

Final Report of the EHR-MPS Evaluation and Education Research (EER) Working Group September 19, 2005

The EERWG Progress Report of July 13, 2005, which appears at the end of this document, lists a set of recommendations that could be used for future actions. The EERWG subsequently met to prioritize these recommendations using the following criteria:

- Significant involvement of both EHR and MPS
- Foundational capability, both internally and as a prerequisite for future actions
- Ability to leverage existing expertise and resources
- Value added to ongoing activities
- Cost/effort associated with implementation
- Timeline associated with implementation
- Potential for external impact

As a result of these discussions, the following recommendations are offered and ranked in order of descending priority. Each recommendation is also characterized by the cost and effort associated with it, along with its timeline and likely impact. While the EERWG believes that several of the high priority recommendations could be initiated shortly, no specific plans are provided. Such plans will depend on recruiting new members to the EERWG, to form the EERG, as noted in 1., below.

1. Establish a mechanism for ongoing EER discussions, the EER Group (EERG)

The current EERWG agreed to form the nucleus for an ongoing EER Group (EERG) that could sustain joint discussions of evaluation and education research related to teaching and learning in the MPS disciplines. Modeled loosely after EHR's Internal Resource Group (IRG), the EERG would meet periodically and invite visitors and paid consultants to attend meetings as appropriate. The EERWG endorsed the idea that the EERG would set up email distribution lists, newsgroups, and wikis. Through these mechanisms the EERG would provide a platform for ongoing EER initiatives involving EHR and MPS.

Cost/effort: Moderate

Timeline: Immediate and continuing

Impact: High

2. Identify a group for guiding evaluation of the College Board's project to update Advanced Placement tests in Biology, Chemistry, Environmental Science, and Physics

There was great enthusiasm for the College Board's proposal, 0525575, to update four science AP tests. Presuming the project receives funding, it affords an extraordinary opportunity for evaluation and education research, as it will have national reach and impact. The EERWG identified a critical need to nucleate a cross-directorate group at NSF, including GEO and BIO representatives, which can monitor the project and work with the College Board on its EER components. The EERG could help constitute this internal working group. Interest was also expressed in making a joint EHR-MPS award to study the impact of the College Board's project.

Cost/effort: High

Timeline: Approx. two years for the initial phase of the project

Impact: High

3. Develop EHR-MPS collaborations to enhance the quality of program announcements, proposal review, and project implementation

For MPS and EHR programs that have EER components, members of the EERG would assist in the preparation and revision of program announcements, or would identify other EHR or MPS staff members who have the appropriate expertise. This form of staff participation would help ensure that EER components are described appropriately. These staff members would also help to locate education researchers and evaluators for preparation and review of MPS proposals; and disciplinary experts for preparation and review of EHR proposals. This type of collaboration could lead to establishment of a reviewer database that would serve both directorates.

Refinement of the current CHE intelligent reviewer database (portal URL:

http://www.nsf.gov/mps/che/reviewer/reviewer_info.jsp) to facilitate this process will be investigated for a pilot effort and other options will be explored.

Cost/effort: Moderate or High, if database construction is included

Timeline: Immediate and continuing

Impact: High

4. Develop a joint EHR-MPS knowledge base of resources on evaluation and education research, targeted to EHR and MPS program directors and PIs

Although development of a sophisticated set of resources would be time- and labor-intensive, the EERWG felt that a limited, basic set of resources could be identified quickly and inexpensively with assistance from REC and using resources from, e.g., SRI, Westat, NRC publications, and Western Michigan University. If they were easily accessible and comprehensible to non-experts, these resources could substantially raise awareness among program directors and PIs of the importance of EER and lower the barriers to utilizing this body of scholarship. The EERWG could organize and publicize this effort.

Cost/effort: Low

Timeline: Immediate

Impact: Moderate

5. Train a cadre of evaluators and education researchers for MPS and EHR awards

The EERWG recognized the need for building EER capacity both internally and externally. Some mechanisms that have been used include supplements to awards to train individuals in EER, support for Fellows associated with CLTs, and internships in education for PhD candidates in the sciences as part of CLTs. The emergence of information visualization tools (see, e.g., <http://ella.slis.indiana.edu/~katy/events/index.html>) may afford excellent opportunities for individuals having interests in EER and could be promoted through EERG-initiated activities. The EERG could help design a strategy for advancing these efforts, or could identify other MPS and HER staff members who are interested in doing so.

