Remedial online teaching on a summer course

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Abstract: This paper is based on experiences with remedial online learning from a national collaboration initiative in the Netherlands involving the University of Amsterdam, Erasmus Rotterdam University and Maastricht University (www.web-spijkeren.nl). The central question is how prior knowledge tests and online remedial summer courses can contribute to mitigating the problems of heterogeneous student enrolment. Although the insights gathered for the paper are from pilots for first-year Bachelor’s programmes, the guidance they provide on how to implement an online summer course programme successfully should prove valuable to other organizations.

Keywords: lifelong learning; distance learning; collaboration initiative; innovative education

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Acceptance for a Bachelor’s or Master’s programme has traditionally been based on required qualifications, experience and/or skills. However, due to the increasing internationalization of students (Ministerie van OCW, 2005), changes in secondary school programmes in the Netherlands (de Vries and Van der Velden, 2005; Tweede Fase Adviespunt, 2005), the introduction of the Bachelor’s-Master’s structure and the new accreditation procedures agreed in the Treaty of Bologna ( Dittrich and Fredericks, 2005; Onderwijsraad, 2005), Dutch higher education institutions face tough challenges in selecting the ‘correct’ student. According to the Ministerie van OCW (2005),1 the average proportion of foreign students in higher education in the Netherlands is 4% and most institutions are striving for greater internationalization in the years to come.

In the Netherlands, the two universities with the highest percentage of foreign students are the University of Wageningen (19%) and Maastricht University (24%). The experiences at the university with the highest amount of foreign students in both absolute and relative numbers show that the foreign students’ prior knowledge levels in mathematics and economics are more diverse and often lower than for students with a Dutch secondary education degree ( Rienties et al., 2005b).

Although foreign students should, officially, be accepted because of the Treaty of Bologna, for some international students the lack of prior knowledge is too large and remedial teaching before entering a programme is therefore desirable. In addition, most students are unable to judge for themselves whether or not they have sufficient prior knowledge and/or experience to start a Bachelor’s or Master’s programme (Prins, 1997).

In the past several remedial teaching programmes have been developed (for example, the James Boswell Institute’s Colloquium Doctum programme, designed to prepare foreign students for entry into Dutch universities). However, their success in terms of students completing the programme is highly dependent on student motivation, teacher involvement and the...
learning environment (Van Leijen et al, 2005). As higher education institutions now have to compete in a European or even a global market, offering only regional/national remedial courses in a fixed geographical location with traditional teaching methods seems to neglect the effects of a changing world. In order to increase the success rates of higher education, an online remedial programme may offer a solution to the problem of lack of prior knowledge.

In this paper, therefore, a general framework for an efficient and effective online summer course will be developed. Subsequently, the online remedial teaching model will be examined in practice by analysing two online remedial teaching courses at Maastricht University, which form part of the Web-spijkeren² project. Finally, the evaluation results from the summer courses will be used to answer three questions:

• How can students assess their current level of mastery before joining a Bachelor’s programme?
• If the level of mastery of an individual student seems low, how can an online summer course help to tackle this deficiency?
• How can online summer courses be designed to increase the completion rates of students who enrol on them?

Online remedial teaching model

Van Leijen et al (2005) have conducted research on various remedial teaching programmes in the Netherlands. A programme offered during the summer carries with it an incentive problem, as most high-school graduates have a strong preference to do something other than study. Hence the challenge is to construct a programme that achieves a balance between study time and time for summer activities such that it provides sufficient motivation to keep students engaged in the course. An online summer course should be able to strike this balance, as in theory it will be possible to teach and learn regardless of time and place. On the basis of various studies on the use of ICT in education and on distance education (Vrasidas and McIsaac, 1999; Keegan, 2002; Roblyer and Wiencke, 2003; Bryant et al, 2005; Schellens and Valske, 2005) and research on remedial teaching (Van Leijen et al, 2005), the following five issues should be taken into consideration in the design and implementation of an online remedial summer course:

• access and availability online 24 hours a day;
• adaptability;
• interactivity;
• responsiveness in providing feedback; and
• flexible learning methods and assessment.

