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FINAL REPORT
FY 2010 NSF COMMITTEE OF VISITOR (COV) REVIEWS

Guidance to NSF Staff: This document is the FY 2010 NSDL NSF Committee of Visitors Final Report of the NSDL Program. The COV followed the specific guidance for the COV review process as described in Subchapter 300-Committee of Visitors Reviews (NSF Manual 1, Section VIII) that can be obtained at <www.inside.nsf.gov/od/oia/cov>.

FY 2010 REPORT FOR NSDL
NSF COMMITTEES OF VISITORS (COVs)

The NSF NSDL Program Staff completed the table below.

Date of COV: December 3-4, 2009
Program/Cluster/Section: National STEM Education Distributed Learning (NSDL) Program
Division: EHR
Directorate: DUE
Number of actions reviewed: Awards: 24 Declinations 29 Other: N/A
Total number of actions within Program/Cluster/Division during period under review: Awards: 65 Declinations: 180 Other: N/A
Manner in which reviewed actions were selected: Proposals from each track (Pathways, Selection Services, Usage Development Workshops, Targeted Research, and Other Services) were sorted by proposal number into their fiscal year of funding (there were four years of funding) with awards and declines put into separate categories. The top and bottom two proposals on the list (sorted by proposal identification number) were selected in each category, theoretically resulting in 40 awards and 40 declines. However, only two tracks in two fiscal years had enough proposals submitted to result in the full four awards and four declines, and 67 proposals were obtained in this method. It was determined that 67 proposals were too many for the COV to review,

given the relatively small size of the program. Thus, an additional 5 proposals were randomly removed from the two tracks in the two years which had four awards and declines, resulting in 62 proposals for review. Two collaborative projects with the same lead proposal were also removed from the list and the lead proposal was added. In addition, three other collaborative proposals with the same lead were removed and the lead proposal was not added to the list, due to a conflict of interest. Two program-wide projects were added to the list because of their importance in the overall structure and function of the NSDL program. Finally, three proposals were removed due to conflicts-of-interest with COV panel members. Where possible, they were replaced with another proposal having the same final action in the same year and submitted to the same program track. Thus, the final number of proposals for review is 53. Only proposals submitted for the regular competition were included in the sort. This selection method was accepted by the Chair of the COV, Marcia Linn.

PART A. INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

A.1 Questions about the quality and effectiveness of the program's use of merit review process. Provide comments in the space below the question. Discuss areas of concern in the space provided.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE ¹
<p>1. Are the review methods (for example, panel, ad hoc, site visits) appropriate?</p> <p>Comments:</p> <p>The COV found that the panels seem to be well balanced and represent the various constituencies, geographically, and type of institution but noted that the number of reviewers varied. Panels of 4-11 persons made the reviews.</p> <p>We could not identify any site visits. The COV recommends augmenting the travel budget for the program to support site visits to large projects.</p>	<p>YES</p>
<p>2. Are both merit review criteria addressed</p> <p>a) In individual reviews? YES</p> <p>b) In panel summaries? YES</p> <p>c) In Program Officer review analyses? Yes, primarily by referencing the individual reviews and the panel summaries.</p> <p>Comments:</p> <p>After reviewing the selected sample jackets, the COV noted some consistency in addressing merit review criteria. However, reviewers may need to pay more attention to the broader impacts criteria.</p>	<p>YES</p>

¹ If "Not Applicable" please explain why in the "Comments" section.

<p>The COV found that the quality of the reviews varies. Some reviewers are much more detailed and analytical than others. We note that there are workshops and guidelines for reviewers. In some cases reviewers did not attend to these suggestions.</p> <p>Unhelpful reviews restate the proposal summary and make little comment as assessment of the program.</p> <p>In contrast, effective reviewers raise relevant questions about the intent of the project. Valuable comments include suggestions or questions about alternative methods for achieving the objective of the grant. Some reviewers raise issues that are also raised in the recommendations for this report such as ensuring that resources in the digital library are useful for users, paying attention to audience needs, and taking advantage of commercially available software.</p>	
<p>3. Do the individual reviewers provide substantive comments to explain their assessment of the proposals?</p> <p>Comments:</p> <p>A majority of reviewers provide substantive comments but some say only a minimal amount. As noted in response to question 2, unhelpful reviews restate the proposal summary and make little comment to assess the program. In contrast, effective reviewers raise relevant questions about the intent of the project.</p> <p>Valuable comments include pointers to similar projects, identification of overlaps in projects, and discussion of whether the proposal will meet the needs of the intended audience.</p> <p>Reviewers vary in their attention to the evaluation of the project and the connection of the project to related research or development.</p> <p>We recommend strengthening panels to include people familiar with maintaining digital collections and people with expertise in educational research.</p>	<p>YES</p>
<p>4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)?</p> <p>Comments:</p> <p>The COV found that panel summaries generally provided the rationale for the panel consensus. As noted in response to 2 and 3 above, difficulties arise when the expertise of the panelists is not aligned with the complexity of the program.</p>	<p>YES</p>

