to introduce teachers to this real-world environmental data-gathering and inquiry at their own campus with their own students. We want their students to have the opportunity to share their data and experiences with scientists and students at other schools.*

Importance of Typical Activities

Partners were also asked about the importance of typical partner activities to their work. Table 4.2 shows that partners rated provision of posttraining support to teachers as very important (77%). Only 16% of partners rated posttraining support as somewhat important, compared with approximately one-third for training teachers, building teacher community, and recruiting teachers (30%, 32%, and 37%, respectively). These results suggest that partners believe that sustaining teacher participation in GLOBE through ongoing support is most likely to contribute to achieving their mission as partners.

Table 4.2
Importance of Activities to Partner Efforts, Percent Reporting

	Not at all important	Somewhat important	Very important
Providing posttraining support	2.7	16.4	76.7
Training teachers	2.7	30.1	63.0
Building community among teachers	5.5	31.5	58.9
Recruiting teachers	4.1	37.0	54.8

N = 70

Sources of Funding

GLOBE partners tap a variety of sources to fund their efforts (Table 4.3). Approximately one-third of partners receive funding from federal or other grants (37% and 31%, respectively). More than one-quarter of partners (27%) use funds available from their home institutions for GLOBE activities, and a similar number (25%) receive state or district funds. Least common funding sources are charges to training participants (15%) and volunteer support and donations (9%).

Table 4.3
Partner Funding Sources, Percent Reporting

Federal funds	37.3
Other grants	31.3
Funds from partner institution	26.9
State/district funds	25.4
Tuition/charges to participants	14.9
Volunteer support/donations	9.0

N = 67

Participation Benefits

An open-ended question asked partners about the benefits to their organizations from participation in GLOBE. These answers were coded into categories. In all, 60 partners responded to the question, and 72 codes were needed to categorize their answers. Note that all applicable codes were used for categorizing each response, and respondents may have noted several benefits, resulting in more codes than responses.

Of explicitly stated benefits to GLOBE participation, the most common was the match of GLOBE to the organization's mission or beliefs (30%; see Table 4.4). Partners also valued their contributions to student learning (20%) and teachers' knowledge (17%). More than one-third of answers (38%) fell into the "other" category. Of these, many expressed admiration for the Program without stating benefits of participation.

Table 4.4
Partners' Perceptions of Benefits to Participation, Percent Reporting

Match to organizational mission/beliefs	30.0
Contributing to student learning	20.0
Contributing to teachers' knowledge	16.7
Connecting schools to GLOBE	11.7
Connecting schools to other institutions	5.0
Other	38.3

N = 60

Most Recent Training

Partners were asked a series of questions about their training activities, specifically in regard to the most recent training session they had offered. Note that not all respondents replied to each survey question or to the sub-items within each. Therefore, a range of number of responses is reported at the bottom of each table of results.

The majority of partners had (87%) offered a training session in spring 2002 or later. The number of teachers in attendance ranged from 1 to 45, with almost two-thirds of the sessions (63%) involving from 12 to 30 teachers. More than half of these training sessions (58%) were led by either 2 or 3 trainers.

One trend that is documented in the survey data is the move toward breaking up GLOBE training into multiple sessions. GLOBE partners have long argued for the need to break training into different components, often by investigation area. According to our survey data, today most training sessions are longer than 1 day and are either held on consecutive days, or spread over weeks or months. Two-thirds of the sessions (75%) were conducted over 3 to 6 days.

Training Content

In terms of training content, the majority of partners spent at least 1 hour of training on protocols for each of four investigation areas (Table 4.5): Atmosphere (60%), Hydrology (56%), Soil (52%), and Land Cover/Biology (48%). About one-quarter of partners spent more than 3 hours on those same protocols: Hydrology (34%), Soil (27%), Land Cover/Biology (25%), and Atmosphere (21%). Only one-quarter of partners (25%) spent at least 1 hour on GPS.

Table 4.5
Training Time Spent on Protocols, Percent Reporting

	No time	1 hour or less	1-3 hours	More than 3 hours
Hydrology protocols	13.7	5.5	21.9	34.2
Soil protocols	13.7	5.5	24.7	27.4
Land Cover/Biology protocols	17.8	4.1	23.3	24.7
Atmosphere protocols	9.6	5.5	39.7	20.5
GPS	6.8	41.1	24.7	

N = 51-55*
* Range is due to variability in number of responses per item.

Training for learning activities did not account for as much time as training for protocols. Most partners spent 3 hours or less on learning activities for each of four investigation areas (Table 4.6): Atmosphere (58%), Hydrology (52%), Soil (51%), and Land Cover/Biology (45%). One-third of partners (33%) did not provide training for Seasons learning activities, while one-third (34%) spent up to 3 hours.

Table 4.6
Training Time Spent on Learning Activities, Percent Reporting

	No time	1 hour or less	1-3 hours	More than 3 hours
Hydrology learning activities	17.8	20.5	31.5	5.5
Soil learning activities	15.1	26.0	24.7	4.1
Atmosphere learning activities	13.7	27.4	30.1	2.7
Land Cover/Biology learning activities	21.9	17.8	27.4	1.4
Seasons learning activities	32.9	17.8	16.4	1.4

N = 50-55*
* Range is due to variability in number of responses per item.

The majority of partners reported spending up to 3 hours training time on other aspects of GLOBE (Table 4.7): GLOBE data reporting forms (64%); GLOBE data visualizations, inquiry using GLOBE data, and integration of GLOBE with state curriculum content standards (each 63%). Just under half of partners (41%) spent up to 3 hours training time on giving feedback to teachers regarding their implementation of GLOBE between training sessions. Almost one-quarter (23%) spent no time on giving feedback on implementation, but many training sessions still run on sequential days, leaving no time for implementation to occur between training days.

Table 4.7
Training Time Spent on Other Aspects of GLOBE, Percent Reporting

	No time	1 hour or less	1-3 hours	More than 3 hours
GLOBE data visualizations	5.5	39.7	23.3	6.8
GLOBE data reporting forms	5.5	24.7	39.7	5.5
Integration with curricula	6.8	39.7	23.3	4.1
Inquiry with GLOBE data	8.2	39.7	23.3	2.7
Implementation planning	9.6	39.7	21.9	2.7
Feedback on implementation between training sessions	23.3	30.1	11.0	2.7
Integration with state standards	17.8	34.2	20.5	1.4

N = 49-55*
* Range is due to variability in number of responses per item.

Knowledge and Skills of Teachers

The survey also asked partners to rate the level of knowledge and skills of teachers who attended the most recent training session. Few partners rated the teachers they trained as very experienced in the areas queried (Table 4.8): science content knowledge (15%), teaching hands-on science (11%), using technology (8%), teaching inquiry in science (7%), and data collection (1%). Between one-third and one-half of partners rated teachers as somewhat experienced in each of these areas.

