AC 2007-2708: TRANSFORMING CURRICULA TO REFLECT NEW IT LITERACIES FOR 21ST CENTURY STEM CAREERS

Patricia Carlson, Rose-Hulman Institute of Technology
Dr. Patricia A. Carlson received the BS from the College of William and Mary in 1968 and the MS and Ph.D. degrees from Duke University in 1969 and 1973 respectfully. Currently Dr. Carlson is Professor of American Literature and Director of PRISM, Department of Humanities and Social Science, Rose-Hulman Institute of Technology.

Dale Bremmer, Rose-Hulman Institute of Technology
Dale Bremmer is a professor of economics in the Department of Humanities and Social Sciences at Rose-Hulman Institute of Technology, Terre Haute, Indiana. He has taught at Rose-Hulman for the last eighteen years, specializing in applied econometrics. Bremmer has also taught at Arkansas State University and Indiana State University. He received his bachelor's and master's degrees in economics from Arizona State University while he earned his doctorate in economics from Texas A&M University.

Transforming Middle-School Curricula to Reflect the New IT Literacies of 21st Century STEM Careers

We report on an assessment-driven realignment of PRISM (http://www.rose-prism.org), a free, web-delivered "window" on digital resources for Indiana middle school teachers of science, mathematics, (pre)-engineering, and technology (STEM). The project is hosted at Rose-Hulman Institute of Technology. Opened in September 2003, with funding from the Lilly Endowment [27], PRISM (**P**ortal **R**esources for **I**ndiana Science and **M**athematics) was recently selected by T.H.E. (Journal of Technology Horizons in Education) as one of the top 15 educational innovators for K-12 in the nation.

Clearly we are not alone in using the concept of an Internet portal to provide resources for teachers. Simultaneous with PRISM's development over the last three years, other collections (many of them highly eclectic and predominately text-based) have appeared, and several have garnered national attention. Some include indices that correlate resources to specific state or national academic standards. Most improve convenience and accessibility by at least an order of magnitude over conventional Internet searches.

Our purpose here is to recount how program assessment and lessons learned over three years of fielding the portal have helped us to identify PRISM's core competencies for transforming middle school STEM teaching and learning.

1.0 PRISM: A Portal with a Purpose

Partnerships between K-12 and collegiate institutes have proliferated over the last two decades. Add the power of the Internet, and you have many vertical alliances hoping to transform education. We believe PRISM represents one of the best of its category. PRISM addresses the classic organizational problem of a knowledge gap: what to do when new methods of operating advance more rapidly than members of an organization can meaningfully assimilate and implement [10]. Rose-Hulman Institute of Technology developed PRISM as a web-delivered learning hub to help teachers of middle school STEM find high quality online resources without investing hours of time in searching and previewing materials [20]. The site has two flagship services:

- PRISM resources (numbering 2,300 and growing) are highly visual and highly interactive materials that engage students in active learning. All resources are reviewed by a board of peer-teachers using uniform criteria and indexed to the Indiana Academic Standards. Items are also cross-indexed by subject and grade level. A robust search feature helps teachers find PRISM resources using learning concepts as keywords.

- The newest PRISM service is MOODLE (http://moodle.org/), an Open Source product that requires no licensing fee and has a number of leading-edge learning mediators. By integrating MOODLE, we are able to give our user community the features and functionality of other, similar commercial products (e.g. ANGEL, WebCT/Blackboard). Registered users of PRISM can set up a lesson or an entire course by creating or importing content, establishing a roster, sequencing activities (including online quizzes and other forms of assessment). They can also enable a peer-review feature so that students can electronically critique each other's work. Especially innovative for middle school, teachers can create virtual student groups that can work together outside the classroom.

The PRISM team has been highly selective in the types of materials we have indexed to academic standards. The bulk of our offerings are non-textual IT resources *that mirror the digital tools used in the modern practice of STEM in the workplace*. The majority of our resources are interactive simulations, cognitive skills games, visualizations, cognition mapping applications, modeling packages, virtual laboratories and user-guided virtual experiments. We also index resource sites providing access to live data and data manipulation tools and to collaborative inquiry activities involving students from many different regions of the US. We look specifically for packages that embed computer-mediated computational tools within contextualized scenarios or digital environments requiring anchored learning and cognition apprenticeships such as those developed by the Cognition and Technology Group at Vanderbilt, led by John Bransford [6, 13, 17, 35, 43].

Availability of leading-edge services/resources, however, does not ensure that these items are being used to the best pedagogical or curricular advantage. This is the unequivocal message of a recent study, *Effective Access: Teachers' Use of Digital Resources in STEM Teaching*, completed by a well-known national research organization [21]. Teachers need new models to see the transformative powers of non-textual digital resources in their classrooms. Unfortunately, studies indicate that traditional approaches to in-service training for teachers (usually of the "half day workshop" variety) often do not lead to change in classroom practice by these same educators [39].

We report here on the dynamics of combining PRISM assessment results and the emerging need for new IT literacy skills in 21st century STEM careers to guide a PRISM transformation. In brief, we plan to move from being a convenient resource provider to becoming a major contributor in STEM pedagogical reform by

1. Advocating for increased awareness of how the uses of IT in the modern practice of STEM professions impacts the educational requirements for these careers.

2. Exploring the possibility that the new IT STEM literacies – with their emphasis on visualization, rich context, staged-problem solving, and electronically enabled collaboration – may more strongly appeal to female and minority students than traditional teaching methods.

In what follows, we first give an overview of the assessment results that have led us to re-purpose our portal. This discussion is followed by highlights of our projected program to improve teacher professional development (TPD) so as to influence standards-driven reform in STEM education over the next decade.

2.0 Some Assessment Results from 2003 through 2006

Our program evaluation model draws from a three-part plan and provides both formative and summative assessment based on three standard methods, as represented in Table A.

Table A: Three General Methods of Assessment

Category	Description
Descriptive – Questions of delivery, access, and usage patterns.	By analyzing routinely-kept data on PRISM system traffic, we can track several discrete variables, both for individual learners and for aggregates
Qualitative -- Questions of professional development and impact on pedagogy/classroom enactment for teachers.	Using surveys, we can determine changes in attitude, perceived self-efficacy, and adaptation of classroom behaviors for teachers using PRISM resources, as well as instructor-reported changes in student motivation and achievement. (The full survey is included in Addendum A.)
Quantitative -- Questions of measures of effect or changes in student achievement as indicated by empirical data from various state provided data, including standardized competency examinations	Based on data publicly reported in the past three years, we have used regression analysis to determine if intensity of PRISM usage has had a positive and significant effect on performance for a target population, while controlling other independent variables [7].

2.1 Descriptive Assessment Using Traffic and Usage Data: PRISM has become the premier web-site for Indiana teachers of 6^{th} -8^{th} grade STEM. Our user community has grown rapidly over time, and trends indicate that the rate will continue to accelerate. As Figure 1 shows, PRISM has enjoyed sustained growth since its inception. In the month of May 2006, we had a total of 11,500 different visits to the system, with an average of approximately 370 unique visitors per day. In the month of December 2006, we had a total of 18,068 different visits to the system, with an average of 583 unique visitors per day. Each metric indicates approximately a 57% growth in seven months.

