National STEM Education Digital Library

CONCEPT PAPER

The STEM Exchange

Enabling Next Generation Approaches for
Community Access to Federally Funded Online Materials

EXECUTIVE SUMMARY

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Created by the National Science Foundation (NSF) as an access point to high quality online learning materials, The National STEM Education Digital Library (NSDL) is a networked system of technical and professional partnerships at the intersection of education and technology, research and practice, K12 and higher education, formal and informal learning.

With the involvement of several hundred research and education organizations committed to supporting the realization of a new vision for STEM learning in a digital world, **NSDL has become more than a static repository of content**. In the early days of the digital library, making previously print-only materials available via the Web was revolutionary in and of itself— but no longer. In response to powerful new opportunities afforded by networked technologies, **NSDL is shifting the emphasis of its mission away from a traditional library model of generalized academic reference toward an educational services model** that builds and leverages open access cyberlearning infrastructure. By expanding upon library traditions of curation and knowledge democratization to embrace 21st Century expectations for ubiquitous information exchange, NSDL can more effectively collaborate with the increasingly diverse user communities who produce, consume, and customize digital learning content. As a result, NSDL's impact becomes embodied as a chain of impacts as we support the educational communities who in turn directly support teachers, faculty, librarians, and students.

The STEM Exchange

NSDL currently provides access to organized information about STEM learning resources primarily through its centralized web portals at nsdl.org and more than a dozen Pathways— partner libraries supporting specific discipline-centered and educational level audiences with vetted content, tools, and professional development. The structure of this access model mirrors traditional library and scholarly publishing practices, from which it draws both its benefits and limitations.

In an initiative to capitalize upon the value of traditional approaches and implement future-facing solutions through new media practices, NSDL is seeking the active participation of STEM education stakeholders in the development of a *STEM Exchange*, the goals of which include: (1) speeding the diffusion of digital content to educational practitioners through a wider range of online dissemination channels and mobile devices, (2) empowering existing teacher communities to mobilize contextualized NSDL materials directly in their own online platforms, and (3) enabling broad user feedback data to enhance understanding about the adoption and impact of cyblearning resources in diverse teaching and learning environments.

The concept of the STEM Exchange includes two fundamental components:

> NSDL is recommending the development of a new information profile around STEM resources focused, not on **describing the resource itself**, but on **facilitating the diffusion of the resource into educational practice** and **explicating diffusion patterns** as the resource is annotated, reviewed, downloaded, embedded, shared, accreted, modified, and updated.

> The platform upon which resource profiles will be collaboratively assembled and exchanged will leverage existing social networking software to create a dynamic system with **interconnected learning resources— instead of people— as the entities with rich information spaces of profiles, friends, groups, and status updates**.

As conceived, the STEM Exchange would increase the openness and portability of NSDL resource collections while also opening up the flow of feedback loops at multiple levels among and between resource creators and educational end users. The STEM Exchange is being designed to accelerate this shift from NSDL as library, to NSDL as cyberlearning tool by enabling the following transformations:

From Resource Description to Resource Diffusion – Digital library advancements have been achieved largely by extending traditional library models for information architecture and management, with a particular emphasis on formalized metadata. Ongoing developments in digital library technologies, including Web 2.0 practices such as folksonomic tagging, have likewise been rooted in models that are dependent on formalizing data to describe the nature and characteristics of each resource. The STEM Exchange will recommend a new approach to resource profiling focused, not on *describing the resource itself*, but on **facilitating the diffusion of the resource into educational practice** and **explicating diffusion patterns** as the resource is annotated, reviewed, downloaded, embedded, shared, accreted, modified, and updated.

From Address Book to Facebook – Libraries have historically provided a baseline of knowledge for use in learning, teaching and advanced research. Yet in practice, operational knowledge is created from the accumulated experiences of practitioners and experts in the community in which it is situated, which is constantly evolving. The STEM Exchange will ideally do for digital educational resources what Facebook did for personal contacts' information. Traditional address book elements such as name, address, and phone number may exist in Facebook profiles as well, but the primary utility of Facebook is to view each person as part of a changing network of people, interests, knowledge, and activities. The information assembled around each person is designed to facilitate other connections and is dynamic—so that people update their own profiles with their most current data. Traditional metadata records for digital learning resources resemble the address book, but we posit that the disruptive technology of social networking sites provides an opportunity to think very differently about how knowledge around digital library resources is assembled, managed, and navigated.

From Information Access to Information Exchange – In significant ways, digital libraries' historic concentration on metadata limits how educational end-users and practitioner communities discover, access, use, reuse, contribute to, and build upon both the resource descriptions and the resources themselves—because the basis of the information exchange is ultimately in the expert technical languages of librarianship such as SCORM, OAI, RDF, metadata schemas, and OpenURL. The STEM Exchange will leverage new modes of information sharing enabled by social networking software that are becoming common skills and practices across professions, generations, and socioeconomic groups. Allowing for those skills to be applied to selection and use of learning materials could significantly lower the barriers for educators, and learners, to interact with resources and to contribute to the information about them. APIs and applications already exist to port profiles and updates from social networking sites to a broad array of other websites and webservices, as well as a range of wired and wireless devices. In this same spirit, the STEM Exchange will unlock the resource base of NSDL to the open-source development of educational widgets and apps, and enable mashup of NSDL content into new learning materials.

From the Library Shelf to the Workspace of the Teacher – Until recently, access to many federally funded learning resources has followed a scholarly publications model that disseminates materials through a few centralized points—if they are made publically available at all. A primary goal of the STEM Exchange will be to mobilize materials from their virtual library shelves into the hands of practitioners wherever they are already conversing, sharing, creating lesson plans, and compiling instructional supports. NSDL 's previous work with existing teacher communities to put resources directly into their workspaces has also been constrained by the limits of metadata. By placing a resource at the center of its own social-style network, the STEM Exchange model has the potential to make formalized metadata just one element of a richer landscape that enables both expert-generated and user-generated information. The resulting, more educationally situated, knowledge space can move the user experience beyond searching for resources to discovering resources, and onward to related professional activities such as collaborating on effective classroom practices and contributing feedback to improve pedagogical value.

Enabling Next Generation Approaches for Community Access

In combining traditional library value propositions with Web 2.0/3.0 functions, NSDL proposes to create a new frame of reference for educational resources that can further improve our collective knowledge and enrich individual understanding where STEM disciplines meet the real work of teaching and learning. The STEM Exchange will not be a social network for teachers, but rather will engage existing online teacher communities and educational peer sharing sites as partners in building an interoperable tool that best meet their needs. The STEM Exchange will not be a standalone resource portal, but rather might function more like the dashboard of a stock brokerage website where investors can research trends, market wisdom, and performance potential and choose to embed that data stream into their own websites. Through these services, the STEM Exchange can serve as an ongoing observation platform for emerging systemic trends in cyberlearning, and as a test bed that can inform resource dissemination strategies for digital content creators including federal agencies beyond NSF.