Table 4.8
Partner Ratings of Teacher Experience, Percent Reporting

	Don't know	Inexperienced	Somewhat experienced	Very experienced
Teacher science content knowledge	2.7	13.7	49.3	15.1
Teacher experience with hands-on science		20.5	47.9	11.0
Teacher experience with technology	2.7	15.1	54.8	8.2
Teacher experience with inquiry in science	8.2	20.5	45.2	6.8
Teacher experience with data collection	5.5	39.7	34.2	1.4

N = 58-59*
* Range is due to variability in number of responses per item.

GLOBE Materials

An exploration of teacher use of and perspectives on GLOBE materials is one of the areas of research begun in Year 8. The partner survey questions were included in spring 2003, and the results are reported in this section. In addition to the data reported here, interviews with a small sample of teachers are being conducted in each of two years (the first was 2002-03), and a synthesis of the responses will be reported at the conclusion of the second year of interviews. Two other sources of data will be used in this 3-year investigation: access to the online Teacher's Guide and partner survey questions. The review of Web site statistics will be presented along with 2 years of teacher interviews.

Partners have insights into the value of GLOBE materials through teacher training and follow-up contact. Therefore, two of the partner survey questions asked about GLOBE materials (see Appendix B). The first asked partners to relay comments from teachers that suggest ways the Guide can be improved. The second asked partners about how teachers have responded to learning activities during training.

Teacher's Guide. Forty partners reported feedback from teachers about the GLOBE Teacher's Guide. Partners frequently mentioned the volume of information in the Guide (35%), which many teachers describe as overwhelming. Several partners suggested breaking the Guide into individual binders, perhaps one for protocols and one for learning activities, or into several binders by investigation area. One partner suggested further shortening of the protocol guide:

> *Have a small ready reference book like the MUC book on each protocol so that when teachers and students go out to do their field work, it would be easy to carry with them. And at the beginning of each protocol restress why they are doing it.*

A few partners saw the size of the Guide and its guideposts as a strength of the Program, commenting that it has "extensive explanations that help teachers with content and procedure" and that "the basic layout is good and can be easily navigated."

Many partners (28%) provided recommendations. Some were directed at improved organization of the Teacher's Guide. These included putting all pages that could be used for photocopying together, color-coding sections of the binder, and consecutive numbering of pages to make returning them to the binder easier. This movement of pages out of and into the binder probably contributed to a suggestion that the hole-punched edge of pages have reinforced edges. Other recommendations were directed at including additional content: short summaries written from both teacher and student perspectives, additional materials for lower elementary grades, investigations and guides for science fairs, and ideas for preventing vandalism to instrument shelters.

There were also unique comments made by one partner and not echoed by others. One partner was concerned that the learning activities "seem to represent activity for activity's sake, with no depth of understanding built in." Another cautioned that teachers have difficulty keeping up with changes to the Guide. Another applauded "the move to inquiry" in science. Another noted that teachers see the revised sections as clearer and more focused.

Learning Activities. The survey asked partners to indicate which of the learning activities they perceive as most effective for grades K-2, 3-6, and 7-12. Five learning activities were selected for all three grade-level groupings (Table 4.9): Observing, Describing and Identifying Clouds (72 partners); Just Passing Through (62); Estimating Cloud Cover (60); Cloud Watch (42); and Leaf Classification (41).

Table 4.9
Perceived Effectiveness of Learning Activities, Number Reporting

K-2	Investigation Area	Learning Activity
33	Atmosphere	Observing, Describing and Identifying Clouds
21	Soil	Just Passing Through – Beginners
15	Atmosphere	Estimating Cloud Cover: A Simulation
14	Atmosphere	Cloud Watch
10	Hydrology	Water Walk
9	Seasons	What Can We Learn About Our Seasons?
8	Land Cover/Biology	Leaf Classification
7	Implementation Guide	Our Home Planet
7	Implementation Guide	Our Special Place
7	Hydrology	The pH Game
3-6	**Investigation Area**	**Learning Activity**
23	Atmosphere	Estimating Cloud Cover: A Simulation
22	Atmosphere	Observing, Describing and Identifying Clouds
21	Soil	Just Passing Through – Beginners
17	Land Cover/Biology	Leaf Classification
16	Atmosphere	Constructing a Model of Surface Ozone
16	Hydrology	Model Your Watershed
14	Atmosphere	Cloud Watch
13	Atmosphere	Studying the Instrument Shelter
13	Hydrology	Water Detectives
13	Hydrology	Practicing the Protocols
7-12	**Investigation Area**	**Learning Activity**
22	Atmosphere	Estimating Cloud Cover: A Simulation
20	Soil	Just Passing Through – Advanced
19	Hydrology	The pH Game
17	Atmosphere	Observing, Describing and Identifying Clouds
16	Land Cover/Biology	Leaf Classification
15	Atmosphere	Building a Thermometer
14	Atmosphere	Cloud Watch
14	Hydrology	Practicing the Protocols
14	Hydrology	Water, Water Everywhere
14	Hydrology	Macroinvertebrate Discovery

N = 48*
* A technical problem with the online survey system resulted in the loss of online responses to this question.

Overall, Atmosphere and Hydrology learning activities appeared most often in the 10 most highly rated activities. For K-2, three Atmosphere activities and two Hydrology activities were in the top 10. For grades 3-6, there were five Atmosphere and three Hydrology activities with top ratings. For grades 7-12, there were four of each. Land Cover/Biology and Soil learning activities were less popular, with only one Learning Activity for each investigation area selected for each grade-level grouping. Seasons and Implementation Guide learning activities were selected as effective only for K-2.

Partner Practices

This section reports survey results concerning current partner practices, including GLOBE training for teachers, providing posttraining support to GLOBE-trained teachers, and contact with school and district personnel.

Recruiting Practices

More than half of partners (56%) reported that recruiting teachers through direct contact with them has been most effective (Table 4.10). One-quarter (26%) reported that recruiting teachers through their professional development activities has been very effective. At the same time, more than one-fifth (22%) have not tried to recruit teachers through professional development. One-fifth of partners (20%) reported that recruiting teachers through district-level personnel has not been effective.

Table 4.10
Effectiveness of Partner Recruiting Strategies, Percent Reporting

	We haven't tried this	Not at all effective	Somewhat effective	Very effective
Teachers directly	2.7	5.5	34.2	56.2
Teachers through TPD	21.9	8.2	42.5	26.0
School-level personnel	15.1	13.7	53.4	16.4
District-level personnel	13.7	20.5	47.9	16.4
Teachers through preservice	28.8	11.0	39.7	16.4

N = 70-72*
* Range is due to variability in number of responses per item.