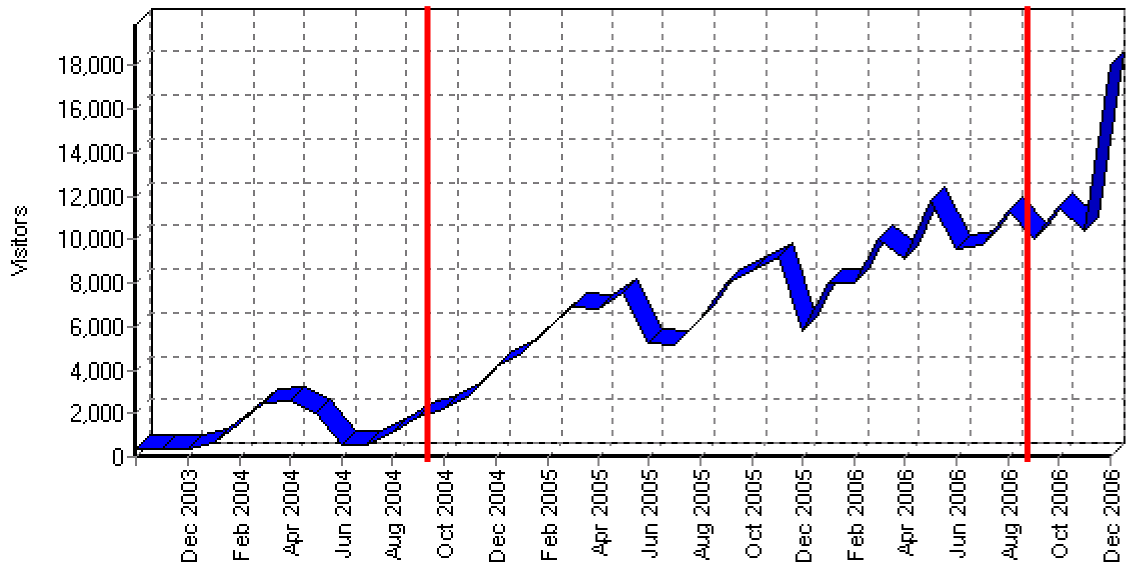

Figure 1: Trend Chart Indicating the Number of General Visits per Month -- Oct. 2003 through December 2006. (Solid Vertical Lines Indicate Points at which Empirical Assessment Took Place)

We have also used PRISM traffic data inferentially to determine robust "user communities." We defined a "user community" in the following way. Using data collected in our system traffic reports, we have taken the number of "hits" and divided by the number of "visitors" for specific locations. If a city has an active user community, the ratio between hits and visitors will be high and – ideally – increasing over time. We have defined a threshold for determining a PRISM user community: a group that reaches a cumulative average of 10 hits per user.

Applying this rule-of-thumb definition, we identified Indiana cities that have recorded active user communities. Table B reports data extracted from the most active cities (rank-ordered based on the total number of unique visitors since 2003). The table indicates the ratio of hits per number of unique users on 11/30/04, on 11/30/05, and on 12/31/06 (the actual number of users is at least an order of magnitude larger than the ratio indicator.)

Table B: Ratios for Selected Indiana Cities Given in Yearly Intervals

30 Selected Indiana Cities

	City	Ratio 11/30/04	Ratio 11/30/05	Ratio 12/31/2006
	Indianapolis, Indiana, United States	42/1	53/1	61/1
	East Chicago, Indiana, United States	16/1	18/1	15/1
	Fort Wayne, Indiana, United States	29/1	39/1	35/1
	Terre Haute, Indiana, United States	28/1	36/1	43/1
	Bloomington, Indiana, United States	50/1	31/1	49/1
	Saint Meinrad, Indiana, United States	106/1	135/1	80/1
	Lafayette, Indiana, United States	21/1	26/1	31/1

Muncie, Indiana, United States	45/1	39/1	47/1
Carmel, Indiana, United States	23/1	24/1	32/1
West Lafayette, Indiana, United States	50/1	30/1	137/1
Cloverdale, Indiana, United States	63/1	75/1	60/1
Evansville, Indiana, United States	50/1	56/1	128/1
Goshen, Indiana, United States	93/1	20/1	42/1
Greenfield, Indiana, United States	16/1	22/1	37/1
Michigan City, Indiana, United States	20/1	35/1	116/1
Ellettsville, Indiana, United States	19/1	34/1	11/1
Valparaiso, Indiana, United States	16/1	21/1	82/1
Bluffton, Indiana, United States	24/1	25/1	59/1
South Bend, Indiana, United States	28/1	33/1	37/1
Marion, Indiana, United States	15/1	33/1	55/1
Hammond, Indiana, United States	N/A	2/1	7/1
Martinsville, Indiana, United States	1/1	1/1	9/1
Connersville, Indiana, United States	149/1	52/1	63/1
Boonville, Indiana, United States	N/A	52/1	89/1
Notre Dame, Indiana, United States	19/1	28/1	43/1
Auburn, Indiana, United States	N/A	3/1	2/1
La Porte, Indiana, United States	2/1	80/1	45/1
Rensselaer, Indiana, United States	19/1	19/1	33/1
New Albany, Indiana, United States	15/1	22/1	10/1
Greenfield, Indiana, United States	16/1	22/1	37/1

2.2 Qualitative Assessment Using Teacher Survey: From the outset, PRISM's goals were to support standards-based educational reform and to help teachers find quality online resources. To see how well we were meeting our objectives, we used a carefully-crafted questionnaire to gather the opinions of our teacher users on three dimensions of PRISM efficacy.

(1) PRISM usage -- facilitates standards based teaching,
(2) PRISM usage -- helps in integrating digital resources into the classroom, and
(3) PRISM usage -- promotes teacher professional development (TPD) through a virtual "community of practice."

We composed the survey items by identifying three teacher-related variables that might influence PRISM's effectiveness: (1) attitude/predisposition, (2) perceived self-efficacy, and (3) enactment through actual classroom activities. Using all three of these variables under each of the three major themes of the project, we constructed a matrix of nine cells (3x3), and composed six survey items for each cell, making for a total of eighteen questions per thematic cluster (as illustrated in Figure 2, below).

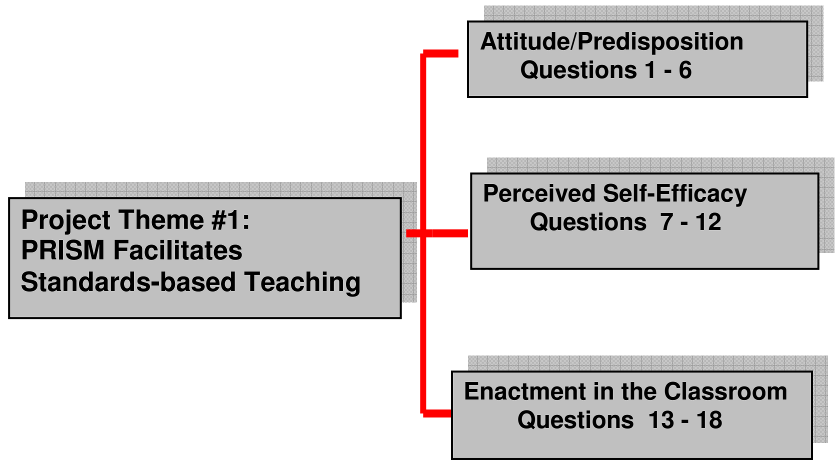

Figure 2: "Theme and Contributing Variables" Structure for User Survey

The survey was given at 23 different Indiana middle schools during the month of November 2006. This study was approved by the Rose-Hulman Institute of Technology Institutional Review Board (IRB) for research involving human subjects and produced 197 completed questionnaires. The survey was done with paper-and-pencil, and responses were entered on a five-point Likert scale:

- Not Enough Experience to Answer
- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

In each case, a lead-teacher was named to distribute the surveys by randomly selecting participants in the STEM disciplines. Note that actual use of PRISM was not a factor in selecting the volunteer respondents. All respondents are anonymous; however, each can be identified by an alphanumeric that makes re-surveying an option for our assessment in the spring semester of 2007, where we intend to measure change scores on attitude, perceived self-efficacy, and enactment as influenced by intensity/frequency of PRISM usage.

