P^3T^3: Purdue Program for Preparing Tomorrow's Teachers to use Technology

Abstract

Following five years of planning, the School of Education at Purdue University has begun the implementation of completely restructured elementary and secondary teacher education programs. The new teacher education programs, which include four strands – technology, diversity, field experience, and portfolio assessment – provide the larger framework for the proposed project. The overall goals of this project are to (1) prepare teacher education faculty in Education, Science, and Liberal Arts to teach pre-service teachers in technology-rich environments, modeling approaches that future teachers should use themselves; and (2) prepare pre-service teachers to demonstrate fundamental technology competencies, using technology as a tool for teaching/learning, personal productivity, communication, and reflection on their teaching. The School of Education will lead the project with collaboration from the Schools of Science and Liberal Arts, four K-12 school districts, and corporate partners.

The project will meet these goals using three unique complementary components: (a) pre-service teachers will be taught by technology proficient faculty who participate in a comprehensive faculty development program in which they learn new teaching/learning technologies and practice using them with mentoring and technical support leading to lasting technology integration into teacher education courses; (b) pre-service teachers will participate in rich and diverse field experiences enabled and enhanced through the use of technology; and (c) a dynamic assessment system will provide pre-service teachers the tools and opportunities to select multiple ways of viewing their evolving teaching practice, reflect on that practice, and use digital representations to meet performance-based assessments as they build digital multimedia portfolios. Ultimately, the pre-service teachers will learn about technology, integrate it as they see it modeled by their instructors, and reflect on their own learning about teaching via digital technologies that they will eventually model and use with their K-12 students.

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Need for the Project

Deficiencies in the preparation of teachers to use technology in the classroom have been highlighted in a number of national reports. These reports indicate that technology is not central to teacher preparation in most colleges of education. Problems include limited use of distance education and computer-assisted instruction in teacher education courses, an emphasis on teaching about technology rather than teaching with technology, lack of faculty modeling of teaching with technology, insufficient funding and faculty professional development opportunities, and lack of emphasis on technology in students' field experiences (Moursand & Bielfeldt, 1999; Office of Technology Assessment, 1995; Panel on Educational Technology, 1997). Given that an estimated 2.2 million teachers are expected to join the work force in the next decade, the time for teacher education to change is now. A recent study by the International Society for Technology in Education (ISTE) commissioned by the Milken Exchange (Moursand & Bielfeldt, 1999) recommended: (1) technology integration across the teacher preparation curriculum rather than limited to stand-alone courses, (2) institutional planning for integration of educational technology into teaching and learning, (3) increased opportunities for student teachers to use technology during field experiences, and (4) faculty development to bring about appropriate modeling of technology uses in their courses.

After five years of reform planning by its faculty and administration, the School of Education at Purdue University has just begun the implementation of completely restructured elementary and secondary teacher education programs (see Appendix E) that make significant strides toward addressing the recommendations of the ISTE/Milken report. The new programs were launched with students entering teacher preparation programs in the fall of 1999. The final elements of the programs will not be implemented fully until the spring of 2002, when the first cohort of students is scheduled to graduate. Purdue University has already committed to the

successful implementation of these reform efforts. **Funding is sought to accelerate the implementation of on-going reforms and to permit Purdue University and its consortium partners to develop and disseminate learning resources for supporting innovative technology integration in teacher preparation**.

The overall goals of this project are to:

- **Prepare faculty**, including teacher education faculty and key Science and Liberal Arts faculty, **to teach pre-service teachers in technology-rich environments, modeling approaches that future teachers should use to teach their K-12 students**.
- **Prepare all teacher education majors to demonstrate fundamental technology competencies**, using technology as a tool for teaching/learning, for personal productivity, for communication, and for reflection on practice through: (1) technology integration into teacher education courses, (2) development of rich and diverse field experiences made possible through the use of technology, and (3) implementation of a dynamic assessment system in which all teacher education students build digital multimedia portfolios.

Project Design

Consortium Members

The **School of Education at Purdue University** is the lead consortium member. Purdue University, Indiana's land grant institution, is one of the 25 largest universities in the nation with approximately 37,000 students on its West Lafayette campus alone. Purdue's preparation of teachers began in 1908; the School of Education was formally created in 1989. Approximately 1,400 students are enrolled as undergraduate majors in elementary, social studies, and special education; a similar number are enrolled as secondary education majors in the Schools of Science and Liberal Arts. Approximately 600 graduate students are enrolled in masters and doctoral programs. Among the 80 full-time faculty, 25% hold joint appointments with the School of Science or School of Liberal Arts.

The School of Liberal Arts, the School of Science, and the Multimedia Instructional Development Center (MIDC) are members of the consortium. Both Liberals Arts and Science play key roles in teacher preparation at Purdue; elementary education students take course work from both schools, and secondary students major in their respective disciplines. The **School of Liberal Arts** is one of the largest schools at Purdue University, encompassing eleven academic departments and fourteen interdisciplinary programs. Nearly one-quarter of all undergraduate students on campus are engaged in its programs of study. The **School of Science** is made up of seven departments and enrolls more than 3,000 undergraduate majors. The **Multimedia Instructional Development Center** (MIDC) is a faculty support organization that provides seminars, information resources, and technical expertise to the university community.

Partner K-12 school districts, all in Indiana, include **Crawfordsville Community Schools (Crawfordsville), Lafayette Schools (Lafayette), Lawrence Township Schools (Indianapolis), and East Chicago Schools (East Chicago)**. These districts provide a spectrum of settings for student experiences and cooperative projects. Crawfordsville is a rural school system enrolling about 2,500 students. The Lafayette school district is located in a medium-sized town and has an enrollment of about 7,300 students. Lawrence Township is an urban/suburban district with an enrollment over 15,000. East Chicago is an urban district with an enrollment of about 6,300. Crawfordsville and Lawrence Township are model technology-using sites. Both Lawrence Township and East Chicago have large minority populations. Working with these urban sites, Purdue will better prepare its student teachers to use learning technologies with low income and minority populations.

Additional consortium members include: **Apple Computer, Corporation for Educational Communication (CEC), Indiana Department of Education, Intel, and the North Central Regional Technology in Education Consortium (NCRTEC)**. These partners will assist with faculty development and implementation efforts. Apple Computer will provide hardware and provide consultation assistance with the faculty development component of the project. CEC will help to support the use of the Athena two-way video network in Indiana,

which it oversees. The Indiana Department of Education will assure that the project aligns with state standards. Intel will provide hardware to support the project. NCRTEC will provide its *Wisdom Tools* CD-ROM and video case study materials as well as assistance with the faculty development phase of the project.