Access and availability

According to Bryant et al (2005), there are many definitions of online and distance education. ‘Distance education’ encompasses two important elements – distance teaching and distance learning. ‘Distance teaching’ applies mainly to the way instruction is provided, whereas ‘distance learning’ relates to students’ learning behaviour (Keegan, 2002). Various definitions are used for ‘online education’ and most of these include terms such as ‘Web-enabled’, pointing to the means by which instruction is provided. This alone of course does not automatically lead to ‘distance education’ (Bryant et al, 2005), but in this article the term ‘online education’ is used instead of ‘distance education’ because it implies that the limitations of time and geographical distance are eliminated. In this context students can work and study whenever they want, taking advantage of so-called ‘ubiquitous learning’. Note that the term ‘online’ refers mainly to technical educational issues. In order to learn independently of time and place, the organizational and didactic aspects have also to be aligned.

Adaptability

As each student is unique, the programme ideally should allow for an individualized learning path based on the prior knowledge, learning style and preferences of the student (Doignon and Falmagne, 1999; Abdullah, 2003). In other words, the module should be flexible in meeting the needs of each individual participant.

Interactivity

Generally, in a face-to-face setting, it is assumed that interaction is a key factor in the learning process (Vygotsky, 1978). According to Vrasidas and McIsaac (1999), interaction is also a central component of online distance learning. And Bryant et al (2003, p 257) note that a ‘fundamental component of distance education is the communication medium’. Being solely available online, the course and learning environment should stimulate interpersonal contact in order to motivate participants to remain engaged (Ronteltap and van der Veen, 2002). However, compared with face-to-face education, it is harder in a virtual education environment to transfer communication elements like body language or intonation. Online courses therefore have to make more intensive use of the available interaction methods (Roblyer and Wiencke, 2003). Interaction is not just a technical mechanism; it is also a social and psychological way of generating relationships. By forming small groups, students will experience peer pressure, which will force them to interact more intensively. At the same time, group
processes and learning processes remain clear and manageable for tutors (Schellens and Valcke, 2005). In a problem-based learning setting (Moust et al., 2002), tutors together with students are responsible for stimulating interaction as well as for stimulating the learning process.

Responsiveness in providing feedback
Vrasidas and Zembylas (2003) argue that feedback is a crucial factor in the interaction that takes place during a course. Besides the fact that it is pedagogically better to provide rapid feedback on performance, it is also important because the period before the summer course starts is short and often crowded with other activities.

Flexible learning method and assessment
Given that learning and assessment methods are subject to change, the programme should be flexible in this respect (Segers, 2004). Depending on the educational vision of an institute, different aspects of the model can be emphasized. In a more teacher-centred educational vision, communication between students will be less important. In a didactic model based on social constructivism and problem-based learning (Moust et al., 2002), more emphasis will be placed on interaction among students.

Summary
Figure 1 shows how our online remedial teaching model incorporates the above factors and their interrelationships. The model makes a distinction between technology and the virtual learning environment (VLE). In other words, it can be adjusted to different educational settings depending on the educational vision. In an individual learning programme, the interaction will take place mainly between the technology and the student (through learning materials, assignments and assessments) as well as between student and lecturer. In a problem-based learning setting, the interaction between students will increase with the help of the technology (discussion forums, chat rooms, e-mail, and so on), while the lecturer will take on a coaching role. The way the student is assessed will depend essentially on the chosen didactic model (Segers, 2004). In addition, the online remedial teaching model will also determine the evaluation method.

Design of online summer courses
As Maastricht University has the highest percentage of international students in the Netherlands (24% in 2005 – Ministerie OCW, 2005), and more than 70% of enrolments in its Faculty of Economics and Business Administration are from abroad, the differences in prior knowledge among enrolling students are enormous. The experience of addressing this problem provides an interesting case study for higher education institutes that are looking towards greater internationalization.

Most first-year and second-year students in the ‘regular’ curriculum at Maastricht University have some problems with mathematics and/or economics (Rienties et al., 2005b). The first online summer courses were therefore developed specifically to tackle those problems. As the majority of the target group lived abroad, the programme was offered completely online, with no physical presence required. An economics and a mathematics online summer course were offered twice during the summer period: this allowed for more flexibility, enhancing the match between a student’s efforts to tackle possible deficiencies in the respective topics and his or her other summer activities. Participants could work anywhere they liked and at the times that suited them best. It is important to note that participation was completely voluntary and was in no way related to the official admission procedures of the university. Moreover, participation in the summer course was free, and the only bonus was an unofficial certificate and a graduation ceremony and drink.

