From mail to email; teachers training using distance learning.

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Abstract
In a teachers training program for mathematics in distance learning the use of digital communication is initiated by students. The classical correspondence model is replaced by using an electronic learning environment, but mathematics teachers have a few specific problems that are not fully solved yet.

Keywords
Mathematics education, teachers training, distance learning, electronic learning environment.

INTRODUCTION
In 2000, the School of Education at Windesheim University started a new teacher training program using distance learning. It was a joint effort of the university and De Leidse Onderwijs Instellingen (LOI), a private enterprise. LOI is the market leader in distance education in the Netherlands, providing correspondence courses for working men and women for many years. Windesheim, my own college, has 28 years of experience in teacher training. The new distance learning program allows students to earn a degree in teaching mathematics in four years. We started in 2000 with 30 students, and now have over 200 students enrolled.
This teacher training program started in the form of correspondence education, using exercises that are evaluated by the lecturers, and returned by mail. It is now becoming a virtual community of students and teachers connected in an electronic learning environment.
While mathematics education has changed dramatically due to rapid developments in information technology, teaching mathematics in distance learning courses using these new technologies proved to be a challenge. The use of graphical calculators and electronic spreadsheets is wide spread; but distance learning is mainly about communication and that implies some special difficulties for math students and their teachers.

In this paper the focus is on communication with students in a distance education program. In the correspondence model that was used in the early years the lecturers were rather anonymous and procedures were very strict. Our students introduced a forum and a digital environment themselves, like an electronic school yard. And nowadays we are busy solving some of the special problems in communicating mathematics. But there still remain some important steps we have to take.

The correspondence model
When a student enters the distance learning program, he gets an overview of the curriculum and he begins his first course. The curriculum is personalized - some topics are excluded as a result of his former education. Every three months he will receive course materials by mail and will buy his books and start studying.
When he has finished a chapter in the course, he completes assignments and submits them by mail. The lecturer evaluates the work, answers any questions, and sends the work back to the student. At the end of the term the student takes an

exam. Some subjects (like didactics of mathematics) have a few scheduled meetings, where students meet with the lecturer and make presentations for the class. Students indicate that the free time on these days is at least as valuable as the scheduled lessons, because they have the chance to meet other students in the same situation. But these meetings are restricted in time and place (only a few Saturday mornings, in the centre of the country).

The electronic school yard

After a few years, our students began to communicate in an online forum hosted on a private website. It was created by one student who was the owner and webmaster. She allowed every student in our program to enrol online, and the forum was used for discussion and announcements about our courses.

When we discovered the website and forum, we wanted to enrol ourselves as the lecturers of the distance education courses. But we were blocked by the webmaster. On a school yard, she reasoned, students behave differently when teachers are near. And so we noticed; students exchanged almost everything we published, including the solution of their exercises and our feedback to students. But we intended that these were only available after they had submitted their solutions! Exams were also published, so we were forced to create new tasks for every exam; for courses like projective geometry this was quite a burden for the lecturer.

After a period of discussions, the webmaster relented and gave us access in a limited way; we got our own corner of the yard. We could enter discussions, we were able to publish exam results and announcements and there was a special section for job advertisements and schools available for practice teaching. Since the whole website was a private matter, the webmaster had all the control. She even banned a few students from the website. And we could do nothing about it but listen to the complaints of the students.

But there is a large difference between a regular school yard and this electronic environment; a school yard is owned by the school, and even if teachers are not always near you, they still have a responsibility for the things happening at the yard. When children complain about others, their teachers will help them to solve the problems. At this so called “school yard” we had no jurisdiction.

In the mean time, with our other students we already worked with Blackboard as an electronic learning environment for some of the courses. For distance learning we felt the need to use a similar solution. And because of a radical change in our curriculum, we have gotten this opportunity.

The use of an electronic learning environment

In the new design of our curriculum, due to the rules of the European Union for standardization of higher education, all our course material is presented online using Blackboard. We arranged a home page for all math students and used Blackboard in all 16 courses in the first year of the curriculum, 8 professional courses and 8 on mathematics. This allows better communication with the students. Our home page became the new meeting area for students, we gave the students access to a lot of our resources, and they entered our school yard, as we intended. Within six month the informal website was shut down because we offered a formal alternative.

We found Blackboard wonderful for organizational issues like schedules, general questions, and logistics. We were able to create groups, to exchange email, and start discussions on new topics.

But when the communication is about mathematics, we found a whole new set of problems using Blackboard. In our correspondence model, tasks were submitted on paper; it was easy for the lecturer to use the student’s solution on paper and write down alternative solutions or draw a few extra lines in a figure.

With the colleagues of our faculty we discussed several solutions for handling figures and formulas. We experimented with a writing device, that was intended to

enable us to write down suggestions and corrections while reading the students work from the screen; but our fine motor skills were simply not good enough for the hardware that we could afford, so the result did not have the professional quality that we wanted to deliver.
We discussed the use of standard software for drawing and editing formulas, but the lecturers argue that the time needed to answer individual questions and to respond to submitted tasks is doubled or worse when we use only electronic communication.
The same holds for discussions with students: an email client usually does not offer an easy to use functionality to discuss mathematics in detail. Table #1 shows the difficulties involved.

Proof of lemma 4.8 part 1, so the implication: a e Zm(m>1) has a multiplicative inverse => D(a,m)=1

Table 1. Part of an email from one of our students.

For a mathematician this is a very free formulation. In a regular form the content would look like Table #2:

Proof of lemma 4.8 part 1, so the implication: $a \in \mathbb{Z}_m \quad (m > 1)$ has a multiplicative inverse $\Rightarrow$ D(a,m)=1

Table 2. The correct formulation using mathematical conventions.

It took me 15 minutes to install the software and to solve all font problems to get this expression.
Storey et al. (2002) conclude that the usefulness of Web-based learning tools like Blackboard is context dependent. The context of mathematics presents us problems we haven't solved yet.
We still use a blended form, going electronically when possible, and using ordinary mail when it fits best. We envy the progress our colleagues teaching history or geography have made. We will keep searching for better hardware and software tools, together with our ICT department, in order to develop proper ways to use ICT in Mathematics courses, especially in communication.

REFERENCES

Storey et al (2002). Evaluating the usability of Web-based learning tools. In Educational Technology & Society 5 (3) 2002. ISSN 1436-4522

Biography

Willem van der Vegt is a teacher's trainer in mathematics at Windesheim University for Applied Sciences. He coordinates the distance education program for future math teachers. He also is involved in computer science education, in service training for computer science teachers and he is one of the organizers of the Dutch Informatics Olympiad.