Descriptive results for each survey item are included in Addendum A. In general, based on the self-report survey, we found that the study strongly supports two of PRISM's major claims: (1) that PRISM facilitates standards-based teaching and (2) that PRISM aids in the integration of digital technologies into the classroom. However, results for our third theme (promoting professional development through virtual "meeting rooms") did not support the claim. In fact, the responses indicated only very weak PRISM efficacy for promoting communication/ collaboration/ professional development through an online community of practice. For the preponderance of the questions within this cluster, respondents (a) did not have enough experience to answer, (b) felt that they had little confidence their ability to use PRISM's online collaboration venues, or (c) simply did not use the PRISM's virtual community of practice.

2.3 Quantitative Assessment Using Statistical Methods: In 2005 and in 2006, we completed a relatively low-cost, opportunistic assessment by identifying and analyzing data sets already being captured by the state department of education at the district and schoolhouse level. Using data publicly reported for middle school education in Indiana (available at http://ideanet.doe.state.in.us), statistical calculations were used to determine how significant the effect of PRISM usage was for changing ISTEP scores (specifically math) during a given time frame and for a given grade level. More detailed results for these two studies are included in Addendum B.

Dr. Dale Bremmer (Professor of Economics at Rose-Hulman) worked with the project, collecting and analyzing data on several different variables that potentially influence performance on ISTEP (Indiana Statewide Testing for Educational Progress), an achievement test that measures student learning as defined by the state's academic standards. In addition to PRISM usage, independent variables included such things as past achievement of students, school and teacher corps characteristics, and other socio-economic features, for a total of about a dozen independent variables. Using statistical regression analysis, we determined the factors – including PRISM usage by classroom teachers – that affected the performance of Indiana eighth graders on the standardized math exam.

In the first study, we used data from the 2004 ISTEP. (At the time of this preliminary study, these were the most recent test data available from the state.) Our unit of measure was the school district level, and we have reported our findings in the literature [7]. Succinctly, we found statistical evidence that PRISM use had a weak, but positive, effect on ISTEP scores. While the results were encouraging, PRISM was relatively new and cumulative number of unique visitors to the site had reached only about 2,000 at the time of the September 2004 ISTEP testing period. (See Figure 1 above; the solid vertical line to the left of the chart indicates the traffic history used in this first study.)

Improved collection methods in 2005 allowed us to track PRISM usage patterns at the school house level from the system's inception in September 2003. We anticipated that this refinement in the empirical model would more closely capture effects of PRISM that were being "washed out" by the large variance in usage intensity at the district level. Our second study was based on individual school house data and analyzed how PRISM affected the change in scores on the eighth-grade ISTEP math exams between the years 2003 and 2006 (inclusive).

We found good results from this second empirical study. Using well-known regression techniques, statistical evidence indicates there is a direct (and statistically significant) relationship between the use of PRISM at a given school and the students' performance on the eighth-grade ISTEP math exam. In other words, increased use of PRISM by a school's teachers, holding everything else constant, leads to larger increases or smaller decreases in their eight-grade students' ISTEP math scores.

The results from both studies, however, should be taken with several caveats. Our regression analyses do not determine causality. The key question is whether continued use of PRISM leads to better teaching, improved learning, and higher standardized scores? Or do better, more motivated teachers use all teaching tools at their disposal, including PRISM? And would these stronger teachers generate an improved learning experience and result in higher ISTEP scores without using PRISM? Furthermore, the positive relationship between PRISM use and ISTEP

8^{th}-grade math scores may be capturing other effects, such as how connected a given school house is to the Internet, the quality of the school's computer and software facilities, and how much time a school gives its faculty to discover new teaching tools.

2.4 Three Forms of Assessment – One Underlying Conclusion: While PRISM has achieved success on several major metrics, all of our assessment results – empirical and experiential – indicate that neither availability nor ad hoc use of digital learning resources is sufficient to drive systemic STEM reform. To the contrary, we content that a combination of abundance and easy access does not automatically improve teaching or enhance learning. The almost hypnotic appeal that digital resources have for students and the availability of computer laboratories in most schools may make for a situation in which new media can be used for surface engagement or as quickly-implemented filler on days when the lesson plan has run dry.

PRISM was designed to support standards-based educational reform. However, our work in the field indicates that strong currents of change are mounting. A major transforming agent for education in the upcoming years appears to be the rapid advancements in informational technology as used in the workplace. New tools for knowledge workers indicate that an eminent next wave of educational reform may focus on academic standards that emphasize scientific visualization, richly-contextualized project-based learning, computer-mediated staged problem-solving and electronically enabled computation / collaboration / communication. Integrating these new digital literacies (as well as continuing to emphasize the standards-driven proficiencies now represented in most states' current educational agenda) embodies the three overarching goals for a new phase of PRISM:

1. To help middle school teachers embrace digital learning tools as extensions of their own dynamic presence in the classroom and to move beyond mere surface appeal in order to integrate computer-mediated learning tools into their traditional STEM curricula.

2. To construct a base-line taxonomy (or cognitive task analysis) of the new IT literacies used in professional STEM practice in order to facilitate the re-alignment of middle school academic standards to answer the challenges for 21^{st} Century global competition.

3. To explore the possibility that the new IT literacies in STEM – with their emphasis on visualization, rich context, staged problem-solving, and electronically enabled collaboration / communication – may more strongly appeal to female and minority students than the teaching methods traditionally used in these disciplines.

3.0 PRISM's New Approach: IT Literacies for STEM Education

Our new plan includes a combination of a three-week, teacher summer institute combined with continuing academic-year support to accomplish three inter-related objectives.

- First, the program will provide 60 seventh and eighth grade STEM teachers an opportunity to custom-build web-delivered learning units featuring the new IT literacies necessary for STEM careers in the 21^{st} Century.

- Second, each of the 60 teachers will work with a mentor, skilled in the latest educational practice for nurturing under-represented learners in STEM courses.
- Third, during the third week of the summer institute, each teacher will collaborate with a cadre of seventh and eighth grade under-represented students, who will field-test the learning units under development. These students will also spend a significant portion of their time touring local high-tech industries, attending hands-on introductions to science and engineering careers, and participating in a virtual scavenger hunt using their newly-honed IT skills.

