PrISM Oregon Research Base

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In order to increase Oregon's capacity to deliver high quality instruction in science and mathematics, the design of PrISM responds first to a criterion of access for elementary teachers at all grades levels throughout the state seeking to enhance their knowledge and teaching skills in these fields. Secondly, the design of PrISM embodies four themes especially pertinent to the improvement of teaching in the elementary years—themes crafted to support elementary teachers in achieving high achievement levels for all students. In structure and in content, PrISM adheres to principles espoused in the professional development literature (Garet, Porter, Desimone, Birman, & Yoon, 2001; Hewson, 2007; Loucks-Horsley, Hewson, Love, & Stiles, 1998; Penuel, Fishman, Yamaguchi, & Gallagher, 2007). For example, PrISM values inquiry contexts for learning science and problem solving ones for learning mathematics as teachers learn to appreciate the importance of learning to design investigations and test conjectures; "by learning through inquiry—putting the principles of inquiry-based science or mathematics teaching and learning into practice and experiencing the processes for themselves—teachers are better prepared to implement the practices in their classrooms" (Loucks-Horsley, et al., 1998, p. 49).

Hewson (2007) acknowledges the central importance to professional development not only of the need to make outcomes explicit, but also the "means, the processes, and *the pathways* [emphasis added] by which those outcomes will be achieved" (Hewson, 2007, p. 1201). Hewson stresses the importance of the "pathway" metaphor because it draws attention to the "starting point, the endpoint, and the various ways by which they might be connected" (p. 1201). These are exactly the concerns addressed by the design of PrISM, as the graphics embedded in this document express.

In an evaluation study of 454 teachers who experienced professional development in order to implement the GLOBE program of international earth science education, Penuel et al. found several strategies effective. First was "proximity to practice"—or transferable results (p. 928). The introductory courses in PrISM feature "opportunities [for teachers] to design and implement lessons in their own classrooms and reflect on the results." The capstone course requires that teachers "develop a unit of study that integrates PrISM themes" and new content knowledge, then "collect data on the results" of its implementation. In addition to these program design features, the geographic locations of universities offering PrISM classes coupled to the use of innovative formats for delivering instruction enable participating teachers to access resources and quickly transform them into practice anywhere in the state.

Penuel, et al., refer to role of colleagues and collaboration as an effective strategy—if reforms are "embraced by peers" (p. 929). They also concur with other evaluators of professional development in science and mathematics education on the importance of "active learning and coherence." Active learning refers to the need to depart from lecture and text-driven instruction and, with guidance, craft experiences first open to personal interpretation, then organized more formally according to the concepts of a discipline as teachers engage in communication and clarification of ideas. "Coherence" refers to the need align the goals of district level innovation or improvement and the goals of personal/professional development with the goals for student learning. The design of PrISM is sensitive to the need for coherence and active learning:

teachers plan their pathway through PrISM offerings according to individual needs, district goals, and advisor feedback. PrISM course guidelines stress active learning.

Peneul, et al. built upon the work of Garet, Porter, Desimone, Birman, and Yoon (2001), who, in addition to active learning and coherence, underscored the value of a focus on content knowledge. This focus has ample representation in PrISM. Peneul et al. also reinforce Garet et al.'s emphasis on collective participation by teachers who work together. While the design of PrISM does not explicitly affiliate with individual schools or districts to tailor a program to match their needs, it does encourage collective participation. Its flexibility, depth, and breadth allow districts to work within the PrISM structure to achieve a specific goal in elementary mathematics and science teaching.

Bell and Gilbert (cited in Hewson, 2007, pp. 1183-1185) distilled a model of professional development that emphasized the interplay of personal, social, and professional development. At the personal level, teachers must recognize that "*some aspects of their practice are problematic*" (p. 1184). For PrISM, the extensive array of choices, plus the increasing demands for accountability in the outcomes of learning in science and mathematics by grade five, prompts teachers to consider what aspects of their practice might be problematic and which resources, in their own judgment, might reasonably help them to improve. As teachers become "*aware of their professional isolation*" (p. 1184) they become ready to engage in conversation with peers about practice. Establishing trust and feeling free from judgment are essential to this stage of development. PrISM scholarships offer incentives to teachers who enroll as teams; PrISM course design principles stress building confidence—not competition for grades in traditional content classes. Progress in professional development, according to Bell and Gilbert, means that teachers must strive for "*a more coherent practice*" (quoted in Hewson, 2007, p. 1184). This striving means both a commitment to continuing to engage in professional development as well as reflecting on changes, and their effects, in classroom teaching. PrISM's themes assist teachers in finding coherence and making changes in practice; PrISM's structure scaffolds teachers engagement in a coherent yet highly flexible approach to professional development, from introductory offerings through content focused classes to a capstone experience.

Design for access

The design for access emphasizes ambitious cooperation among both public and private universities across the state. Seven institutions have agreed to a common tuition, registration process, and recruitment strategy, encouraging teachers to select components that best server their professional needs and earn recognition in the form of a PrISM certificate. Synchronizing the institutional policies and practices allows teachers seamless, easy access to a wide array of programs. In turn, PrISM provides these programs with visibility and recruitment.

PrISM exemplifies the leveraging of resources across institutions of higher learning. It increases access to electives within degree programs and expands participant opportunities for specially funded programs. PrISM excludes classes taught in the traditional, classroom-setting, term-long format in favor of innovative formats: distance learning, a mixture of on-line and face-to-face classes, weekend schedules, and concentrated summer institutes. Access to PrISM exists through a homepage serving all seven institutions and communicating program details to any teacher curious about it. This hompage links to “landing pages” at each of the seven institutions where teachers may learn in detail about each institution’s offerings.

