The LON-CAPA Academic Consortium

LON-CAPA

The LearningOnline Network with Computer-Assisted Personalized Approach (LON-CAPA) is a fully integrated cross-institutional learning content management and assessment system. It is open-source (GNU General Public License) and free.

LON-CAPA has its roots in two predecessor systems, namely CAPA (1992) and LectureOnline (1997), which were originally developed at MSU with a special focus on large-enrollment science and math courses. It has since evolved to have three functional layers:

1. A cross-institutional content repository, including content replication and subscription mechanisms
2. An intermediate layer for content assembly and digital rights management, storing assembled content back into the repository and opening assembled content up to the third layer
3. A full-featured course management system, including gradebook, communication, etc, to readily deploy content in courses

LON-CAPA enables instructors to create and/or assemble learning resources, including personalized assignments, quizzes, and examinations with a large variety of conceptual and quantitative problem functionality. In particular, the system provides ample functionality to develop problems which differ from student to student (different numbers, graphs, tables, animations, options, etc), thus encouraging student collaboration on a conceptual level without being able to simply exchange the answers.

Each resource created by any member of the network is infinitely reusable by any other member of the network, thus allowing for collaborative content creation across a single or multiple institutions. The underlying cross-institutional content repository spans over 40 universities, colleges, and high schools. It allows instructors and institutions to share online resources with their peers, yet enforce access, copyright, and royalty mechanisms, and to assemble lessons, chapters, and complete courses from a shared pool of over 60,000 modular learning resources.

One of the biggest infrastructure questions facing course management systems is their scalability as a function of number of distinct classes offered, number of students using the system, and peak login load in any given hour. The main technical innovation of LON-CAPA is its network of replicating content and load-balancing access servers that address this scalability issue. This system relies only on the LINUX operating system and open-source freeware. All other software components were produced by the LON-CAPA team during the course of this project.

Success

The ultimate measure of success for our system is whether it indeed proves to be an effective tool in increasing educational outcomes for students. A number of systematic studies, conducted primarily within undergraduate physics and chemistry courses, suggest that LON- CAPA can have a pronounced impact on student learning. All of these studies were published in the peer-reviewed literature.

One study followed an introductory calculus-based physics course from the years before system implementation until late into its deployment. In the years before using LON-CAPA, the final grade distribution exhibited the traditional bell shape around a grade of 2.5, with relatively few students receiving grades of 3.5 or 4.0. After the move to LON-CAPA, the proportion of students earning a grade higher than 3.0 increased dramatically. Notably, independent evaluators judged that the examinations used in the course after deployment were more challenging than those used in earlier years, and so the positive change in educational outcomes cannot be attributed to a lowering of standards for the class.

Two other studies suggest that LON-CAPA may increase the participation and success of women in the sciences. One study focused on a year-long physics course for non-science-majors, in which the system was used only during the second semester. Final grades from the second semester indicated that women were especially likely to benefit from the system. The second study indicated that women, who began the course significantly less well prepared than men, improved their performance relative to men across the semester until there were no gender differences by the final exam.

A majority of students, typically 80%, consider that LON-CAPA helps them learn and understand the course material. That this does not lead to frustration is surprising, since according to several self-evaluative studies, the time students spend working on assignments and other course requirements has increased by nearly a factor of two.

LON-CAPA is the 2003 Winner of the ComputerWorld Honors 21st Century Achievement Award, as well as recipient of a 2004 Sloan-C Award for Most Outstanding Effective Practice.

Funding

The continued development and operation of LON-CAPA on the MSU campus costs approximately $500,000 per year, which pays for two support and training staff, three programming staff, a project coordinator, and a partial faculty salary. LON-CAPA, is one of two supported learning content management systems on campus, the other being the commercial system ANGEL. Over the last 13 years, LON-CAPA has been supported with funds provided by Michigan State University and on grants from the National Science Foundation, and the Sloan and Mellon Foundations. At MSU, LON-CAPA supports nearly 17,000 student course enrollments each semester in over 400 course sections. Many of these courses cannot be adequately served by commercial products at

their current level of sophistication, particularly since those commercial products frequently address the broad common denominator without investing in the specialized functionality, which would make them truly useful for science and math.

