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## Position Paper for the Catalyst Leadership Retreat, November 2002

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The Preparing Tomorrow's Teachers to Use Technology (PT3) program was designed to prepare teachers to teach and learn effectively with technology. The PT3 program has enabled more than a third of the nation's teacher preparation programs to establish innovative technology programs. A unique contribution to educational improvement resulted, crossing traditional boundaries to address issues of national importance that transcend state, district, or local agencies. A shared research and development community resulted that supports both improvement of local and national and research into teacher quality with infusion of technology in higher education and K-12 schools. This position paper describes the overarching goals required to build upon and sustain the progress of the last three years. Taken together, these recommendations emphasize the need to build upon best practices created during the past three years and disseminate them to all teacher preparation programs. To ensure that prior gains contribute to future educational goals, implications are identified, which include a strong need for scientifically based research to support systemic change (including projects that evaluate both teacher preparation and student learning advances in K-12 schools) and a need to situate these goals within the context of the overall Teacher Quality program.

William Wulf, president of the National Academy of Engineering, has observed that few people understand the compound effect of the exponen-

tial rate of improvement in information technology. An early article in *Popular Mechanics* based a prediction on early vacuum tube computers such as ENIAC to state that in 1949, “computers in the future may have only 1,000 vacuum tubes and perhaps weigh only 1.5 tons.” In response, Professor Wulf commented, “Today I carry in my briefcase a computer that is one hundred times faster than ENIAC. This is not my laptop computer or even a PDA. It’s a holiday card that plays a tune when opened!” (Wulf, 2003).

Exponential technological change has redefined scholarship in higher education and practice in K-12 schools. Wulf founded the [Institute for Advanced Technology in the Humanities](#) to support exploration of transformational technologies. (*Editor’s note:* See the [Resources](#) section at the end of this paper for web sites.) [The Valley of the Shadow](#), a tale of two communities in the American Civil War, was one of the first exemplars to emerge. The site, developed by historian Ed Ayers offers hypermedia access to a massive trove of letters, diaries, newspaper accounts, military records, census data, business records, maps, images, music, and other sources gathered by a team of scholars over a 10-year research process. The inaugural *e-Lincoln Prize* was awarded to the project because of its transformative effect on historical scholarship. The award jury concluded, “The project has forever changed the way we approach historical research.”

The Valley of the Shadow irreversibly altered notions of historical research and also has changed Professor Ayers’ history classes. He can no longer tell a simple linear story, because his students have too much access to the messiness of real history. Instead, he invites the students to join him as colleagues in the process of historical research, making further contributions that enrich the on-line archive. A Catalyst grant has provided support to extend use of this and other exemplary digital resources to K-12 schools, so they too can process historical research

Similar redefinitions of scholarship and working practices enhanced with technology are occurring in most disciplines, including the core curriculum areas of English, math, and science. Catalyst and implementation projects have provided many examples and resources to develop these practices and related inputs to teacher quality.

## EXPONENTIAL CHANGE AND LEARNING

Exponential change in information technology is transforming university scholarship and offers new opportunities for enhancement of K-12 teaching and learning. Two significant facts attest to the acute need for effective integration of technology into classrooms:

- First, a growing body of scientific evidence indicates that appropriate uses of technology positively impact student learning when teachers are competent and well prepared.
- Second, America's economic growth depends on a highly educated workforce capable of using rapidly developing and ever-changing information technology.

Both of these factors make it imperative that teachers have opportunities to teach and learn effectively with technology. A Pew *Internet and American Life Project* study reports that for the first time, a majority of college students now use the Internet more than the physical library for research (Jones, 2002). In the near future, K-12 students will have similar access to digital communication and learning devices.

The current and next generation of teachers must be able to leverage effectively these tools and the learning models they enable as instructional resources to improve student learning. The definition of effective teaching in the U.S. has changed by virtue of the information and technology-rich learning environments evolving in our schools and the pervasiveness of technology in society. Ensuring an effective teacher in every classroom requires that each teacher effectively use modern tools, resources, and teaching approaches.

To do so, teachers each need to develop their skills to take advantage of the emerging technological infrastructure. There is strong evidence that intensive professional development, accompanied by research and technical assistance, makes a major difference in how teacher preparation programs rise to meet this challenge.

Over the past three years, the U.S. Department of Education has invested more than a quarter of a billion dollars in 500 teacher preparation programs to improve instruction through appropriate technology integration. The *Preparing Tomorrow's Teachers to Use Technology* (PT3) Program of the U.S. Department of Education has created a shared research and development community that is making a unique contribution to educational improvement. Collaborations have crossed traditional boundaries, and this community is addressing issues of national importance that transcend state, district, and local agencies, providing external input on teacher preparation and fostering learning communities. The implications extend far beyond the original catalyzing focus of technology. We now must sustain and build upon the progress of the last three years.