Context

The newly created and implemented teacher education programs at Purdue University are designed to overcome the limitations of traditional teacher education programs, such as knowledge acquisition divorced from application, a non-coherent approach to course work, and a lack of emphasis on current best practices including attention to diversity, performance-based assessment, and integrated technology use. **Purdue's new teacher education programs, through the use of integrated strands, are designed to develop technology-proficient educational professionals who are educational leaders based on research and best practice**. Constructed around current performance-based standards and an overarching model of teacher preparation (see Appendix E), the major elements of the reformed programs are shown in Table 1. The four strands shown in Table 1 – technology, field experiences, diversity, and professional portfolio – are key to the success of the new programs, and they are central to the proposed project. Through the proposed project, technology will be infused as a critical component of each of these four strands.

Technology Strand

In the new teacher preparation programs, the technology strand is manifest in: (1) concentrated course work focused specifically on educational technology (e.g., EDCI 270, Introduction to Educational Technology – an introductory course that focuses on helping students build basic technology knowledge and skills *within the context* of planning, implementing, and evaluating instruction); (2) integrated instruction in the application of technology in specific disciplines and with a variety of learners *throughout* block courses and in methods courses; and (3) reliance on supporting technologies to link students with faculty and peers, to provide examples of

exemplary practice and of diversity, and to support students' development of their portfolios. Our focus on using technology in the teacher preparation programs is not merely to do the same thing better; technology has the power to transform educational practice. We focus on leveraging the power of technology to move practice away from the traditional teacher-centric approach toward an active, learner-centered, and performance-based approach in which students engage with meaningful content while using technology as a tool to support complex thinking, problem solving, and communication.

Table 1. Elements of Purdue's Reformed Teacher Education Programs

Coherent: The programs rely on a sequence of coherent experiences, aligned with national and state standards, that integrate practical and theoretical knowledge.
Developmental: The programs adopt a developmental, spiraling approach (i.e., students focus on themselves as learners/teachers, then explore schools and classrooms, then study learners and learning, then engage in extended classroom teaching).
Block Approach: The programs are structured in six sets of "block" courses with courses in the same block being linked by a joint field experience called Theory into Practice.
Inquiry-Oriented: The programs emphasize an inquiry-oriented approach that utilizes authentic activities, such as participation in meaningful activities in school and community settings. In addition, specialized knowledge is emphasized (e.g., pedagogical content knowledge, the knowledge developed by teachers to help others learn).
Content Emphasis: Students who major in the School of Education (these majors are elementary education, special education, and social studies education) complete 127 credit hours for graduation and have early and frequent field experiences. Secondary education students (biology education, English education, etc.) major in their respective disciplines while completing pedagogical studies in the School of Education.
Strands: Strands are woven throughout the programs to provide quality and coherence. · **Technology** – Pre-service teachers learn to utilize tools of the information age to facilitate the learning of their students, for personal productivity, and to foster reflective thinking about their own practice as they learn about technology as a teaching/learning tool. · **Field experiences** – Theory into Practice gives future teachers the opportunity to work in a variety of school settings with diverse groups of students. · **Diversity** – In order to meet the needs of all students, pre-service teachers focus upon adapting instruction to diverse learners. Diversity is broadly defined to include: socioeconomic, religious, and intellectual diversity; special needs and gifted student populations; as well as ethnic and cultural diversity. · **Professional Portfolio** – Documentation of the pre-service teachers' growth is collected throughout the program for assessment and self-reflection. The creation of an electronic portfolio, as described in this proposal, will also strengthen students' skills in using technology. The portfolio provides the foundation for performance-based licensure.

Field Experiences Strand

Of course, adequate teacher preparation demands frequent and appropriate field experience, another strand of the new programs. Our new programs feature Theory into Practice field experiences for students. However, there are challenges with this expanded field experience component. For one, the complexity of multiple placements creates management difficulties. Technology (e.g., e-mail, desktop video conferencing) can help by providing communication capabilities that allow faculty to mentor students in the field and stay in touch with sponsoring schools. Because of the limited selection of schools in the geographical area immediately surrounding Purdue University, it is difficult to always place students in settings that provide appropriate experiences, including the opportunity to work with technology-proficient teachers. One solution is to rely on *some* virtual experiences. Students create and engage in online case studies, interact with multimedia cases that pose various problems and show exemplary technology practices, and observe settings (e.g., urban schools) that are not immediately accessible. While not a substitute for true field experiences, these virtual experiences permit us to broaden students' perspectives in ways that simply would not be possible otherwise. At the same time, we recognize that there is a need to provide students with effective field experiences relating to, among other things, technology use. In this proposal we suggest other ways that this shortcoming might be addressed.

Diversity Strand

Diversity is also a key strand in our new teacher preparation programs. However, Purdue University is not located within close proximity to a major urban center and the diversity that such a center would afford. The School of Education makes extensive efforts to provide pre-service teachers with experiences of various forms of diversity (e.g., socioeconomic, rural/urban, religious, cultural, intellectual, special needs/gifted populations) in neighboring schools. Nonetheless, we recognize the need to engage students with the cultural and ethnic diversity found in major urban centers. Technology can assist us with this task. Available communication technologies (e.g., Vision Athena, a two-way video network already in place in much of Indiana,

and the Internet) will be used to link teacher preparation classes and students to diverse sites. In addition, we will continue to utilize the diversity that does exist within nearby schools with special attention to the role that technology might play in helping our students understand and work with diverse students (e.g., using assistive technologies with special needs learners).

Portfolio Strand

Portfolios are a key element of an overall program that is designed to help teacher candidates attain the knowledge, dispositions, and performances necessary to become effective teachers. Purdue University has committed to implementation of a Unit Assessment System, a performance-based approach to teacher licensure that will include the use of student portfolios, by June of 2001. Each student will develop a professional portfolio that will: (1) be used for self-reflection on learning, (2) document professional growth, and (3) provide the foundation for performance-based licensure. At the beginning of their programs of study, pre-service teachers construct an entrance portfolio that focuses on themselves as learners and teachers. As they progress through the program, students add artifacts about schools and learners as well as artifacts that demonstrate their ability to transform subject matter knowledge into classroom practice. At the end of their programs, teacher candidates create exit portfolios that serve to synthesize their professional development.