Prior knowledge tests
A fundamental assumption is that not every student will need an online summer course. Therefore, an online diagnostic test to ascertain prior knowledge was developed before the start of the academic year. The online tests for economics and mathematics were available and accessible at all times via the Internet and...
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The six tasks were preceded by ‘Task 0’, the purpose of which was to demonstrate to students the process of PBL in a discussion board. The course coordinators simulated a discussion on a related but non-economic topic.

(2) The summer course manual included a chapter that explained the content and sequence of the different steps in the seven-jump process as well as a guide to the virtual learning environment.

(3) During the first week, extra attention was paid to the first contributions of participants. If mistakes were made, immediate constructive feedback was provided (Schellens and Valcke, 2005).

Virtual learning environment (VLE). In order to participate in the task discussions, students were given access to the VLE used in Maastricht. ELEUM incorporates most of the characteristics of the online remedial teaching model. It allows students to do quizzes and give immediate feedback on their results and learning process (Tempelaar and de Gruijter, 2005; Rienties and Wolter, 2004). In addition, ELEUM incorporates interactive communication tools such as discussion boards, chat rooms and e-mail (Ronteltap and van der Veen, 2002). By way of primary learning material, an electronic version of a first-year economics book from Parkin and Bade (2004) was used, which includes chapters from the book, videos, interactive materials and animated graphs.

Formative and summative assessment. The course used various formative and summative assessment methods. According to Marshall (1999), formative assessment supports the learning process of students without grading, while summative assessment gives insight into the final level of the student with an accompanying mark. Students could take three formative tests and decided for themselves when to take them. These tests were used to provide the students with feedback on their level of mastery of the learned topics. The course concluded with a summative exam, in which students had to work on a problem similar to those they had discussed during the course and which they had to solve by applying their newly acquired knowledge.

Interactive communication. With regard to ensuring rapid feedback, interactive tools proved very attractive. The use of a discussion board (‘asynchronous’ communication) makes it possible for students to interact with each other, share new insights and get help if certain aspects need clarification. This is different from ‘synchronous’ communication (for example, chat or MSN Messenger), which requires all participants to be online at the same time. By designing a course around asynchronous communication, a substantial degree of flexibility is created. This has been extensively researched by analysts of computer-supported
collaborative learning (CSCL) (Gunawardena et al., 1997; de Wever et al., 2006). Asynchronous communication allows students to participate actively in a discussion at their preferred time without running the risk of missing vital parts of it. Moreover, it allows for group dynamics that are missing when a student has to follow a remedial course alone (Rienties et al., 2005a). Hence a discussion board can be used as a formative assessment tool.

Online summer course in mathematics
The procedure used for the online summer course in mathematics was to a large extent similar to that for the economics course. The workload was equivalent: 10–15 hours per week for 4–6 weeks. In contrast to the economics course, this was largely an individual course, based on individual learning, with nearly all interaction taking place between the student and the learning environment. Students worked with an online programme (ALEKS), which again assessed their level of prior knowledge and then offered a unique individual learning path. This programme is based on the ‘knowledge space’ theorem (Doignon and Falmange, 1999; Falmange et al., 2003). If a student goes faster (or slower) through the learning material, ALEKS will immediately adapt the learning path accordingly. In principle, this means that the programme adapts the learning path to the knowledge, progress and learning style of the student.

The lecturer, who is also responsible for the first-year introductory course on mathematics in the ‘regular’ curriculum, chose a module similar to the complete mathematics programme in Dutch secondary education. Students had to solve mathematical problems and ALEKS provided hints where necessary. Although students worked individually, they could contact the lecturer if the explanations provided by the programme were insufficient or unclear to them. The pass/fail decision was based on the knowledge level a student had achieved at the end of the course.

Evaluation
In order to analyse whether the two online summer courses were effective, they were evaluated using a protocol developed by Kaper et al. (2005). This evaluation protocol takes into consideration the specific demands of flexible education involving heterogeneous students. In order to be able to measure the expectations of participants at the beginning as well as at the end of the course, online questionnaires were distributed. At the beginning, students were asked about their motives and incentives for participating in the online summer course programme.

Results
Online course in economics
According to the entry questionnaire, students enrolled on the course because they were dissatisfied with their level of mastery in economics. They indicated that they liked the idea of working online to improve their knowledge and at the same time appreciated the opportunity to contact other students as well as the tutor. In general, the participants indicated that, at the start of the course, they had received sufficient information about its goal and context. They also clearly expressed a preference for teamwork rather than working individually.