The past decade brought unprecedented change for public school teachers in the United States [8, 34, 41]. Our goal in this three-year program is to provide teachers of 7th and 8th grade STEM an in-depth experience that includes both exposure to theory-driven instructional design (including issues of diversity) and an opportunity to be the architect of their own IT-enhanced pedagogy [3, 4,19, 22, 25, 40]. We envision the 60 participants as change agents who will – in turn – help others to traverse the gap between individual initiatives and systemic change.

3.1 PRISM's Learning Tools That Mirror Professional Practice: In the original PRISM grant proposal to the Lilly Endowment, we identified middle school as our target population. The transitional years of grades 7th and 8th prove critical for students who lose interest and lack success in STEM subjects. Negative experiences discourage students from taking the type of courses in high school that makes them competitive, either in the workplace or in pursuing a college degree in science, mathematics, engineering, or associated technologies.

We believe this target audience offers remarkable opportunities for introducing new IT literacies into existing curricula. Most middle school STEM courses currently make use of commonly-available office automation and standard workplace productivity software. As part of various instructional units, students are exposed to word processing, presentational software, webpage construction, rudimentary databases, and spreadsheets [28]. However, moving to the next level of computer-mediated STEM tools (e.g., GIS/GPS, CAD/CAM, data mining, animation/ rendering, complex computation such as symbolic algebra programs, or sophisticated modeling) proves difficult because of the expense in licensing application packages and – more importantly – the readiness level of the student population. Real-world digital tools have complex interfaces and require skills in observation, collection, preparation, and interpretation – most of these are well beyond reasonable expectations for a 7th or 8th grader.

PRISM offers over 2,300 age-appropriate resources, the vast majority of which are carefully designed learning environments serving as cognition facilitators for teaching complex, higher-order skills. Most contain mediation such as scaffolding, tutoring, graphical organizers, thinking frames, and/or visual workspaces that model higher-order concepts in a manner appropriate for early-stage learners. For example, symbolic algebra packages (such as *Mathematica*® or *Maple*®) may improve student achievement in mathematical concepts, but the learning curve is steep, requiring substantive classroom time teaching the idiosyncrasies of the tool rather than the concepts/content of the course. On the other hand, PRISM resources partner with the fledgling student and provide the embedded guidance that allows the novice to practice the more robust skills of an expert within a sheltered and nurturing environment.

PRISM's proven strength for middle schools has been its database of IT learning tools that mirror digital tools used in the real-world practice of STEM. We now will make a concerted effort to enhance PRISM's usefulness for STEM middle school teachers across the country by developing learning modules that showcase IT skills embedded within standards-driven course content. We propose a series of three summer institutes (held on the Rose-Hulman campus) in which a total of 60 local teachers of 7th and 8th grade STEM – selected through competitive application – work to enrich the current curriculum for one of their courses (see further description given below).

One valuable product from these workshops will be a set of at least 120 transferable learning modules, rigorously designed to merge IT literacies with the curriculum of a traditional STEM course. A second equally valuable product derived from the workshops will be a taxonomy of new IT literacies linked to Indiana state standards and enacted through an appropriate set of learning units (as depicted in Figure 3). Having a meta-level model (even in a first-cut form) helps to transition state-mandated learning objectives into 21st Century workforce educational needs.

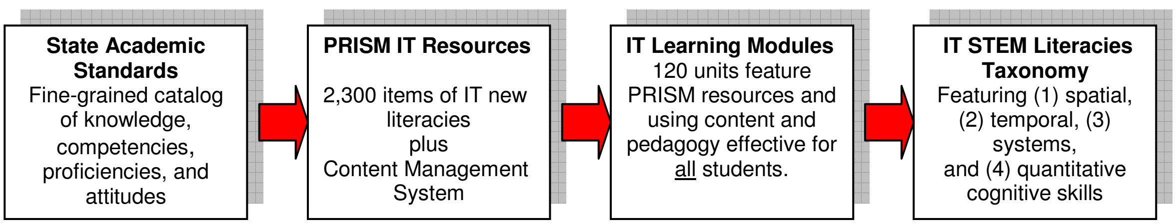

Figure 3: Model for Deriving Taxonomy of New IT STEM Literacies

3.2 Participants and Their Roles: This educational intervention combines the talents of five different groups: (1) 60 middle-school STEM teachers, (2) 240 middle school students, drawn from under-represented populations in STEM, (3) Rose-Hulman Institute of Technology faculty, staff, and students, (4) consultants and content experts, both from academia and from industry, and (5) practicing professionals from local industries. The role of the pre-collegiate participants is described below.

Teachers of 7th and 8th Grade STEM – 20 teachers per year, selected through competitive application from four school corporations located within a sixty-mile radius of Rose-Hulman Institute of Technology. Recruiting will emphasize a mix among the targeted grade levels and disciplines. As preparation for the summer workshop, teachers will identify one of their courses for IT-skills enrichment. They will then select at least two units of study within the course's curriculum that they would like to teach using digital tools that mirror professional practice.

Students from Demographics Under-represented in STEM Careers – each teacher will sponsor four students from his or her school to attend the one-week summer camp on the RHIT campus – making for a total of 80 students per year. In addition to working with their classroom teachers, these students will be hosted by local firms on plant trips that demonstrate high-tech jobs in bio-medical, engineering, and manufacturing fields.

WEEK ONE – Building the Foundation

(1) Visiting Expert #1 gives a two-day workshop on integrating IT competencies into the STEM core curriculum. **(2)** Visiting Expert #2 gives a two-day workshop on accommodating diversity in STEM learning. **(3)** PRISM staff gives a one-day workshop on learning resources in the digital library and on using a Content Management System (MOODLE).

WEEK TWO – Enriching Learning Modules to Incorporate IT Literacies

- Five days of iterative "design, build, critique" cycles that culminate in at least two substantive learning modules per participant. Moving beyond the notion of a digital library as a collection of supplemental materials of transient topical interest, each teacher will learn to use digital resources as a "significant catalyst for change in . . . teaching" [21, p.5]. Mentored by RHIT faculty and using templates provided by the PRISM team, the participants will iteratively construct a blueprint for each of the modules before actually completing the unit by adding content. These planning prototypes will include activities that encourage learner inquiry and reflection, as well as being cognitively, socially, and pedagogically appropriate for cultural and gender differences [1, 4, 9, 19, 22, 23, 29, 32, 41]. Table C characterizes both the process and the product for a learning module.

Table C: Constructing a Blueprint for a Technology-Enriched Learning Module

Component	Description
Identify Learning Goals	A module consists of learning goals, drawn from a cluster of objectives given in the Indiana Academic Standards. (These standards are very similar to the proficiencies and competencies specified in all other state and national standards.)
Enumerate Desired Learning Outcomes	Characterize the observable behaviors that indicate particular knowledge, skills, attitudes, and/or beliefs have been mastered. If appropriate, include a cognitive/affective tasks analysis.
Develop a Pedagogy and Instructional Methods Profile	Create an instructional design for the unit. This includes (a) identifying a learning theory framework (such as social constructivism) and (b) tentatively selecting types of activities (such as teamwork). Determining the mix of technology and non-technology in the learning experiences is central to this top-level design.
Develop Content and Integrating PRISM's Learning Tools	With a theory-driven framework in hand, teachers develop a case or a scenario that contains at least one major research question for students to investigate. Using an active learning paradigm, the inquiry culminates in a product that reifies learning. *During this critical phase, teachers integrate and sequence appropriate computer-mediated learning tools from the PRISM database.*
Incorporate Assessment and Evaluation Based on Learning Outcomes (see above)	Encourage a wide variety of assessment types for student achievement – beyond the traditional quantitative formats – to include such things as performance-based rubrics, portfolios, and student-designed assessment. Focus upon alternative assessment forms that require students to produce a response rather than select from a list of possible responses. Ensure equity through ethnic, racial, economic, and gender fairness.