The portfolio is seen as a dynamic tool that prepares future teachers to reflect on practice while engaging them in such reflection. Furthermore it enables them to present evidence of their growth over time. What begins as a representation of novice thinking-about-teaching becomes a presentation of skill and competency that could be used in a job interview. Technology provides the means to create and maintain a dynamic portfolio, one that can include multiple representations of student thinking and one that can change over time as students grow and mature as professionals. The student portfolio will consist of a variety of multimedia materials that may include artifacts such as materials designed by the student, videos of classroom experiences, lesson plans and written reflections, photographs, mentor's or instructor's comments, classroom observations, research projects, and written or oral commentaries. In addition to showcasing

students' development as practitioners, developing a multimedia portfolio will require that students develop the skills (e.g., scanning, digitizing, digital video and audio production, web page development) necessary to create it. The portfolio integrates instruction, learning, and assessment, and it puts a special emphasis on the use of the technology itself. As part of this project, we propose to develop a dynamic web-based portfolio management and utilization system that will support students' portfolio development and faculty members' use of the portfolios in instruction and assessment.

Purdue University and its consortium partners are committed to preparing educational professionals who will participate in professional, social, and technological change as lifelong learners; use a wide variety of educational technologies to foster students' learning and for personal productivity; and be prepared for life in an information society. By weaving together technology and the other strands of our teacher preparation programs, we can achieve this goal.

Project Goals

Following are the specific implementation goals and sub-goals for this project.

1. **Faculty will teach pre-service teachers in technology-rich environments**, using conceptual technologies (technologies for learning and thinking about complex systems), **modeling approaches that future teachers should use to teach their K-12 students.**
   - All teacher education faculty, including graduate teaching assistants and key faculty in the Schools of Science and Liberal Arts, will meet or exceed all ISTE/NCATE foundations in technology competencies for teachers (see Appendix F).
   - Technology will be meaningfully integrated into teacher preparation courses and key courses taken by pre-service teachers in the Schools of Science and Liberal Arts.

- The School of Education at Purdue will meet or exceed all CEO Forum STaR (School Technology and Readiness) Chart institutional standards at the Advanced Tech level (see Appendix G) by the end of the grant.
- Existing technology resources will be expanded through: (1) addition of a full-time technical support person dedicated to this project, and (2) continual development of innovative educational technologies designed to help students learn to use not only what is available today but what is likely to become commonplace in the future.

2. **All teacher education majors will demonstrate fundamental technology competencies**, using technology as a tool for teaching/learning, personal productivity, communication with faculty and peers, observation of diversity and exemplary practices, and reflection on practice and the role of technology in practice.
   - All graduating students will meet or exceed the ISTE/NCATE foundations in technology competencies for teachers (see Appendix F) by the end of the project.
   - Throughout their programs of study, students will construct, build upon, and use electronic portfolios as part of their preparation to become teachers. These portfolios will serve as the foundation for performance-based licensure and a focal point for teacher reflection on teaching practice and the use of technology.
   - The Purdue School of Education will create a model web-based infrastructure (with capacity for optical media storage) for portfolio creation, maintenance, flexible manipulation, and use in the teacher education programs. Teacher education students will use this infrastructure to build their own multimedia portfolios, to reflect on practice through examination of their own and others' portfolios, and to learn about portfolios.
   - In cooperation with partner K-12 schools, students' practical experiences will be enhanced through the capability to observe diverse school sites as well as sites featuring technology-proficient in-service teachers and communication among students, faculty, and K-12

partners will be enhanced by using technology (two-way interactive video, multimedia cases, and the Internet).

Project Implementation Activities

The project's key implementation initiatives are listed here and described in more detail in the passage following.

1. **Phased implementation of technology integration** into teacher education courses and selected supporting courses in Science and Liberal Arts. The implementation will scale up so that at least 75% of teacher education courses will include appropriate technology integration, and have a meaningful web presence, by the end of the project.
2. **Professional development of faculty and graduate teaching assistants** designed to parallel the course implementation. By the end of the project, all teacher education faculty (and graduate teaching assistants who teach in the teacher education program as well as key faculty in Science and Liberal Arts) will have participated in professional development activities designed to assist them in personally meeting technology standards and integrating learner-centered technology into their courses.
3. **Development of a web-based portfolio system** and support infrastructure to allow students to create and maintain professional, multimedia portfolios. Portfolios will be a key part of on-going teacher preparation, fostering reflection and used in courses as the focus of some activities, as well as an assessment tool. In addition, students must learn about important educational technologies in order to create the portfolio.
4. **Development of key technology tools and support structures** needed to support the technology integration. These will include:
   - networking infrastructure for the Internet and two-way video,
   - web-based communication tools (e.g., online communities for linking consortium partners and for allowing student teachers to interact with faculty supervisors and peers),

- tools and templates for simplifying faculty integration initiatives (e.g., sample templates for integrating digital video into Powerpoint, predetermined settings for successful use of video conferencing over the Internet),
- tools for demonstrating/illustrating technology integration in education (e.g., web and multimedia cases), and
- integration infrastructure (e.g., mobile wireless computing resources, "classroom of the future").

1. Technology Integration in Teacher Preparation

A phased implementation of technology integration into teacher education courses and selected supporting courses in Science and Liberal Arts will build on the foundations already laid by the teacher preparation program reforms, which, as noted above, include technology as an explicit program strand. The strand begins with EDCI 270, Introduction to Educational Technology, a required 2-credit hour course which, unlike many technology courses for pre-service teachers, frames the development of technology knowledge and skills (e.g., word processing, data manipulation, web use, multimedia) within a clear educational context of planning, implementing, and evaluating instruction. As part of this course, students begin the creation of their multimedia portfolios. Although students leave this course with a solid foundation (mastering most of the ISTE/NCATE competencies), single courses are insufficient to address teacher preparation needs. Therefore, technology is woven throughout the pre-service teacher experience.

The teacher education reform documents specify that technology is one of the four key strands in the new programs. This strand is evidenced, in part, by a requirement that each block course include overt technology experiences. While the requirement is strongly framed, because the new programs are just now starting, the role of technology in the block courses, methods courses, and key supporting courses in other academic schools has not yet been fully articulated. That articulation will be a key part of this implementation grant.

