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Situated Acquisition of Mathematical Knowledge

Teaching mathematics within electrical engineering courses

M. Hennig¹

Doctoral Student
University of Paderborn
Paderborn, Germany
hennig@get.upb.de

B. Mertsching

Professor
University of Paderborn
Paderborn, Germany
mertsching@get.upb.de

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In recent years, a number of studies have shown multifaceted issues in regard to the mathematical expertise of undergraduate engineering students. Referring to this, the students' increasingly diverse range of levels and types of qualifications and their continuing deterioration of mathematical competencies are often referred to as one of the major challenges [1,2,3]. More critical concerns stem from the fact that the initial phase usually comprises lectures requiring mathematical expertise which in some cases clearly goes beyond school mathematics, but will be presented only later in mathematical courses. Taking into account that the first year is critical for student success [2] and to avoid high dropout rates, revised concepts for teaching engineering mathematics in respect to individual students' demands are required. Furthermore, overloaded schedules [4] lead to the conclusion that students would not engage in additional uncoupled academic programs in regard to mathematics. In this article, a new generalizable concept to address the above mentioned challenges *within* undergraduate engineering courses is introduced by way of example in a Fundamentals of Electrical Engineering lecture.

MATHEMATICAL ISSUES

In order to get an overview of particularly difficult subjects students have to cope with in terms of the course contents and allowing for a more effective teaching of mathematics within the course, a questionnaire was developed and given to the students at the end of the course semester. The first step in this regard was a detailed analysis and preparation of an appropriate summary of mathematical sub-

¹ M. Hennig, hennig@get.upb.de



jects appearing in the course. Within the scope of the evaluation it was found that three different classes of levels of difficulty can be derived and the proposed approach mostly covers the subjects which have been evaluated as particularly difficult by the students. Therefore, a survey concerning students' difficulties in respect to specific mathematical subjects in the context of the course is presented, a field for which investigations hardly exist.

SITUATED MATHEMATICS TEACHING

The proposed approach focuses on gaining mathematical competencies in the situated context of a specialist subject and comprises an adaption of the course and the implementation of a complementary blended learning scenario including a web-based learning platform. Common exigencies in regard to a convenient design for interventions from the theory of situated cognition [5] were considered, where learning is contemplated as an active, constructivist process that is directly linked to and enhanced by a specific context. The concept is discussed in regard to related measures as well as pedagogical foundations and corresponding research questions are addressed.

CONCLUSION

In summary, due to the fact that related previous interventions have been applied successfully for years, it was depicted that revised concepts for teaching engineering mathematics can be realized by implementing proven, existing pedagogy. Thereby, a detailed analysis of mathematical subjects appearing in the course, the utilization of multimedia elements and a close interlocking of the course elements are important aspects of the concept. ■

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