<p>5. Does the documentation in the jacket provide the rationale for the award/decline decision?</p> <p>(Note: Documentation in jacket usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.)</p> <p>Comments:</p> <p>In general the individual reviews, panel summary and program officer agree and provide the rationale for the award/decline decision. The program officer occasionally overrules the review panel when there is disagreement. As noted in response to 2 and 3 above, difficulties arise when the expertise of the panelists is not aligned with the complexity of the program.</p>	<p>YES</p>
<p>6. Does the documentation to PI provide the rationale for the award/decline decision?</p> <p>(Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written or telephoned with diary note in jacket) of the basis for a declination.)</p> <p>Comments:</p> <p>Our analysis indicates that the information received by a PI whose proposal is declined, states diplomatically but explicitly the concerns raised by the review panel or the program officer that led to the negative decision. Responses are more comprehensive for proposals that were nearly competitive.</p>	<p>YES</p>
<p>7. Is the time to decision appropriate?</p> <p>Note: Time to Decision --NSF Annual Performance Goal: For 70 percent of proposals, inform applicants about funding decisions within six months of proposal receipt or deadline or target date, whichever is later. The date of Division Director concurrence is used in determining the time to decision. Once the Division Director concurs, applicants may be informed that their proposals have been declined or recommended for funding. The NSF-wide goal of 70 percent recognizes that the time to decision is appropriately greater than six months for some programs or some individual proposals.</p> <p>Comments:</p>	<p>YES</p>

<p>For three of the four years under review, the dwell time fit the performance goal of 70% of the proposals being informed about funding decisions: 98% in 2005, 100% in 2007 and 78% in 2008. Sixty-five percent of proposals were in the 0-6 month category in 2006.</p>	
<p>8. Additional comments on the quality and effectiveness of the program's use of merit review process:</p> <p style="padding-left: 40px;">The COV has no further comments</p>	

A.2 Questions concerning the selection of reviewers. Provide comments in the space below the question. Discuss areas of concern in the space provided.

<p>SELECTION OF REVIEWERS</p>	<p>YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE²</p>
<p>1. Did the program make use of reviewers having appropriate expertise and/or qualifications?</p> <p>Comments:</p> <p>As noted previously, panels often lacked reviewers with expertise in educational research and in library collection design. For example, one proposal is problematic because (a) it lacks a research-based educational rationale (the belief that vocabulary definitions are useful is actually an educational misconception as noted below), and (b) it proposes to create a technology that appears to already exist as indicated by one of the references provided by the proposers (http://www.hyperwords.net/).</p> <p>Specifically, examination of the reviews and review summary reveals that the reviewers were not aware of the limitations of the pedagogical innovation. Although we found some discussion of the limited novelty of the proposal this was not acted upon. Specifically, the summary of the proposal suggests that the proposed innovation is using new internet technologies when, in fact, it is not. In addition, the summary overstates the goals of the project.</p>	<p>YES</p>

² If “Not Applicable” please explain why in the “Comments” section.

<p>From the standpoint of educational research, this proposal does not make the case for the educational value of this approach. The main claim is that the approach will be more engaging—but not necessarily more successful.</p> <p>The reviewers were not aware of literature showing that definitions and glossaries are known to be weak educational tools. For example, a study of vocabulary acquisition conducted by Miller and Gildea (1987) showing that children learned little about words from dictionary definitions (preconstructed and transmitted knowledge), but learned much from wresting the meanings of new words out of natural sentence contexts (knowledge constructed from data), particularly if the goal was to use the words productively in novel sentences (transfer). Miller and Gildea's participants were children learning English, their first language; however, their finding has been replicated with both adults (Gildea, Miller & Wurtenberg, 1990) and adults learning a second language (Nesi & Meara, 1994).</p> <p>Review of the proposal revealed no mention of educational value for the innovation. No educational research is cited in the 17 references included. All cites focus on technology. One actually seems to already accomplish the goal that the proposal addresses: http://www.hyperwords.net/</p> <p><u>PLEASE SEE SECTION A.4, Question 2 for further discussion of the educational research issue.</u></p>	
<p>2. Did the program use reviewers balanced with respect to characteristics such as geography, type of institution, and underrepresented groups?</p> <p>Note: Demographic data is self reported, with only about 25% of reviewers reporting this information.</p> <p>Comments:</p> <p>The COV commends NSF for making an outstanding effort and an excellent result in the composition of the panels. Grants and reviewers come from similar institutions. Apparently a larger percentage of grants came from Public/university college in 2008 than was typical in 2005, with an increase from 47% to 71%. These findings also are true for a much greater percentage of reviewers coming from research level institutions. Additionally, the proportion of male to female has increased from 50/50 to 60/40 from 2005 to 2008.</p>	<p>YES</p>
<p>3. Did the program recognize and resolve conflicts of interest when appropriate?</p> <p>Comments:</p> <p>The COV found no evidence of conflict of interest; reviewers appear to have followed proper review procedures.</p>	<p>YES</p>

4. Additional comments on reviewer selection:

The program could benefit from a selection of reviewers with broader expertise. For example, projects that include the professional development component benefit from reviewers with expertise in science education and/or science education research. See A.2.1

RECOMMENDATION: Ensure that the review panels have expertise in all the relevant dimensions such as library science,/collection design, disciplinary knowledge, educational research, and technology.

A.3 Questions concerning the resulting portfolio of awards under review. Provide comments in the space below the question. Discuss areas of concern in the space provided.