In accordance with existing reform implementation procedures, the specifics of technology implementation in Education courses will be determined by those faculty committees (e.g., an Accountability Team assesses individual course concordance with overall program vision and objectives, an Implementation Team monitors enactment of course and Theory into Practice components) that now oversee implementation of the reformed programs. Key faculty in the Schools of Science and Liberal Arts will work with Education faculty to determine appropriate applications of technology in their courses that enroll teacher education students. In Science, the focus will be on mathematics and chemistry courses; in Liberal Arts, the focus will be on communications and composition courses. Thus, the impact of the project will extend beyond the School of Education to improve the pedagogical environment of the university as a whole. Through these efforts, we expect students to develop technology proficiencies in an environment where appropriate technology use is routinely modeled.

The consortium partners recognize that field experiences are also a key element of successful development of technology-using teachers. Unfortunately, a fundamental problem confronting Purdue and many other teacher preparation institutions is the scarcity of technology-proficient teachers and technology-rich environments where we can place pre-service teachers for field experiences. Three tactics will be employed to address this problem: (1) technologies such as two-way video and CD-ROM/web-based cases will be employed to allow students to observe master technology-using teachers, (2) technology will be added as an overt criterion used in the placement of student teachers, and (3) new approaches to placement of students for field experiences will be tested. An example of the latter will be a pilot program to place multiple pre-service teachers as a team with one exemplary technology-using teacher, rather than placing a single student with a single teacher. Purdue's faculty believe that team teaching is likely to play a greater role in the classrooms of the future, and this approach will allow students to experience a team model while also affording the opportunity to explore a variety of technology applications with an expert in-service teacher.

To gauge progress in technology integration efforts, the CEO Forum STaR Chart standards will be used at the onset of the project to assess the "state of the School" with respect to technology. Each year of the project, this assessment will be repeated to determine movement toward targeted levels of meaningful integration of technology into specific courses. The goal is that by the end of the project at least 75% of teacher education courses, and selected supporting courses in Science and Liberal Arts, will exhibit meaningful technology integration, and students will engage in technology-oriented field experiences.

2. Professional Development

A key element of the proposed project will be helping *all* staff and faculty in the School of Education to become effective educational technology users themselves. In order to accomplish this, a training and development plan will be implemented. The professional development will consist of a week-long introductory workshop followed by year-long participation in mentoring teams that will focus on technology integration.

Each summer of the project, faculty development workshops will be offered during times of high faculty availability. Experienced technology-using faculty will lead the workshops with support provided by graduate assistants specializing in educational technology as well as consortium partners. The Technology Resources Center, an internal SOE resource and support group, and the Multimedia Instructional Development Center (MIDC), a campus-wide support center, will conduct technology training. Consortium partners, Apple Computer and NCRTEC, will provide assistance.

In year 1 two workshops will be offered, while in years 2 and 3 three workshops will be conducted. Each workshop will enroll about 20 participants. Groups will consist of about 10 Education faculty members, 4 graduate teaching assistants who work with teacher preparation courses, 2 faculty members from Liberal Arts and/or Science, 2 Education undergraduates, and 2 master technology-using teachers from our K-12 partner schools. Education faculty rarely link with K-12 schools and other partners on projects related to technology implementation (OTA, 1995). Therefore, the participant make-up of the workshops is designed to overcome this

limitation. The creation of close working groups composed of university faculty members, graduate and undergraduate students, and in-service teachers will foster the kinds of links needed to make the project successful over time.

Summer workshops will combine three key elements: (1) modeling of appropriate uses of technology through participants' immersion in a problem-centered activity involving rich use of technology for gathering information, manipulating data, and communicating results as well as for enhancing one's thinking; (2) reflecting on practice and the role of technology in both K-12 and higher education classrooms using materials such as the *Captured Wisdom* interactive CD-ROM cases developed by NCRTEC, and (3) development of basic knowledge and skills (e.g., use of WebCT for development of a course web presence) related to technology and its implementation in the teacher education programs. These workshops will help to initiatie the technology integration process. However, "one-shot" workshops are notoriously unsuccessful if not coupled with long-term support and opportunities for growth (OTA, 1995).

To achieve extended support, an academic year-long mentoring program will follow the workshops. An experienced faculty member who integrates technology in her or his teaching, along with graduate teaching assistants and undergraduates, will work with a team of less-experienced faculty members who completed the summer institute. Each team member will pursue personal and course technology integration goals (e.g., a faculty member may learn to use WebCT for the purpose of making course support materials available on the web). Teams will meet regularly (once every week or two) to discuss implementation activities and to provide mutual support. In addition, a web-based electronic community of mentoring teams will be established. Teams will focus on integrating technology, where appropriate, into the faculty members' teacher education courses. Faculty who successfully complete the year of professional development activities, and who effectively model technology use for their students, will be eligible to lead the following year's professional development activities.

3. Development of a Dynamic Web-Based Portfolio Assessment System

Portfolios are emerging as useful tools for school districts and schools to assess the performance of teachers. As a result, many colleges of education are also moving toward portfolio assessment. The development of a unit assessment system in the School of Education, based in large part on performance-based standards, assumes that there are natural points in pre-service teachers' professional education when they can be assessed on knowledge, performances, and dispositions that are systematically related to competent teaching. The key issue is not when but *what* can be used to systematically document teaching.

The portfolio system proposed in this project will meet two vital needs of the teacher education program: (1) it will provide a systematic way for teacher candidates to document the knowledge, performances, and dispositions that will qualify them to teach (i.e., meet standards outlined in the unit assessment system); and (2) it will provide them with a dynamic self-assessment and reflection tool. The first goal is readily achievable through a traditional portfolio system, but the second goal is more difficult to achieve through traditional paper and notebook systems. Therefore, we propose to develop a unique electronic portfolio system, built to operate on the web, to meet this goal. Given the pervasiveness of the web today, and its standard protocols for interconnecting diverse computers, it is only natural to rely on a web-based system for portfolio development. Systems that rely on stand-alone computers for portfolio support are doomed to obsolescence and/or the need for continual technology upgrades. A web-based system can grow with the needs of the students and will be accessible from anywhere that there is an Internet connection.

