

What did we do and deliver?

The project initially had a strong focus on the conditions needed to (technically) share educational resources under open licenses. During the run of the project the project team realized that these conditions only become relevant in the case of an active community of math teachers, able to find each other, each other's experiences, ideas, and resources, eventually leading to the need for technical conditions. Therefore during the run of the project the focus changed a bit more towards community building and managing, and less towards the conditions of open sharing of educational resources and its implementation in practice.

This means that the original focus on work packages changed towards stronger focus on community building and management, and experimentation with sharing of educational resources using tools such as a learning management system MOODLE and a repository for educational resources Equella.

Community

During the project the project team realized that a quality increase in education can be influenced positively when (math) teachers share and reuse each others educational resources, but that this only happens when the people know and trust each other, each other's ideas, experiences, and their resources. Knowing the context, purpose, type, setup etc of the resources are important conditions before someone else's resources are actually (re)used.

That is why the project focus placed a larger emphasis on the creation and management of a community of math teachers at the four Technical universities.

Survey results

Late 2017 a survey was issued among all 4TU math teachers. This resulted in a large number of responses from all four participating universities (95). Of these respondents 43 math teachers indicated they would like to be kept updated, where 35 indicated they would be interested in being considered part of a math teaching community as active members. This indicates that there actually is an interest to act as part of a bigger community.

In the end, what the project team learned from the input received from the 4TU teaching community, is that getting to know and meet each other, and discuss topics subject to mutual interest are considered useful and desirable. The benefits of being part of a community lie both in the social aspect (knowing your peers in the community, feeling as part of a bigger group), as in the collaborative aspect (learning from other perspectives, working together on common topics and challenges, and making use of each other's work and resources).

However time is an important limiting factor. One might conclude that it is hard for 4TU math teachers to be able to take the time to invest in community activities, either because the time available is addressed by other pressing issues in their daily reality or because the community activities are not considered important or useful enough in competition with other tasks.

Roadshows

To stimulate the community feel, roadshows were initiated, aimed at informing about the aims of the project and forging a community, involving members from the math teaching

community in the process. All four 4TU institutes were included, with varying success. Not all institutes unfortunately reached the same percentage of math teachers.

The project team saw the time issue back in the roadshows, which were organised to address the survey results and discuss next steps in creating, maintaining and building upon an active community.

Existing community meetings

In the end reaching math teachers and putting them in contact with their peers proved very successful in some cases:

- Groups of math teachers at their own university. Especially at Delft University of Technology this worked very well. At Delft University of Technology there is a history of a community approach to Delft math teachers, and math education is structured as interfaculty math education. There is a strong community of lecturers, meeting regularly and discussing learning materials.
- The annual InterTU Study day is an inter university community meeting with a long history.

We learned that it works better to embed community activities in existing and (in the eyes of the intended audience) useful/purposeful situations, with clear goals and clear personal gains (to the audience), rather than organising new meetings. This way the valuable limited time of the math community members is respected and the meetings fit with the needs of the community members.

Newsletter

Over the course of the project a newsletter was sent out regularly. Taking into account the limited impact of newsletters in general, the newsletter did help to keep the community members informed in addition to other community based activities mentioned earlier.

We did learn that it is important to send the newsletter on a regular basis. Other learning points were:

- Share what is useful according to the receiving end (so gather that input/demand). It could be useful to actively include the community members in preparing input for the newsletter for instance.
- Show that input was processed (reward their effort).

Technical infrastructure

In order to share educational resources, use and reuse them, or work together to develop them, teachers need a technical infrastructure, which supports these activities. A repository is the default option to share and find resources. However, teachers also want to have means to use the resources in their own environment. For this it should be possible to adapt resources to their own needs, and to offer them to their students, whether they are at teacher's institute or external. A technical infrastructure should provide means to:

- share resources
- find resources
- adapt resources
- offer the resources to various groups of students