- The 20 teacher participants will be assisted by "coaches" drawn from RHIT faculty in science, mathematics, and engineering and from professionals drawn from local businesses and industry. Junior/Senior level RHIT students will also assist with the development of the learning modules.

WEEK THREE – Students Work with Teachers
The students try out the units of study developed by their sponsoring teacher. However, their role is more than that of test subjects; they will serve as partners with their teacher and will provide the critical element of the learner's perspective for the materials being developed. Students will also spend 50% of their 40 hour week (a) participating in a hands-on experience to introduce the various RHIT engineering programs, (b) ½-day tour of a high-tech biomedical facility, and (c) ½ -day participation in a team-building, cap-stone exercise requiring the use of digital tools.

ACADEMIC YEAR – Teachers Implement Their Units in the Classroom
Teachers will field their learning modules, ideally once in the fall semester and again in the spring semester after incorporating improvements based on the first iteration. Two one-day gatherings will provide opportunities for participants to present the results and "lessons learned."

5.0 In Conclusion -- Re-Engineering the PRISM Program

Based on our three years of working with the Indiana teacher corps, the PRISM team is moving the project beyond providing convenient access by developing a cohesive, well-designed program to ensure that our IT-rich resources are used in a focused way and that instructors employ our educational technologies to enable enduring learning outcomes for all students [14, 18]. We view this transformation of PRISM's mission as supporting the nation's long-term commitment for aligning K-12 education with skills expectations inherent in postsecondary and modern workforce standards [2, 28, 37]. Indiana has become a national model for enhancing academic requirements to meet real-world demands [2]. We will promote PRISM as a national model for integrating new IT-literacies into traditional STEM classrooms and curricula.

References

[1] American Association of University Women (2004). *Under the Microscope: A Decade of Gender Equity Projects in the Science*, Washington, DC: American Association of University Women.

[2] American Diploma Project (2006). *Closing the Expectations Gap 2006: An Annual 50-State Progress Report on the Alignment of High School Policies with the Demands of College and Work.* Washington, DC: Achieve, Inc. Available: http://www.achieve.org/node/546

[3] Banks, J.A. (1996). "Multicultural Education: Historical Development, Dimensions, and Practice." In J. A. Banks & C.A.M. Banks (Eds.), *Handbook of Research on Multicultural Education* (pp. 3-23). San Francisco, CA: Jossey Bass.

[4] Beidler, J., Holz, H., Yasuhara, K, Adams, E. (2005). "The Many Facets of Diversity," ACM SIGCSE *Bulletin*, 37(1):558-559.

[5] Born, W. K., Revelle, W., & Pinto, L.H. (2002). "Improving Biology Performance with Workshop Groups," *Journal of Science Education and Technology*, 11(4):347-365.

[6] Bransford, J. D., with the Cognition and Technology Group at Vanderbilt. (2001). "Adventures in Anchored Instruction: Lessons from beyond the Ivory Tower," In R. Glaser (Ed.), *Advances in Instructional Psychology*, Vol. 5 (pp. 35-71). Mahwah, NH: Lawrence Erlbaum Associates.

[7] Bremmer, D and Carlson, P. (2006). "An Assessment Framework for a Large-Scale, Web-Delivered Resource Project for Middle School Teachers of Math, Science, and Technology," *Proceedings*, ASEE Conference, 18 - 22 June, Chicago, IL.
[8] Brown, J. S. (March/April 2000). "Growing Up Digital," *Change Magazine*. Available: http://www.aahe.org/change/digital.pdf
[9] Butler, D. (2000), "Gender, Girls, and Computer Technology: What's the Status Now?" *Clearing House*, 73(4):225-29.
[10] Carlson, P. A. (2002), "A Community of Practice: Web Portals and Faculty Development," *Journal of Computing in Higher Education*, 13(2):4-24.
[11] Carlson, P. A. (2001), "A Grassroots Approach to Educational Partnerships," *Journal of Technological Horizons in Education*, 29(3), 83-87.
[12] Clewell, B.C. & Campbell, P. B. (2002). "Taking Stock: Where We've Been, Where We Are, Where We're Going," *Journal of Women and Minorities in Science and Engineering* (8):255-284.
[13] Cognition and Technology Group at Vanderbilt (1992), "The Jasper Series as an Example of Anchored Instruction: Theory, Program Description, and Assessment Data," *Educational Psychologist*, 27(3):291-315.
[14] Congressional Commission the Advancement of Women and Minorities in Science, Engineering, and Technology Development. (2002). *Land of Plenty: Diversity as America's Competitive Edge in Science, Engineering, and Technology*. Washington, DC: United States Congress.
[15] Countryman, J., Feldman, A., Kekelis, L., & Spertus, E. (2002). "Developing a Hardware and Programming Curriculum for Middle School Girls," ACM SIGCSE *Bulletin*, 34 (2):44-47.
[16] Donovan, M.S., Bransford, J.D., & Pellegrino, J. W. (1999). *How People Learn: Bridging Research and Practice.* Washington, DC: National Academy Press.
[17] Duran, M. & Kariuki, M. (2004). "Using Anchored Instruction to Teach Pre-service Teachers to Integrate Technology in the Curriculum," *Journal of Technology and Teacher Education*, 12.
[18] Education Commission of the States (2006). *Engaged Learning: Fostering Success for All Students*. Denver, CO: Educational Commission of the States.
[19] Gabbard, D., L'Esperance, M., Perez, T., & Atkinson, T. (2002). "Dealing with Disengagement through Diversity: An Electronic Curriculum for Cultural Relevance, *Multicultural Education*, 10(2):41-48.
[20] Gunwald, P. (2003). *Key Technology Trends: Excerpts from New Survey Research Findings. Exploring the Digital Generation*. Educational Technology. Washington, DC: US Department of Education.
[21] Hanson, K. & Carlson, B. (2005). *Effective Access: Teachers' Use of Digital Resources in STEM Teaching.* Newton, MA: Gender, Diversities, and Technology Institute of the Education Development Center, Inc.
[22] Johari, A., Bentley, J. P. H., Tinney, M. V., & Chia, B. H. (2005). "Intercultural Internet-based Learning: Know Your Audience and What It Values," *Educational Technology Research and Development*, 53(2):117-127.
[23] Jones, K., Evans, C., Byrd, R., Campbell, K. (2000). "Gender Equity Training and Teaching Behavior," *Journal of Instructional Psychology*, 27(3):173-177.
[24] Jurow, A. S. (2005). "Shifting Engagements in Figured Worlds: Middle School Mathematics and Student Participation in an Architectural Design Project. *Journal of the Learning Sciences*, 14(1):35-67.
[25] Kadel, R. (2005). "How Teacher Attitudes Affect Technology Integration," *Learning and Leading with Technology*, 39(5):34-35, 47.
[26] Larkin.T.L. (2003). "Learning Styles in the Classroom: A Research-guided Approach," *Proceedings of the International Conference on Engineering and Computer Education* (ICECE 2003). Santos, Brazil.
[27] Lilly Grant #2001-2578-000, *Web-Portal: Integrating the Digital Learning Space for Indiana's Middle School Science, Mathematics, and Technology Teachers*.
[28] Malyn-Smith, J. & Wong, J. (2001-2006). "IT Applications across Career Clusters." http://www2.edc.org./itacrosscareers .
[29] Nair, S., Hanson, K, & Reidy, S. (2003). "Bridging Barriers: Using Technology to Attract, Retain, and Mentor the Engineering Workforce of Tomorrow," WEPAN Conference, Chicago, IL.
[30] National Research Council (1996). *The National Science Educational Standards.* Washington, DC: National Academy Press.
[31] National Science Council (2005). *Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum*. Washington, DC: National Academies Press.
[32] National Science Foundation. (2000). Women, Minorities, and Persons with Disabilities, 2000. Available: http://www.nsf.gov/sbe/srs/nsf00327/frames.htm