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE³, OR DATA NOT AVAILABLE</p>
<p>1. Overall quality of the research and/or education projects supported by the program.</p> <p>Comments:</p> <p>The education projects supported by the program and reviewed here have varied levels of impact and quality in terms of outcomes. When we accessed materials and projects online we often discovered that links were broken, materials could not be located, or NSDL search could not locate materials. When we tried large scale search engines like Google we could easily locate the materials</p> <p>Specifically, the definition of the nature of research and of related research findings is often missing in education projects. Projects need to draw on research by others that is relevant to the topic. Research and evaluation plans often need clarification. Research to understand funded proposals that can improve the field is often lacking.</p> <p>Our findings on the quality of research include the following:</p> <ul style="list-style-type: none"> • Research on the value of the infrastructure projects is also limited or lacking. Many of the infrastructural innovations seem to work but are not used as far as we can tell. • Research on the impact and quality of the materials in the repository 	<p style="text-align: center;">APPROPRIATE/ NOT APPROPRIATE</p>

³ If “Not Appropriate” please explain why in the “Comments” section.

<p>is completely lacking. Materials are NOT well-vetted. Although the repository has been culled, many examples of materials that do not work and resources that are either outdated or unsupported by current educational research exist.</p> <ul style="list-style-type: none"> • Research is necessary to determine when and how people can make use of any sort of repository. So far, the main research finding is that people come to workshops or visit websites. Is this a valuable use of their time? Do the materials they select improve their practice or improve student learning? Without answers to these questions we cannot evaluate the impact of the funded projects. <p>Some projects have high quality and a potential for strong impact but lack final reports because they are not completed.</p> <p>As an example, one project states that “the outcomes of this targeted research will provide a set of strategies and methods for conducting online evaluation of digital libraries, including combination with traditional evaluation data, and identification of strengths and weaknesses of particular educational data mining approaches. This project will also inform future system design and configuration to enable the application of educational data mining of digital libraries to better understand and meet the needs of end users within and beyond the NSDL community. This research will contribute to emerging cyber-infrastructures for education.” The results will be available in the future to document this claim.</p> <p>The COV suggests that NSDL staff clarify the definition of the nature of research for the education projects to help proposers conduct useful investigations.</p>	
<p>2. Does the program portfolio promote the integration of research and education?</p> <p>Comments:</p> <p>While the program portfolio has proposals that recognize the need for a research underpinning, the research component does not appear to be strong in any of the proposals reviewed. As an example one proposal describes the need but does not provide evidence. It states that the proposal contributes new interdisciplinary knowledge on Knowledge Discovery from Data and the application of Educational Data Mining to digital libraries. It also claims tht the work contributes to growing research on teacher learning using cyber-enabled approaches but does not provide citations or examples.</p> <p>We recommend that the NSDL program strengthen the emphasis on research, encourage proposers to integrate their findings with those of other investigators, and place emphasis on continuity across time. Proposers could be encouraged to generate future research questions that could be followed with new and/or continuation proposals.</p> <p>For example, one proposal summary documents the limited impact of the</p>	<p style="text-align: center;">NOT APPROPRIATE</p>

<p>NSDL. The researchers report that results from our previous research show that NSDL and its member collections have far to go to achieve their aim to be: "...<i>the premier path</i> to a rich array of current and future high-quality STEM education content and services, and also function as a <i>forum where resource users may become resource providers</i>"...(NSDL 2007 RFP). Our research shows that faculty and instructors (regardless of their discipline, type of campus, e.g., service to under-represented students, community colleges or research institution) do not know about the NSDL, choose Google above all other searching options (even if they do know about the NSDL and other DLs), and do not use DLs as a source for learning about teaching and learning, let alone contribute to one.</p> <p>The researchers go on to say that one of the lessons learned from the process of working with individual Pathways projects is that since the PIs and staff for the most part are not schooled in social science research methods, they need a considerable amount of education to bring them up to speed on how evaluation works and on the dynamics of survey construction. The researchers report that this process required far more contact and iterations than we had estimated to help developers design a satisfactory survey tool. The researchers report that the work is not done and say that they are planning a follow-up meeting with members of project staff and their partners to review the results of the survey. We anticipate making more changes to the tool as a result of this meeting.</p>	
<p>3. Are awards appropriate in size and duration for the scope of the projects?</p> <p>Comments:</p> <p>Determining the ideal scope of a digital repository deserves attention. What makes sense for size and scope of a digital library investigation? How do proposals for specific pathways get evaluated from the standpoint of scope? Many of the small projects are very fragmented. In addition, the new investigators often submit very small projects that cannot integrate a big enough set of resources to make the work meaningful. This situation is partly due to the need for collaboration across institutions doing work in similar areas.</p> <p>The COV suggests that the program expand the portfolio to include larger projects rather than pursue the fragmented efforts that are sometimes represented in smaller projects. Larger collaborative projects are important. Funding fewer, larger projects could improve the value of the resulting repositories.</p>	<p>APPROPRIATE</p>
<p>4. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Innovative/potentially transformative projects? 	<p>APPROPRIATE</p>

