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JEM – Joining Educational Mathematics

http://www.jem-thematic.net

Annual Report

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e*Content*plus

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a multiannual Community programme to make digital content in Europe more accessible, usable and exploitable.

[1] OJ L 79, 24.3.2005, p. 1.

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PROJECT OBJECTIVES

The JEM thematic network addresses the need to improve the didactic tools and the teaching materials in mathematics. Recent technological advances regarding the representation of mathematics on the web make it possible to create and to deliver high-quality, reusable, interactive mathematical content to students' computers worldwide. Centres of excellence in mathematical research and education are scattered across the continent and all too often their efforts fail to add up in the absence of an efficient system for collaboration and for communication between technology developers and authors of eContent. In Europe alone, mathematics instructors lecture students at about 4000 establishments of higher education every day of the week. They hold introductory classes consisting of basically the same notions but they cannot share the didactic materials with each other because they are unaware of a suitable language-independent easy-to-use platform.

The goal of the JEM thematic network is

1. to pool together the required expertise and
2. to contribute to the coordination of content enrichment activities in the area of mathematics,
3. to promote standards and best practices,
4. to deliver powerful synoptic high-quality user information and support pages, invoked in e-learning platforms operated by the partners.

The JEM range of awareness activities are addressed to educational content stakeholders in mathematics and focus on the benefits of enriching digital content with semantic markup. Additionally, technology developers are exposed to the concrete requirements of authors of digital content. JEM enlists the leading developers of the technologies as instructors and tutors for author of eContent and, as a result, distributes best practice sample material via established servers of major universities, commercial publishers and professional societies, like the European Mathematical Society. The JEM portal offers a social networking platform that identifies the community of experts in high-quality eContent for eLearning mathematics. By supporting authors, developers and distributors, the JEM portal ensures that a constant flow of information on the production of eContent is available and recorded in terms of re-usable documentation.

The JEM network aims to create greater compatibility within European higher education in mathematics in the spirit advocated by the Bologna process. Implementation of the European Credit Transfer and Accumulation System will be more easily achieved if high quality courses and curricula can rely on a common repository of educational content, on commonly agreed entry tests and assessment exams. Moreover, by strongly promoting cooperation in quality assurance it aims to show that technological innovation applied to learning has the potential to provide an opportunity to all.

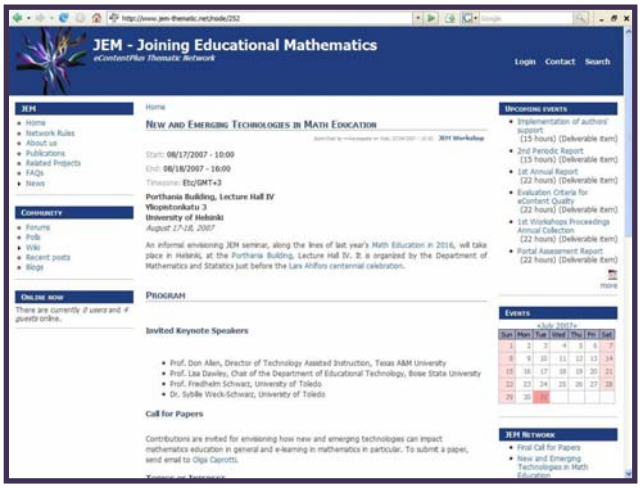
CONSORTIUM

The JEM network currently enlists 20 nodes who are characterized by their main role as eContent stakeholder for the area of mathematics, physics or statistics education.

The technology developer partners include the leading European groups for producing advanced learning software solutions and can offer a wide range of ICT tools to enhance mathematics teaching. They include University of Helsinki, Technical University of Eindhoven, Jacobs University and NAG Ltd, with a long tradition in research on representation and software for the electronic communication of mathematics. The commercial Maths for More together with Universitat Politècnica de Catalunya has produced sophisticated systems for doing mathematics on the computers, with a special attention to their usability in education. University of Birmingham offers a widely used software system for mathematics assessment, which generates random exercises and automatically grades the students' answers. RWTH Aachen University, Technische Univeristät Berlin and ISN Oldenburg offer full learning environments for teaching applications of mathematics in Statistics and Physics. Advanced multilingual software is the expertise of Chalmers University of Technology.