Recruiting Incentives

In terms of recruiting incentives, more than half of partners (53%) reported that paying for GLOBE equipment has been very effective (Table 4.11). More than one-third (37%) reported that aligning training with other local teacher professional development initiatives has been very effective. More than one-fourth (27%) reported that paying teachers for training has been very effective, but many partners (48%) have not tried this incentive.

Table 4.11
Effectiveness of Partner Recruiting Incentive Practices, Percent Reporting

	We haven't tried this	Not at all effective	Somewhat effective	Very effective
Payment for GLOBE equipment	19.2	2.7	21.9	53.4
Alignment with TPD	16.4	2.7	38.4	37.0
Payment to training participants	47.9	5.5	16.4	27.4
Participation in standards development	56.2	4.1	26.0	9.6
Requirement for teachers to participate	56.2	20.5	16.4	1.4

N = 69-71*
* Range is due to variability in number of responses per item.

Posttraining Supports

The most common type of posttraining support provided by partners to teachers was GLOBE equipment (40%; see Table 4.12). Assistance with equipment setup and use was also commonly provided (29%). One-third of partners (33%) have provided contact via phone or e-mail, but only one-fifth (20%) have made visits to schools. Fewer than one-quarter (3% to 23%) of partners provided any of the other forms of support asked about.

Table 4.12
Posttraining Support Provided by Partners, Percent Reporting

Provided GLOBE equipment	29
Provided contact via phone or email	24
Assisted with setup and equipment use	21
Provided refresher training	17
Aligned GLOBE with standards	16
Made site visits	15
Provided supplementary materials	14
Provided teacher listserv	13
Provided meetings to share experiences	11
Arranged contact with scientists	10
Provided incentives for data reporting	7
Provided computers and technology	6
Monitored data accuracy	5
Provided feedback on data contributions	5
Provided funding for administration	2
Provided funding for program activities	2

N = 29*
* A technical problem with the online survey system resulted in the loss of online responses to this question.

Contact with Schools and Districts

Partners reported that frequent contact with the schools and districts is not typical for them (Table 4.13). Partner contact with teachers was most typical: 44% reported having contact with teachers two or three times per year, and 23% reported making contact four or more times per year. More than one-third of partners typically have no contact with other school or district personnel: 36% have no contact with principals, 37% with district administrators, and 49% with technology coordinators.

Table 4.13
Frequency of Partner Contact with School and District Personnel, Percent Reporting

	No contact	Once	2-3 times per year	4 or more times per year
Teachers	5.5	12.3	43.8	23.3
District administrators	37.0	15.1	15.1	11.0
Principals	35.6	27.4	13.7	5.5
Technology coordinators	49.3	11.0	11.0	4.1

N = 57-62*
* Range is due to variability in number of responses per item.

Needs and Challenges

Partners rated information about funding sources as the most useful support the GLOBE office could provide (69%; Table 4.14). About half (49%) rated more information about how scientists use GLOBE student data as very useful. Partners tended to rate the other potential supports as somewhat useful: meetings with other partners (49%), guidance on teacher workshops and visits by GLOBE staff to partners (45% each), and guidance on teacher recruitment (43%).

Table 4.14
Usefulness to Partners of Potential Supports from GLOBE Program, Percent Reporting

	Not at all useful	Somewhat useful	Very useful
Information on funding	2.7	23.3	68.5
Information about scientists' use of data	4.1	38.4	49.3
Meetings with other partners	4.1	49.3	38.4
Guidance on teacher recruitment	16.4	42.5	32.9
Guidance on teacher workshops	16.4	45.2	28.8
Visit to partner	27.4	45.2	19.2

N = 66-69*
* Range is due to variability in number of responses per item.

More than two-thirds of partners (Table 4.15) rated three aspects of their work as major challenges: acquiring funding (74%), teachers' perceived conflicts (e.g., pressures to teach to standards and improve test scores) with implementation of GLOBE (73%), and finding resources for posttraining follow-up (70%). About half (49%) rated inadequate resources at GLOBE schools as a major challenge. Most partners indicated that the knowledge their trainers bring to their work is not a challenge to meeting goals: 75% reported their trainers have adequate science knowledge, and 73% reported they have sufficient familiarity with classrooms.

Table 4.15
Partner Challenges to Meeting Goals, Percent Reporting

	Not a challenge	Minor challenge	Major challenge
Finding funding		21.9	74.0
Teachers' perceived conflicts	1.4	17.8	72.6
Resources for follow-up	6.8	16.4	69.9
Resources at schools	6.8	37.0	49.3
Recruiting teachers	12.3	50.7	31.5
Inadequate teacher science knowledge	16.4	53.4	21.9
Teacher mobility	17.8	56.2	19.2
Determining effective follow-up	16.4	54.8	19.2
Structuring workshops	32.9	47.9	15.1
Conflict over goals	34.2	42.5	13.7
Inadequate trainer familiarity with classroom realities	72.6	19.2	
Inadequate trainer science knowledge	75.3	16.4	

N = 66-70*
* Range is due to variability in number of responses per item.

Summary of Findings

The Year 8 GLOBE partner survey provided a profile of partner practices and challenges and evidence of the changes that they have experienced as the GLOBE Program has matured. There are a number of findings that are important to consider.

Survey results indicated that although GLOBE partners are located with in several types of home institutions, many are housed within undergraduate institutions. These GLOBE partners could follow the lead of others, such as GLOBE Idaho, and take advantage of their involvement with or close proximity to preservice teachers. GLOBE

Idaho has offered GLOBE training to preservice teachers with science, elementary, and second-language specialties so that these teachers can bring GLOBE to the schools they go to after graduation. By integrating more closely with preservice programs, partners located in universities might be able to reach many more teachers with GLOBE.

The GLOBE Program has increasingly emphasized an inquiry approach to GLOBE implementation in classrooms. However, only 6% of partners stated that inquiry in science was part of their mission, and about one-quarter reported spending 1 hour or more on inquiry with GLOBE data during teacher training. Teachers are currently unprepared to use inquiry approaches so additional time on this topic during GLOBE training may be needed.

Similarly, most partners now see posttraining support for teachers as their priority, but not many have provided the kinds of support that tend to be most effective, such as visits to schools and helping teachers align GLOBE activities with curriculum content standards. Clearly, funding is one of the factors limiting visits to schools, but partners could potentially improve support for alignment of GLOBE to standards by increasing the amount of time spent on the topic during teacher training.

The learning activities that partners indicated go over particularly well with teachers during training were those of an introductory nature, such as cloud identification. This finding is surprising for the higher grades, but it is consistent with findings that partners say teachers aren't as prepared as they could be to implement GLOBE. Many lack science content knowledge, and most lack skills for using inquiry approaches. It may be that these introductory activities are more accessible to teachers than are more complex activities in investigation areas where teachers lack content knowledge.