<p>Comments:</p> <p>We had difficulty finding funded projects that were viewed as innovative or potentially transformative.</p> <p>The program has a broad and unclear focus that makes it hard to determine what the program intends to transform. The COV identified some examples of transformative innovations, but we are not sure that these are necessarily the right directions for the program:</p> <ul style="list-style-type: none"> • The Teacher’s Domain proposals have broad participation and seem to reach a wide audience of K-12 teachers. • Some of the “cyberinfrastructure” proposals may be innovative in terms of the technological advances for searching and retrieving information, but their relationship to and impact on the nsdl.org site is unclear. • The “NSDL Curriculum Customization” project may fit the definition of transformative as it clearly aims at helping people find, use, and “customize” resources in the NSDL as well as in other sources. <p>The ideal focus for cyberinfrastructure projects is on strategic cyberinfrastructure objectives and not on those objectives met by private sector research and development. The 2005 COV recommended more emphasis on projects for new audiences, and the pathways projects appear to address this emphasis.</p> <p>Given the level of resources, it would be valuable to focus on a few areas to achieve long term impact. Supporting a sequence that allows for reuse of ideas seems ideal. For example, to the COV sees benefit of proof of concept projects that can be replicated in new fields. Ideally a project could be demonstrated for one audience or topic area and serve as a model for a group wanting to use the approach for a new audience.</p> <p>The COV suggests that proposers be required to identify a clearly defined audience and convince the reviewer that it will be possible to recruit users. Some projects have had difficulty with recruiting. It appears that a narrow audience is more likely to be affiliated with some organization or grant program [like MSP] making it easier to recruit users.</p>	
<p>5. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Inter- and Multi- disciplinary projects? <p>Comments:</p> <p>The COV found that the program portfolio has a balance of proposals that vary in award size and in single and multiple investigator awards. The COV found that more recently more small awards and only a few large (million \$) awards had been granted. The COV was concerned that many of the small awards could not achieve the program goals due to lack of partners with</p>	<p>APPROPRIATE</p>

<p>relevant expertise. As noted above, we encourage larger, collaborative proposals. We suggest rebalancing the portfolio to encourage larger, multidisciplinary and multi-institutional projects that have appropriate scope for the key problems in the domain. For example, projects that integrate application of cyberinfrastructure tools with particular pathway projects could help advance the technological base for searching, accessing and using the developed resources.</p>	
<p>6. Does the program portfolio have an appropriate balance considering, for example, award size, single and multiple investigator awards, or other characteristics as appropriate for the program?</p> <p>Comments:</p> <p>The COV found that the program portfolio has a reasonable balance for award size, single and multiple investigator awards. The portfolio could be rebalanced to encourage larger, multidisciplinary and multi-institutional projects that have the appropriate scope for the key problems in the domain.</p>	<p>APPROPRIATE</p>
<p>7. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Awards to new investigators? <p>NOTE: A new investigator is an investigator who has not been a PI on a previously funded NSF grant.</p> <p>Comments:</p> <p>The program shows a sizeable increase in new proposers (71.4%) in 2008, close to the level of total percentage of grants funded from submissions. In the earlier years, it was 2005 (7.7%) & 2006 (9.1%) which climbed in 2007 to 25%. The COV commends the program on attracting new investigators but also raises the need to encourage larger, collaborative, transformative projects.</p>	<p>APPROPRIATE</p>
<p>8. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Geographical distribution of Principal Investigators? <p>Comments:</p> <p>The COV found evidence in the program portfolio that shows an appropriate balance of geographical distribution of Principal Investigators.</p> <p>Given the population distribution in the united states, a preponderance of proposals seems to come from four states (California, New York, Massachusetts, and Colorado). Few, if any come from the southern states: Louisiana, Mississippi, South Carolina, North Carolina, Kentucky, and</p>	<p>APPROPRIATE</p>

<p>Tennessee. This distribution reflects the concentration of research institutions in a few states. The COV feels that the distribution of principal investigators is consistent with availability of those interested in doing this sort of work.</p>	
<p>9. Does the program portfolio have an appropriate balance of:</p> <ul style="list-style-type: none"> • Institutional types? <p>Comments:</p> <p>Proposals in the portfolio come primarily from research universities, businesses, and large Museums/Organizations. The percentage of research level institutions is increasing each year, consistent with the changing emphasis of the program.</p>	<p>APPROPRIATE</p>
<p>10. Does the program portfolio have an appropriate balance:</p> <ul style="list-style-type: none"> • Across disciplines and sub disciplines of the activity? <p>Comments:</p> <p>The COV found that the program portfolio shows balance and covers a broad range of disciplines.</p>	<p>APPROPRIATE</p>
<p>11. Does the program portfolio have appropriate participation of underrepresented groups?</p> <p>Comments:</p> <p>Yes, the distribution seems reasonable. See 6.5.3 or 6.5.4.</p> <p>The portfolio reflects participation of some African American and Latino PIs and Co-PIs.</p>	<p>APPROPRIATE</p>
<p>12. Is the program relevant to national priorities, agency mission, relevant fields and other constituent needs? Include citations of relevant external reports.</p> <p>Comments:</p> <p>The COV found that addressing relevancy in a rapidly changing technology landscape is a challenge.</p> <p>The recently released Cyberlearning report addresses national priorities, agency mission, relevant fields and other constituent needs. The</p>	<p>NOT APPROPRIATE</p>

recommendations of this COV indicate ways that the NSDL program can better achieve these goals.

Citation: www.nsf.gov/pubs/2008/nsf08204/nsf08204.pdf

13. Additional comments on the quality of the projects or the balance of the portfolio:

Curation must be a critical component in the mission of NSDL. Curation, in this instance, should include some method to vet the initial quality of the resources generated, a means by which the resources are reviewed and assessed for continued usefulness and currency, as well as a way to archive materials. The COV recommends establishing a process that draws upon designated disciplinary expertise (science/education) to assess continued value of the learning resources. Curation should also include an established plan and expectation to archive the resources for future reference. Even if resources are “weeded” from the NSDL portal, it will be necessary to keep a permanent record of the resource to verify it existed.