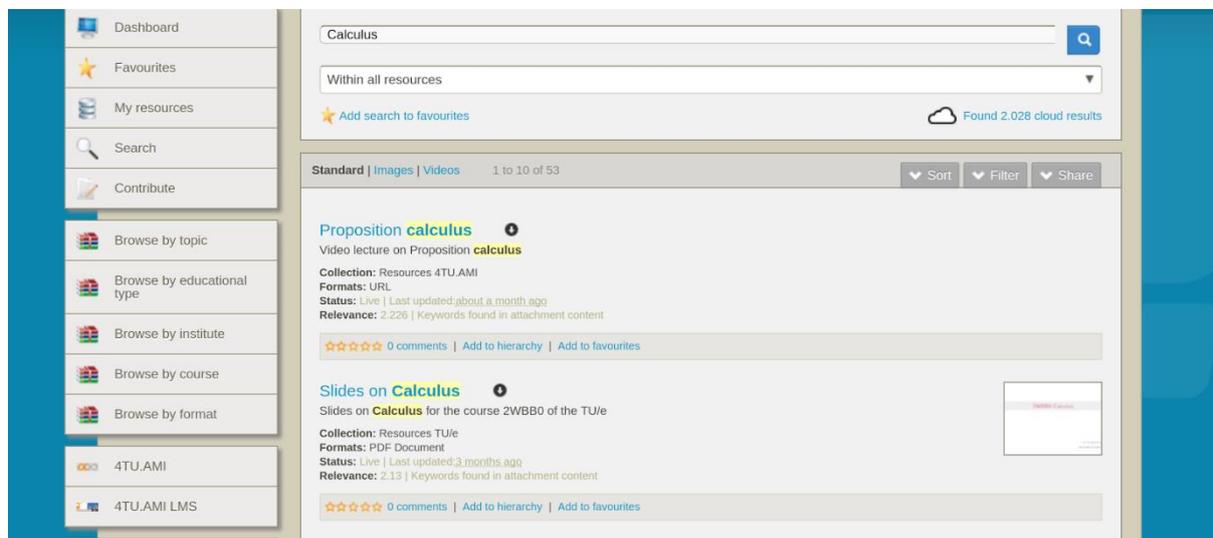
To realise such an environment, we have set up an infrastructure based on open source components, consisting of:

- a repository for sharing and finding resources (Equella).

- a Learning Management System (LMS) equipped with various open source tools for
 - creation of learning resources, including tools for assessments, interactive quizzes, interactive videos,
 - offering (joint) courses to external students.
- connections through LTI with LMS of the various institutes to offer the resources to students at own institute.

Repository

We have set up a 4TU.AMI-repository for sharing educational resources on mathematics. The repository is based upon the open source repository software Open Equella (see <https://www.apereo.org/projects/open-equella>). The repository is set up to support the sharing and reuse of mathematical educational resources of the 4TU.AMI project on blended learning. For this a metadata scheme has been developed fitting this use case. The repository can be found at <https://oncourse.tue.nl/equilla>



LMS

Moodle is a well known open source LMS that is used all over the world. We have set up our own version of moodle as a LMS for the 4TU.AMI project Blended Learning. This version of Moodle is enriched with various plugins that support the teaching of mathematics. These plugins include:

- MathDox exercise-system in the form of SCORM-packages with interactive mathematical exercises, which are parametrized and automatically graded.
- various question types for moodle quizzes, including formula type.
- H5P for interactive videos, and presentations with support for math formulas.

The 4TU.AMI LMS can be found at <https://oncourse.tue.nl/4TU.AMI>

4TU.AMI My courses This course

- Assignment on Limits
- Video Lectures: Computing Limits
- Exercises on Computing Limits
- Assignment on Computing limits
- Video Lectures: Continuity
- Exercises on Continuity
- Assignment on Continuity
- Differentiation
- Integration
- Test yourself
- Extra
- My courses

ADMINISTRATION

- Course administration
 - Turn editing on
 - Edit settings
 - Users
 - Filters
 - Reports
 - Grades
 - Gradebook setup
 - Badges
 - Backup
 - Restore
 - Import
 - Publish

Limits and Continuity

In this chapter we introduce one of the fundamental concepts of Calculus, the **limit**. The reader is referred to Chapter 2 of Calculus Volume 1.

