Chapter 11
Self-Regulated Learning and Self Assessment in Online Mathematics Bridging Courses

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ABSTRACT

Varying mathematical skills, rising dropout rates, and growing numbers of first year students confront the universities with major organizational and pedagogical problems. In this chapter, the authors describe an innovative way of teaching and learning designed to improve this situation by bridging courses particularly including self-diagnostic e-assessment and supporting self-regulated learning. The development of highly structured e-learning material has been and still is the most important objective. The material has been implemented, extended, evaluated, and improved since 2003. Our chapter refers to multimedia learning material for bridging courses which was developed by the project "Multimediavorkurs Mathematik" in collaboration of research groups from the German Universities of Kassel and Paderborn and the Technical University Darmstadt.

For providing an overview of our whole bridging-course programme, at first we will discuss our material concerning content-related, didactical, and authoring aspects. Then we will discuss our course scenarios with regard to pedagogical and organisational aspects. Focusing on selected results of an accompanying evaluation study we will finally discuss the acceptance and success of our courses and highlight some interesting findings concerning our learners.

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INTRODUCTION

The transition from school to university studies is a difficult one. The gap between school and university mathematics seems to be larger than in other subjects (cf. Gueudet, 2008; Bescherer, 2003; de Guzman, Hodgson, Robert, & Villani 1998; Holton, 2001; Tall, 1991). Moreover, mathematical requirements vary widely from mathematics majors via mathematics in engineering through to mathematics for future elementary teachers. Universities could in principle change their entrance courses but are mostly not willing to do so. Instead they offer pre-term bridging courses and/or bridging courses which are provided parallel to the first year courses as a kind of additional, remedial courses. Having a look at beginning students of study programmes with mathematical content and discussing with experts of bridging courses from other German universities (cf. Biehler, Hochmuth, & Koepf, 2010), one can identify various problems:

- The students have very heterogeneous mathematical competencies: In Germany, for instance, different government regulations have led to differing intended school curricula. The variability is even larger at the level of the "attained curricula", i.e. students' knowledge.
- The traditional German university entry qualification (the Abitur), has become only one qualification to enrol at a university among some emerging others. Now, also an entitlement to study at a Fachhochschule or an education as a master craftsman qualifies as a prerequisite at some German universities. These different qualifications increase the heterogeneity especially with regard to mathematical competencies.
- Different fields of study need different kinds of mathematics. The lectures on mathematics for electrical engineering have different requirements than lectures for pre-service teachers or mathematicians.
- Universities expect more self-regulated learning than at school level. In general, the contact to teachers and tutors is not as close as in school. There are more opportunities for learners to stay anonymous; no person asks them to learn and do their homework, and, thus, more self-dependent preparation is required. Most first-year students are unfamiliar with this kind of responsibility for their own learning and have difficulties in organizing their learning processes. Following Roll et al. (2006, p. 360) further metacognitive competencies need to be developed at university level. Minguillon, Huertas, Juan, Sancho, & Cavaller (2008) point amongst others to methodological skills, technological skills or the ability of critical appraisal.
- As a general rule, mathematics at university level is more abstract than at school. Most first-year students have problems with this abstractness. Moreover, although they may have passed the final mathematics exam at school level, the mathematical competencies required, for instance fluency in symbolic calculations and deeper understanding of concepts are not available (cf. Juan, Huertas, Steegmann, Corcoles, & Serrat, 2008, p. 5).

The project VEMA – "**V**irtuelles **E**ingangstutorium **Ma**thematik (Virtual Entrance Tutorial for Mathematics) (http://www.mathematik.uni-kassel.de/vorkurs) started in 2003 with the objective to develop multimedia resources primarily for supporting the pre-term bridging courses. The project was initiated at the University of Kassel and was extended to the Universities of Darmstadt and Paderborn later on. The material was also designed to be supportive for students' self-regulated, remedial learning in the first year of study or in bridging courses that run in paral-

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