The web-based portfolio system will be truly dynamic in three ways: (1) it will encourage ongoing collection and archiving of relevant performances deemed important by a teacher candidate, (2) the teacher candidate can choose a variety of media forms to represent the complexities of teaching, and (3) the teacher candidate will choose, by reflecting on the individual performances, which of her or his archived materials best represents a given performance standard. In short, the dynamic aspect of the web-based model lies in both its capability to store a range of

media that are easily accessible and the way it will provide the teacher candidate with a scaffold for systematically thinking about his or her work and reflecting on the performances. The dynamic model may open up a whole new range of reflective practices by allowing teacher candidates to juxtapose a variety of representations of their work, each highlighting or complementing aspects of ongoing practice and their learning about the practice. Most important, however, the model will provide a direct connection between ongoing assessment and reflective practice.

Teachers will learn about and use technology as a *recursive* practice rather than as a process of linear infusion of tools and content. In this recursive, dynamic assessment model:

- Pre-service teachers learn about various technological tools, the processes of using those tools to construct multiple representations of the complexities of teaching, and ways of creatively retrieving those representations by constructing a dynamic evolving portfolio.
- As they learn about the technology and the dynamic process of using technology for the immediate, relevant purpose of constructing their portfolios, and as they use the tools and applications to hone their evolving portfolios, they learn both tools and processes that will enable them to create technology-rich classrooms for their students.

Table 2 represents the recursive nature of the dynamic assessment model and indicates how Jan, a pre-service teacher, reflects on her practice through selecting various archived information either individually or in juxtaposition with other information.

Hence, pre-service teachers learning about technology also *use* technology to represent the many facets and complexities of teaching. As they learn about technology and its importance in their own process of learning to become teachers, they consider possible future uses of technology to promote their own students' learning. For example, Jan now knows how to digitize video, scan documents, and edit digital photos. She plans to use digitized video so her students can integrate reading, writing, and classroom inquiry by constructing documentaries of important events in school using a variety of media to render multiple representations of the events and presenting their work to both local (peers and parents) and extended (the web) audiences. Just as these technologies helped her understand the complexities of her teaching, she now feels confident in

using them to help her students understand the complexities of representing events by juxtaposing various kinds of media in ways that will create new definitions and new understandings. Jan has not only learned the technological tools, she has learned, through her own experiences in recursively constructing an evolving portfolio, how the technologies can create powerful new ways for her students to make sense of the world and how they represent it.

Table 2. Dynamic Use of an Electronic Portfolio

Teaching practice targeted for documentation and reflection	Forms of electronic representation to construct self-assessment and reflective mini-cases	Selection of archived electronic representations to promote reflection	Technology tools and process learned for future teaching
Jan, a pre-service teacher, wants to document one of her field experiences in which she facilitated a discussion of a reading assignment. She plans to use this lesson to document her skills in conducting a class discussion and to reflect on her own teaching.	Documents: · reflection piece: formal reflection paper · transcript of lesson Digitized media: · video of lesson · scanned notes taken after lesson · photos of the group and how it was set up in the context of the classroom	Jan wants to demonstrate a performance objective in which she encourages a variety of discourse: · She selects both the lesson transcript and the video to show how she used her discourse to involve discussants. · Reflection: While she watches the video, she notices that she queries two students more than others. --She revisits her notes taken after the lesson to see if she was aware of this after the lesson --She watches the video again to further explain this seemingly lack of balance	· Videotaping a lesson withcamcorder · Digitizing the video and --saving a version for playing on a local drive --saving a streaming format version to play from web server · Scanning a document · Using a digital camera and saving the files in a local directory and on a web page.

The construction of dynamic portfolios also promotes reflective practice by promoting self-constructed and self-reflective teaching mini-cases. Specifically, building on the core foundation of the Twenty-First Century Conceptual Tools (TCCT) project (see Appendix H), which documents the importance of case studies and case-based teaching and learning, pre-service teachers will self-select various types of documentation they believe best represent their knowledge, performances, and dispositions. The self-selected media they choose to archive can be retrieved for their own purposes, and/or added to the corpus of cases in the School of Education. Hence, teacher candidates will not only have their own evolving portfolio from which to draw

mini-cases of teaching, but they will have access to a much broader corpus of mini-cases, systematically constructed by their peers in a wide range of settings with a wide range of teaching and learning scenarios, from which to draw.

Finally, the emphasis on portfolios as a tool for reflection and assessment will also help pre-service students to learn as much about alternative assessment methods as they will about documentation, via technology, of learning. As studies of technology integration have shown (e.g., Apple's Classrooms of Tomorrow), integration of technology into the classroom changes the teaching and learning process itself. Students become active participants. Teachers shift from being the "sage on the stage" to the "guide on the side." And, accompanying this shift is a movement toward more performance-based forms of assessment such as portfolios. Thus, the portfolio system will serve as an effective model of assessment for our students as well.

In addition to the portfolio development infrastructure itself, we will develop an informational/educational communal web site to support portfolio development. Not only will the web be utilized to facilitate the development and storage of individual portfolios, a communal web site will be established to assist pre-service teachers with the portfolio development process and the reflective thinking involved in the process. The site will enable users to reflect on questions of philosophy and practice and develop meaningful portfolio artifacts and descriptions. Features may include: guided reflection, samples of artifacts, discussion groups, links to standards, and links to information about portfolio building.

Given the growing popularity of performance-based assessments and portfolios, it is expected that Purdue's proposed system will be a model that may be of interest to many other institutions, especially those of a size comparable to Purdue. Because it will be built and supported directly on the web, this system will be immediately available to other institutions.

4. Development of Technology Infrastructure and Tools

In order to implement the proposed project, it will be necessary to enhance existing resources and develop tools that will facilitate technology integration in the teacher education programs. For example, the proposed web-based electronic portfolio system will require

significant computing and support resources. Students will need access to supporting equipment such as scanners, digitizers, camcorders, and other hardware. For preservation of final portfolios, CD and/or DVD recorders will be needed to "burn" copies of the materials from the web. If one assumes Purdue's current teacher education population of about 2800, and that each student's final portfolio will occupy a CD-R (650 Mb), the server for the portfolio web system will require approximately 1.5 terabytes of storage space – a significant amount by today's standards but a figure that is likely to be more widely accessible in the future. In addition, a full-time technical support person will be hired specifically to support and maintain the computer systems dedicated to this project and assist faculty/staff with implementation activities.

The basic computing infrastructure will also be upgraded to support the increased level of activity resulting both from extensive course integration of educational technology and the multimedia portfolio system. At present, the School of Education is supported by networking capable of only 10 Mbps. This will be upgraded to 100 Mbps networking.

