

Challenges in Using GLOBE for Student Inquiry in Thailand

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When GLOBE was first introduced to Thailand its uniqueness as real science, study Earth as a System science, using the natural world as the laboratory for science learning, gathering important data for the global science community and inspiring the next generation of citizen scientists were recognized by most concerned scientists and scholars. Thailand has tried very hard to implement this distinguished program in the schools all over Thailand. The teachers were very excited to join the program but the students learning in GLOBE still fall short of GLOBE original inquiry concept. The students learn just only how to do some protocols, to collect data and to send data to be accumulated in the GLOBE data archive. All the challenges were analyzed and figured out. It was found that the schools have faced many challenges, such as time pressure, finding place for GLOBE in existing curriculum, testing demands, equipment and administrator support. After the follow up meetings with teachers and administrators of all GLOBE schools, there are some hopes that those challenges can be overcome by the understanding of administrators and enthusiasm of the teachers on the apparent value of GLOBE that meet the National Science Education Standard requirements. The biggest challenges are some myths and misconceptions about the essential inherent features of the GLOBE scientific inquiry of the teachers. To be able to use GLOBE to promote original inquiry of the students to do science, to learn about the nature of science and to learn science of the natural world as Earth as a System Science, the teachers must be facilitated to acquire those abilities themselves. The Thai teachers are familiar with the highly structured inquiry, guiding toward known outcome for a long time. They get used to direct the students science projects that focus on the experimental

design, carry on in the laboratory, controlling all control variables to see the relationship of only predetermined independent variable and dependent variable to prove known facts. GLOBE investigations are free-ranging exploration of unexplained phenomena and uncertainty. GLOBE view science as conceptual structure of nature that were revised as the result of new evidences. GLOBE need open-ended inquiries that allows students to discover the relationships they do not already know which are essential to science as a way of thinking and an attitude of mind. GLOBE provides hands-on, minds-on opportunities for the students to develop higher order of thinking of application and synthesis that will be their stock in trade. The ultimate contribution of GLOBE rational inquiry is the value underlie science, the Spirit of Science, defined as longing to know and to understand, questioning of all things, search for data and their meaning, demand for verification, respect for logic, consideration of premises, and consideration of consequences. These are the characteristic of scientists, of a person who think, a rational person. In the most open approach of GLOBE, students could confront phenomena without textbook or laboratory based questions. They could intrinsically ask questions, gather evidence and propose scientific explanation based on their own investigations. They could understand science value in GLOBE measurements, accuracy, consistency, persistent and coverage of the evidence data.

Evolved over time, several efforts were undertaken to vitalize GLOBE program in schools up to its highest value. Exemplary cases of success has been rare however. Student inquiry with GLOBE is not yet widespread. Many teachers are just beginning to explore the possibilities and to grapple with the challenges of using this approach in the classroom. What are the challenges to students inquiry with GLOBE? GLOBE teacher is the most fragile and most precious element of GLOBE structure. Inquiry is often new to teachers. Teachers had hoped to conduct inquiry with GLOBE but had not succeeded in releasing themselves from highly structured inquiry that guide the students to proceed toward known outcome. Teachers were enthusiastic about inquiry approach but directed science learning as “ready made science” rather than as “science in the making”. Teachers did not

realized that learning environments that concentrate on conveying to students what scientists already know do not promote inquiry. Inquiry is often new to students. Students have little experience asking questions and designing research to answer them in ways that are appropriate to scientific investigation, to learn, to work productively in teams as they conduct their research.

Successful at facilitating meaningful student inquiry with GLOBE depend on believing of teachers that students who use inquiry to learn science engage in many of the same activities and thinking process as scientists who are seeking to expand human knowledge. The teachers need to have the driving goal of getting students to think critically and creatively, providing students with hands-on and minds-on experiences, more opportunities to pursue their own questions and more focus on understanding larger scientific concepts rather than disconnected facts, moving away from the traditional approach by encouraging students to participate in the evaluation of scientific knowledge, What count?, What pattern exist in the data?, What explanations account for the patterns. Is one explanation better than another?...

