GOALS

1. Enhance K-12 teacher agency in use of Project-Based Learning (PBL)
2. Enhance K-12 teacher agency in conducting GLOBE observations and projects
3. Increase understanding of the connection between nutrient runoff and HABs
4. Increase student confidence in conducting science and stewardship projects
5. Assess NOAA B-Wet project efficacy utilizing the IRB-approved GLOBE Mission EARTH (GME) evaluation plan and NOAA B-WET national evaluation

#### Project Outcomes and Evaluation

For this project, evaluation is being performed by University of Toledo personnel under IRB #301107. Using tools adapted or developed for the GME program at its inception nine (9) years ago, data is collected from both teachers and students using several instruments. After we receive IRB approval, we collect both qualitative and quantitative data from the teachers. Teachers are asked to complete a pre (formerly the teacher needs assessment)- and post-program survey as well as a post-program interview. Student data is mostly quantitative. They are asked to complete a pre- and post-program survey focused on their attitudes toward science and the GLOBE and NOAA resources used in their classroom. The student science attitudes survey was adapted from the Test of Science Related Attitudes (TOSRA2).

In June, prior to participating in the professional learning experience at Earth Heart Farms, teachers were asked to complete a pre-program survey. Six (6) teachers from five (5) schools completed the pre-program questionnaire before the professional learning experience. Most (5 of 6) taught elementary grades (K – 5) and had 10 or more years of teaching experience. Four (4 of 6) had no prior experience in STEM before becoming a teacher.

Most teachers (4 of 6) who completed the pre-program questionnaire had little experience with GLOBE Mission Earth. The data revealed that:

* Two (2 of 6) had used GLOBE or NASA resources before joining the GME program.
* These teachers were most likely to use hands-on science activities or teacher-led inquiry-based activities.

Most (5 of 6) teachers had experience using digital tools, including google earth, ArcGIS, and Labquest. Most (5 of 6) teachers also had access to scientific instruments, although one wrote, “I do not know what instruments we have and I do not have experience using them.”

GLOBE protocols teachers were most likely to use were:

* Atmosphere
* Clouds
* Temperature (air, surface, water, soil)
* Precipitation
* Conductivity

Teachers reported their students had their own computers to use at school. Most teachers who completed the pre-program planned on involving students in the following activities during the upcoming school year:

* Data collection (using GLOBE protocols)
* Science journals
* Student-led projects and/or activities
* Lab assignments/reports
* Teacher-led projects and/or activities
* Outdoor experimental activities

Most (5 of 6) teachers who completed the pre-program questionnaire believed they needed dedicated learning materials and specific protocols to incorporate more hands-on and outdoor experiences into their curriculum. Teachers believed the professional learning experience that would benefit them most was analyzing and visualizing data.

Before implementing the GLOBE protocols in their classrooms, teachers send home an information form to parents. This information form explains our research project and their child’s participation options. About a week after the parent information form goes home, teachers ask their students to complete the pre-program student attitude survey. At this time, 398 students in grades 4 – 8 and 76 students in grades 9 – 12 have accessed this survey. This data will be calculated and compared to the post-program student attitude survey later in the school year.

Teachers

Tools for teacher evaluation were carefully chosen and revised in a year-long process (see the table below). The pre-program survey (formerly called the needs assessment) informs GME on the following: number of years teaching, participation in PD, standard practice of teaching, and willingness to do field work with their students. The formative assessment questions, used over ten years by the University of Toledo, are completed at the end of each PD session. The program teams use the feedback provided to make adjustments in the PD sessions, to an extent that is practically possible. The PD survey assesses how well the program met the needs of the teacher.

Time table listing the evaluation components for 2023-2024 teachers

| **Evaluation tool** | **2023** | **2024** | **2025** |
| --- | --- | --- | --- |
| **Quarter** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** |
| Teacher needs assessment (before PD), name changed to pre-program survey to minimize teacher confusion as to the purpose of the tool |  | ✓ |  |  | ✓ |  |  |  |
| Spatial skills assessment (pre, post)\* |  | ✓ |  |  |  |  |  |  |
| Formative assessment questions (during PD) |  | ✓ |  |  | ✓ |  |  |  |
| Post PD Survey (after PD) |  | ✓ |  |  | ✓ |  |  |  |
| Post implementation PD survey (after the end of the intervention) (currently ongoing) |  |  |  |  | ✓ |  |  |  |
| Teacher interviews (at the end of the school year)  |  |  |  |  | ✓ |  |  |  |

\*Note that in 2024, we discontinued the use of the spatial skills assessment.

The spatial skills assessment, developed by the Association of American Geographers (Lee and Bednarz 2012), measures the growth of the teacher in this area. At the end of the school year (end of May/beginning of June), teachers are asked to participate in a post-implementation verbal interview. The interview is conducted by a GME staff member not directly involved with the teachers during the school year, to maintain an openness with the teachers’ answers. The questions in the interview ask teachers to provide details of their successes, struggles and suggestions for improvement. This information is then used to improve our program and will be reported in the annual report.

Students

The tools used to assess what is being done in the classroom and its impacts it is having on the students are listed in the table below. As stated earlier, the spatial abilities test is the same for teacher and student. The science attitudes survey was adapted from the Test of Science Related Attitudes (TOSRA2). The TOSRA2 contains 41 items that the students rate on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree). The TOSRA2 comprises the following eight, previously validated, sub scales: (1) Social Implications of Science, (2) Normality of Scientists, (3) Attitude toward Scientific Inquiry, (4) Adoption of Scientific Attitudes, (5) Enjoyment of Science Lessons, (6) Leisure Interest in Science, (7) Careers in Science, (8) Supplemental Items. Pre-tests are taken near the beginning of the school year before the students start working on NOAA and GLOBE. The post-tests are taken after they have completed their projects at the end of the school year.

Time table listing the evaluation components for 2023-2024 students

| **Evaluation tool** | **2023** | **2024** | **2025** |
| --- | --- | --- | --- |
| **Quarter** | **2** | **3** | **4** | **1** | **2** | **3** | **4** | **1** |
| Student spatial skills (pre and post)\* |  |  | ✓ |  |  |  |  |  |
| Student science Attitudes (pre and post) |  |  | ✓ |  | ✓ |  |  |  |
| Students uploading data to GLOBE |  |  | ✓ | ✓ | ✓ |  |  |  |
| Students work on projects |  |  | ✓ | ✓ | ✓ |  |  |  |
| *Deliverable: Students present projects at the GLOBE Mission EARTH SATELLITES Conference, GLOBE Midwest Student Research Symposium, GLOBE International Virtual Science Symposium (IVSS) and the GLOBE Annual Meeting* |  |  |  | ✓ | ✓ | ✓ |  |  |

\*Note that in 2024, we discontinued the use of the spatial skills assessment.