During the course, students had to collaborate on solving problems derived from PBL tasks. When the summer course began, the students briefly introduced themselves in the ‘Café/Small Talk’ section with a photo and information about their personal background. Students used the Café/Small Talk section intensively to get acquainted with each other, as recommended by Roblyer and Wiencke (2003). They also used it for information on practical matters such as finding a room or applying for a grant. Thus the online course also contributed to the establishment of trust within the group and of the institution. It is reasonable to assume that those students who are more convinced about their choice of subject will commit more to the institute and will put more effort into their studies. Establishing early trust in the institution on the part of the students reduces the chance that they will become isolated in the new environment and drop out in the preliminary stages of their course.

At first, the students found it difficult to understand the seven-jump process. They placed daily threads and reacted to each other’s contributions. Six weeks later, an average of 370 threads per group had been placed, which can be seen as a rough approximation of the intensity of usage. The highest-performing student placed 27% of the messages and the lowest-performing student placed 2%.

At the end of the course, an evaluation was conducted to see whether it had matched the students’ expectations (see Table 1). Students were very positive about both the performance of the instructors and the online summer course itself. More specifically, they felt that they had got a lot out of the course and that it had enabled them to remedy their knowledge deficiency to such an extent that they now felt ready to start at Maastricht University. On average, the students worked for 13 hours per week over six weeks. The students who did not pass worked only for six hours per week. With regard to the VLE, the students found the
digital materials to be of very good quality. Moreover, they liked the fact that they could collaborate with each other on the summer course: they thought it was fun to use the discussion boards and they perceived the general atmosphere in the group to be friendly. They also felt strongly that the teamwork approach helped them to tackle their knowledge gaps. The observation that increased interactivity in distance education is positively related to student satisfaction (and therefore to better pass rates) is consistent with earlier findings by Roblyer and Wiencke (2003).

In the end, 25 out of 50 students passed the online course in economics. Compared with other remedial courses (Van Leijen et al., 2005), and taking into account the facts that the students had never physically met one another and participation was completely voluntary, a pass rate of 50% can be considered fairly high.

**Online course in mathematics**

With regard to the mathematics course, at the outset students revealed themselves to be highly motivated – most were taking the course simply because they were not satisfied with their level of mastery of the subject. The students indicated that they had received sufficient information about the goal and context of the course. In contrast to the economics summer
course, there were no questions regarding any form of collaboration, for the reasons mentioned above concerning the use of the individual learning tool ALEKS. The students said that they were motivated to complete the summer course because they were able to work at their own pace.

Ultimately, 29 of the 55 students (53%) successfully completed the course. Again, the students were positive about both tutor and course. The course offered substantial added value and a stimulating environment, and provided useful learning materials. The students signified that they had gained sufficient knowledge and skills to enable them make a successful start on their formal study programme. They worked an average of 53 hours during the course. In contrast to the economics students, they preferred to work individually rather than in collaboration. Table 2 presents the complete evaluation results.