At other institutions, LON-CAPA is supported through a variety of arrangements, ranging from graduate student to partial staff and faculty assignments.

An open-source freeware system naturally does not derive any income from license fees, and while the open-source model promises community-based sustainability from the contributions of its members, in reality, most of the coding is still done at MSU. Including its predecessor systems, LON-CAPA has been supported by Michigan State University for over 13 years – longer than any commercial system has been around.

With approval from the MSU Board of Trustees, the LON-CAPA group recently spun off a commercial business, EduCog, LLC, which provides fee-based coding services of their end-of-the-chapter problem libraries to science textbook publishers, as well as fee-based hosting to institutions that are unable or unwilling to maintain their own installations.

Consortium Goals

The goal of the LON-CAPA Academic Consortium is to sustain and guide the continued development and growth of LON-CAPA, recognizing that this platform has already been disseminated to over 50 institutions outside of MSU. Consortium members shall promote LON-CAPA from an institutional level, both on and off campus. The Consortium members shall actively pursue common external funding sources jointly and independently as appropriate.

Open-Source Character of the Software

The code-base of LON-CAPA is open-source software, covered by a GNU General Public License. As such, the source-code is freely available and can be modified by anybody. However, the Consortium shall insure trademarking of the name LON-CAPA, and maintain control over the releases of the software called LON-CAPA, as well as membership in the main content cluster ("Network") of the system.

Membership

Consortium membership is available to institutions at three levels:

- **Core Member**: The institution is at the level of R1 or equivalent (as determined by the LON-CAPA Academic Consortium Board) and commits at least $200,000 per year for five years toward furthering the consortium goals. The institution maintains at minimum one full-time (100%) code developer exclusively dedicated to the LON-CAPA project working as an active member of the Core Development Group. Additional commitments can include but are not limited to programmer time, support staff, and documentation efforts. Membership renewal shall be re-negotiated by the Board one year before

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expiration of the current membership term.

- **Sustaining Member**: The institution commits at least $125,000 per year for five years toward furthering the consortium goals. Commitments can include but are not limited to code development staff, support staff, and documentation efforts. Membership renewal shall be re-negotiated by the Board one year before expiration of the current term.
- **Associate Member**: The institution commits at least $50,000 per year for three years in on-campus staff and resources toward furthering the consortium goals. Membership renewal shall be re-negotiated by the Board six months before expiration of the current term.

A detailed annual accounting of the breakdown of each member institution's commitment will be submitted to the Board at the Annual LON-CAPA Conference and Workshop.

Core Development Group

The software platform has a Core Development Group, which is cross-institutional and consists of software developers from the Core and Sustaining Member institutions. Any developers participating in this group must maintain an annual appointment of no less than 25%-time dedicated to the LON-CAPA project.
The goal of the Core Development Group is to move the LON-CAPA project forward by responding to the needs of the Member Institutions and users. All major development projects must be presented to and approved by the Board (so as to avoid the possibility of any one developer or group of developers spending time on a project that cannot or will not be implemented.)

Benefits of Consortium Membership

Members actively guide and support the further development and growth of the LON-CAPA system. Member Institutions receive waivers of registration fees for LON-CAPA conferences and workshops in accordance with their level of Membership: Core Member Institutions receive three full waivers, Sustaining Member Institutions receive two full waivers, and Associate Member Institutions receive one full waiver per event. All fees will be waived for presenters at conferences and workshops. Assistance with registration fees for faculty and staff from membership institutions will be available on a case-by-case basis pending sponsorship by the hosting institution, grants, or commercial partners.