Not surprisingly, funding is the major challenge faced by partners. The information about funding is also their choice for the most useful support the GLOBE Program could provide. These survey results suggest that there is a need for Program staff and GLOBE partners to review the alignment of partner use of their limited resources with GLOBE Program priorities.

5. Conclusions and Recommendations

This year marks the eighth full year of GLOBE implementation for schools around the world. The Program remains broad in its reach and has reached a level of stability that distinguishes it among science inquiry programs in K-12 education. Its strength and stability also make it possible for the Program to grow in depth and to face change and challenges that might threaten other programs' very existence. In this chapter, we outline some of the challenges and prospects for the Program that GLOBE's new leadership faces as it takes on responsibility for renewing the vision for the Program and managing it in the next 5-year funding cycle.

Although this report includes findings from studies conducted since the new partnership has taken responsibility for managing GLOBE, we want to remind readers that the findings cannot be attributed to their work. The responses of teachers and partners to the benefits and challenges of GLOBE investigated by our interviews and survey, moreover, reflect primarily the work of the 8 years of the Washington, D.C.-based management team and its partners. It will take some time before teachers and students experience the impact of the changes in GLOBE's management.

New and Enduring Challenges for GLOBE

As new leaders take on the task of continuing and expanding the reach and quality of GLOBE, many of the challenges they face have been present almost since the Program's inception. Preparing teachers to implement GLOBE, for example, has long been a challenge. New efforts to redesign teacher training to focus more on professional development show promise because they are closely aligned with research on how teachers learn. Ensuring that schools report data is another enduring concern. Several separate evaluation results now suggest the central importance of providing posttraining supports to ensure higher levels of data reporting. In addition, we know from earlier studies that once schools start reporting data and do so consistently, they are likely to continue doing so. Efforts to help schools get started—buying and setting up equipment for teachers, for example—tend to pay off. Finally, ensuring that students gain an opportunity to learn science concepts and develop inquiry abilities remains a problem for the Program. Efforts like the GLOBE Learning Expedition help provide incentives for schools to use GLOBE data to support student research, but research projects remain relatively rare within the Program and are not the primary focus of all partners in their training sessions.

There are also some new challenges for the new leaders, associated with a decrease in the amount of funding available for GLOBE. The UCAR-CSU collaborative must run GLOBE with 30% less funding than the Washington headquarters had annually, and without a diverse base of funding support from multiple federal agencies. GLOBE's Science PIs also have received lower funding for their work, which may make it difficult for some of them to devote as much time to the project. And GLOBE's partners continue to struggle in a broader funding environment in which grant monies and government funding are tighter because of the economic downturn and large state budget deficits.

GLOBE's UCAR-CSU leaders are well aware of these funding challenges. They are planning aggressive campaigns to increase the base of funding support for GLOBE. GLOBE's PIs remain committed to the program, in part because of the strength of the community that has developed over the past 8 years among the scientists and educators involved in the Program. Partners, for their part, remain resourceful in finding opportunities to help fund equipment and time for teachers to spend outside their classes attending training.

Long-term strategies are needed to address both funding challenges and the enduring challenges of improving the quality of teachers' opportunities to learn about the Program and students' experiences with GLOBE. We consider some opportunities that we see as evaluators, on the basis of this year's evaluation data and earlier studies of program implementation and outcomes.

Opportunities for Improving Teacher Preparation to Implement GLOBE

In the past 2 years, GLOBE has paid increasing attention to the nature and quality of teachers' opportunities to learn how to implement GLOBE. A key shift has been from a focus on *training* to a focus on *education,* with emphasis on organizing teachers' introduction to the program as a set of learning experiences organized about principles of how people learn (see National Research Council, 1999, for a summary of research on designs for teacher learning that draw on cognitive science research). This advance makes more focal to professional developers in GLOBE issues that are of central concern to teachers: how to introduce GLOBE to students, how to organize instruction around GLOBE activities, and how to develop a deeper understanding of what GLOBE is and can do for students. All too often, the focus in the past has been on an introduction to the protocols, to the exclusion of extensive discussions of classroom implementation. These changes are, from a research standpoint, important advances.

Partners have also developed some innovative approaches to pacing teachers' learning about GLOBE more effectively. They discovered early in the Program that for some teachers, a 5-day training session can be overwhelming, especially when teachers are exposed to so much new material in subject areas with which they may not be familiar. Partners have broken up training into different sessions, based on investigation area. They have also spread out the training days across the school year, enabling teachers to gain practice in implementing GLOBE between sessions. Some partners have also tried giving more attention to local issues in training and spending time helping teachers see the alignment between GLOBE activities and local standards.

A key dimension of teacher preparation is helping teachers see how GLOBE is an avenue for exploring issues of local concern to students and their communities. In the high-minority schools implementing GLOBE that we contacted, all of the teachers could name an issue they were exploring that helped to sustain their involvement in GLOBE activities with students in classrooms. In many cases, partners who provide training to teachers are also helping teachers to see or make those connections on their own, whether by providing additional curricular materials or by facilitating encounters with environmental scientists and community leaders. These partners' experiences are important guides for others and offer lessons and strategies that have broad relevance to the GLOBE community.

The GLOBE office can play a role in this effort, as well. Partners indicated on the survey this year that they would like more information about how scientists use GLOBE data. They may not communicate this aspect of GLOBE to teachers in training because they do not know enough about the work of GLOBE scientists and how student data matter to them. Informal interviews with teachers confirm the view that few teachers have opportunities to learn about how scientists in GLOBE work. Snippets or cases of GLOBE scientists' work might be valuable materials to distribute; aspects of the Teacher's Guide that address scientists' work could also be pointed out in partner training.

Partners have also indicated to us that teachers may not have mastery of the science content that is part of GLOBE. The popularity of GLOBE's materials aimed at younger students—even among high school teachers—and the paucity of data reporting for more advanced topics, such as soil, support this interpretation. Additional professional development efforts could help teachers with gaining the content knowledge they need to teach GLOBE well. Without a solid grounding in that content knowledge, it is unlikely that students' opportunities to learn the concepts and skills the Teacher's Guide says students can learn by working with the protocols and learning activities provided will be optimized.

Furthermore, GLOBE might develop additional ways for teachers with limited experience in teaching or preparation in science to dive more deeply into issues relating to leading GLOBE activities successfully. Helping students learn from GLOBE will necessarily depend on teachers' knowledge of the content of GLOBE activities, but it is also likely to depend on their pedagogical content knowledge, a topic we have discussed as part of earlier evaluations (Means et al., 2001). GLOBE already provides rich content to teachers; however, they may need to be introduced to that content in different ways, depending on their own science background and teaching experiences.

Opportunities to Assist Schools in Getting Started with Reporting Data

Earlier evaluation studies have pointed to the fact that once schools start reporting data consistently over time, they are likely to continue to do so (Means et al., 2002). Preliminary analyses of the entire data set of GLOBE schools in the United States suggest that the best predictor of whether a school will report in any given month is whether the school reported in the preceding month. The challenge is to understand more deeply what factors lead to schools' reporting in the first place!