[33] Northrup, D. (2003). "Introducing Equity in the Classroom," *Women's Educational Equity Resource Center Digest.* Available: http://www.edc.org
[34] Oblinger, D.G. (2004). "The Next Generation of Educational Engagement," *Journal of Interactive Media in Education*, 8 (Special Issue on the Educational Semantic Web). Available: http://www-jime.open.ac.uk/2004/oblinger-2004-8.pdf
[35] Rogoff, B. (1990). *Apprenticeship in Thinking*. New York: Oxford University Press.
[36] Sanders, J. (2002). "Something is Missing from Teacher Education: Attention to Two Genders," Available: http://www.josanders.com/pdf/phidelta.pdf
[37] Secretary's Commission on Achieving Necessary Skills. (2000). *What Work Requires of Schools.* Washington, DC: U.S. Department of Labor.
[38] Siviloti, P. A. G. & Demirbas, M. (2003). "Introducing Middle School Girls to Fault Tolerant Computing," ACM SIGCSE *Bulletin*, 35(1):327-331.
[39] Supovitz, J. & Turner, H.M. (2000). "The Effects of Professional Development on Science Teaching Practices and Classroom Culture," *Journal of Research in Science Teaching*, 37(9):963-980.
[40] Sutton, R. (1991). "Equity and Computers in the Schools: A Decade of Research," *Review of Educational Research*, 61(4):475-503.
[41] Tolley, K. (2003). *The Science Education of American Girls: An Historical Perspective*. London: Routledge Falmer.
[42] Vannatta, R.A. & Fordham, N. (2204). "Teacher Dispositions as Predictors of Technology Use," *Journal of Research on Technology in Education*. 36(3):253-271.
[43] Wang, F. & Hanafin, M. J. (2005). "Design-based Research and Technology-enhanced Learning Environments. *Educational Technology Research and Development*, 53(4):5-23.

Acknowledgements:
PRISM is funded by the Lilly Endowment, Inc., and we gratefully acknowledge their support. Any opinions, finds, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the Lilly Endowment.

Addendum A

Qualitative Assessment Survey Results
197 Respondents

Teachers marked their response on a five-point Likert scale: (1) Strongly Agree, (2) Agree, (3) Disagree, (4) Strongly Disagree, (5) Not Enough Experience with PRISM to Answer. In the composite presented below, we conflate the responses into three categories, agree (1 and 2), disagree (3 and 4), or not enough experience (5). The results are given in as percentages of total responses for the survey item. These results are descriptive. More complete analysis – using interpretive statistical methods such as correlations and regressions – are in process.

Table A:
Theme #1: Facilitating Standards Based Teaching

Teachers: Attitude/Predisposition				
Questions		Agree	Disagree	N/E
1	I think having a collection of computer-based teaching resources, indexed to state standards, available for me to use in the classroom is a good idea.	94.93%	1.53%	3.55%
2	Using the computer-based teaching resources available from PRISM makes teaching the material from the state standards easier for me.	67.51%	4.06%	27.4%
3	Before knowing about PRISM, I used other web-based resources to find lessons that would meet particular state standards.	69.54%	19.29%	11.17%
4	I consider the computer-based teaching resources available from PRISM to be an asset when it comes to my teaching the state standards.	73.60%	3.05%	22.84%
5	I have time to integrate the computer-based teaching resources available from PRISM into the lessons I am currently teaching.	49.24%	30.96%	18.78%
6	I like using PRISM to find standards-based resources to use in my classroom.	67.51%	3.56%	28.43%
Teachers: Perceived Self Efficacy				
Questions		Agree	Disagree	N/E
7	I am confident in my ability to meet state standards in my teaching.	92.38%	3.56%	4.06%
8	I am better at matching what I teach with the state standards when I use conventional texts and paper-based curriculum guidelines than when I use the computer-based teaching resources available from PRISM.	28.43%	47.20%	23.35%
9	Overall, my ability to address state standards in			

	the classroom has improved as a result of using the computer-based teaching resources available from PRISM.	53.80%	14.72%	30.46%
10	I am good at matching conventional activities to the state standards in my classroom.	89.34%	6.60%	3.55%
11	I am good at matching the computer-based teaching resources available from PRISM to the state curriculum standards.	61.93%	8.12%	28.93%
12	I am good at integrating computer-based activities into my lessons.	69.54%	25.89%	3.55%
Teachers: Enactment				
Questions		**Agree**	**Disagree**	**N/E**
13	I feel that using PRISM to locate standards-specific teaching resources has enriched my teaching practice.	59.39%	9.65%	28.43%
14	Computer access time is a problem for me in being able to make use of PRISM resources at my school.	42.14%	44.67%	13.20%
15	Computer access time for my students is a problem in being able to plan lessons that use PRISM resources at my school.	50.76%	32.49%	16.75%
16	I use the computer-based teaching resources available from PRISM simply as an add-on or as filler for my conventional lesson plans.	39.09%	29.95%	29.95%
17	I often use the computer-based teaching resources available from PRISM to introduce new topics that address state standards.	38.58%	30.46%	29.95%
18	I feel that I have a better understanding of the state standards when I integrate PRISM resources into my lessons.	45.17%	23.86%	29.95%