Governance

The Consortium is governed by a Board with a Chairperson elected by the board to serve one-year terms. The main function of the Chairperson will be to formalize the meeting schedule for the year and to convene the meetings. Any member institution can appoint one representative to the Board, and suggest additional Board members, subject to confirmation by the Board. Member institutions shall have relative voting weights in correspondence to their membership level:

- Core Members; 4 votes
- Sustaining Members: 2 votes
- Associate Members: 1 vote

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The Board membership, voting composition, and this document are subject to annual review by the Board as adjustments may be in the Consortium's best interest. The Board shall determine if proposed membership commitments are compatible with the goals of the Consortium.

The Core Development Group has a full-time (100% appointment) Technical Director. The Technical Director position may reside with any Core Member Institution. The Technical Director will determine which developers are best suited for each project based on the skills of the developer and institutional priorities. Management of the day-to-day programming activities, as well as reporting of defects and submission of enhancement requests shall be handled by an appropriate publicly available software system. Final implementation decisions about technical changes, personnel assignments, and the architecture of the system rests with the Board and the Core Development Group, whose Technical Director carries the overall responsibility for the integrity of the system and may veto proposed changes with the support of the majority of the Board.

Content Cluster (Network)

Only institutions and companies maintaining a Consortium-sanctioned release of the LON-CAPA software shall be eligible to be connected to the content cluster (the Network). The Board shall maintain control over the Network. Board approval is needed for an institution or company to join the Network. The Board shall have the right to disconnect an institution from the Network if it deems the connected machines to be continually ill-maintained, unavailable, or if the security of the system or the integrity of the intellectual property rights management is not appropriately managed. An appropriate warning by the Board shall by issued prior to disconnection if possible. Technical control of Network membership shall rest with one of the Core Institutions. Technical personnel at the Network-controlling institution shall be empowered to make emergency temporary configuration changes if necessary, and inform the Board for final resolution.

Meetings

The Consortium Board has annual meetings in connection with the annual LON-CAPA Conference and Workshop. In addition, the Board shall have bi-monthly meetings, which may be conducted virtually. The Technical Director will provide a progress report at each bi-monthly meeting of the Board, and will use the users listserve to send out a monthly digest of projects and their status. The Core Development Group will meet weekly with virtual attendance when necessary. These weekly meetings will allow the Technical Director to manage the workload of the Core Development Group. The Core Development Group shall offer regular Developer Workshops as frequently as is appropriate as determined by the Board. A proposed schedule of meetings follows. Member Institutions are encouraged to hold regular user meetings during the academic year.[1]

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[1] It is agreed that this document is a work-in-progress, and is subject to continued revisions as directed by the LON-CAPA Academic Consortium Board of Directors.

Proposed Meeting Schedule for the LON-CAPA Consortium and Associated Groups

August 2006	Core Development Group Weekly Meetings
September 2006	LON-CAPA Academic Consortium Board of Directors Meeting (virtual) Core Development Group Weekly Meetings
October 2006	Core Development Group Weekly Meetings
November 2006	LON-CAPA Academic Consortium Board of Directors Meeting (virtual) Core Development Group Weekly Meetings
December 2006	Core Development Group Weekly Meetings
January 2007	LON-CAPA Academic Consortium Board of Directors Meeting (virtual) Core Development Group Weekly Meetings
February 2007	Core Development Group Weekly Meetings
March 2007	LON-CAPA Academic Consortium Board of Directors Meeting (virtual) Core Development Group Weekly Meetings
April 2007	Core Development Group Weekly Meetings
May 2007	LON-CAPA Annual Conference (19–20 May, MSU) LON-CAPA Academic Consortium Board of Directors Meeting Core Development Group Weekly Meetings
June 2007	Core Development Group Weekly Meetings
July 2007	LON-CAPA Academic Consortium Board of Directors Meeting (virtual) Core Development Group Weekly Meetings