Several partners are experienced authors of online educational material for mathematics and their institutions offer online courses and distance education. Universiteit van Amsterdam has a wide experience in using ICT-supported courseware. Three JEM partners represent purely virtual universities: the German FernUniversität Hagen, the Spanish UNED National Distance University of Education, and the Catalonian Universitat Oberta de Catalunya. All of them deliver instruction purely online. Universidade de Lisboa, Buskerud University College, and Aristotle University of Thessaloniki are traditional higher education institution where the introduction of ICT support is taking place gradually.

Whilst all partners have specific dissemination channels, consisting of a network of students, or organizations or professional societies, the JEM network also includes the commercial publisher Liguori Editori and the major international academic society of professional mathematicians, the European Mathematical Society.



PROJECT RESULTS/ACHIEVEMENTS

The JEM portal has been designed and setup as a collaborative website publishing contributions from every registered member and distributing the deliverables, and publications of the network. There are currently approximately 100 registered users. We have not yet started to actively publicize the portal. All registered users can post event announcements, news, release software or lecturing materials and share their academic blogs.

The network has organized several events and distributes the records of the presentations as slideshows or as video recordings through the portal's pages. Currently there are approximately 70 publications archived as dissemination on the portal and those which were part of the First and Second JEM Meetings are collected in a public deliverable (Rikko Verrijzer, 2007).

The JEM portal pages aim to distribute synoptic information concerning technologies, their usage and scenarios relevant for elearning mathematics. This information can be entered freely by users by adding new pages to the wiki or by using specific templates for Software, tools and services[2] and for Case Study[3]. Software and Case Study are linked to the proper pages in the wiki by the editors. The JEM web pages have been hit approximately 250K times with an increasing trend as the network becomes more active and organizes more events.

Concerning standardization activities, several JEM members are active within the W3C-Math working group and the OpenMath Society. As a result of this synergy, a common resolution has been adopted by these bodies aimed at ironing out differences and incompatibilities between MathML and OpenMath in their upcoming versions MathML3 and OpenMath3. An encouraging sign showing the growing popularity of semantic markup is the adoption of OpenMath as exchange language among dynamic geometry systems, which is the topic and goal of the newly funded eContentplus project Inter2Geo in which two JEM nodes are involved. Another new OpenMath-based protocol for grid computing, called SCSCP, has been developed by Technical University of Eindhoven and presented during the Second JEM Meeting.

The Network started with 16 founding members and has acquired 4 new members during the first 12 months thus establishing itself in Finland, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden, and UK. In addition, the European Mathematical Society has joined the network and its president Ari Laptev has agreed to lead the Committee on e-Learning Quality. The Standardization Committee is lead by Michael Kohlhase, the newly appointed president of the OpenMath Society.

TARGET USERS & THEIR NEEDS

Ultimately, target users who will benefit the most from the objectives of the JEM thematic network are students and life-long learners who need to acquire skills in mathematics, possibly by self-study. Today's technologies can help considerably in assisting teachers to train these skills in a large number of students with no additional effort.

During this last year, diagnostic entry tests for university freshmen are gaining increasing attention due to the opening of universities to international students with different backgrounds and preparation but also due to larger gaps in students coming from primary schools. Several JEM nodes have worked and are working to produce diagnosing and self-assessment exercises to test the mathematical backgrounds of incoming students at university. A pioneer JEM member in this respect is the AMSTEL Institute that continuously increases its collection of self-assessment materials and has raised awareness of this problem in other JEM partners. In some cases, like at the Universitat Politècnica de Catalunya, the diagnostic test will take place for the first time in September as a result of JEM cooperation. Since also other partners are interested in this activity, the network will devote a special session during the upcoming meeting to report on results and methodology. Where possible, the network might decide to publish a collection of multilingual entry tests that can be adapted to the local requirements while remaining generally usable in Europe.