Teachers who see value in GLOBE and believe that it will help them meet their state's standards for learning are among those who are more likely to use GLOBE effectively in their classrooms (Penuel et al., 2003). Helping teachers make connections between GLOBE activities and their state's standards may be a key factor also in helping teachers get started implementing GLOBE and reporting data. Nearly every teacher today feels some pressure to teach to these standards; as a result of the federal No Child Left Behind legislation, they will also soon be under pressure to demonstrate annual improvement of all student groups on state science tests in selected grades. Unfortunately, it is difficult for the GLOBE office to make these connections from afar for teachers; local partners are needed for this kind of work. More than documents and materials are needed, moreover; the need to coordinate with teachers' own curricula makes it difficult to provide teachers in a region with a single map showing the relationship between GLOBE activities and standards. Many GLOBE teachers have reported to us on site visits that they benefit most from having a GLOBE partner talk through the possible connections among state standards, GLOBE activities, and teachers' existing curricula.

Earlier evaluation studies have pointed to the importance of selected posttraining supports (Penuel et al., 2003; Penuel & Means, 2004). Leading those that are cited by partners as effective is helping teachers obtain and set up equipment. Given that partners have been fairly successful in finding funding to support equipment purchases, a focus on equipment set up seems to us to be an investment of energy that would yield a high return in terms of first-time data collection. For roughly one-quarter of partners, this will represent simply a continuation of current practice, but for other partners, helping teachers out in this way might be a new strategy for promoting implementation.

A third area of opportunity for encouraging first-time data reporting is to work more closely with principals. Partners tend to have very infrequent contacts with principals. Yet principals are key to ensuring the support of any innovation that goes on in a school building; they are especially important for catalyzing a *schoolwide* emphasis on a program. A school wide effort may be needed to ensure data reporting; we know that individual teachers find it hard to report on weekends and holidays. Some with broad schoolwide support report that it is much easier to report data knowing that their colleagues and other members of the school community can help. Teachers in low-implementing high-minority schools tend to lament the absence of collaboration among colleagues around GLOBE. School leaders are important catalysts for collaboration around an innovation (Means, Penuel, & Padilla, 2001); more efforts are needed to explore ways to involve them more actively in GLOBE.

Opportunities for Supporting Partners' Work in Securing Funding and Resources

Funding is the top challenge for U.S. partners. Although this fact comes as no surprise, it is especially difficult today—under current economic conditions—for partners to raise money. At present, the largest source of funds for GLOBE partners is other federal monies. Partners also receive funds from local grants, from their partner host institutions, and from state funds. A small percentage of partners rely on charges to participants and donations for their work.

Given the current sources of funds, there may be a role for the GLOBE office in helping to monitor federal grants and in encouraging more sharing of information on grant opportunities on the partner list-serv. Some sharing now takes place, but partners indicated that they were most interested in more support from the GLOBE office with finding new sources of funding. Both "push" and "pull" strategies may be needed here: pushing information just-in-time to partners about upcoming opportunities and announcements that pull partners to the GLOBE Web site, which could have more readily available information on possible funding sources for GLOBE.

We see GLOBE as at another one of its critical junctures. It must make do with less, drawing on the strength of the community of educators, students, and scientists who have been doing GLOBE for years. But it must also expand beyond the approaches to teacher preparation that have been common and that have not yielded the kind of consistent data reporting that scientists need. Efforts to redirect energies are needed for some partners in order to expand the reach of GLOBE to all students who might benefit from its powerful resources for promoting environmental science learning.

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Appendix A

GLOBE Minority Survey
Interview Script

I. Introduction

Thank you for taking the time to talk with me today. We are interested in how the GLOBE program is taught in schools that have many minority students. I'm going to ask you questions addressing your perceptions of how well GLOBE can be taught in your school to minority students.

II. Vision for GLOBE (3-5 minutes)

First I'd like to know a little about what your vision for the GLOBE program was at your school when you were first trained. I'm just looking for short responses to get a feel for your vision of GLOBE.

1. When were you trained?
2. What did you hope to do with GLOBE? (*PROMPT: goals*)

III. School Context (3-5 minutes)

Now I'd like to ask you about your school context.

1. Tell me about the kind of neighborhood in which your school in located. (*PROMPT: Interested in immediate environment*)
2. Is there interest at the school for science instruction in general?
3. What kinds of pressure to improve test scores is present at your school?

IV. GLOBE Implementation (5 minutes)

These questions ask you about how you use GLOBE in your school.

1. Is GLOBE offered at the school? If so, in what course or courses? Tell me about how much you engage in the following activities with your classes:
   a. data collection
   b. data analysis
   c. data reporting
2. Can you tell me one good story about which of the above they were most enthusiastic about?

V. Support Systems (10 minutes)

The next few questions ask you about the kinds of support you received or that you knew were available for GLOBE from particular groups of people. If you received support, please describe how much support you received and also describe the forms the support has taken. Please note any extraordinary opportunities or barriers to support that you experienced.

1. Describe the kinds of support that you received or you knew was available for GLOBE from:

	PROMPT FOR:
a. school leaders	*Computers, equipment, time, money, instructional independence, transportation*
b. the local community	*Natural resources*
c. parents	*Effect of poverty-level/affluence-level*
d. Non-profits or other orgs	*Equipment, use of space*
e. GLOBE partner	*Level of contact, form of contact*
f. Other GLOBE teachers	*Negative effect of teacher turnover, benefits of collaboration*

2. What kinds of support don't you currently receive but would find useful?
3. *If it has not yet been touched upon:* What aspects of GLOBE do you take care of all on your own?

VI. Value of GLOBE (5 minutes)

We are interested in how useful you find GLOBE to be in your science classroom.

1. Does GLOBE relate easily to your students' interests and needs? (*PROMPT: Cultural considerations; Listen for: GLOBE's underlying content and concepts and GLOBE's procedures, and whether the teacher makes such distinctions or not, and how the teacher relates these two aspects of GLOBE to the interests and needs of minority students*)
2. Which aspects of GLOBE are the most relevant to your students? The least? (*PROMPT: Local issues and considerations*)

VII. Student Engagement (5 minutes)

These questions focus on how much your students have had a chance to organize science activities as they use GLOBE in the classroom.

	PROMPT FOR:
1. Who takes the primary responsibility for the collection, analysis, and reporting activities?	*Entire class? Some people? One or two individuals?* If they say the class takes no responsibility or it's too much for them to take on, *why do you think so?*
2. How difficult do you think GLOBE concepts are for your students to understand?	*Evidence of behaviors that lead the teacher to believe that GLOBE is too hard.* Push on concepts and big ideas (not processes), such as the difference between weather and climate, process of global warming, causes of different cloud formations, the effect of water's chemical balance on life.

