Collaborative Research: Resource of Open Problems for Education (ROPE)

The proposed project will develop an online, electronic library, the Resource of Open Problems for Education (ROPE), that will provide many innovative, well-tested, and documented problems that mathematics that will be useful in a wide range of courses and assignment types. Because working problems is at the heart of student learning and engagement with mathematics, this will be a tool that may promote student learning and be of use to authors, instructors and students alike. Any user will be able to search ROPE for problems by keyword or by specific subject matter or characteristics. Problems will be contributed by the community of users and will have associated descriptive information that will include user feedback and comments, as well as statistics on the frequency of the problem's use. Users will be able to comment on and rate problems, and flag them using a commonly understood "endorse" feature (similar to those used on social networking sites). They will also be able to create and share collections of problems, and collections of these collections, for later use. These collections may be for specific assignments (homework, quizzes, worksheets, etc.) and may be collected to describe problems sets or assignments for entire courses. ROPE will have passive and active editorial management, the former by being able to sort search results by ratings and usage and the latter by the community of users of ROPE.

Intellectual Merit

The Resource of Open Problems for Education (ROPE) will address a current need in undergraduate mathematics education: the need for a widely-available source of high-quality, well documented problems that instructors can use in a variety of educational venues. Much of the learning that takes place in mathematics is driven by students' work, and the success of that learning is fundamentally dependent on the types of problems on which they work. ROPE will provide a resource that will be *free and open-source*, providing problems for users without commercial entanglements. Because it will have a powerful search capability, users will be able to easily find problems that allow them to address their needs for instruction or learning. It will allow users to create *collections of problems*, and *collections of collections*. This capability will allow many different use-cases: for example, instructors may construct homework sets, quizzes, and groups of these for entire courses; or may construct model courses with supporting material that they can then share with colleagues; etc. And it will support a *community of users* who may contribute problems, content and feedback on problems, and who may share their work and problem collections with others. All of these characteristics, taken in sum, will result in a widely accessible and useful resource that may have a significant impact on mathematics education as a whole.

Broader Impacts

The Resource of Open Problems for Education (ROPE) will be an easy-to-use, high-quality resource that provides something that teachers and learners of mathematics need: a source of

problems to evaluate and promote learning. Its broad impact will stem from its ability to be such a resource for a wide range of users and users, from students looking for sample problems to study from to mathematics instructors creating entire IBL courses. The PIs have extensive and varied contacts with faculty in a large number of institutions and communities of faculty, including Project NExT, those interested in inquiry-based learning, and open-content authors, which will allow for effective dissemination to those groups most likely to use the resource. We therefore expect that ROPE will have broad impact, reaching instructors at all types of colleges and universities who are teaching any standard mathematics course in any of a number of different ways. We further expect that as ROPE develops we will be able to extend it to include other disciplines, though that is not a goal of this proposal.