#### RECOMMENDATIONS

In 1998, a group of educational leaders produced a paper that detailed necessary actions to successfully integrate technology into teacher preparation (*Ames White Paper*; Willis, 2000). Many of the recommendations outlined in the *Ames White Paper* have been initiated through U.S. Department of Education programs that followed. It is now time to celebrate these accomplishments and develop recommendations to sustain the momentum achieved.

The first Catalyst Leadership Retreat was convened by the U.S. Department of Education in fall 2002. This retreat brought together key educational leaders and presidents of national education associations, teacher educator organizations and leaders of projects that are catalyzing action across the United States. The goal of this leadership summit was to build upon the current foundation and leverage the valuable resources that have been established. The following recommendations are designed to enhance teacher quality at all levels. Future funded initiatives should do the following:

1. Contribute to a networked *community of practice* to enhance teacher quality. It is important to provide resources to sustain and extend mechanisms to allow program participants and their colleagues to easily interact, convene, learn in groups, debate issues, draw consensus

around actions, guide the community, disseminate results internally and externally, and provide technical assistance for program improvement.

2. Include projects of national scope. National Centers for Teacher Quality would provide oversight and leadership, including the integration of technology in appropriate ways that contribute to improving student achievement and classroom management, while also supporting movement of educational institutions to an evidence-based model. National initiatives of this kind serve as catalysts for the discovery and early adoption of new scientifically based technological processes. They enable educators to work together within and across projects and programs.
3. Implement data-driven research practice. Enhancement of preservice teacher education programs should be based on data-driven research. Technology plans should be grounded in best practices that will improve student learning outcomes. This should be made available through digital portals that bring together new resources with existing proven resources. A uniform XML tagging scheme for teacher education research databases could make these materials accessible and also support research into the challenges of innovation and change in teacher preparation.
4. Recognize exemplary efforts that enhance learning. Recognize those who achieve excellence at all levels, particularly in areas of high need. This will ensure that best practices are acknowledged and widely disseminated, especially in cases presenting particular challenges for education and teacher preparation.
5. Reduce barriers to learning technologies. Projects should prepare future teachers to address digital equity issues facing their K-12 students. Teachers should be able to identify local resources that can reduce barriers to students' access to learning technology resources in the classroom and the home. These resources include public libraries and community technology centers. A national help desk or center could be established to assist teacher preparation programs, allowing them to ensure that all teachers and those who prepare them address digital equity obstacles. The national help desk could also analyze and maintain a database of access needs in schools.

6. Apply internationally recognized Program Evaluation Standards. Projects and initiatives must apply internationally recognized standards, developed by the Joint Committee on Standards for Educational Evaluation (1994) and reinforced in the 2001 Helsinki Agreement. The committee has established standards for ethical treatment of participants and use of mixed methods, multiple measures, and different types of analyses to strengthen conclusions beyond those drawn from only a single source.
7. Identify critical conditions for development of effective teachers. Existing research demonstrates that the knowledge and skills required by future teachers include (a) strong content knowledge, (b) pedagogic flexibility, (c) ability to address diverse student needs, and (d) good communication skills. These conditions must also be matched to state and national standards, so that external demands on teacher preparation are coherent.
8. Draw upon international exemplars. Successful practices in the U.S. should draw on knowledge and practice developed in other parts of the world. Progress in the U.S. should be benchmarked against gains in other countries and capitalize on international research.

Taken together, these recommendations emphasize the need to build on the tools, models, and networks created in the past three years. These tools, models, and networks need to be disseminated to all teacher preparation programs to ensure that all teachers will be prepared to teach effectively. They provide a base for future teaching quality that ensures effective use of technology for K-12 student achievement.

There is a strong need to continue scientifically based research on these results. This research should include projects evaluating both teacher preparation and student learning advances. Through this research, we will build a shared body of knowledge on the emerging discipline of technology in teacher preparation.

## IMPLEMENTATION STRATEGIES

The following section describes implementation strategies for achieving the recommendations described above and detail regarding the intent of the recommendations.

### **Purpose, Goals, and General Strategies**

The *purpose* of these recommendations is to maximize learning for all. They are based on the premise that technology will continue to change at an exponential rate, affecting both societal needs, and opportunities to enhance teaching and learning. The overall *goal* is to prepare teachers to effectively employ emerging technologies to enhance student achievement. *Strategies* for preparing effective teachers include

1. Prepare teachers to teach subject matter more effectively with technology.
2. Prepare teachers to understand the effect of exponential change on society.
3. Use technology to address individual needs.

