

# Structuring Group Learning within a Web-based Science Inquiry Program

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## ABSTRACT

With an increased emphasis on inquiry in science education nationwide, we examined trends in the ways science teachers organized students into groups to implement one prominent one Web-based science inquiry program, Global Learning and Observations to Benefit the Environment (GLOBE). Our study focused on survey and case study data that SRI International collected as part of its ongoing evaluation of GLOBE (Means et al., 2001). We hypothesized: (1) teachers who are active in implementing an inquiry-based science program more frequently employ collaboration for cognitively complex activities than teachers who are less active implementers; (2) active teachers use collaboration more over time; and, (3) active GLOBE teachers who organize learning by collaborative groups perceive greater learning benefits than active teachers who rarely used collaboration. Our study confirmed that active teachers of an inquiry-based science program use collaboration more over time, but they are no more likely than less active teachers to see collaboration as beneficial to student learning. We also found that active teachers were likely to use collaborative small groups primarily to support data collection and reporting tasks to make them fit better into the classroom schedule than for data analysis and interpretation.

## Keywords

collaboration, science inquiry, classroom culture

## INTRODUCTION

The emphasis on scientific inquiry standards (AAAS, 1993; NRC, 1996, 2000) has led more teachers to incorporate collaborative projects and investigations into classroom practice. Two decades of cognitive research cite many benefits of collaboration on student learning, especially in science (Dansereau, 1988; Forman & Larreamendy-Joerns, 1995; Jeong & Chi, 1997; NRC, 1999). In this study, we wanted to examine teachers' reasons and actual practices for using student collaboration to teach one prominent inquiry science program, Global Learning and Observations to Benefit the Environment (GLOBE). GLOBE is a seven-year-old international science and education program that involves elementary and secondary students in 9,658 schools in 95 countries. Backed by NOAA, NASA, NSF, the Environmental Protection Agency and the Departments of Education and State, GLOBE attempts to improve science achievement and environmental awareness by having K-12 students collect data about atmosphere, water, soil, and land cover, report those data regularly to a central Web site, and analyze those data via Web-based visualization tools. More than 10,000 teachers have been trained in GLOBE since its beginning, and there are 5.7 million pieces of student data reported. We hypothesized active U.S. GLOBE teachers probably used collaboration more often for more cognitively complex types of GLOBE activities than less active teachers -- a random sample of U.S. teachers who had been trained in GLOBE but who were reporting less data to the GLOBE Web site. We also hypothesized that active GLOBE teachers would use collaboration more over time, and that they held more positive perceptions of the pedagogical benefits of group work than less active GLOBE teachers.

## METHODOLOGY

We analyzed data collected from 390 active U.S. teachers and 131 active international teachers who were selected because their classes regularly submitted data to the GLOBE Web site from December 1999-February 2000. We also analyzed data from a random sample of 512 teachers trained in the United States between June 1998 and August 1999, and who generally chose not to implement GLOBE or who reported less data. We also used case study data featuring interviews and observations collected during site visits to five GLOBE sites across the United States. To test our hypotheses, we aggregated data from our GLOBE Year 5 evaluation (Means et al., 2000) that compared how frequently active teachers and less active teachers organized students into six possible social configurations (single student, small group, multiple small groups, whole class, adult, no one) to engage in five different categories of GLOBE activity (data collection, data entry, data exploration on Web, data analysis, learning activities). To check for changes in use of collaboration over time, we compared two years' of teacher surveys. To compare perceptions of learning benefits, we divided perception data into two groups at active GLOBE teachers: frequent and infrequent group users.

## RESULTS

The results showed that active GLOBE teachers used collaboration more than less active teachers for the procedural tasks of data collection, data entry, and exploring data on the Web site. Active GLOBE teachers did not differ from less-active GLOBE teachers in their use of small groups to support more cognitively complex tasks such as student-led discussions of

GLOBE data, preferring to a whole class, teacher-led discussion. In our case studies of active GLOBE schools, we did observe teachers engaging students in collaborative inquiry into data discussion, but we also observed group work being used as a way to manage data collection activities. At the same time, active GLOBE teachers organized students into groups more in 1999-2000 than they did in 1997-98. Active GLOBE teachers' use of small groups for data entry increased 12 percent. More than 90 percent of active GLOBE teachers and 82 percent of less active GLOBE teachers perceived similar benefits to collaboration, both for improving group skills and data understanding.

## CONCLUSION

Our findings raise questions about why collaboration is used primarily for aspects of science inquiry related to data collection and reporting rather than data analysis and interpretation in active GLOBE classrooms. The study shows that teachers believe students can effectively learn about data collection while working in groups, yet they have not used student groups more for the tasks of discussing, analyzing, and interpreting data. It may be this finding is partly a result of our selection procedure, which focused on teachers' frequency of data reporting. It may be that a high proportion of teachers who report the most GLOBE data may be more focused on classroom management than engaging students in group inquiry. It may be that most teachers are overwhelmed by the complexity of GLOBE's collection procedures or lack materials to scaffold other phases of student-led inquiry. GLOBE has addressed this problem by adding an inquiry element to its professional development programs. An alternate explanation is that teachers and students may perceive that data collection is a cognitively complex task, and one that is critical to helping students understand scientific practice. For example, group-using active teachers had more confidence in students' data collection abilities than non-group using teachers. Finally, it may also be that in the GLOBE program, the small collaborative group is becoming what Saxe (1991) would call a hybrid form, one that merges the practices and goals of science culture into the classroom culture. The study suggests that teachers need special support to engage student groups in more complex tasks of data analysis and interpretation.

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