A.4 Management of the program under review. Please comment on:

1. Management of the program.

Comments:

The management of the program has the standard NSF structure with a Lead Program Officer coordinating the efforts of a group of associated program officers along with a small support staff. The process is effective and well done. We offer several suggestions:

- Expand the Cross-Directorate Steering Committee with an additional person from the Education and Human Resources Directorate in order to strengthen the education component of the proposals.
- Improve the program and the strength of the awarded proposals by conducting site visits. The 2005 COV Reports stated that “the Program could be improved through outreach to provide guidance on proposal preparation. The present procedure is largely reactive. We understand that travel budgets are limited, which makes outreach difficult, but sequestering of a small amount of project funds for this purpose could go a long way in enhancing development of a sustainable NSDL Program.”
- Concerns about clarity and evaluation stated in the two previous COV Reports (2002 and 2005) remain relevant.

One example is “the lingering issue of the lack of Program clarity, and its role in project evaluation. Specific projects need to clearly fit into the NSDL Program.”

The 2005 COV Report statement remains relevant: “Management needs to continually map out projects against Program goals and objectives to determine how well they align with goals and objectives, their degree of coherency, redundancy, any major lacunae, etc.”

As stated elsewhere in this section the comment that, “every PI needs to make explicit how his/her proposed project maps against Program goals and objectives” is still very much a concern.

2. Responsiveness of the program to emerging research and education opportunities.

Comments:

Evaluation of projects is not informed by current educational research standards. For example, **one proposal** has an evaluation that does not meet the standards of educational research. The rating questions are not appropriate to the tasks and do not capture the reasoning of the respondents. Since the research had a small number of participants, there were limitations. Nevertheless, the COV noted that the least positive responses were for using the materials. Yet, the researchers were not aware of the limitations of their innovation based on the responses of users.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

We note that the program has commissioned several studies and evaluations to gather data to inform program planning. As noted in the recommendations below and in the Cyberlearning Report, the program would benefit from more planning. The COV feels it is important to focus the program on promising practices as delineated in comments below.

4. Responsiveness of program to previous COV comments and recommendations.

Comments:

Comments from the previous COV that remain concerns of the current COV:

NSDL FOCUS

2005: NSDL

“leadership needs to identify its primary and secondary target audiences, find out what they want and need, and respond to those. At the present time, the primary customers seem to be the PI’s. Although this situation may have been essential in the beginning, after 5 years, it necessitates a shift in the emphasis to the “end users.” Making presentations to professional conferences, writing articles in professional journals, and posting listserv notices are insufficient means of marketing to communities like classroom teachers, parents, and lifelong learners. COV recommends development of a marketing and communication strategy and tactics—a communications program—that will get the word out to each of the key NSDL constituencies, present and prospective.

2009:

Identification of target audiences and their needs is still an issue. Complications arise with the difficulty of locating the NSDL resources and with problems due to broken links. We are pleased to learn that the total number of resources has been reduced from millions to 200,000 to make

the marketing more targeted. However, even in the pathways projects, the materials are chaotic and lack coherence. Many are reports or documents rather than real educational resources. The repository feels more like a resource for the NSF rather than for end users.

REVIEWERS

2005: The COV believes there should be a greater diversity of expertise among the reviewers. K-12 teachers, free-choice learning educators, and expertise in the private sector are all relatively under-represented on the panels; and college and university faculty are relatively over-represented.

2009:

We note the need for reviewers with more expertise in STEM education, innovative forms of evaluation, and contemporary trends in technology. Many proposal reviews did not even comment on the pedagogical aspects of the proposal. Some proposals implement pedagogical ideas that are discredited in the literature.

HIGH RISK PROPOSALS

2005: Two perspectives on “high risk” arise. First, the ultimate success of NSDL depends on broad usage of its services and products by diverse communities of users. This usage requires taking risks on individuals and institutions that do not have a strong record of grant getting. The other aspect of high risk is technology.

2009: Defining high risk in terms of educationally relevant, technology-rich projects that go beyond current commercial opportunities would dramatically change the nature of NSDL and potentially reach an important audience of innovators who are not currently supported by the program.

RELEVANCE TO NATIONAL PRIORITIES

2005: “It is not clear from the portfolio of projects that there is a clear Program. The annual reports provide clear mission/purpose statements, but the connections of the projects to these Program goals and objectives are not well defined.”

2009: This criticism remains true for the current COV. The goals of the program are not easy to discern and the examples do not seem to achieve the goal of advancing access to quality educational resources or improving STEM educational practice. The cyberlearning report offers a blueprint for aligning the program with national priorities and could inform future solicitations.

SEE DISCUSSION OF MANAGEMENT

5. Additional comments on program management:

Many of the issues raised in this COV have been raised in earlier COVs and deserve attention.

PART B. RESULTS OF NSF INVESTMENTS

The NSF mission is to promote the progress of science; advance national health, prosperity, and welfare; and secure the national defense.

The COV commented on (1) noteworthy achievements based on NSF awards in the portfolio under discussion; (2) ways in which funded projects have collectively affected progress toward NSF's mission and the strategic outcome goals of Discovery, Learning, and Research Infrastructure; and (3) expectations for future performance based on the current set of awards. As requested, we did not comment on the fourth strategic outcome goal of stewardship.

NSF investments produce results that appear over time. The COV review gave consideration to significant impacts and advances that have developed during the last four years regardless of when the investments were made.

