"*Collaboration Services for the Math Forum Digital Library*"
Project Summary

Statement of need. NSDL is intended to serve learners in both collaborative and individual settings, as well as formal and informal modes. If one carefully studies learning in school, workplace and home, one finds that most learning is a subtle mix of collaborative and individual effort. Unfortunately, to date digital library services focus almost exclusively on the needs of individual users. Support for "collaboration" has been largely limited to mechanisms for anonymous, asynchronous collaboration within the whole user community, where results obtained by individuals may be fed back into metadata for future use by all. Little support has been developed for direct collaborative use of digital libraries by small groups of people working together.

Project approach. The adaptation of groupware components from current CSCW and CSCL systems makes it feasible to develop collaborative learning environments as digital library services, significantly increasing the potential impact, efficiency and value of digital libraries. This Project provides a model and test case of such an approach – within the successful Math Forum Digital Library (MFDL).

Target audience. The MFDL offers a variety of theoretical, practical, pedagogical, interactive and fun resources and services related to K-12 mathematics. It already supports a user community of close to a million distinct users. A popular service is the Problem of the Week (PoW), which is solved in and out of schools, by individuals and small groups. The MFDL now aims to extend the appeal and mathematical depth of these PoWs by bringing students together in small, online groups for asynchronous and synchronous collaborative learning at a distance.

The *Project goals* for advancing collaborative services in the NSDL are the following:

1. To better understand the computer support needs of small groups collaborating in a digital library.
2. To design a collaborative learning environment within a digital library.
3. To evaluate the use of a collaborative learning environment within a digital library.
4. To incorporate a collaborative learning environment within a digital library as a sustainable service.

The *Project objectives* are to achieve these goals using the MFDL as a model and test case:

1. To study the computer support needs of small groups of students (user teams) collaborating on PoWs in the MFDL.
2. To develop special PoWs and associated curricular resources for collaborative usage, with the help of teachers and student teachers (creator teams). These teams will mine the MFDL and provide new resources to it as well as rate, annotate and organize existing resources.
3. To design a Math Forum Collaborative Learning Environment (the MFCLE) within the MFDL, with the help of international CSCL (computer support for collaborative learning) researchers and developers (design teams).
4. To prototype, evaluate and iterate the design of the MFCLE, in accordance with HCI best practices.
5. To implement a stable version of the MFCLE, providing collaborative work areas and tools to communicate and collaborate with team members and other MFDL community members.
6. To evaluate the use of the MFCLE by user teams, creator teams and design teams.
7. To incorporate the MFCLE as a sustainable service of the MFDL.
8. To disseminate the MFCLE as a reproducible model of a digital library service that promotes collaborative learning.

The *Project team* consists of four co-PIs, creator teams (student teachers, teachers and MFDL staff) and design teams (national and international CSCL researchers and MFDL staff). PI Stahl has developed numerous collaborative learning environments, has published on CSCW and CSCL theory, methodology and evaluation, and teaches HCI. Co-PI Weimar has been Director of the MFDL since its founding in 1994. Co-PI Bach is professor of educational technology. Co-PI Shumar is an educational ethnographer and long-time evaluator of the MFDL.

Intellectual merit. This Project creatively combines leading-edge collaboration technologies with one of the most popular services of a successful digital library to provide a model of support services for collaborative digital library usage. The Project brings together four co-PIs with the required mix of expertise, along with teams of engaged educators and international researchers.

Broader impact. The Project develops collaboration services for digital libraries, providing a sustainable model. It promotes the involvement of geographically isolated, disadvantaged and disabled students, distributed teachers and international researchers by inviting them into collaborative learning teams hosted, supported and informed by a digital library. It pioneers a path for enhancing NSDL impact and building virtual learning communities.