PrISM maintains a resource page for faculty designing on-line instruction (http://prismoregon.org/research.php). This page includes access to research about best practices for using the Internet in higher education as well as links to professional organizations and national standards documents with information vital to on-line courses, including tested rubrics for designing such instruction.

Design for literacy and integration

PrISM offerings embody four themes and adhere to course guidelines established by the cooperating institutions. Clearly, elementary education places a high priority on language development, literacy skills, and mathematical proficiency. In addition, elementary teachers are called upon to teach topics from a host of subjects from the social and natural sciences. The PrISM themes and course guidelines acknowledge these realities. Ideas of literacy from different communities of discourse and integration of diverse content as unified experiences frame the themes; devotion to modeling best practice dominates the course guidelines.

Treating learning in science and mathematics as learning to communicate within a community that shares particular aims, approaches to problems, and styles of thinking, helps elementary teachers view teaching these subjects as an extension of their commitment to goals of literacy (Lemke, 1990; Gallas, 1995). Moreover, these literacies, seen in the context of community practice and discourse, underscore that the work of teaching science and mathematics often becomes the work of helping children make “cultural border crossings” (Aikenhead 1999) from the culture of everyday thinking (and family background) to the cultural realms of inquiry science and mathematical problem solving. In these realms, the norms of replicable observation, explicit logic, symbolic representation, unifying explanations, reliable prediction and so forth matter greatly. The culture of science, on which to base school science, is one of communicating observations and inferences (Settlage & Southerland, 2007).

Elementary teachers need to experience support in making their own crossings into these realms and PrISM guidelines set expectations for instructors to model this practice. Offerings must address the translation of course experiences into viable classroom practices and at the same time explicitly attend to the psychology of learning a concept when teaching it.

Elementary education may provide learners the experience of coherence and avoid the competition for time among different subjects when integration in the sense of promoting multiple literacies proves successful. From the perspective of a subject, coherence refers to connecting what we know to how we know it. Again, this principle informs the PrISM course guidelines—a way of helping instructors decide what to emphasize, and what may be left out, when planning a course in science or mathematics for elementary teachers. PrISM course include a focus on content from this perspective, yet without succumbing to the temptation to treat science as a set of universal processes: “We need to help students understand the variety of methods and techniques that scientists use to explore the diverse phenomena in the world—that is, the process of knowledge construction as it’s actually practiced (in all its localized instances) rather than the facile stereotype of some non-existent, singular scientific method" (Rudolph, 2007, p. 3).

The opportunity for place-based education

National standards (NCTM, 2003; NRC, 1996) invite curriculum designs that sustain the achievement of outcomes valued for all learners without specifying what such courses of study must be. This is a welcome invitation for Oregon, a leading center of "place-based education" (Gruenewald, 2006, 2003; Smith, 2007; Sobel, 2004). Fully half of Oregon's teachers reside in moderate and sparsely populated regions outside of the Willamette River corridor (Portland to Springfield), itself a geographically extensive area. Oregon school districts serve children from coastal communities dependent on tourist and fishing economies as well as ranch family children from the arid reaches of the Oregon "Outback." Schools dot the Klamath Mountains in the southwest, the Wallowas in the northeast, the Blues in the center of the state, and the soggy Coast Range in the west. Schoolyards present vistas of the Cascade and Newberry volcanics, rimrock of the high lava plains, and cliffs of the Columbia Gorge. Industry and commerce are as varied as the landscape itself, from ports to forest products, from athletic wear to computer chips. Education that connects students to place, that fosters "attachment with meaning" (Gruenewald, 2003; Semken, 2005), holds the promise of promoting social commitment to sustainability (Senechal, 2008)—and at the same time may has the flexibility to incorporate the skills and benchmarks encoded in standards documents.

Thus, rather than an obstacle, geographic diversity is a special asset to elementary education in Oregon. These varied landscapes and communities provide opportunities to integrate learning experiences in the context of achieving a sense of place (Smith, G. A., 2002). This approach—unifying subjects through the cultivation of knowledge about one's own community and landscape—conforms to aims of civic education and conceptual change, particularly the idea of "usefulness in a social context" (Smith, E. L., 1991).

In the cognitive sense mentioned above, coherence refers to appreciation of the synergistic relationship between inference and observation, between discovering "more about the world while simultaneously learning how to investigate the world" (Kitcher, 1993, p 202). Place contextualizes inquiry learning somewhat differently and within a wider social and political context. The wider context achieves coherence not only terms of the correspondence between investigative method and explanatory aim, but also in terms of the integration of experience by the child learning through inquiries and stories about local culture and landscape.

PrISM's themes conform to these rationales: the essential role of literacy, the value of integrating subjects, respect for focusing on content knowledge, and the importance of achieving a sense of place. PrISM is not a tested, sequenced package of lessons that elementary teachers may learn to implement in order to scaffold children's learning reliably toward specific objectives. Instead, PrISM marshals an array of programs—some designed as workshops containing exactly such packaged lessons, some asking teachers to embark on adventures in learning content for themselves for the first time—and organizes access to them across Oregon. PrISM empowers teachers to make their own choices, in consultation with an advisor, and at the same time evaluates the offerings they might choose from. This evaluation assures that teachers have access to learning experiences that stress literacy and integration as well as content knowledge. The evaluation assures that instructors place priority on helping teachers gain confidence as well as proficiency in teaching science and mathematics. Most importantly, offerings approved for PrISM emphasize classroom practice and psychologies of learning in science and mathematics. The PrISM certificate requires substantial effort spanning several terms and a capstone project demonstrating synthesis, implementation, and dissemination of PrISM components.

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