Table B:
Theme #2: Integration of Digital Resources into the Classroom

Teachers: Attitude/Predisposition				
Questions		**Agree**	**Disagree**	**N/E**
19	I am eager to adopt teaching strategies based on digital technology into my teaching repertoire.	84.77%	11.17%	3.55%
20	I would rather integrate digital technologies into the classroom using the computer-based teaching resources available from PRISM than integrate the computer-based resources available from textbook publishers.	50.76%	25.89%	21.83%
21	I have the time to integrate computer-based	58.89%	38.58%	2.54%

	teaching resources into my classroom activities.			
22	I feel that using the computer-based teaching resources available from PRISM provides a worthwhile contribution to the learning process in my classroom.	70.05%	4.06%	25.38%
23	I have the necessary school support to integrate technologically based teaching strategies into my classroom.	80.21%	17.26%	2.03%
24	I believe that most computer-delivered educational enhancements fail to meet their promised effectiveness in the classroom.	27.92%	67.53%	3.05%
Teachers: Perceived Self Efficacy				
Questions		**Agree**	**Disagree**	**N/E**
25	I feel that I am better at using digital resources in my classroom than most of the other teachers in my school building.	47.72%	48.22%	3.05%
26	I am better at integrating technology into my classroom when I use resources available from PRISM than when I use digital learning activities available from other sources, such as from the textbook publisher.	37.05%	31.47%	28.93%
27	Overall, my ability to integrate digital resources into the classroom has improved as a result of using the computer-based teaching resources from PRISM.	47.72%	19.29%	31.47%
28	I would be able to give a short workshop to my peer teachers on how to use PRISM.	26.91%	52.80%	19.80%
29	I feel I do not have the necessary technology skills to successfully incorporate computer-based teaching resources into my classroom routine.	22.33%	75.13%	2.54%
30	I am good at developing lesson plans that balance my own teaching strengths with digital technology enrichments.	70.05%	26.4%	3.05%
Teachers: Enactment				
Questions		**Agree**	**Disagree**	**N/E**
31	See Item 1, Table E			
32	See Item 2, Table E			
33	Integrating the digital resources I find through PRISM has enhanced my awareness of new instructional methods.	57.87%	11.68%	29.44%
34	Integrating the digital resources I find through PRISM has made preparing lessons easier for me.	49.24%	19.29%	29.95%
35	I use the computer-based teaching resources available from PRISM as a secondary technology resource.	51.77%	16.75%	30.46%

36	I often tell other teachers about instructional resources that I have found using PRISM.	37.06%	32.49%	29.44%

Table C:
Theme #3: Promote Virtual "Community of Practice" for Communication, Collaboration, and Professional Development

Attitude/Predisposition				
Questions		Agree	Disagree	N/E
37	I have time to collaborate with my peers via the discussion forums available on PRISM	13.20%	53.81%	32.49%
38	I am interested in collaborating with other Indiana teachers using PRISM's "virtual" meeting rooms.	36.04%	41.62%	21.32%
39	I consider the computer-based teaching resources from PRISM an asset when it comes to promoting collaboration with other teachers.	46.20%	20.30%	30.96%
40	I like the idea of using digital technologies as a vehicle for my professional development.	85.78%	12.19%	1.52%
41	I find that I am more likely to use the computer-based teaching resources available from PRISM to explore classroom innovations and new pedagogies than I am to use conventional resources like journals or workshops.	42.64%	30.96%	24.87%
42	I enjoy engaging in professional development activities.	81.72%	16.75%	1.52%
Teachers: Perceived Self Efficacy				
Questions		Agree	Disagree	N/E
43	I am good at collaborating with colleagues via the discussion forums available on PRISM.	10.15%	44.16%	43.65%
44	I am good at using Internet resources as an enhancement for my professional development.	78.68%	20.30%	0.51%
45	I am good at sharing my ideas and experiences with other teachers.	85.78%	12.69%	1.02%
46	Overall, my ability to collaborate with colleagues has improved as a result of my use of the discussion forums available on PRISM.	13.20%	42.13%	43.15%
47	I am good at working in a group to develop curriculum or classroom activities.	83.25%	14.22%	1.52%
48	I am good at giving feedback to other teachers	72.08%	23.35%	3.55%

	about their classroom activities.			
Teachers: Enactment				
Questions		**Agree**	**Disagree**	**N/E**
49	See Item 3, Frequency Table E			
50	See Item 4, Frequency Table E			
51	I use the "virtual" meeting room in PRISM to facilitate working with other teachers who are not located in my school building.	3.05%	45.68%	50.76%
52	My collaborations with teaching colleagues via the discussion forums available on PRISM have had a positive impact on my teaching practice.	13.71%	27.41%	57.87%
53	See Item 5, Frequency Table E			
54	See Item 6, Frequency Table E			

Table D:
Reported Frequency for Six Identified Activities

Reported Frequency of Usage						
Questions		**Daily**	**1x/ Week**	**1x/ Month**	**1x/ Year**	**Never**
1	I use computer-based teaching resources in my classroom.	19.80%	35.03%	32.99%	5.06%	5.58%
2	I use computer-based teaching resources available from PRISM in my classroom.	2.03%	12.69%	34.01%	15.74%	33.50%
3	I collaborate in person with my teaching peers.	40.61%	31.47%	20.81%	2.03%	2.54%
4	I collaborate with my teaching peers using the discussion forums available on PRISM	0.51%	2.54%	6.60%	5.08%	83.25%
5	I act on suggestions made by teaching peers.	21.83%	35.03%	35.53%	3.05%	2.54%
6	I visit the PRISM website to see the events calendar or newsfeeds.	1.02%	14.21%	25.89%	5.58%	51.27%

Table E:
Impact of Standards Based Teaching on Students

	Student Motivation, Interest, and Engagement			
Questions		**Agree**	**Disagree**	**N/E**
55	I find that my students are more motivated to learn material covered by the state standards when the lesson incorporates the computer-based teaching resources available from PRISM than when the lesson is based on conventional resources.	50.25%	17.26%	32.49%
56	My students ask more insightful questions about the content covered by the state standards when the lesson includes computer-based teaching resources available from PRISM than when the lesson uses conventional resources.	35.53%	28.93%	35.53%
57	I find that my students have fewer discipline problems during a lesson that incorporates the computer-based teaching resources available from PRISM than when the lesson incorporates conventional resources.	39.59%	25.38%	35.03%
58	I feel that my students are more confident of their command of the material in the state standards when the lesson incorporates the computer-based teaching resources available from PRISM than when the lesson incorporates conventional resources.	37.56%	27.92%	34.52%
59	My students engage more readily in content from the state standards when we use the computer-based teaching resources available from PRISM than when we use the conventional text and paper-based curriculum.	47.21%	17.26%	35.03%
60	My students express more interest in learning when the lesson includes resources available from PRISM than when the lesson includes only textbook or paper-based resources.	53.30%	12.18%	34.52%
	Student Achievement			
Questions		**Agree**	**Disagree**	**N/E**
61	I find that my students demonstrate higher achievement on my in-class assessments of the state standards when lessons incorporate the computer-based teaching resources available from PRISM than when lessons incorporate only textbook or paper-based resources.	44.16%	19.80%	36.04%
62	I find that my students do a better job drawing connections among course topics when lessons			

	incorporate computer-based teaching resources from PRISM than when lessons incorporate only textbook or paper-based resources.	44.67%	19.29%	36.04%
63	I find that my students have better retention of course material when the lesson includes computer-based teaching resources available from PRISM than when the lesson includes only textbook or paper-based resources.	45.69%	18.78%	35.53%
64	My students show more mature problem-solving behaviors when the lesson includes computer-based teaching resources available from PRISM than when the lesson includes only textbook or paper-based resources.	36.43%	27.41%	36.04%
65	My students are better able to transfer what they learn in one setting to another situation when my lessons incorporate the computer-based resources available from PRISM than when lessons includes only textbook or paper-based resources.	40.61%	23.35%	36.04%
66	I find my students better able to make connections between learning concepts and real-world applications when they are using PRISM resources than when the lesson includes only textbook or paper-based resources.	46.19%	17.77%	36.04%

Addendum B

Quantitative Assessment Empirical Results
Regression Analysis

Study #1: Completed in late 2004, this empirical study examined the influence of PRISM use at the school district level on ISTEP scores for 8^{th} grade mathematics. Even though the PRISM website had been open for only one year at the time students took the 2004 ISTEP, we still found a weak positive influence.

