

On-line E-portfolios in Higher Education -A Multidisciplinary

Approach

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Abstract:

The Science Teaching for Ohio's New Economy (STONE) and Partners in Earth System Science (PIES) professional development programs are long term, collaborative experiences for in-service k-12 teachers. The summer and academic year components of both programs are designed to increase the integrated science content, pedagogical knowledge and technological abilities of teams of K-12 teachers in high need Ohio school districts. Teachers selected for participation are from schools serving a population of students who are approximately 63% economically disadvantaged. Each of the programs are composed of three distinct phases. These are Phase I Summer field and lab experiences, Phase II on-line internet experiences where the E-portfolios are developed and implemented and Phase III academic year web conferences to continue the development of the E-portfolios, assess

students learning gains in content and discuss future plans. The participating teachers serve as catalysts and mentors to other teachers in their schools and districts, driving curriculum change within their school buildings and school districts. The development of E-portfolios are a critical element of both the STONE and PIES programs. During the academic year, Participants of both the STONE and PIES programs meet in an online setting to develop and share classroom activities, strategies to assess student learning in inquiry-based activities and share plans to continue their activities in the future.

Keywords: Inquiry-based experiences, professional development workshops, e-portfolios and Next Generation Science Standards (NGSS)

Introduction:

The Partners In Integrated Earth Systems Science (PIES) and Science Teaching for Ohio's New Economy (STONE) professional development programs have been funded through the Ohio Board of Regents and Ohio Department of Higher Education Improving Teacher Quality professional development program for the past 10 years. PIES and STONE were developed using educational research e.g. Collias, Pajak and Rigden, (2000), Rivers & Sanders, (2002) and Darling-Hammond & Branford (2005). Teacher quality is a critical factor in student learning. This factor has a greater impact than other classroom variables such as the previous academic achievement level of students, class size or the ethnic and socioeconomic makeup of the classroom (Wright, Horn, & Sanders, 1997). For a generation or more there has been a consensus about what constitutes high-quality teacher professional development. Components of effective professional development discussed in Darling-Hammond (2009) are that teacher professional development should be sustained and intensive, collaborative, connected to their practice and focused on the teaching and learning of specific academic content. The structure of both STONE and PIES are aligned with these findings. During Phase I, these programs have a summer field trip and lab experience during the summer. In the beginning of the k-12 academic year Phase II, there is an on-line internet collaboration where the E-portfolios are the platform used by participants to describe their individual classroom settings, share inquiry based activities they develop and discuss strategies for the assessment of student work. Phase III continued the development of E-portfolios, connecting participants online to assess

students learning gains in content to meet the state and national standards (NGSS).

Physical science concepts such as water and air quality are critical factors that contribute to environmental quality. Therefore, one of the key elements of both Project PIES and STONE is the quality of water. Water testing by participants in various settings are analyzed and later used in activities for k-12 students. Other key concepts are air pollution and seismic damage caused by quarry operations. For example, STONE participants view the explosion of an actual quarry wall in Ohio. The explosion of the quarry allows the students to view and discuss what physical factors come into play such as dust settling on water and homes in the area of the quarry as well as potential seismic damage to nearby structures. These field experiences connecting chemistry, biology, geology and math continue into the summer Phase I lab setting where students are engaged in more inquiry-based activities built upon from the field experiences such as the box problem, Figure 1a,1b.

During the academic year phase II and phase III components on-line e-portfolios are used to continue the inquiry-based learning experiences in their own classrooms, with their own k-12 students. The science content knowledge gained by the k-12 students as a result of the activities implemented by their teachers are studied by the R.R. Hake (2002) method of content gained analysis.

Results/Discussion:

During the Phase I lab experience of STONE the teachers collaborate to solve a real-world problem as carried out in the aggregate industry.



Figure 1a. Box without the sand. Note the irregular bottom surface of the empty box.



Figure 1b. Box with the sand added and five straws used to estimate the volume of sand in the box.

They are asked to determine the amount of sand in a copier paper (44cmx29cmx26cm) box with an irregular paper-mache bottom surface. This simulates a real-world aggregate industry question, namely, how much raw material do we have covering the bedrock? One of the challenges for the participants is that they are only given five straws to use in order to determine the thickness of the sand. They must decide the best place to place the straws to estimate the amount of sand covering the irregular bottom surface of the box (Fig.1-a) and cannot move the straws around to determine the volume of sand in the box (Fig.1-b). Therefore, these real-world experiences mimic the needed skills used by working geoscientists. In order for teachers to integrate inquiry-based learning experiences into their classrooms during the academic year online collaboration in on-line E-portfolios during

phase II and III of STONE and PIES are used.

Below is a table (Table 1) that describes all the aspects of phase II E-portfolios with required directions to succeed with implementation into own classroom.

Table 1.

Weeks	Directions
WEEK-1	Go to the Week 1 Introductions folder in the discussion area and describe your classroom in terms of the grade level (s) you teach, the number of students you serve and any other information you choose that would help your colleagues understand the inquiry activity you will be developing such as teaching in a self-contained classroom, teaching a subject area other than science or any other pertinent information. To receive full credit, visit and comment/respond to at least two other participant's classroom introductions.
WEEK-2	Go to the Week 2 Assessments folder in the discussion area and post by midnight Wednesday September 23 rd how you will assess students that engage in inquiry based activities. For example, multiple-choice tests can assess content knowledge but are not as good in assessing process skills. How will <i>you</i> assess process skills as well as science content in your inquiry activity? Then from Thursday through Sunday of Week 2 read and reply to the posted assessment strategies of other participants. <i>To receive</i>

	<i>full credit for the week, you will need to visit and comment meaningfully on at least two other participant's postings.</i>
WEEK-3	Go to the Week 3 Inquiry Activity folder in the discussion area and post your inquiry activity and pre-post content assessment by midnight Friday October 11th. To receive full credit for this weeks work the activity you post must follow the inquiry activity format guidelines you were provided and include the pre-post assessments you created. You must also go to the Week 3 Inquiry Activity and read other participants inquiry activities and assessment plans. Then comment meaningfully on at least two other participant's week 3 postings.
WEEK-4	Go to the Week 4 Reflections folder in the discussion area and post your lessons learned from the inquiry activity you planned and implemented, what you will do differently in the future and plans to use the inquiry activity you developed from professional development as a springboard for future learning in your classroom.

These on-line E-portfolios continue collaboration with other teacher participants and help their own students build their own content knowledge through inquiry-based classroom activities. During Phase III, STONE and PIES teachers continue the process of networking with each other (schools all over the state of Ohio communicate) on-line to discuss how the

inquiry-based learning is continuing in their classrooms and build a community of learners among their colleagues across Ohio.

Conclusion:

Our STONE and PIES professional development programs have been found to be rewarding for participating teachers and their k-12 students as well. Larger than expected gains in k-12 student content knowledge measured by pre and post activity testing indicate that k-12 students engaging in activities developed and taught by PIES and STONE participant teachers are retaining more content knowledge than expected. The Hake based findings indicate that teachers and their own students had content gains greater than 0.7 which have been found to be typical with inquiry-based modes of learning in science. Our collaboration with industry such as Bowser-Morner and Ohio Aggregate and Industrial Mineral Association have connected PIES and STONE teachers to industry and government regulatory agencies such as the Ohio Environmental Protection Agency. These connections help their students consider STEM careers and provide insights into what real world working geoscientists do to build our country's infrastructure and protect our environment.

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