V. Teacher Background (3-5 minutes)

Finally, I'd like to know a little bit about your background.

1. How many years have you been teaching?
2. When were you trained in the GLOBE program?
3. How did you find out about GLOBE?
4. What is your educational background? (*PROMPTS: Do you have a degree in science? Have you received any extra science training? How did you come to science teaching?*)
5. How did you come to your current school?
6. Are you a member of any professional organizations? (*PROMPTS: NEA, NSTA*)
7. Do you hold any teacher leadership roles in your school or district, such as mentoring?

VI. Conclusion (2-3 minutes)

Thank you for taking the time to talk with me today.

1. Do you have any questions?
2. Is there anything that you would like to add?

Appendix B

OMB No. 0648-0310
Approval expires March 31, 2003

A SURVEY OF GLOBE PARTNERS

For questions regarding this survey, contact Amy Lewis at 1 (800) 682-9308

Please use a black pen; pencils or red and blue pens cannot be read by our scanners. When asked to mark boxes, make an "X" through the boxes.

First Name ☐☐☐☐☐☐☐☐☐☐

Last Name ☐☐☐☐☐☐☐☐☐☐☐☐

Name of Partnership: Partnership name (merged)

Your position/title: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Date: ☐☐ / ☐☐ / ☐☐
m m d d y y

PARTNER BACKGROUND AND PRIORITIES

1. What type of organization is your GLOBE partnership? *(Mark the **one** best answer.)*

- ☐ K-12 school
- ☐ School district
- ☐ 4-year college or university
- ☐ 2-year community college
- ☐ Museum
- ☐ Local media organization
- ☐ Local government agency
- ☐ State government agency
- ☐ Professional teacher organization
- ☐ Parent group
- ☐ Local small business
- ☐ Local affiliate of a large business
- ☐ Community-based nonprofit organization
- ☐ Faith-based organization
- ☐ Other science or science education initiative

Specify: ☐

2. What do you see as the primary mission of your GLOBE partnership?

☐

3. How important is each of the following activities to the work of your partnership?
(Mark one for each line.)

	Not at all important	Somewhat important	Very important
a. Recruiting new teachers to GLOBE	☐	☐	☐
b. Training new GLOBE teachers	☐	☐	☐
c. Providing support to teachers or schools after training	☐	☐	☐
d. Building a community of GLOBE teachers	☐	☐	☐

TARGETING AND RECRUITING PRACTICES

4. How effective have the following targeting and recruiting practices been for attracting new teachers to GLOBE in your partnership? *(Mark one for each line.)*

	Not at all effective	Somewhat effective	Very effective	We haven't tried this
a. Targeting district-level personnel (e.g., superintendents, curriculum or technology coordinators)	☐	☐	☐	☐
b. Targeting school-level personnel (e.g., principals, curriculum or technology coordinators)	☐	☐	☐	☐
c. Direct teacher contact	☐	☐	☐	☐
d. Teacher contact through professional organizations (e.g., meetings, conferences, listservs). *Please list the specific types of organizations:*	☐	☐	☐	☐
e. Targeting preservice program coordinators and staff	☐	☐	☐	☐

Please add any other recruiting practices:

5. How helpful have the following incentives and practices been to your teacher recruitment efforts? *(Mark one for each line.)*

	Not at all effective	Somewhat effective	Very effective	We haven't tried this
a. Aligning GLOBE training with state or local teacher professional development programs	☐	☐	☐	☐
b. Asking schools or districts to require teachers to participate	☐	☐	☐	☐
c. Paying training participants	☐	☐	☐	☐
d. Offering to pay or help pay for GLOBE equipment	☐	☐	☐	☐
e. Participating in efforts to develop state or local standards or assessments	☐	☐	☐	☐

GLOBE TRAINING

Questions 6-13 refer to the most recent GLOBE training you offered. The most recent training refers to the last GLOBE workshop you've given, whether in a single or in multiple sessions.

6. a. When was your most recent GLOBE training held?

Date training began: ☐☐ / ☐☐ / ☐☐ (m m / d d / y y) Date training ended: ☐☐ / ☐☐ / ☐☐ (m m / d d / y y)

b. How many participants attended the most recent GLOBE training you offered?

Number of teachers: ☐☐☐

7. a. How many trainers conducted the most recent GLOBE training you offered?

Number of trainers: ☐☐

b. If possible, note how many of these trainers were from each of the following types of institutions (the primary institution they work with). *Count each trainer only once.*

College or University Faculty		*K-12 Schools*		*OtherInstitutions (Please specify.)*	
Education department	☐☐	Elementary school	☐☐	______	☐☐
Science department	☐☐	Middle school	☐☐	______	☐☐
Other departments	☐☐	High school	☐☐	______	☐☐
		Other K-12	☐☐		

8. How long was the most recent GLOBE training you offered?

a. If the training was offered in a SINGLE session, enter the length of that session in hours below and proceed to question 9. If the training was offered in multiple sessions, go to 8b.

Number of training hours: ☐☐

b. If the training was offered in MULTIPLE sessions, enter the number of days on which training took place and the average length of each day's training in hours.

Number of training days: ☐☐ Average number of training hours per day: ☐☐

9. How much time was devoted to each of the following topics during the most recent GLOBE training you offered? *(Mark one for each line.)*

		No time	1 hour or less	1 - 3 hours	More than 3 hours
a.	Atmosphere protocols	☐	☐	☐	☐
b.	Atmosphere learning activities	☐	☐	☐	☐
c.	Hydrology protocols	☐	☐	☐	☐
d.	Hydrology learning activities	☐	☐	☐	☐
e.	Land Cover/Biology protocols	☐	☐	☐	☐
f.	Land Cover/Biology learning activities	☐	☐	☐	☐
g.	Soil protocols	☐	☐	☐	☐
h.	Soil learning activities	☐	☐	☐	☐
i.	Seasons learning activities	☐	☐	☐	☐
j.	GPS	☐	☐	☐	☐
k.	Use of GLOBE data reporting forms	☐	☐	☐	☐
l.	Use of GLOBE data visualizations	☐	☐	☐	☐
m.	Use of inquiry with GLOBE data	☐	☐	☐	☐
n.	Ways to integrate GLOBE with state standards	☐	☐	☐	☐
o.	Ways to integrate GLOBE with teachers' curricula	☐	☐	☐	☐
p.	Implementation planning	☐	☐	☐	☐
q.	Mentoring/feedback on implementation steps taken between training sessions	☐	☐	☐	☐

Please add any other important topics:

10. In your most recent training, did you identify or provide materials in any of the following ways? *(Mark all that apply.)*

☐ Orient teachers to the structure of the GLOBE Teacher's Guide (e.g., use of "grey boxes" and "looking at the data" sections to support protocols and learning activities)

☐ Review one or more sections of the GLOBE Teacher's Guide

☐ Provide tips on use of materials

☐ Provide supplementary or tailored materials (e.g., additional activities to build on a GLOBE learning activity, or a modification of a GLOBE learning activity)

11 a. In your most recent training, did you include time helping teachers to integrate GLOBE into the curriculum, as opposed to doing GLOBE as a stand-alone activity?

