

## **EXPERIENCES WITH THE USE OF THE MUMIE E-LEARNING PLATFORM AT THE TU DELFT**

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## **INTRODUCTION**

MUMIE is an open-source e-learning platform for learning and teaching mathematics and computer science. It grew out of the needs of practical teaching at the interface between high-school and university. MUMIE is highly flexible. Its courses and course material is easily adjusted to any kind of pedagogical scenario. It has built in learning and training environments with wiki-like dedicated social networks for virtual tutorials and self-organized learning. Powerful authoring tools support the production of new content. In 2009 a pilot experiment with the use of MUMIE was held at the TU Delft. MUMIE was offered to first year students Aerospace engineering as an extra option to support their learning in the Linear Algebra course. The TU Berlin had already made an extended course Linear Algebra. Part of the material developed at the TU

Berlin was used and translated from German into English. The results of this pilot were promising. Around 70% of the students who did use MUMIE recommended the MUMIE program for future courses. So it was decided to continue with MUMIE. In this paper some results, challenges and future plans are described.

## **1 DOES MUMIE SUPPORT STUDENT LEARNING AND SUCCESS?**

### **1.1 WHY USE MUMIE?**

The main reason for using MUMIE at the TU Delft is to encourage students to start to learn at the beginning of a course. Especially for math courses we all know that most students start too late and do not keep up with the scheduled topics and exercises. Exam results are often disappointing for students as well as for the staff. For the TU Delft MUMIE was interesting to use because it combines theory with interactive visualizations and exercises that are automatically corrected. The TU Berlin had already a course developed in the Linear Algebra domain. Starting to develop a new course from scratch costs much more time. Furthermore MUMIE is open source ware for institutes of Higher Education and has the interesting possibility to improve the quality of the platform and to share the content with other institutes of Higher education.

### **1.2 The set-up of the Linear Algebra course and the use of MUMIE**

The set-up of the course is as follows;

- The course is given over the second and third quarter in the form of lecture-instructions ( a combination of lectures and instruction).
- Participation is voluntary. Everybody can participate if they like.
- Students can work with MUMIE either at home or at the university, at their own pace in their favourite time.
- The content in MUMIE follows the theory as given in the study guide. Every week a specific topic is covered as specified in the study guide.
- Every two or three weeks homework exercises have to be completed and are corrected automatically.
- Half a bonus point can be earned in every quarter if the score for all exercises together is above 60%, resulting in either 0, 0.5 or 1 extra bonus point at the end of the course.
- This bonus point could only be used for the exam in April, not for the re-sit.
- One of the MUMIE exercises is also presented in the exam.
- There is a single exam at the end of the third quarter.
- A score of 6 or higher is needed to pass the course.

For all problems and feedback concerning MUMIE a teacher assistant is available. This teacher assistant is also involved in maintaining MUMIE. The advantage is that there is no extra work load for the teachers.

### **1.3 Participation and success rate**

In table 1 participation of MUMIE in the study programme 2010/2011 and 2011/2012 is shown.

*Table 1. Participation MUMIE and average grades with and without MUMIE*

Year	Registered MUMIE users Number	No MUMIE users	Active MUMIE users (received 0.5 or 1.0 bonus point)	Active MUMIE-users average exam grade (without bonus)	Non-MUMIE users average exam grade
2010/2011	400	87	309 (63%)	6.53	4.97
2011/2012	341	77	256 (61%)	6.04	4.47

The results show that that MUMIE benefits the student in getting a higher grade for the exam. Students participating in MUMIE are stimulated to frequently spend time studying the material and not wait until last moment. It is also assumed that students using MUMIE might have gained extra insight in the mathematical concept from using the interactive visualizations in MUMIE. Last but not least students who participate in MUMIE are willing to put extra effort in the course in order to pass the exam.

In table 2 you see the results of the first exam for the discussed course in the last four study years. In the last two study years MUMIE has been offered as an extra option.