### **Projects of National Scope**

The national scope of the current program has made it possible to streamline the accreditation system for integration and coherence of national technology standards. This promotes improved teacher quality. A shared research and development community has emerged that is making a unique contribution to educational improvement by:

- Addressing issues of national importance that transcend states, districts, or local agencies and provide external input.
- Developing and fostering learning communities, which result in collaboration that crosses the traditional boundaries (P-12; institutions

of higher education, professional organizations, federal and state educational agencies; the private sector and philanthropic organizations).

Economies of scale and crucial new inputs into educational improvement efforts result from these synergies. The national scope allows states and local agencies to share resources and address educational standards more effectively. It also permits development of national evaluation and assessment tools for conducting scientific research.

Programs of national scope also enable educators to address efficiently the needs of low incidence populations, including those with special needs and citizens in isolated or rural communities. This is a key element of a strategy to ensure that no child is left behind. National initiatives allow diverse partners to pool data and expertise providing resources and ensuring accountability across educational systems. This approach ensures that qualified teachers are prepared for every classroom to enable student achievement at the highest level.

### **National Centers for Teacher Quality**

National Centers for Teacher Quality (NCTQ) that support these efforts could provide oversight to organize the scope of future work. An important component must be the preparation of teachers to integrate technology in appropriate ways that contribute to improving student achievement and classroom management.

A national technical assistance center could aid education projects in conducting scientifically based research and assessment strategies to evaluate and inform their progress. A guide for funded projects on design of effective project evaluation and research processes could also enhance communication of findings. The following are required to ensure that educational institutions move to an evidence-based model to improve teacher quality:

- Articulate expectations clearly and forcefully in multiple venues.
- Provide support to encourage the desired change.
- Assess the results.

- Ensure that consequences correspond with outcomes.

The technological quality branch of the NCTQ could provide leadership to drive this change. A series of subcontracts should be extended for a comprehensive program of review to assess what works.

The digital resources that demonstrate increased student achievement should then be disseminated nationally through the Center's outreach. This outreach should include an annual national leadership meeting, as well as regional workshops to ensure that all teacher preparation programs can uniformly succeed in producing the kind of teachers the nation deserves.

The products and practices proven to be effective should be added to existing databases, which should be maintained and extended. All of the educational databases of resources and proven practices should become interoperable by following a standard metatagging of fields and a common access method. This interoperability will allow an educator to undertake a single search across all educational databases to secure the information needed to support learners, and those who prepare teachers.

## **Program Evaluation and Research**

The Program Evaluation Standards developed by the Joint Committee on Standards for Educational Evaluation (1994) have been endorsed by all major research and educational professional associations. These standards should be integrated into the evaluation plan for any initiative.

Recent developments in research methodology support the use of mixed methods and multiple measures to capture more accurately and completely the variations, interactions, and outcomes of a project. The use of different types of analyses strengthens the conclusions that can be drawn from any single source. This is particularly important in the complex field of education and particularly with regard to teacher quality for in-service and preservice teachers.

## **Conclusion**

The U.S. Department of Education Preparing Tomorrow's Teachers to Use Technology program developed the capacity for change in projects in more

than a third of the nation's teacher preparation programs. This has resulted in improved quality of teacher preparation. It has also led to simultaneous enhancement of teacher quality in K-12 schools that have joined these universities and colleges as partners.

These positive outcomes have been widely circulated in academic journals and professional meetings. Each issue of *Contemporary Issues in Technology and Teacher Education* includes a "Current Practice" section highlighting best practices achieved through this program. The *Journal of Technology in Teacher Education* and the *Educational Technology Research and Development* journal are both devoting upcoming special issues to these outcomes. The annual meetings of the *Society for Information Technology and Teacher Education* and the *National Education Computing Conference* have established special conference strands devoted to these achievements, as well. These efforts have been undertaken in concert with the teacher educator associations representing the core content areas in science, mathematics, English, and social studies and those representing teacher educators in general, including the Association of Teacher Education's Technology Commission.

This is the only joint collaborative venture of this kind in teacher education of which we are aware. It symbolizes the level of national collaboration that has been achieved through this program. The initiative has mobilized a community of change agents in teacher preparation programs and professional associations nationally. Establishment of National Centers for Teacher Quality would capitalize upon this capacity, disseminating successful practices to other teacher preparation programs and supporting the larger national Teacher Quality program.

### **The Authors**

This position paper was edited by Glen Bull (University of Virginia), Elizabeth Byrom ( Director, Technology in Learning, SERVE), Niki Davis (Iowa State University), Don Knezek (International Society for Technology in Education), Bob McLaughlin (ThinkQuest), and Ann Thompson (Iowa State University) on behalf of the Leadership Retreat.

