

An open maths marketplace

1. Appropriateness and Fit to Programme Objectives

This project undertakes to build a market for online tutoring contracts in mathematics. Our strategy is to build these services around an existing free/open mathematical knowledge repository, the encyclopaedia that has been developed over the past decade at PlanetMath.org. The key idea in this proposal is that transcripts of paid online tutoring sessions will be integrated into an increasingly comprehensive set of freely available open educational resources (OERs).

Thus, people will have a concrete financial motive to benefit from their investment of time and expertise, but these investments will be made in such a way so as to pay dividends to the whole learning community. The real challenge of this project is thus a subtle mix of software engineering, social engineering, and economics. We may expand these points in terms of the specific objectives outlined in Paragraph 6 of the call:

(a) This project will provide online tutoring and good practices around coordinating both paid tutors and volunteer contributors, as well as strategies for managing a knowledge base of mathematical and pedagogical content. We will be providing services not just to students, but also to tutors, for example, by helping tutors build their reputation with badges that certify tutoring quality.

(b) The typical aim of a market is to provide a place for exchange between individuals. The market itself does not benefit, except financially. Our context is different: here, the aim is to capture the “positive externalities” of educational transactions. In particular, we are developing not just a business model, but also a strategy for extracting value from learning interactions in order to provide better quality services and freely available learning resources. The knowledge base we will build will provide further opportunities for downstream users to develop added-value services. In particular, we expect service providers using our site to up-skill so as to be able to offer increasingly complex mathematical services in our open maths marketplace.

(c) We will be working with cutting-edge tools that are being developed entirely as open source. Key ingredients for the asynchronous and archival aspects of the project include the popular content management system Drupal, and the up-and-coming Linked Open Data paradigm. We are mixing these general-purpose technologies with special-purpose tools for working with mathematical content, ranging from LaTeXML for building interactive mathematical documents, to Geogebra for interactive geometrical figures. For real-time tutorial sessions, we will use the open source collaborative editor, Etherpad, along with other collaboration tools. Text-based interactions will be particularly easy to integrate into the larger knowledge base, but audio and video material can also provide added value by being tagged according to subject matter and the heuristic or pedagogical strategies employed.

2. Responsiveness to Need or Opportunity and potential impact

Tutors will be motivated to tap into a growing demand for high-quality mathematics instruction, delivered globally, at a flexible pace. Our approach exploits the power of Web 2.0 to add value to student- and tutor-contributed materials. We will build an increasingly complete and well-integrated knowledge resource, using valuable material that is otherwise wasted: frequently asked questions and common responses will be documented in easy-to-follow pedagogical guides.

Not only do students need access to qualified, accomplished, teachers and tutors: teachers, and other professionals also, increasingly need to be able to learn new skills while on the job. We expect the market to offer services tailored not only for students in formal education, but also to adult learners who do not have time to go back to school.

We do not yet know what balance of financial motivation and open sharing works best, nor can we say what is the best balance of individual study and tutorial support. Presumably there is no one-size-fits-all answer. What we are confident about is that an online learning environment that facilitates a wide variety of mathematical interactions will help us to better understand what works best under which conditions. We will be in a good position with this project to both apply what we learn to improve our own practices, and, because of our commitment to openness, to serve as a key reference point for others who are interested in improving mathematics education.

3. Partnership suitability

The lead partner is the School of Mathematical and Computer Sciences at Heriot-Watt University, co-founder of Edinburgh's International Centre for Mathematical Sciences (ICMS). We provide expertise on all major areas of pure and applied mathematics, both research, and teaching. PlanetMath.org, Ltd., a US (Virginia) based 501(c)3 non-profit organisation, will provide infrastructure and hosting, as well as a seed community of editors and users. PlanetMath.org is a pioneer in online, collaborative, mathematics, and has for years been visited by upwards of 12,000 users a day.

4. Commitment to Sharing and Dissemination

We will build a maths-enhanced version of the open source real-time editor, Etherpad, which will function as a shared interactive blackboard in tutorial sessions. Etherpad will be integrated with other existing open source real-time communication technologies, including both mainstream tools (voice and video chat), and mathematics-specific tools (Geogebra for geometrical figures, SAGE for computer algebra). Transcripts of tutorial sessions, and advice on problem sets, will be shared publicly under a non-restrictive Creative Commons license. Doing tutoring in the open will have the following benefits: first, members of the PlanetMath community can go over previous tutoring transcripts to extract and highlight frequently asked questions, and prepare corresponding pedagogical guides and other expository enhancements to PlanetMath's encyclopaedia. Second, openness provides a degree of security to both the consumer and the service provider, in the form of quality assurance, dispute arbitration, and reputation building. We will work with JISC to disseminate best practices and related research results.

5. Senior Management Commitment and cross-institutional reach

Leading this effort will put us close contact with knowledge workers across the UK and around the world who are able to provide increasingly complex mathematical services. In the process we will have the opportunity to explore new approaches to lifelong learning that we anticipate shall be useful in other educational contexts. Letters of support are attached.