*Table 2. Exam results*

Study year	Participants regular first exam	Succes rate
2008/2009	381	48%
2009/2010	380	66%
2010/2011	484	72%
2011/2012	417	59%

The results show some progress in the number of students that passed the exam but there are always variables we can't control: like differences between the capacities of students of the various cohorts and differences in the degree of difficulty of the exams.

#### 1.4 Experience and feedback from students

At the end course students had to fill in a survey about their experience with using MUMIE. Feedback from the students was very important for in order to improve the material for next years. For this reason it was in 2011 mandatory for students to fill in the questionnaire in order to gain the bonus points. In 2011, 331 filled in the survey, in 2012, 228 students. The survey consists of 16 pre-defined multiple choice questions with an opportunity to leave feedback at the end of the survey. In Table 3 the main results concerning the use of MUMIE are shown.

*Table 3. Main results student survey*

Answers	2011 (n=331)	2012 (n=228)
I went through entire MUMIE lectures and I have done most of the lectures	39%	36%
I have done all or most homework exercises	83%	86%
The difficulty of applets in lecture part in MUMIE was just right	63%	59%
The difficulty of homework exercises to be sent in was just right	57%	54%
The applets were very helpful and helpful to understand course material	58%	51%
The applets motivated me to learn the course strongly agree and agree.	60%	55%
MUMIE is very well/well/enough structured	78%	80%
I recommend to use MUMIE for the Linear Algebra course	83%	73%

There was of course also a lot of critical feedback. We consider this feedback as very useful in order to improve the use of MUMIE, the MUMIE platform, the content and the relation between MUMIE and the traditional lectures/instructions.

## **2 IMPROVEMENTS AND FUTURE PLANS**

### **2.1 Progress and improvements**

At the TU Delft the Linear Algebra course in MUMIE is offered as an extra option parallel to the regular course. We are satisfied with the use of MUMIE by the students and with their feedback. In the frame work of blended learning we have the intention to embed MUMIE more into the regular courses. For example the powerful visualizations can also be demonstrated during the lectures and the results of students can be discussed there as well.

### **2.2 IMPROVEMENTS OF THE MUMIE PLATFORM**

Due to our experience and the experience with MUMIE at the TU Berlin the MUMIE platform has been improved in the last years.

In June 2011 version 3.0 was released. For students the biggest advantage was that this new version is now compatible with all the major browsers (Chrome, Firefox, Internet Explorer, Safari and Opera). Also the possibilities for students to keep track of which exercises had been completed/saved and which not have been improved. Now the student has much easier overview of the exercises that have been saved and completed.

For teachers the new release makes it more easy to create the courses in a more flexible and logical way. An updated version of the authoring tool (MIAU) accommodates these improvements.

### **2.3 Improvements of the content in MUMIE**

Not all the topics in the regular course are covered in MUMIE. The missing items and exercises will be added in the coming years. We'll also add exercises into MUMIE that are comparable to the exam questions so students get a better idea what is expected from them. The use of the Linear Algebra course in MUMIE will be extended to the Computer Science programme.

### **2.4 Collaboration and EU project**

To extend the usage of MUMIE for mathematical courses a collaboration between TU Berlin, KTH Stockholm, Aalto University, Integral Learning and the TU Delft has been set up. With these partners we have written an EU proposal to develop together bridge courses in MUMIE for incoming bachelor and master student to prepare themselves better to the requirements of bachelor and master programmes of universities of Technology. This proposal has been rewarded with high marks.

### **2.5 Conclusions**

Just like writing a book using MUMIE takes a lot of time. Although we have decided at the TU Delft that the teachers will be supported by teaching assistants and the teachers will define and select the content and exercises, it still costs a lot a time. However we also see the advantages this open source ware platform. To collaborate and share will not only speed up the improvements of the MUMIE platform but will also encourage the discussion about the content, quality and effective learning arrangements of mathematical courses at the Universities of Technology in Europe.

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