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[2] http://www.jem-thematic.net/view/software

[3] http://www.jem-thematic.net/view/casestudy

UNDERLYING CONTENT

One of the deliverables of the JEM network is a set of Guidelines for Quality of the content that will be reviewed and distributed via the portal. The quality profile for the JEM network is available online and defines quality as relating to obtaining the best learning achievements. The JEM review process will try to evaluate the quality of resources, however it cannot assure the quality of the learning outcome or of the teaching based on such resources. The JEM review process is intended to highlight resources that have been created by following sound pedagogical criteria and show proper use of technology.

It is also conceivable that a collaborative approach aiming at including all e-content stakeholders in the review process is more suitable for social networking. The JEM portal offers the option to rate a Software item in a scale of 1-5. If such a scheme proves successful, it might be extended to offer the possibility to any registered user to rate and write a review for posted learning resources.

To day, the JEM partners have informally contributed extensive sample material, including full online courses in Single Variable Calculus (Seppälä, 2006), Complex Numbers and Functions (available in Spanish and in Catalan) (M. A. Huertas, 2007), and Physics (ISN Oldenburg, 2007).

SUMMARY OF ACTIVITIES

The JEM collaborative framework design and implementation has been completed during the first year of lifetime of the network and is now running stable since a few months. We expect to raise the number of actively contributing partners so that the dissemination impact of the website becomes noticeable. Publicity for extending the number of registered users is a top priority for the immediate future.

Software developments have been reported by the JEM technology members and can be accessed by JEM registered users[4]. This includes several learning platforms, e.g. EMILeA-stat, physic-multimedial, lectora, new tools such as search engines for physics repositories, and for mathematical formulae, innovative Web 2.0 software such as SWiM, a semantic wiki for collaborative mathematical editing. The STACK assessment system has undergone considerable improvements, including better support for CAS, and newly designed question types presented during the JEM meetings. The MathDox mark-up language has been enhanced so that it natively supports planar geometry, MathML-presentations and TeX fragments. The JEM portal supports developers in documenting and disseminating news concerning their work by allowing software descriptions according to a custom-designed Software template collecting useful synoptic information for the JEM community. JEM Software descriptions include a clear indication of the persons in charge of developer and user support, so that they can be contacted. The portal offers additional functionalities in case there is the need to hold a discussion forum or a survey poll. JEM has encouraged and prompted all developers' teams to setup newsfeed from their project's web pages that can be distributed as news from the JEM pages.

Concerning the production of enhanced eContent, the JEM partners Universitat Politècnica de Catalunya, Technical University of Eindhoven, Helsingin Yliopisto, and Universiteit van Amsterdam have all undergone development of electronic resources to perform diagnostic testing and self

[4] http://www.jem-thematic.net/about/progress

assessment in mathematics aimed at freshmen students. These interactive exercises intend to bridge the gap between secondary school mathematics and higher education. Ontology-based metadata enhancements of learning resources have been reported by Universitat Oberta de Catalunya that will lead to a repository of learning objects, while FernUniversität Hagen has begun to work on metadata for their e-learning tools which include a collection of Java applets, CAS-based exercises and flashcards. ISN Oldenburg has made available physics-multimedial, a rich collection of elearning materials for physics teaching up to bachelor level.

IMPACT & SUSTAINABILITY

The purpose of the JEM Thematic Network is to make mathematics education more efficient by proper use of technology. JEM does not develop new tools or software solutions but rather advances the proper use of existing tools, services and content. Once an educational organization starts using technology in education there is no turning back. Hence sustainability of the impact of JEM is automatic. JEM will facilitate the academic community to get proper information by organizing workshops, seminars, and, most importantly, by maintaining a web site containing information about technology, content, and of services.

BIBLIOGRAPHY

ISN Oldenburg. (2007). *physik-multimedial*. Retrieved from http://www.physik-multimedial.de/cvpmm/cgi-bin/decide.pl

M. A. Huertas, A. G. (2007). *Web-based course in Complex Numbers and Functions*. Retrieved from http://cimanet.uoc.edu/anmat/es/index.xml

Rikko Verrijzer, M. S. (2007). *1st Workshops Proceedings Annual Collection.* JEM Thematic Network .

Seppälä, M. (2006). *Single Variable Calculus*. Retrieved from http://www.webalt.com/Calculus-2006/