☐ Yes ☐ No ***(Skip to Question 12)***

b. If yes, did you use any of the following instructional approaches to support the goal of curriculum integration? *(Mark all that apply.)*

☐	Discuss alignment of GLOBE with state standards
☐	Provide a mapping of GLOBE to state standards
☐	Engage teachers in mapping GLOBE activities to state standards
☐	Review the matrices mapping GLOBE to national and other standards provided on the GLOBE Web site
☐	Present information on ways to integrate GLOBE with teachers' own curriculum or classroom activities
☐	Engage teachers in discussing how they might integrate GLOBE with their own curriculum or classroom activities
☐	Present tips on ways to tailor GLOBE to the local environment/students' needs (e.g., use GLOBE activities to familiarize students with local environmental features)
☐	Engage teachers in tailoring GLOBE to their local environment/students' needs
☐	Demonstrate the links between data analysis activities and the mathematics curriculum
☐	Discuss how data sets (GLOBE or other) can be used to illustrate mathematical concepts
☐	Discuss the scientific significance of students' data collection activities

12. a. In your most recent training, did you spend time on ways to promote student inquiry within GLOBE activities?

☐ Yes ☐ No ***(Skip to Question 13)***

b. If yes, did you use any of the following instructional approaches to support the goal of student inquiry? *(Mark all that apply.)*

☐	Formulating scientific questions
☐	Making predictions about data they are collecting
☐	Monitoring the accuracy of their data collection activities
☐	Finding trends and patterns in data
☐	Interpreting data
☐	Developing presentations of their findings

12. b. ***(Continued.)*** **If yes, did you use any of the following instructional approaches to support the goal of student inquiry?** *(Mark all that apply.)*

- ☐ Review the inquiry section in the GLOBE Implementation Guide available online
- ☐ Show teachers how to introduce GLOBE according to their students' knowledge and experience (i.e., using the beginner, intermediate, advanced sequencing provided in the Teacher's Guide)
- ☐ Review the GLOBE Inquiry CD-ROM
- ☐ Discuss how data from protocols can be used to support student inquiry
- ☐ Discuss how to help students use data as a source of knowledge about a local issue
- ☐ Offer examples of successful student inquiry projects that teachers might consider adopting or adapting
- ☐ Engage teachers in an inquiry activity within the training that goes through all the steps (develop a hypothesis, plan the investigation, collect and analyze data)
- ☐ Model specific steps of the inquiry process during the training

13. How would you characterize the prior experience of teachers who attended the training? *(Mark one for each line.)*

	Don't know	Inexperienced	Somewhat inexperienced	Very experienced
a. Experience with rigorous data collection	☐	☐	☐	☐
b. Experience with hands-on environmental science	☐	☐	☐	☐
c. Experience with student inquiry	☐	☐	☐	☐
d. Experience with using technology in the classroom	☐	☐	☐	☐
e. Science content knowledge	☐	☐	☐	☐

14. What feedback about the materials in the GLOBE Teacher's Guide have teachers given you that would be valuable in improving the Guide's effectiveness?

15. a. Which of GLOBE's learning activities go over particularly well with teachers of grades K-2? That is, which activities go smoothly for these teachers and are appropriate for their students?

Implementation Guide	***Soil (continued)***
☐ Our Home Planet	☐ Just Passing Through - Advanced
☐ Our Special Place	☐ From Mud Pies to Bricks
Atmosphere	☐ Soil and My Backyard
☐ Observing, Describing and Identifying Clouds	☐ A Field View of Soil - Digging Around
☐ Estimating Cloud Cover: A Simulation	☐ Soil as Sponges: How Much Water Does Soil Hold?
☐ Observing Visibility and Sky Color	☐ Soil: The Great Decomposer
☐ Making a Sundial	☐ Making Sense of the Particle Size Distribution Measurements
☐ Calculating Relative Air Mass	☐ The Data Game
☐ Studying the Instrument Shelter	***Land Cover/Biology***
☐ Building a Thermometer	☐ Leaf Classification
☐ Land, Water, and Air	☐ How Accurate is it? Introducing the Difference/Error Matrix
☐ Cloud Watch	☐ What's the Difference?
☐ Constructing a Model of Surface Ozone	☐ Odyssey of the Eyes
☐ Making a Contour Map	☐ Some Like It Hot!
☐ Draw Your Own Visualization	☐ Discovery Area
☐ Learning to Use Visualizations	☐ Site Seeing
Hydrology	☐ Seasonal Changes in Your Biology Study Sites
☐ Water Walk	***GPS***
☐ Model Your Watershed	☐ What is the Right Answer?
☐ Water Detectives	☐ Relative and Absolute Directions
☐ The pH Game	☐ Working with Angles
☐ Practicing the Protocols	☐ Celestial Navigation
☐ Water, Water Everywhere	***Seasons***
☐ Macroinvertebrate Discovery	☐ What Can We Learn About Our Seasons?
☐ Modeling Your Water Balance	☐ What Are Some Factors That Affect Our Seasons?
Soil	☐ How Do Seasonal Temperature Patterns Vary Among Different Regions of the World?
☐ Just Passing Through - Beginners	☐ What Can We Learn by Sharing Local Seasonal Markers with Other Schools Around the World?

15. b. Which of GLOBE's learning activities go over particularly well with teachers of grades 3-6? That is, which activities go smoothly for these teachers and are appropriate for their students?

Implementation Guide	***Soil (continued)***
☐ Our Home Planet	☐ Just Passing Through - Advanced
☐ Our Special Place	☐ From Mud Pies to Bricks
Atmosphere	☐ Soil and My Backyard
☐ Observing, Describing and Identifying Clouds	☐ A Field View of Soil - Digging Around
☐ Estimating Cloud Cover: A Simulation	☐ Soil as Sponges: How Much Water Does Soil Hold?
☐ Observing Visibility and Sky Color	☐ Soil: The Great Decomposer
☐ Making a Sundial	☐ Making Sense of the Particle Size Distribution Measurements
☐ Calculating Relative Air Mass	☐ The Data Game
☐ Studying the Instrument Shelter	***Land Cover/Biology***
☐ Building a Thermometer	☐ Leaf Classification
☐ Land, Water, and Air	☐ How Accurate is it? Introducing the Difference/Error Matrix
☐ Cloud Watch	☐ What's the Difference?
☐ Constructing a Model of Surface Ozone	☐ Odyssey of the Eyes
☐ Making a Contour Map	☐ Some Like It Hot!
☐ Draw Your Own Visualization	☐ Discovery Area
☐ Learning to Use Visualizations	☐ Site Seeing
Hydrology	☐ Seasonal Changes in Your Biology Study Sites
☐ Water Walk	***GPS***
☐ Model Your Watershed	☐ What is the Right Answer?
☐ Water Detectives	☐ Relative and Absolute Directions
☐ The pH Game	☐ Working with Angles
☐ Practicing the Protocols	☐ Celestial Navigation
☐ Water, Water Everywhere	***Seasons***
☐ Macroinvertebrate Discovery	☐ What Can We Learn About Our Seasons?
☐ Modeling Your Water Balance	☐ What Are Some Factors That Affect Our Seasons?
Soil	☐ How Do Seasonal Temperature Patterns Vary Among Different Regions of the World?
☐ Just Passing Through - Beginners	☐ What Can We Learn by Sharing Local Seasonal Markers with Other Schools Around the World?