The COV used the program and award portfolio information that NSF provided, as well as members' own knowledge, and other appropriate information to develop the comments for this section. We assessed award "highlights" as well as information about the program and its award portfolio as it relates to the three outcome goals of Discovery, Learning, and Research Infrastructure.

B. Please provide comments on the activity as it relates to NSF's Strategic Outcome Goals. Provide examples of outcomes ("highlights") as appropriate. Examples should reference the NSF award number, the Principal Investigator(s) names, and their institutions.

B.1 OUTCOME GOAL for Discovery: "*Foster research that will advance the frontier of knowledge, emphasizing areas of greatest opportunity and potential benefit and establishing the nation as a global leader in fundamental and transformational science and engineering.*"

Comments:

Many of the professional development and pathways projects focus on improving the access and use of digital resources in education, which is a laudable goal for advancing science and engineering education. However, they lack appropriate evaluation and studies of impact on learning. Most of the cyberinfrastructure projects focus on emerging and relevant technological research and development. It is not readily apparent how this research transfers to the nsdl.org site.

The Teachers' Domain (WGBH) appears to be an excellent project, well defined and evaluated; and the results have accomplished the goals of the NSF program. (**DUE: #0632082, #0734839, and #0840737.**)

The ChemEd DLib: A Pathway for Chemical Sciences Education project **DUE #0632303** is another example of an inter-disciplinary collaborative proposal that is well defined and broad. The project interfaces with other projects such as CSERD and comPADRE. A comment in the Panel Review Summary underscores the comments voiced by members of this COV: "The plan should allow for search engines such as Google to index resources where possible so that they are more widely accessible."

B.2 OUTCOME GOAL for Learning: "*Cultivate a world-class, broadly inclusive science and engineering workforce, and expand the scientific literacy of all citizens.*"

Comments:

The NSDL program funds many projects related to helping teachers become more adept users of digital resources, which theoretically should improve the cultivation of an S&E workforce and the scientific literacy of all citizens. However, we found little evidence from the funded projects related to workforce development or scientific literacy.

After developing software to produce a Customized Math Forum accessible to high school students from various backgrounds and their teachers, we note the successful completion of **DUE #0532776** in 2008. The original Math Forum has over 1.2 million learning resources and was first filtered according to cognitive, affective, and social dimensions. Once the development of three test versions of the site occurred, students from 4 high school math classes (3 in US and 1 in Taiwan) participated in 1 day of pre-testing, 2 days of using the sites, and 1 day of post-testing. Assignment of classes to the sites was done randomly after students logged on. The autonomously developed software allows for “mass customization” of digital libraries in a variety of disciplines, thus making NSDL more accessible to all students and their teachers. Each user is pre-tested so the software can tailor the problems to the individual’s level of expertise and continuously adapt to his/her performance.

In addition, the PI has co-authored three books on intelligent interactive tutors.

However, many projects produced materials that are poorly catalogued and difficult to use. For example, Searching NSDL for the results of funded projects proved difficult. No obvious links appear to exist from the main NSDL page to the MathDL, ChemEdDL or other pathways projects. A general search for “pathways” yields over 21,000 results, of which none of the pathways projects turns up in the top search results. A general search for ChemEdDL yields all kinds of superfluous results, none of which is the ChemEdDL. A Google search for “ChemEdDL” yielded the proper link as the top result. A link to pathways was eventually found buried under Organization in About NSDL. Also, a search for “teacher’s domain” links yielded appropriate results, but all the links were broken (error 404 – page not found). It was easier to go directly to the teachersdomain.org website and search for materials there.

These searching difficulties also raised questions about the translation of cyberinfrastructure projects directly back to the nsdl.org site. These difficulties further raised questions regarding who is responsible for maintaining the site, who makes decisions regarding submissions and who evaluates the nsdl.org collections. A review of the collection policies revealed that they have not been updated since Dec 2007; the editor is Ann Miller. No information about Ann Miller appeared in the contact section of the NSDL website. Instead, we found links to people at UCAR as part of the “NSDL Center for Sustaining Broader Impacts” projects under both “contacts” and “organization.”

B.3 OUTCOME GOAL for Research Infrastructure: “*Build the nation’s research capability through critical investments in advanced instrumentation, facilities, cyberinfrastructure and experimental tools.*”

Comments:

The cyberinfrastructure component of the NSDL program is active and working on relevant issues and problems with respect to searching, accessing, integrating and customizing digital resources in STEM education. However, these issues are not yet satisfactorily solved. For example, it is still difficult for the average teacher or faculty member to find relevant resources for classroom use without participation in professional development workshops. Research has shown that effective

professional development must be linked to instructional practice of the teacher/faculty member, so the issue of digital object use will not be solved easily or with a quick fix.

One promising example is a project that was completed in 2008 (**DUE #0632143**) The NSDL Science Literacy Maps [<http://strandmaps.nsd.org>] based on AAAS Project 2061 benchmarks and national science education standards is available and is ready for evaluation. The project provides a concept browsing interface for K-12 teachers and students in science and mathematics. After identifying the concept and grade level, users can access pop-up boxes or links to find related NSDL resources. Evaluation of this resource is necessary.

The Contents of the NSDL are not comprehensive, currently tested, or well documented. Members of the COV searched for materials they find valuable and were not able to locate them in the repositories. What is striking is that the grain size is not specified. Often short visualizations and hundreds of related activities all appear as one entry. No distinction is made between student materials that use technology-based resources (model, probe, and programming language) and those that do not. Another problem is the gradual decay of materials.