The appendix provides a list of those attending the retreat and additional participants who joined in at a later stage. We thank them all.

## References

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## Resources:

- Ames White Paper - <http://www.citejournal.org/vol1/iss1/seminal/article1.htm>  
Institute for Advanced Technology in the Humanities-<http://www.iath.virginia.edu/>
- Preparing Tomorrow's Teachers to use Technology - [www.pt3.org](http://www.pt3.org)  
Valley of the Shadow - <http://www.iath.virginia.edu/vshadow2/>

APPENDIX

LIST OF THOSE ATTENDING THE LEADERSHIP RETREAT AND ADDITIONAL PARTICIPANTS

| First name | Last name  | Organization  |
|------------|------------|---|
| Stephanie  | Ash        | Alabama Department of Education                             |
| Anna       | Baldwin    | Clemson University  |
| Cynthia    | Barnes     | Education Commission of the States                          |
| Helen      | Barrett    | ISTE, University of Alaska                                  |
| L.B.       | Berg       | Center for Technology and Teacher Education, William & Mary |
| Bonnie     | Brownstein | Institute for Schools of the Future                         |
| Paul       | Bucci      | State System of Higher Education                            |
| Glen       | Bull       | University of Virginia, SITE                                |
| Elizabeth  | Byrom      | UNC-Greensboro/SERVE (SUNRAY)                               |
| William    | Callahan   | University of Northern Iowa                                 |
| Brett      | Christie   | Sonoma State University                                     |
| Ruthmary   | Cradler    | SOUNDPRINT Media Center, Inc.                               |
| Niki       | Davis      | SITE, Iowa State University                                 |
| Anna Maria | de Freitas | SOUNDPRINT Media Center, Inc.                               |
| Karen      | Dilka      | Association of College Education for DHH                    |

|          |             |  |
|----------|-------------|--|
| Wen-Li   | Feng        | The Ohio State University                      |
| Connie   | Foster      | University of Wisconsin System                 |
| Tim      | Freesmeyer  | Western Illinois University                    |
| David    | Gibson      | National Institute for Community Innovations   |
| Lavona   | Grow        | US Department of Education                     |
| Juanita  | Guerin      | Louisiana Systemic Initiatives Program (LaSIP) |
| Burnette | Hamil       | Mississippi State University                   |
| Cathy    | Higgins     | New Hampshire Department of Education          |
| Jayne    | James       | CRL, University of Kansas                      |
| Cheryl   | Juarez      | Miami Museum of Science                        |
| Donald   | Knezek      | ISTE   |
| Karla    | Krueger     | University of Northern Iowa                    |
| Ellen    | Lupinski    | DTI Associates, Inc.                           |
| Hilary   | Maybaum     | ThinkQuest                                     |
| Robert   | McLaughlin  | National Institute for Community Innovations   |
| Ellen    | Meier       | Teachers College, Columbia University          |
| Donna    | Mertens     | Gallaudet University                           |
| Patricia | Morgenstern | Spring Arbor University                        |

*Contemporary Issues in Technology and Teacher Education, 3(2)*

|         |           |                                       |
|---------|-----------|---------------------------------------|
| Lynn    | Nolan     | Clemson University                    |
| Michael | Novak     | Shodor Education Foundation           |
| Gary    | Obermeyer | Great Cities Universities Foundation  |
| Shannon | Parks     | Alabama Department of Education       |
| Kyle    | Peck      | Penn State University                 |
| Ami     | Plotkin   | DTI Associates, Inc.                  |
| David   | Popp      | Penn State University                 |
| Timothy | Pritchard | The Ohio State University             |
| Moira   | Rankin    | SOUNDPRINT Media Center, Inc.         |
| Keith   | Restine   | University of North Texas             |
| Donn    | Ritchie   | San Diego State University            |
| Beverly | Rodgers   | University of Texas Austin            |
| Reuben  | Rubio     | Spring Arbor University               |
| Selma   | Sax       | Wexford, Inc.                         |
| Zahrl   | Schoeny   | University of Virginia PT3 Catalyst   |
| Sandi   | Sheppard  | PA State System of Higher Education   |
| Robert  | Sibley    | Advanced Network and Services         |
| Arati   | Singh     | PA State System of Higher Education   |
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*Contemporary Issues in Technology and Teacher Education, 3(2)*

|           |          |  |
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| Feng-Kwei | Wang     | University of Missouri - Columbia      |
| Stacey    | Warner   | ISTE                                   |
| Edee      | Wiziecki | Shodor Education Foundation            |
| Rhonda    | Yates    | Mississippi Department of Education    |

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