Although the School of Education is already relatively well-equipped with computing resources, additional resources will be added as part of this project. A wireless "laboratory" consisting of 10 laptop computers and a wireless ethernet hub will be made available to faculty within the first year. Outfitted on a rolling cart, faculty will be able to use this wireless "lab" within any classroom in the building. In addition, a "classroom of the future" is being planned and will be fully implemented no later than the second year of the project. The intent of this facility is to explore new ways to use technology in education. The traditional laboratory model is already beginning to decline in schools. What will replace it in the future? How can we use existing technologies and emerging technologies (e.g., wireless hand-held devices) in ways that focus on the educational aims while making the technology transparent to the user?

In order to create links between Purdue's School of Education and its consortium partners, a web-based community will be created. The electronic community will consist of web information, bulletin boards, chat rooms, and other tools designed to support person-to-person and group-to-group communication. This web site will become a focal point for the project.

Finally, a focus of the project will also be on the development of tools for faculty integration of technology. College faculty, like K-12 teachers, often lack the time needed to explore ways to integrate technology (Moursand & Bielfeldt, 1999). To make it easier for faculty to integrate technology, tools and templates will be developed that can be appropriated by faculty for their individual needs with minimal effort. For example, a faculty member might want to put some video on the web, but would be put off by the demands of video digitizing and the confusing array of streaming video options. A template for accomplishing this task will be developed by providing appropriate software and hardware, with pre-established settings, that individuals can use to create digital video clips without having to struggle learning the ins and outs of several complex software packages. The technical support person, in cooperation with key members of the faculty, will develop this and similar templates. These sorts of tools will allow faculty to focus on the *uses* of the technology while worrying less about the technical details of how to do it.

Resources

Purdue University will be the lead entity in the consortium. The University has many resources and advanced facilities to support the activities and personnel in this project. In addition to an excellent campus infrastructure, the University will provide a significant upgrade to the networking facilities in the Liberal Arts and Education Building (LAEB) in which the School of Education is located. This project aligns with a campus-wide effort to support, in particular, the educational uses of a technology, multimedia, and distributed learning systems.

University Technology Resources

The Purdue University Computing Center (PUCC) maintains the campus network as well as 24 instructional computing laboratories equipped with Windows, Macintosh, and Sun workstations. Instructional laboratories are located across campus and in the residence halls. Off-campus users can access the systems via standard dialup modems, ADSL, or direct ethernet connections from some residence halls. The Liberal Arts and Education Building, which houses the School of Education, contains 6 PUCC computer labs, fully wired classrooms and offices, and

one of the highest concentrations of computer projection equipment in classrooms on the campus. As part of a campus agreement with Microsoft, all computer labs on campus have access to current Microsoft products (among others) and students may purchase these products for personal use for only a $5 CD duplication fee.

School of Education

The School of Education maintains excellent facilities designed to support the activities of personnel who will work on this project as well as the pre-service teacher population. These facilities include the Technology Resources Center (TRC), Apple Computer Laboratory, Ameritech Distance Education Classroom and laboratory, and others.

The TRC is a resource facility and a student, faculty, and staff instructional support operation for individuals wishing to learn about and effectively use educational technology. The TRC serves as a demonstration site that showcases the latest applications of teaching and learning technologies and a resource center for faculty and student use. The TRC provides pre-service teachers in the School of Education access to the latest educational materials, including computers, educational software, Internet access, and textbooks (the TRC is an official textbook adoption review site for the Indiana Department of Education). The TRC also houses the Office of Technical Services, with a staff of four persons, that provides support with hardware, software, and distance education technologies to faculty and staff in the School of Education.

The School of Education maintains two main computer laboratories. The Apple lab is equipped with 20 G3 Macintosh workstations and a teacher station. The Macintosh computers include AV displays and video in/out for still- and full-motion video capture. Also available are three color scanners, four Apple Phone cameras and software for video conferencing via the Web, as well as a laser printer and Intranet server. The Ameritech Distance Education Classroom and laboratory is dedicated to supporting educational classes and programs that connect to remote education/learning settings. The distance education component of the room is based on a PictureTel 4000 compressed video system with a Socrates touch control unit, document camera, integrated computer, touch-to-talk microphones, three large monitors, two remote controlled

cameras, and a ceiling-mounted video data projector. The room also houses 21 workstations, 400 MHz Windows computers, with high-speed Internet access. The lab includes an intranet server, scanner, and laser printer. To enhance distance education capability, the School of Education recently acquired CUSeeMe server software and several sets of workstation equipment for video conferencing over the Internet.

Two new planned initiatives will provide additional support. A portable computer "lab" featuring 10 laptop computers, equipped with wireless networking, and a mobile cart housing a wireless networking hub will be deployed in year one of the project. This mobile "lab" will permit faculty and students to use computers as part of instructional activities in any classroom within the building. A second initiative features the development of a "classroom of the future." Space has already been allocated for this new facility that will feature explorations of new technologies (e.g., hand-held devices) in the service of education.

Consortium Partners

The other members of the Consortium also offer resources that will enhance the project. At Purdue, the Multimedia Instructional Development Center (MIDC), an arm of PUCC, provides assistance to faculty and staff for integration of educational technology. In addition to providing a facility for multimedia production, the MIDC provides seminars, information resources, and technical expertise to the university community. The MIDC provides training to help faculty and staff with support in the design, development, and use of educational technologies on campus. The MIDC will assist with the professional development portion of the project, and its facility will be available to faculty for development.

Among the K-12 partners, both Lawrence Township Schools in Indianapolis and the Crawfordsville Schools bring exceptional expertise in the use of educational technologies. Lawrence Central High School was the first site in the state of Indiana to adopt the use of a multimedia curriculum for the teaching of science instead of a traditional textbook. Crawfordsville has just completed an ambitious effort to equip all of its teachers with laptop computers. Now, many students in the district are also receiving laptops.

Corporate partners will also contribute resources to the project. The Corporation for Educational Communication (CEC) manages the Athena network, a two-way video network now connecting over 300 schools and education service providers (e.g., Indianapolis Children's Museum, Indianapolis Zoo) in the state of Indiana. This network, the second largest fiber optic video network connecting schools in the United States, will support communication among consortium partners during the project. Both Apple Computer and Intel have pledged equipment, including servers that will be used to support the initial phases of the electronic portfolio system.