PART C. OTHER TOPICS

C.1. Please comment on any program areas in need of improvement or gaps (if any) within program areas.

SUCSESSES

- Pathways is a good direction for NSDL
 - Pathways stimulate sustainability and usability.
 - Development of the WGBH Project for Teachers Domain is a good example.
 - Another good example is the Exploratorium project for informal/museum education resources.
- Projects on Cyberinfrastructure have stimulated thinking about complex issues such as metadata

OPPORTUNITIES

- Promote equity.
- Take advantage of Cyberlearning.
- Develop and implement criteria for educational resources that aid teachers and instructors.
- Provide connections across NSF programs and offer a way for PIs to distribute their innovations into a public database. Ensure that these innovations meet the criteria for the NSDL.
- Help developers build on what already exists.

GENERAL SUGGESTIONS

- Distinguish between curation of the collection and development of the infrastructure that provides access to the collection.
- Distinguish curation from usability and perceived quality by teachers/students.
- Ensure that existing educational research is incorporated and that projects include experts in relevant disciplines.
- Support users so they can make efficient and effective use of the resources.
- Take advantage of Pathways to incorporate social networking and form narrow, well-defined communities.
- Make sure that infrastructure projects add value and do not replicate innovations found in e-business or in other research projects.

VISION

Complexity of education is not matched to the resources of the digital library. The program seems broad and the vision is diffuse.

RECOMMENDATION: We recommend a narrowed, more strategic vision that aligns with the Cyberlearning report:

- Focus on users.
- Narrow topics so the audience is clear.
- Showcase NSF accomplishments.
- Take advantage of the education requirement of the broader impacts requirements across the foundation. Include NSDL opportunities in other RFPs.
- Require that projects develop materials that can be included in the NSDL with specific criteria outlined.

EQUITY GOAL

Analyze how the NSDL can provide equitable access to powerful materials.

RECOMMENDATION: Develop foci within Pathways that target districts and schools that lack resources for customizing materials to the needs of their students.

INTEGRATION OF EDUCATIONAL RESEARCH AND EDUCATION

Integrate research with development to ensure that projects are effective. Research directions include:

- Determining outcomes -- evaluation of impact on teachers and students.
- Design of innovations – building on past findings available in the literature and in online repositories.
- Design of infrastructure—building on commercial and research advances. Testing with broad audiences

RECOMMENDATION: Add specific language about research to the RFP. Ensure that proposals include educational researchers in the mix of expertise among the leadership. Require proposers to document past research in the area and say how their efforts will build on findings. Make sure that the proposal reflects the best available scholarship (For example, research on professional development should inform design of workshops and courses.) Select reviewers for the panel of reviewers who have the requisite expertise.

SUPPORT FOR SEARCH OF COLLECTIONS

The COV used many strategies to locate materials mentioned in annual and final reports of projects. Materials were very hard to find and links were often broken. GOOGLE was generally better than any search supported by the project. In general, commercial search engines are far better than any search limited to NSDL resources. We have conducted a few benchmark comparisons between Google, Yahoo, and Bing and the NSDL collection. Using these engines is more efficient and effective than to use the cumbersome and poorly vetted NSDL alone.

We suggest exploring a public-private partnership with Google or another provider where NSDL would create value-added metadata based on the NSDL community's insights into what teachers need. The role of NSDL would be to push to the top of the search the materials that meet quality criteria. Such an approach requires a fundamental rethinking of the criteria to ensure that resources meet the needs of the audience.

RECOMMENDATION: Abandon NSDL search and take advantage of commercial providers to support search and strengthen the “portal” aspect of the NSDL.

CURATION

Manage the collection and assess new, interactive technologies (e.g., nanoHUB) for disseminating resources. Require projects to test and maintain materials. Require that when materials are no longer reliable and useful they be removed within a year. Be sure that curation focuses on quality and contemporary usability which require persistent monitoring.

RECOMMENDATION: Ensure that resources are either de-accessioned after a set period of time or are tested each year. Ensure accessible materials are marked: free and open source. For future reference, keep a record of de-accessioned resources.

QUALITY CONTROL

We should not expect users to have to do extensive evaluation of materials in the digital library. For example, teachers/users should not have to determine whether the molecular software is accurate.

RECOMMENDATION: Develop a common set of criteria that guarantee users will find a trusted, usable, effective set of resources.

Criteria should include:

- Establish scientific quality – Materials should be vetted by discipline experts.
- Build on student ideas. Have materials start with understanding of the ideas students develop from their observations of the natural world.
- Provide evidence of impact. Accept only resources that have been classroom or learner tested. Include information about the impact.
- Include appropriate outcome measures. Indicate what the users should expect with regard to student progress. This could be performance-based, observation-based, or more traditional.
- Ensure usability by the audience. A typical user should be able to implement a resource without technical support.

- Include only accessible materials. Materials should be free and open source. If specialized software is needed this should be readily available.

RECOMMENDATION: Apply these criteria to all resources included in the NSDL and require that new proposals meet these criteria.

REFINE THE PATHWAY APPROACH TO TAKE ADVANTAGE OF THE COMMUNITY

Pathway projects offer promise for NSDL but need to be carefully designed. Small projects may be too limited and not include sufficient expertise. Last year over 70% of the proposals were funded and many were quite small. These small projects attracted first time proposers to NSF but may not pay off in the long run.