Total estimated study time 14 hours

Limits

Video Lectures: Limits

Video lectures on:

- Limits
- One sided Limits
- Limits and infinity

Estimated study time: 1/2 hours

Exercises on Limits

Estimated study time 1 hour

Assignment on Limits

Study Section 2.1, 2.2 and 2.5 of Calculus Volume 1.

Hand in (in pdf) your worked out solutions of the following exercises

2.2: 68, 69, 70, 71, 72, 76, 77

2.5: 190, 193, 195, 197, 198, 205

Estimated study time 3 hours

LTI-Connections

LTI is a protocol for sharing educational tools between various applications. The 4TU.AMI LMS does provide the possibility to act as an LTI provider. This means that each separate activity in a course in the LMS can be offered as a plugin in another LMS, like Canvas, Blackboard or Brightspace. So, a teacher can set up a quiz or an interactive video in the 4TU.AMI LMS, and the use it inside the Canvas LMS of his or her institute. Students can then use the quiz or video from within Canvas.

2017 Semester A ...

Account Dashboard Courses Calendar Inbox Help

Home Assignments Announcements Syllabus Grades Quizzes

Calculus week 2

Vectors

1 2 3 4 5 6

Determine the sum of the two vectors $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$ and $\begin{pmatrix} -5 \\ -3 \end{pmatrix}$.

$\begin{pmatrix} 4 \\ -2 \end{pmatrix} + \begin{pmatrix} -5 \\ -3 \end{pmatrix} = \begin{pmatrix} \\ \end{pmatrix}$

Submit

We have experimented with this environment to test whether it would be suitable as an infrastructure for the community of mathematics teachers at 4TU.AMI. The 4TU.AMI-

repository has been tested by 20 teachers. They uploaded learning resources and searched for content. We have asked them, with a questionnaire, to provide us with information on how they experienced the use of the repository.

Results

The 4TU.AMI LMS (as well as a TU/e-local version OnCourse) has been used intensively by several teachers of the 4TU.AMI community as well as TU/e-teachers of the mathematics and other departments. The environment is very much appreciated by most of the teachers. It offers a lot of possibilities, and due to the fact that the underlying software Moodle is open source, it is also possible to adapt to the wishes of the community.

The LTI connections work well, in particular with Canvas. The connection has been implemented in various courses of the TU/e. However, to implement the connection, one needs to have special rights of the central administrator of an LMS of an institution. This right is not always granted.

Education: Open sharing and development of learning solutions

The ambition of this project was to prepare the institutions, technology and teaching community to share, find and reuse each other's educational resources, with the eventual goal that these resources would be implemented in daily educational practice, resulting in an even higher quality of resources and learning experience for students.

However, we soon realised implementing openness in educational practice would be a step too far in the limited amount of time we had for the project. Emphasis was placed on community activities and technical aspects. The step towards actual teaching practices needs to be taken at a later stage.

Communication & Dissemination

Over the course of the project several activities were undertaken to increase awareness for the project goals, learn, spread the message and increase the community. Besides the community activities described elsewhere, the following activities were undertaken (among others):

- A [video](#) was recorded to introduce the project, shared on a [dedicated website](#) facilitated by SURF.
- Several presentations were offered for SURF, addressing a wide range of members of Dutch HE institutes (like: [vakcommunities bijeenkomst 21 Sept 2017](#); [Preconference day SURF Onderwijs dagen, 7 Nov 2017](#); and others).
- Several workshops in the Math domain were offered ([ICAB, 22 Nov 2017](#); Wiskundig genootschap: [Koninklijk Nederlands Mathematisch Congres \(KNMC\) 3-4 April 2018](#)).
- A workshop was offered at *the* international open education conference ([OE Global 2018](#)), to showcase the project and request input from an international (open education) community (25 April 2018).
- An article about the project was published by the 'KWG - nieuw archief voor Wiskunde and by EdMedia (29 June 2018).
- Internal presentations and messages were sent within the project institutions, informing the non-math teaching community about the project (internal workshops, Open Education Week contributions, meetings and newsletters). The same was done for 4TU media (4TU.AMI newsletter for instance).