The Indiana Department of Education has pledged personnel support for ensuring that the pre-service teacher education efforts in this project align with state technology initiatives. The North Central Regional Technology in Education Consortium has pledged personnel support for the professional development portion of the project as well as its *Captured Wisdom* interactive CD-ROMs and videos of exemplary classroom K-12 technology integration.

Management Plan

An **Advisory Board** consisting of representatives from each of the consortium partners will meet quarterly to review the progress of project components and provide direction and recommendations for project activities. In addition, several mechanisms will be used in support of ongoing consultation and advice from this board including the communal web site, use of electronic mailing lists, electronic mail, and other forms of consultation. The make-up of the Advisory Board is shown in Table 3.

On-going operations will be managed by an **Executive Committee** consisting of ten key representatives of the project and those committees/groups that monitor and make decisions about teacher education at Purdue University. This group will meet at least monthly, and will maintain additional contact through electronic communication and the project co-directors' participation in the elementary and secondary education standing committees.

Table 3. Advisory Board

Consortium Member	Representative	Role
Purdue School of Education	James D. Lehman, Co-PI David G. O'Brien, Co-PI Marilyn Haring, Dean Project Coordinator Technology Support Person	Overseeing and managing all phases of project implementation and evaluation
Purdue School of Science	Dennis Sorge, Director of Academic Services	Technology integration in selected mathematics and chemistry courses
Purdue School of Liberal Arts	Barbara Dixon, Assistant Dean	Technology integration in selected communications and composition courses
Purdue MIDC	John Campbell, Director	Providing 24 days of technology workshops for faculty, 3 staff members, and 300 hours of consultation as well as access to multimedia production facility
School City of East Chicago	Linda Nolan, Director of Instructional Services	Providing access to two school sites: Harrison Elementary and West Side Jr. H.S.; maintaining Athena network link; master teacher participation
Crawfordsville Community Schools	Participating teacher to be named	Providing access to two school sites: one 1st/2nd grade and one 5th grade; maintain Athena network link; master teacher participation
Lafayette School Corporation	Christopher Himsel, Director of Secondary Education	Providing access to up to four school sites: Jefferson H.S., Tecumseh Middle School, and two elementary schools; master teacher participation
Indianapolis Lawrence Township Schools	Participating teacher to be named	Providing access to two school sites: Lawrence Central H.S. and one 5th grade; maintain Athena network link; master teacher participation
NCRTEC (North Central Regional Technology in Education Consortium)	Kristin Ciesemeier, Director	Providing 8 days of workshops for faculty; supplying 10 sets of *Captured Wisdom* CD-ROMs and 2 sets of videos
Indiana Department of Education	Dwayne James, Office of the Superintendent	Assure correlation of project with state standards
CEC (Corporation for Educational Communications)	Ruth Blankenbaker, Executive Director	Maintaining Vision Athena network for two-way video communication among consortium members
Apple Computer	Diana Moon, Director of Strategic Initiatives	Providing server for portfolio system support and 3 days of workshops and consultation by an education and a technology advisor
Intel	Paul Zimmerman, Academic Relations	Providing a server for portfolio system as well as 10 workstations for the "classroom of the future"

The Executive Committee will advise the Project Directors about project implementation activities and day-to-day operations. The membership of the committee will be:

- Project Co-Directors, Project Coordinator, and Technology Support Person: The contributions of these individuals are detailed below.
- Chairs of Elementary and Secondary Teacher Education Committees: The chairs of these two standing committees are knowledgeable about and facilitate activities related to the implementation of the reformed programs at Purdue.
- Director of the Office of Professional Preparation and Licensure (OPPL): The director is responsible for coordinating the implementation of the new performance-based standards and monitoring the development and implementation of unit assessment system. The web-based portfolio system will be an integral part of the unit assessment system.
- Representatives from Implementation Committees: A representative from each of three key reform committees – the Accountability Team (oversees course alignment with reform program goals), the Implementation Team (oversees actual implementation of reform courses and Theory into Practice components), and Portfolio Task Force (guides implementation of the portfolio assessment system) – will serve to coordinate project activities with the on-going reform implementation process in the School of Education.

James D. Lehman, Project Co-director, will chair the Advisory Board and Executive Committee and coordinate components of the project tied to various consortium partners. In addition, he will oversee the management of all activities related to the project goals. Lehman will also assume specific responsibility for the design, delivery, and monitoring of activities supporting goals #1 and #2 (Implementation Activities 1-3), including the design and implementation of the phased technology integration into the curriculum, and the design and implementation of the faculty and staff development workshops and mentoring components. He will coordinate and oversee the mentoring groups during the academic year. He will also monitor aspects of the formative evaluation plan relating to those goals.

David G. O'Brien, Project Co-director, will coordinate all aspects of the project related to teaching and learning components of the web-based portfolio, its connection to the unit

assessment plan, and K-12 field experiences. Specifically, O'Brien will assume responsibility for implementation of activities supporting goal #2 (Implementation Activity #3) that relate to what pre-service teachers include in their digital portfolios and how they use the electronic artifacts to both reflect on their teaching and complete performance objectives. O'Brien will also serve as the primary liaison between the project and components of teacher education that interface with it and will engage in ongoing interaction with the advisory committee personnel.

Support Personnel

A half-time administrative aide, termed a project coordinator, will assist with managing day-to-day operations of the project. This individual will assist the Project Co-Directors with all details of project implementation and evaluation.

A full-time technical support person will be responsible for the technical support needed to implement project goals. Specifically the technical support person will design, implement, or modify existing facilities to support the web infrastructure needed for the creation, maintenance, and dynamic access of digital portfolios including the installation and maintenance of hardware, software, and the design of web tools and templates for faculty and students. The person will also support the infrastructure needed for consortium partners to work with each other over distance, including the maintenance of a networking infrastructure for the Internet and two-way video. Finally, this person will coordinate the support activities of other persons (e.g., graduate assistants) offering technical support.

Graduate assistants will also support the project by serving several functions. First, graduate students specializing in educational technology will assist faculty members in planning and facilitation of staff development workshops: they will help with presentations, facilitate group work and other activities, and engage faculty members and fellow graduate teaching assistants in the year-long mentoring program following workshops. Graduate students will also offer technical support to faculty and teaching assistants using technology to support their instruction (e.g., helping someone author web pages, digitize video, manage a WebCT site).