Pathway projects can create communities of users who support each other with guidance from experts. The projects can ensure that users get support from peers and experts. Materials in the NSDL are not easy to use. We reviewed the Teacher Domain—arguably the best project we located. We identified the need for conventions to ensure that the user experience is consistent. We note that support for users is currently missing.

RECOMMENDATION: To ensure effective pathway proposals, we suggest that proposers:

- Encourage proposals for models that can be replicated by other organizations.
- Incorporate the research base into the proposals.
- Utilize accepted educational research methods for determining the outcomes of the project.
- Include staff that have educational research experience as central members of the team and include funding for them in the proposal.
- Include staff that have expertise in managing collections from the beginning.
- Require staff to document an ongoing, sustainable mechanism for ensuring fidelity of the resources posted.
- Make sure that technological innovations build on existing solutions and are not in competition with commercial products.

INFRASTRUCTURE PROJECTS

Ensure that infrastructure projects are transformative and unique. We recommend that NSF fund things that are not a priority for e-business or represent already developed or available resources.

RECOMMENDATION: Ensure that the infrastructure projects add value not achievable using commercially available products. Partner with e-businesses when feasible to achieve education goals.

PROFESSIONAL DEVELOPMENT

These materials are not easy to use and require professional development to become part of the curriculum. Target professional development to the specific user. Generic professional development about technology is less useful than specific. Teachers benefit from learning how to use quality resources and from developing the skill of recognizing and using powerful instructional materials. Be

sure the professional development aspects of funded projects have adequate resources and co-PI expertise.

Current research suggests the value of testing professional development with narrow communities to be sure the users have common needs. An example is: creating a 5th grade curriculum for users. Build on research showing ways to create and sustain communities. Ensure that users can get support from peers and experts.

RECOMMENDATION: Build on the effective methodologies emerging from NSF supported work on professional development.

REVIEWERS

RECOMMENDATION: Ensure that the review panels have expertise in all the relevant dimensions such as library science/collection design, disciplinary knowledge, educational research, and technology.

OPEN SOURCE

RECOMMENDATION: Reconcile the NSDL with the Cyberlearning report recommendations about open source.

INTEROPERABILITY

RECOMMENDATION: Reconcile the NSDL with the Cyberlearning report recommendations about interoperability.

C.2. Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

We recommend that the program revisit the vision to focus on a few key strategic contemporary issues. The program is encouraged to hold a retreat and to develop a clear focus based on the current state of knowledge in cyberlearning. The NSDL should focus, not on being comprehensive but on creating models that communities can use to maintain collections. These models should ensure that repositories provide a selected, trusted resource for educators to find reputable, useful, effective materials.

The NSDL could catalog relevant NSF-funded work and include data supporting impact in specific projects. This approach would include providing adequate metadata to describe operating system requirements and/or other equipment essential to using the learning resources. This approach could be an NSF service or requirement.

Members of the COV agreed that it is essential to de-accession enough of the current catalog so only the gems are on the shelves. A major goal of NSF is to protect its investment and help the field. Currently the NSDL does not deliver trusted materials

Members of the COV also agreed that the search function of nsdl.org is ineffective. It is currently difficult to locate resources on nsdl.org. The COV suggests that the program consider the following:

abandon the search functionality altogether and turn the nsdl.org page into a resource page that points more explicitly to the pathways projects and other large collections that meet a common set of criteria. These collections can use commercial search functions. The site should make connections to funded pathways projects and other important digital resources more explicit and visible.

Discussions broadly across the NSF are essential for the revisioning process.

C.3. Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

Many NSDL projects are teacher professional development projects – helping teachers learn how to access and use digital resources in an effort to create more effective teachers. These projects seem to overlap with other NSF programs that focus on professional development of teachers (Math and Science Partnerships, for example). What is the relationship between NSDL PD projects and other NSF funded PD projects? Are they reviewed using the same criteria? Is NSDL the appropriate program for PD projects, even if their focus is the use of digital objects and resources? Or how can the two programs collaborate?

Some members of the COV saw ways for NSDL to be useful to programs across NSF. It may be useful to include NSDL project requests in other RFPs (e.g., Math and Science Partnerships) in order to connect the work to other programs.

C.4. Please provide comments on any other issues the COV feels are relevant.

The mechanism for submitting materials to nsdl.org is not very transparent. A "recommend a resource" page allows you to input a URL but has no mention of the process that occurs after that (how long does it take, what are the criteria, and how will I know whether the resource is even appropriate for the site?). And, no place exists to add information regarding the effectiveness of the recommended resource, which is a major goal of NSDL (to promote the development and use of effective resources). Perhaps this occurs after the initial submission but that is not clear. An old PDF (revised Dec 2007) was the only information we found. The contacts page did not identify the editor named in this document. A generic "contact" email appears at the bottom of the "recommend a resource" page, and this seems inadequate.

The issue of open source materials needs resolution. Ideally the materials would all be open source. Currently there is no way to filter out resources that are not free (e.g., linked journal articles) or require registration on a separate site (teachersdomain.org). We recommend that the NSDL provide such filters and warn users about possible costs.

C.5. NSF would appreciate your comments on how to improve the COV review process, format and report template.

The materials provided for the COV were excellent. The COV has no suggestions for improving the process.

SIGNATURE BLOCK:

For the NSDL 2009 COV
Marcia Linn
Chair