What could be done to help the teachers to remove several myths that misrepresent GLOBE rational inquiry? What could be done to engage the schools in promoting GLOBE rational inquiry of the students? What could be done to intrinsically motivate the schools to be proud of accomplishing as part of their commitment to partake in the program? What could be done to encourage the schools to overlook the implementation challenges and to encourage them to do everything possible in the interest of GLOBE? Using GLOBE as student rational inquiry seems highly dependent on the initiative of highly motivated and skill teachers and supportive situations such as standard that map well to GLOBE topics, curricular freedom to try out new approach in the classroom. Teacher's GLOBE scientific knowledge, science education background, understanding of GLOBE philosophy, ability to reflect GLOBE incorporate, adapt, and integrate into existing curriculum, taking responsibility of their own professional development in the use of GLOBE program must be nurtured. Teacher mentoring programs may help to shape teachers pedagogical knowledge with

respect to the implementation of GLOBE rational inquiry approach in their particular schools. Learning from successful examples of student inquiry, and implementation strategies would be helpful. Resources for compelling locally relevant inquiry projects for different types of local environment would be extremely useful.

GLOBE Learning Communities (GLC) has been recognized as the powerful GLOBE rational inquiry implementation strategy since the first start. Two active GLOBE schools in Thailand have worked with NASA soil scientists, university scientist, local NGO scientists and IPST GLOBE team in using automated data logger to collect data on soil moisture, soil temperature and air temperature to join the research on GAPS- General Purpose Simulation Model of the Atmosphere-Plant-Soil System as on going student-scientist collaboration research. The other on going and future student-scientist collaboration researches with local university scientists, local NGO scientists, local government agency scientists, local scientists of Royal Development Projects regarding Environment, local people, farmers who own local wisdom of local natural **resources** and environmental problems will be encouraged. Doing science by actual practice in natural setting of the local environment with those **scientists** will enable the students and teachers to use rational inquiry to do science, to think critically and evaluatively, to understand how scientist produce science and to be confident that they can produce science themselves, and best of all, to develop spirit of science. Broad expertise, resources and experiences of the GLC will be pooled and focus on a common commitment to support GLOBE rational inquiry. The students and teachers will be able to identify and learn about their local environmental problems with their scientific thinking by themselves and be able to make some contributions concerning the environment to their own communities.

The major issues concerning the misconceptions of rational inquiry, lack of understanding of GLOBE philosophy of the teachers could be solved by providing essential resources, successful example of GLOBE rational inquiry, arranging GLOBE teachers forum, GLOBE teachers mentoring workshop, GLC workshop, GLOBE students-teachers-scientists collaboration researches, GLOBE student conference

to empower the teachers to understand, to think critically and evaluatively on the philosophy behind learner-centered teaching on the environment. It is the must for the teachers to understand “Environment”, “Environmental science”, “Nature”, “Earth as a System”, “Nature of Science”, “Scientific Inquiry”, “Scientific Thinking”, “Learner-Centered”, “Local Wisdom”, “Learning Community” and “Natural Science Education Standard” which underlie the philosophy of GLOBE rational inquiry and learner-centered teaching on the environment. The actual practices to acquire real understanding of those concepts by the teachers themselves must be focused.

Believing that scientific behaviors of the teachers to be able to conduct GLOBE rational inquiry effectively can be nurtured and facilitated before they come to be the efficient in-service teachers by the pre-service education. Those concepts underlie GLOBE philosophy mentioned above will be conveyed to the student teachers through the dissemination of innovation materials, examples of specific pilot / demonstration, successful case studies. Above all approaches, the actual practice suited to local context is the must. At the first stage, this GLOBE pre-service implementation strategy needed to be concentrated on the same GLOBE partner universities for the reason that to strengthen the capacity of training of the nucleus group in the same university who can share experiences closely and easily to save sharing the resources and times.

Selected efficient, inquiry based informal education and non-formal education services to provide learners to learn by themselves according to their interests, potential, readiness and the opportunity available from individual society, environment, media or other sources are considered as valuable and appropriate additional GLOBE rational inquiry implementation strategy.

Establishing professional development network for environmental educators and facilitators to explore innovative GLOBE implementation strategies is worthwhile as well.

With the highest hope of inspiring the next generation of citizen - scientists of the Institute for the Promotion of Teaching Science and

Technology (IPST) as GLOBE Thailand country coordinating and implementing agency with the cooperation of concerned GLC cooperating agencies will take her honored responsibility to do her best to carefully and effectively address all the challenges and search for the innovative GLOBE rational inquiry implementation strategies to help achieving this valuable goal of the country.