15. c. Which of GLOBE's learning activities go over particularly well with teachers of grades 7-12? That is, which activities go smoothly for these teachers and are appropriate for their students?

Implementation Guide	***Soil (continued)***
☐ Our Home Planet	☐ Just Passing Through - Advanced
☐ Our Special Place	☐ From Mud Pies to Bricks
Atmosphere	☐ Soil and My Backyard
☐ Observing, Describing and Identifying Clouds	☐ A Field View of Soil - Digging Around
☐ Estimating Cloud Cover: A Simulation	☐ Soil as Sponges: How Much Water Does Soil Hold?
☐ Observing Visibility and Sky Color	☐ Soil: The Great Decomposer
☐ Making a Sundial	☐ Making Sense of the Particle Size Distribution Measurements
☐ Calculating Relative Air Mass	☐ The Data Game
☐ Studying the Instrument Shelter	***Land Cover/Biology***
☐ Building a Thermometer	☐ Leaf Classification
☐ Land, Water, and Air	☐ How Accurate is it? Introducing the Difference/Error Matrix
☐ Cloud Watch	☐ What's the Difference?
☐ Constructing a Model of Surface Ozone	☐ Odyssey of the Eyes
☐ Making a Contour Map	☐ Some Like It Hot!
☐ Draw Your Own Visualization	☐ Discovery Area
☐ Learning to Use Visualizations	☐ Site Seeing
Hydrology	☐ Seasonal Changes in Your Biology Study Sites
☐ Water Walk	***GPS***
☐ Model Your Watershed	☐ What is the Right Answer?
☐ Water Detectives	☐ Relative and Absolute Directions
☐ The pH Game	☐ Working with Angles
☐ Practicing the Protocols	☐ Celestial Navigation
☐ Water, Water Everywhere	***Seasons***
☐ Macroinvertebrate Discovery	☐ What Can We Learn About Our Seasons?
☐ Modeling Your Water Balance	☐ What Are Some Factors That Affect Our Seasons?
Soil	☐ How Do Seasonal Temperature Patterns Vary Among Different Regions of the World?
☐ Just Passing Through - Beginners	☐ What Can We Learn by Sharing Local Seasonal Markers with Other Schools Around the World?

16. Which of these supports has your GLOBE partnership provided for those who have completed your GLOBE training? *(Mark all that apply.)*

☐ GLOBE equipment	☐ Refresher training sessions
☐ Computers and technology (e.g., Internet connection)	☐ Meetings, conferences to share GLOBE experiences
☐ Monitoring the accuracy of their data collection	☐ Teacher listserv
☐ Assistance on technical setup and equipment use	☐ Supplemental materials (e.g., implementation tips, additional learning activities)
☐ Funding for administration and overhead	☐ Alignment of GLOBE activities with state or local curriculum or accountability requirements
☐ Funding for programmatic activities	☐ Site visits by partnership staff or mentor teachers
☐ Incentives in return for reporting certain types or amounts of data	☐ Personal contact with partnership staff or mentor teachers through phone or e-mail
☐ Monitoring and feedback on data reporting contributions	☐ Contacts with scientists

Please add any other supports provided:

17. Please tell us about any creative support strategies you've used that might be of value to other partners:

18. How often do you typically have contact with the following personnel for the GLOBE schools within your jurisdiction? *(Mark one for each line.)*

		No contact	Once	1 - 3 times per year	More than 4 times per year
a.	Teachers	☐	☐	☐	☐
b.	Principal	☐	☐	☐	☐
c.	Technology Coordinator	☐	☐	☐	☐
d.	District Administrator	☐	☐	☐	☐

PERSPECTIVES

19. How useful would each of the following supports be to your partnership, if the GLOBE office were to provide them? *(Mark one for each line.)*

	Not at all useful	Somewhat useful	Very useful
a. Making a visit to your partnership	☐	☐	☐
b. Facilitating meetings with other partners	☐	☐	☐
c. Providing information on where and how to find funding for your partnership	☐	☐	☐
d. Providing guidance on ways to structure workshops for teachers	☐	☐	☐
e. Providing guidance on recruiting new teachers	☐	☐	☐
f. Providing more information about how scientists use student GLOBE data in their own research	☐	☐	☐

20. How much of a challenge is each of the following to your partnership's ability to meet its goals? *(Mark one for each line.)*

	Not a challenge	Minor challenge	Major challenge
a. Conflict over goals (e.g., training versus follow-up)	☐	☐	☐
b. Finding funding	☐	☐	☐
c. Recruiting teachers	☐	☐	☐
d. Finding productive ways to structure workshops for teachers	☐	☐	☐
e. Knowing what kinds of follow-up are most effective	☐	☐	☐
f. Having enough personnel or time to carry out follow-up support activities	☐	☐	☐
g. Inadequate resources at GLOBE schools (e.g., Internet access, funds for equipment	☐	☐	☐
h. Teachers' perceived conflicts with pressures to teach to standards and improve test scores	☐	☐	☐
i. Inadequate teachers' science knowledge	☐	☐	☐
j. Inadequate trainers' science knowledge	☐	☐	☐
k. Inadequate trainers' knowledge of classroom contexts	☐	☐	☐
l. Teacher mobility/change of assignment	☐	☐	☐

21. **What are your primary sources of funding for GLOBE, including general operating expenses and GLOBE workshops?**

22. **Please tell us about any creative strategies you've used to increase capacity (e.g., partnerships with other organizations, useful sources of funding, etc.):**

23. **What benefits do you see in participating in the GLOBE program as a partner?**

Thank you very much for your help in completing this survey.

If you have any further comments, you may use the space below. In particular, we are interested in learning about the challenges you face and the approaches you've used that may serve as useful models for other partnerships.

Please use the enclosed business reply envelope to return the survey to the address below:

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Menlo Park, CA 94025