Project Evaluation

An independent evaluator will conduct the evaluation for the PT3 project. The evaluation will use multiple methodologies and both formative and summative evaluation measures. Multiple methodologies involving both quantitative and qualitative data (document analysis, surveys, observations, and interviews) are necessary to fully measure all aspects of this dynamic project and achieve triangulation. The formative evaluations will occur throughout the life of the grant. Formative reports will focus on the progress made toward the project goals and will allow for a proactive approach to the study. Semi-annual reports will enable the PI's and executive committee to continually refine and improve the project based on timely information.

Upon the conclusion of the grant, a summative evaluation report will be conducted which will focus on the general success of the project in meeting its project goals and the overall impact the project has made. This evaluation will also include narratives on the overall impact the project has had on students, faculty, K-12 schools, and the School of Education.

The following chart depicts the goals, indicators, benchmarks, and measures, which will be used for the evaluation.

GOAL #1: Faculty Use of Technology

GOAL	INDICATOR	BENCHMARK	MEASURE
FACULTY DEVELOPMENT	Faculty will participate in a summer intensive workshop Faculty will participate in an academic year team-mentoring network	By the end of year 1 of the grant, 25% of faculty will have engaged in workshop and mentoring network By the end of year 2, 60% By the end of year 3, 100%	· Data on faculty attendance of workshops · Data on mentoring networks
TEACHER PREP COURSES	Faculty will refine how technology is integrated into their classrooms Faculty will teach in technology rich classes Faculty will use conceptual technology	By the end of year 1 of the grant, 25% of the courses will have integrated technology By the end of year 2, 50% By the end of year 3, 75%	· Observation · Class syllabi · Faculty survey on use/access to technology · Student survey on use/access to technology

StaR Chart Advanced Tech Standards	See CEO Forum StaR Chart	By the end of year 1 of the grant, the SOE will meet or exceed the Early Tech Standards on the StaR chart By the end of year 2, it will meet or exceed the Developing Tech Standards By the end of year 3, it will meet or exceed the Advanced Tech Standards	· Student survey on use/access to technology · Faculty survey on use/access to technology · Interviews · Observations
TECHNOLO-GICAL SUPPORT	Sufficient technological support and resources will be available	A full-time technical curricular support person will be hired Faculty and students deem the access and adequacy of the hardware and software satisfactory	· Observation · Student survey on use/access to technology · Faculty survey on use/access to technology · Interview
TECHNOLOGY RESOURCES	Technology resources will be expanded through the continual development of the innovative school-based technology	By the end of year 1 of the grant, a mobile computer "lab" will be established By the end of year 2, a flexible classroom space will be developed By the end of year 3, at least 1 additional classroom space will be converted to accommodate new student uses of technology	· Observation · Faculty survey on use/access to technology

GOAL #2: Student Use of Technology

GOAL	INDICATOR	BENCHMARK	MEASURE
ISTE/NCATE technology competencies	Students will be competent in basic computer/ technology operations & concepts Students will apply tools to enhance own professional growth & productivity Students will apply computer & related technologies to support instruction	By the end of year 2 of the grant, students will have these skills	· EDCI270 grades · Portfolios · Observations · Technology Teacher Survey

PORTFOLIOS	All teacher education students will build a dynamic digital portfolio All teacher education students will engage in reflective practice related to portfolio development	Upon completion of EDCI 270 all students will have begun a portfolio and will have met all criteria upon graduation At checkpoints in unit assessment, students will evidence reflection on evolving teaching	· Portfolios · Data on portfolio checkpoint outcomes · Student Interviews
	The School of Education will create a model web-based infrastructure for portfolios	The web-based infrastructure will be complete by the end of year 1 of the grant	· Observation
DIVERSITY	Electronic access to ethnically diverse populations and technologically advanced sites will be provided to students	By the end of year 1 of the grant, at least 1 experience will be integrated into course blocks 1&2 By the end of year 2, at least 1 additional experience in blocks 3&4 By the end of year 3, at least 1 additional experience in blocks 5&6	· Course Syllabi · Observation · Student survey of use/access to technology
COMMUNICA-TION TECHNO-LOGIES	Computer technology will be implemented to maintain close working relationships with K-12 colleagues, student teachers, & provisionally certified teachers on the job	By the end of year 1 of the grant, a web-based community linking all consortium partners & all teacher education students will be established By the end of the project, desk top video conferencing will be piloted with at least 3 school sites involving teachers & university supervisors	· Observation · Document analysis · Consortium partner survey of communication technologies · Student survey of communication technologies · Interviews

In addition to the above evaluation measures, pre-post project surveys will be used. Prior to implementation of the project a pre-survey will be administered to faculty and students. This will provide a baseline of faculty and student knowledge, use, and comfort-level with technology. A post-survey will be administered at the conclusion of the project. The results of the two surveys will be compared and the results will be included in the summative evaluation.

A team of three visiting experts in technology and teacher education will conduct an external evaluation review. Allen Glenn, Dean of the College of Education at the University of Washington, and Elizabeth Rhodes, a member of the AACTE Committee on Technology in Teacher Education and the School/University Liaison at Xavier University, have agreed to serve in this capacity. We have also invited Rodney Reed, the former Dean of the College of Education at Penn State University, to join this team. As of this writing, Dr. Reed has yet to confirm; in the event that he cannot participate, another individual of similar background will be asked to join the external review team. The team will come to campus two days per year for each of the three years, review our progress as we have documented it, and submit a report. Their report will become a part of the formative and summative evaluation reports.

Annual evaluation reports will be available on the project web site and on an electronic CD. Reports will demonstrate where the Purdue School of Education was at the beginning of the project, its annual progress, and its outcome and technological position at the end of each year.

Impact

Purdue University, as part of its land grant mission, is dedicated to providing assistance to the people of Indiana, the United States, and the world. That assistance includes preparing teachers for the classrooms of the 21st century. Purdue's School of Education has demonstrated its commitment to excellence and to an innovative vision of teacher education through five long years of reform efforts. That work is now reaching fruition with implementation of new teacher preparation programs that provide renewed focus on technology, diversity, practical experience, and portfolios. With this grant, Purdue will be able to implement its teacher education goals, prepare technology-proficient teachers, and provide models of effective teacher preparation for other teacher preparation institutions. This project will impact 80 teacher education faculty, 16 faculty from Liberal Arts and Science, about 2800 pre-service teachers per year, as well as K-12 partners schools and their students. Purdue University and its consortium partners are committed to sustaining this project and its activities both now and into the future.