Cost/effort: Moderate to High

Timeline: Long-term

Impact: Moderate

6. Develop a joint EHR-MPS educational research agenda for emerging areas

The EERWG felt that education research will play a vital role in understanding frontier developments like cyberscience (including visualization and analysis of massive cyberinfrastructure databases and use of the Open Science Grid), emergency/crisis response, and use of game-based learning to enhance science education. These frontiers of NSF research are often highly interdisciplinary. The EERWG could provide leadership in organizing seminars to raise awareness of EER opportunities associated with emerging areas, in collaboration with appropriate partners from across NSF. As noted above in 2., an award to the College Board to update AP tests would also provide an opportunity to establish a joint research agenda.

Cost/effort: Low

Timeline: Immediate and continuing

Impact: Moderate to High

7. Nurture talent at the K-12 level through EHR-MPS programs and projects

The K-12 educational enterprise is enormously important to the nurturing of future scientific talent. The EERWG felt that the EERWG could play a significant role in initiating activities to promote more effective recruitment of the future technical workforce and ensuring that they are informed by EER methods and tools. An example of EERWG involvement would be the College Board initiative described above, as students in AP courses represent a particularly rich and increasingly diverse talent pool. Re-conceptualization of high school science laboratories and the former Young Scholars program in which DMS participated were identified by the EERWG as worthy of consideration. PHY's QuarkNet and DMR's Strange Matter exemplify other projects where EER expertise would be valuable in assessing effectiveness with respect to student interest and learning. A role for the EERWG might be to convene workshops to invite community participation in identifying appropriate initiatives.

Cost/effort: High

Timeline: Long-term

Impact: Moderate to High

8. Identify criteria for success for broader impacts

The EERWG felt that the EERWG should track developments related to the community's response to the broader impacts review criterion but decided that the information and tools are not currently in place to make this a higher priority at this time. Because examples of broader impacts are becoming increasingly available (see, e.g., www.nsf.gov/chem/broaderimpacts for an example of a more systematic collection effort) and data mining tools are becoming increasingly sophisticated, the EERWG believes that this recommendation should be revisited periodically.

Cost/effort: High

Timeline: Long-term

Impact: High

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Appendix

Progress Report of EHR-MPS Evaluation and Education Research (EER) Working Group July 13, 2005

Over the course of our meetings, the Working Group identified a number of areas where productive collaborations between EHR and MPS staff have occurred. Examples include EHR input for the Physics Education Research program; DMS participation in the MSP and MIE programs; linkages of CHE REU and LSAMP programs; EHR assistance with unsolicited proposals like QuarkNet; and cross-directorate input for program announcements like CCLI, URC, and DCF. In general, these interactions have been ad hoc and largely at the program officer level.

The Working Group feels that this is an opportune time to think about a more systematic approach to EER involving the two directorates. A draft set of potential initiatives is presented below. These initiatives represent a combination of short- and long-term efforts. Their implementation costs and benefits need to be better defined, but the Working Group believes that these initiatives have the potential to strengthen EER connections across the EHR and MPS directorates.

- **Establish a group for ongoing EER discussions for EHR-MPS**

Create mechanisms for MPS and EHR to continue joint discussions of education research and evaluation related to teaching and learning in the MPS disciplines. Meetings, email distribution lists, newsgroups, and wikis could be used.

- **Pursue collaborations that benefit from sharing expertise**

For MPS and EHR programs that have an educational component, include representatives from both directorates when preparing/revising program announcements.

Develop mechanisms for enabling MPS projects to locate education researchers and evaluators; and for enabling EHR proposals to identify disciplinary experts.

Establish an MPS and EHR common reviewer pool and selection process, as the two directorates often need expertise that can be identified through the other directorate.

Develop a joint MPS-EHR knowledge base of resources on evaluation and education research, targeted to MPS and EHR program directors, as well as to PIs.

Create a mechanism for training a cadre of evaluators for MPS and EHR awards.

- **Develop a joint EHR-MPS educational research agenda**

Co-sponsor a series of seminars to raise awareness of evaluation and education research and to identify gaps in our understanding. This can be done in collaboration with the EHR's IRG on education research.

Identify emerging areas that are ripe for investment in evaluation and education research, such as cyber-enabled MPS education and earlier exposure to undergraduate MPS research.

- **Develop joint EHR-MPS programs and projects to nurture talent at the K-12 level**

Partner to support projects and mechanisms that might enhance opportunities for identifying and nurturing talent through AP courses, high school laboratories, a reconstituted Young Scholars Program, etc.

- **Identify criteria for success for broader impacts**

Collaborate with our communities to enhance the broader impacts components of projects and to establish means for determining their effectiveness.