### Table 2. Students’ end evaluation of the online summer course in mathematics.

<table>
<thead>
<tr>
<th>Description</th>
<th>Total AV</th>
<th>N=39 STDEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>This summer course offered me a lot</td>
<td>4.5</td>
<td>0.6</td>
</tr>
<tr>
<td>The contents of the summer course were inspiring</td>
<td>4.2</td>
<td>0.5</td>
</tr>
<tr>
<td>The format of the summer course was good</td>
<td>4.3</td>
<td>0.7</td>
</tr>
<tr>
<td>The summer course was well-organized</td>
<td>4.4</td>
<td>0.7</td>
</tr>
<tr>
<td>The quality of the material in ALEKS is good</td>
<td>4.3</td>
<td>0.7</td>
</tr>
<tr>
<td>The material in ALEKS motivated me to keep up with the subject matter</td>
<td>3.9</td>
<td>0.7</td>
</tr>
<tr>
<td>Learning in an e-learning environment like ALEKS is not different from learning from a hard-copy book</td>
<td>2.4</td>
<td>0.9</td>
</tr>
<tr>
<td>It was fun that I could attend this summer course via the Internet</td>
<td>4.2</td>
<td>0.8</td>
</tr>
<tr>
<td>The time allocated was sufficient to study the required amount of subject matter</td>
<td>3.2</td>
<td>0.8</td>
</tr>
<tr>
<td>The goals of the summer course were clear to me</td>
<td>4.1</td>
<td>0.6</td>
</tr>
<tr>
<td>The contents of the summer course fitted well with my pre-existing knowledge</td>
<td>3.6</td>
<td>0.9</td>
</tr>
<tr>
<td>The format of the summer course was good</td>
<td>4.2</td>
<td>0.5</td>
</tr>
<tr>
<td>The way of working in ALEKS is straightforward</td>
<td>4.0</td>
<td>0.9</td>
</tr>
<tr>
<td>The assignments/tasks stimulated me to study</td>
<td>3.9</td>
<td>0.8</td>
</tr>
<tr>
<td>I gained enough knowledge and skills in mathematics to start my studies at Maastricht</td>
<td>3.5</td>
<td>0.8</td>
</tr>
<tr>
<td>I think that by attending this summer course I will get better results in my future studies at Maastricht</td>
<td>3.9</td>
<td>0.8</td>
</tr>
<tr>
<td>It is easy to understand how to operate in the ALEKS learning environment</td>
<td>4.5</td>
<td>0.6</td>
</tr>
<tr>
<td>It was fun to work with ALEKS independently</td>
<td>4.2</td>
<td>0.7</td>
</tr>
<tr>
<td>It was good that I could work on the subject matter at my own pace</td>
<td>4.5</td>
<td>0.6</td>
</tr>
<tr>
<td>I think that I have learned more by attending this course individually than I would have learned if I had to collaborate</td>
<td>3.5</td>
<td>1.0</td>
</tr>
<tr>
<td>I was given the support that I needed</td>
<td>4.0</td>
<td>0.8</td>
</tr>
<tr>
<td>The explanation in ALEKS if you are unable to solve a question is generally sufficient</td>
<td>3.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Next to the explanations in ALEKS I have used hard-copy books on mathematics</td>
<td>1.9</td>
<td>1.1</td>
</tr>
<tr>
<td>Questions via e-mail were answered well by the teacher</td>
<td>3.8</td>
<td>0.8</td>
</tr>
<tr>
<td>The entry test on the UM Website was a good way of showing me what I did and did not know</td>
<td>3.8</td>
<td>1.0</td>
</tr>
<tr>
<td>The questions in the ALEKS tests were clear</td>
<td>3.9</td>
<td>0.8</td>
</tr>
<tr>
<td>It was easy to see how the ALEKS tests had to be done</td>
<td>4.1</td>
<td>0.8</td>
</tr>
<tr>
<td>The intermediate tests in ALEKS were instructive</td>
<td>3.6</td>
<td>0.8</td>
</tr>
<tr>
<td>The intermediate tests in ALEKS gave me a good picture of what I still had to study</td>
<td>4.0</td>
<td>0.8</td>
</tr>
<tr>
<td>I worked regularly on the assignments/tasks in this summer course</td>
<td>3.5</td>
<td>1.2</td>
</tr>
<tr>
<td>It was easy to motivate myself to finish this summer course</td>
<td>3.6</td>
<td>1.1</td>
</tr>
<tr>
<td>Give an overall grade for the quality of this summer course (1=very bad; 10=very good)</td>
<td>8.6</td>
<td>0.9</td>
</tr>
<tr>
<td>Give an overall grade for the quality of support you were given by ALEKS in this summer course (1=very bad; 10=very good)</td>
<td>8.3</td>
<td>1.1</td>
</tr>
<tr>
<td>In total, I spent . . . hours on this summer course</td>
<td>52.9</td>
<td>29.0</td>
</tr>
</tbody>
</table>

*Note:* All questions except for the last three were answered on a Likert scale of 1 (totally disagree) to 5 (totally agree).
both summer courses appear to have been successful in terms of helping to remedy students’ knowledge deficiencies and thus leaving them better prepared for their university studies. Comparing drop-out ratios, no strong differences were noted. According to the results of the evaluation questionnaire, there was also no significant difference between the courses in terms of students’ satisfaction – both courses, and thus both didactic scenarios, achieved positive evaluations on all criteria.

Remarkably, the students who participated in both courses judged both didactic scenarios to be adequate. The question then arises of whether students were indifferent to the didactic scenario or whether they felt that individual learning best suited the mathematics summer course while collaborative learning best suited the economics course, and thus that the designers of both courses had made appropriate choices.