TABLE A: A Priori Expected Signs of the Regression Coefficients
Dependent Variable: ODDS = Odds of 8^{th} Grade Students in Given School District Passing Math ISTEP in 2004 (in logs)

Independent Variables	Variable Name	Expected Sign	Type of Relationship with Dependent Variable
Past Achievement			
6^{th} Grade Students Passing Math ISTEP in 2002 (%)	MATH602	+	DIRECT
6^{th} Grade Students Passing English ISTEP in 2002 (%)	ENG602	+	DIRECT
School District Characteristics			
Average Teacher Age	AGE	+ or -	UNCERTAIN
Average Teacher Salary (in $1000)	SALARY	+	DIRECT
Average Expense per Student: 2002-2004 (in $1000)	EXPEND	+	DIRECT
Attendance Rate (2003-2004)	ATTEND	+	DIRECT
Instructional Hours	HOURS	+	DIRECT
Minority Students (% - 2004-2005)	MIN	-	INVERSE
Special Education Students (% - 2004-2005)	SPED	-	INVERSE
College Attendance Rate – Class of 2004 (%)	HIGHER	+	DIRECT
Other Regional Socio-Economic Variables			
Adults Never Attending High School (% - 2000 Census)	EDLV	-	INVERSE
Single Parent Families (% 2000 Census)	FAM	-	INVERSE
Prism Use			
At Least One PRISM Member (1 = Yes, 0 = No)	MEMBER	+	DIRECT
Average Number of Days Used per Member (in 100s of days)	DAYS	+	DIRECT
Threshold test: Average number of days > 100	THRESHOLD	+	DIRECT

TABLE B: Regression Results
Dependent Variable: Odds of 8th Grade Students Passing Math ISTEP in 2004 (in logs)

Independent Variables	(1)	(2)	(3)
Constant	**-11.225*** (3.460)	**-11.171*** (3.443)	**-12.000*** (3.364)
Past Achievement			
MATH602: 6th Grade Students Passing Math ISTEP in 2002 (%)	**1.114*** (0.367)	**1.148*** (0.368)	**1.084*** (0.370)
ENG602: 6th Grade Students Passing English ISTEP in 2002 (%)	**1.418*** (0.505)	**1.365*** (0.513)	**1.331**** (0.515)
School District Characteristics			
AGE: Average Teacher Age	**-0.033**** (0.014)	**-0.033**** (0.014)	**-0.033**** (0.014)
SALARY: Average Teacher Salary (in $1000)	**0.022**** (0.010)	**0.022**** (0.010)	**0.022**** (0.010)
EXPEND: Average Expense per Student: 2002-2004 (in $1000)	**0.041** (0.029)	**0.041** (0.029)	**0.043** (0.029)
ATTEND: Attendance Rate (2003-2004)	**0.102*** (0.032)	**0.102*** (0.032)	**0.111*** (0.031)
HOURS: Instructional Hours	**0.237**** (0.103)	**0.237**** (0.104)	**0.237**** (0.103)
MIN: Minority Students (% - 2004-2005)	**-0.005**** (0.002)	**-0.005**** (0.002)	**-0.005**** (0.002)
SPED: Special Education Students (% - 2004-2005)	**-0.020*** (0.006)	**-0.021*** (0.007)	**-0.020*** (0.006)
HIGHER: College Attendance Rate – Class of 2004 (%)	**0.005**** (0.002)	**0.005**** (0.002)	**0.004**** (0.002)
Other Regional Socio-Economic Variables			
EDLV: Adults Never Attending High School (% - 2000 Census)	**-0.008**** (0.004)	**-0.008**** (0.004)	**-0.009**** (0.004)
FAM: Single Parent Families (% 2000 Census)	**-0.012**** (0.005)	**-0.012**** (0.005)	**-0.012**** (0.005)
Prism Use			
MEMBER: At Least One PRISM Member (1 = Yes, 0 = No)		**0.025** (0.057)	**0.054** (0.057)
DAYS: Average Number of Days Used per Member (in 100s of days)		**0.034** (0.065)	**-0.133** (0.080)
THRESHOLD: Threshold test: Average number of days > 100			**0.309***** (0.159)
R^2	**0.547**	**0.549**	**0.558**
F Statistic	**26.815†**	**22.976†**	**22.174†**

*, **, and *** indicate the null hypothesis that the coefficient is less than or equal to zero is rejected at the 1, 5, or 10 percent level, respectively. † indicates the null hypothesis that all the slope coefficients are simultaneous equal to zero is rejected at the 1 percent level.

<u>Study #2</u> Completed in late 2006, this empirical study examined the influence of PRISM use at the <u>school house level</u> on the change in ISTEP scores from 2003 to 2006 (inclusive). Data indicated a positive and statistically significant relationship, as indicated in the tables below.

Table C
Variable Definitions and Expected Signs of Regression Coefficients

Dependent Variable		
Variable Name	**Definition**	
CHANGE	The change in the percentage of a school's 8th graders that passed the ISTEP math exam between 2003 and 2006	
Independent Variables		
Variable Name	**Definition**	**Expected Sign**
VISITS	The number of times people at the school accessed PRSIM since 2003 (in 1000s)	Positive
%PASS03	The percent of 8th graders at the school that passed the ISTEP math exam in 2003	Negative
%MINORITY	The percentage of the school's 8th graders in 2006 that were minority students	Negative
%FREE	The percentage of the school's 8th graders in 2006 that were entitled to free or reduced-cost lunches	Negative
%SPECIALED	The percentage of the school's 8th graders in 2006 that were in special education	Negative
%MALE	The percentage of the school's 8th graders in 2006 that were male	Uncertain
%ESL	The percentage of the school's 8th graders in 2006 that learned English as a second language	Negative
SALARY	The average salary of the school's teachers in 2006 (in $1,000)	Positive
EXPERIENCE	The average number of years of experience of the school's teachers in 2006	Negative

Table D
Regression Results

Dependent Variable

Variable Name	Definition
CHANGE	The change in the percentage of a school's 8th graders that passed the ISTEP math exam between 2003 and 2006

Estimated Regression Coefficients for the Independent Variables

Variable Name and Definition	Regression Results
Constant	33.627** (2.226)
VISITS Number of times people accessed PRSIM since 2003 (in 1000s)	0.003†† (1.328)
%PASS03 Percent of 8th graders passing ISTEP math exam in 2003	-0.328† (-2.843)
%MINORITY Percentage of 8th graders in 2006 that were minority students	-0.121† (-3.033)
%FREE Percentage of 8th graders in 2006 entitled to reduced-cost lunch	-0.088 (-0.953)
%SPECIALED Percentage of 8th graders in 2006 in special education	-0.231 (-1.135)
%MALE Percentage of 2006 8th graders in 2006 that were male	-0.042 (-0.305)
%ESL Percentage of 2006 8th graders with English as a second language	-0.026 (-0.083)
SALARY 2006 average teacher salary (in $1,000)	0.260 (1.198)
EXPERIENCE 2006 average years of teacher experience	-0.754† (-2.983)
R^2	0.318
Adjusted R^2	0.206
F-statistic	2.846‡