To answer this last question, one item in the evaluation questionnaires asked the students to judge the appropriateness of the didactic scenario, using the other didactic scenario as a benchmark. In the mathematics questionnaire, they were asked to express their view of the statement, ‘I think that I have learned more by individually attending this course than I would have learned if I had had to collaborate’. For the economics questionnaire, the statement was formulated the other way around. These statements received average scores of 3·5 for the mathematics course and 3·2 for the economics course. Thus, although the scores were less pronounced than in most other evaluation items, there was a tendency for individual learning to be regarded as more suitable for the mathematics course and for collaborative learning to be seen as best suited to the economics course. The students’ opinion on the appropriateness of the didactic scenario is dependent on the success of the course. In fact, this was the only evaluative statement for which a ‘pass’ student provided an answer significantly different from that provided by a ‘fail’ student. This may indicate that some students failed the summer course because they regarded the didactic scenario as suboptimal.

**Conclusion and discussion**

This paper has addressed the issue of how prior knowledge tests and online remedial summer courses can contribute to the mitigation of problems of heterogeneous enrolment. First, an online remedial teaching model was developed. The five success factors that an online remedial course developer should take into account are continuous access and availability via the Internet; adaptability; interactivity; rapid feedback; and flexible learning methods and assessment.

The online remedial teaching model was then implemented in practice for two summer courses organized by Maastricht University. Before students were allowed to join the courses, they had to take an online prior knowledge test. More than 200 prospective students from over 30 countries made use of this opportunity. A large proportion (≥75%) of the prospective students scored below the threshold on the prior knowledge tests for mathematics and/or economics. This suggests some justification for our assumption that, due to internationalization, prior knowledge problems in mathematics and economics are becoming widespread in higher education. Eventually, around 100 students took part in one or both of the online summer courses. As most prospective students of Maastricht University live abroad before joining the academic programme, the courses were offered 100% online.

Although both courses implemented a different didactic scenario, both matched the online remedial teaching model. The didactic models were chosen to fit the content of the course – ePBL for the economics course and working individually with ALEKS for the mathematics course. Encouragingly, most of the participants spent a substantial amount of time on the course and the pass rates are at least similar to those achieved by other experiments with online virtual learning. The student evaluations of both courses were very positive, with the participants indicating that they now felt ready to start their studies at Maastricht University. More specifically, there is some evidence that individual learning was regarded as more suitable for the mathematics course, and collaborative learning as more suitable for the economics course.

The implementation of both summer courses focused mainly on the didactic and organizational aspects, since the technical infrastructure was already in place. Both courses were implemented using existing ICT infrastructures, comparable to those of other higher education institutions. As long as sufficient expertise and resources are invested, the problems accompanying the increasing internationalization of students can be tackled.

Further research is necessary to prove whether online summer courses have a temporary or structural effect on the prior knowledge level of students. In addition, it remains to be investigated whether the participants, compared to those who did not take part in the summer courses, performed better in the formal curriculum. Furthermore, a ‘sample bias’ may have occurred: the students’ performance in their regular curriculum will therefore be monitored by means of a longitudinal study. Finally, more research is needed on the
motivation of participants. In future summer courses, the subgroups of participants will be enlarged and the didactic scenarios will be implemented at other institutes. To enlarge the statistical power of the research, more specified and detailed information about the subgroups will have to be gathered.

Notes
1Ministerie van OCW is the Department of Education, Culture and Science in the Netherlands.
2The results of this paper are part of the ‘Web-spijkeren’ project (www.web-spijkeren.nl), a collaboration of the University of Amsterdam, the Erasmus University Rotterdam and Maastricht University. ‘Web-spijkeren’ is a Dutch combination of two words: ‘Web’ (online) and ‘bijspijkeren’ (remedial teaching). This paper was founded in part by the National Foundation of ICT in Higher Education SURF, ICT en Onderwijs, Tender 2004 and Maastricht University.
3Only students registered for the Bachelor’s programme at the Faculty of Economics and Business Administration were allowed to take part in the summer course.
4As most German students have to participate in a one-year civil service programme after graduating from secondary school or undertake an internship in a company, their actual mastery of mathematics and economics is probably lower than that of students who have just recently graduated from secondary school.
5Electronic Learning Environment University Maastricht (ELEUM) is based on Blackboard and is being further developed by Maastricht University.
6ALEKS (Assessment and Learning in Knowledge Spaces) (www.aleks.com).

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