

RESEARCH ON TEACHING IN THE EDUCATION OF TEACHERS FOR TECHNICAL VOCATIONAL COLLEGES

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Abstract — *Lessons in classrooms in technical vocational colleges will be a combination of instructional and constructional design. Such learning environments are marked by active and self-learning trainees, the learning in concrete technical vocational problems and the social nestling of learning among communities.*

The challenge for the teacher education in master courses at Universities is to give students the opportunity, to develop their knowledge to create and to test such kind of learning environments. In addition there are only few results of research on teaching in the field of technical vocational apprenticeship.

To that purpose the Leibniz University of Hannover testes a special kind of programme for teacher education during the courses of the master study programmes. Within lesson projects at technical vocational colleges the students apply their technical, pedagogical and didactical knowledge in creating learning environments. On that way the students learn the methods of research on teaching. Therefore they create and test learning environments for lessons in technical vocational colleges. To raise the effectiveness they select and apply methods of empirical social research and apply them. They document their research and discuss the results with members of the community of practicing teachers.

Key words: *(Technical) Teacher Training, Reflective Teaching*

STANDARDS FOR THE EDUCATION OF TEACHERS

The conference of the ministers for education and the arts of the Länder of the Federal Republik of Germany decided on the standards for the education of teachers. The standards include 11 competencies which are assigned to the competence areas education, teaching, judging and innovation. To the area innovation belongs the competence to understand the profession of teachers as a permanent task to learn. To every single competence area belong standards for the theoretical instruction and standards for the practical training.

For the practical training is relevant: The graduates reflect their professional career and their competencies and the development of them. They are able to come to the obvious conclusion, they use the results of the educational sciences for their own work, document their work and the results for themselves and for others. They give feedback and use the feedback of others to optimize their own pedagogical work. [1]

We suppose that the standards can be developed during the programme for teacher education at the universities by a programme which includes the projecting of innovating learning situations. The projecting is based on the reception of the relevant scientific literature of the subject that is taught and on the relevant scientific educational literature. To judge how the learning situation works the teacher students have to decide the factors that are relevant for the success. For that they use practices of formative evaluation.

In the following paragraph I describe lessons of technical didactic in which the development and the testing of innovative learning situations is included.

THE LESSON “FACHDIDAKTISCHES PROJEKT”

During the education of teachers for vocational technical education at colleges in the subjects mechanical engineering and electronics the practical lesson is held as a project in technical didactics. That includes two lessons in different semesters. The projects are positioned to the master programme at universities. Each lesson consists from a seminar and a practical training at a vocational technical college or at a business which educates trainees.

Inside of the lesson “Fachdidaktisches Projekt” the students plan and test lessons for trainees which include theoretical and practical training. These learning situations are relevant to the common curriculum for technical vocational schools of the Länder. [2]

To prepare themselves the students visit a seminar. Here they learn the methods to develop and to evaluate learning situations in the field of vocational technical training. Although they learn how to find and how to use scientific literature and how to use well tested and documented learning situations for their own argumentation.

In practical studies the students develop and test complex learning situations. Always the situation is characterised by an innovative approach. The students plan the learning situation, carry them through, and develop their effectiveness according to the aims. For the self regulated work of the trainees they select or develop technical systems which can be used in classrooms or in laboratories of the schools. On the other hand they create textbooks. With the textbooks the trainees learn how the technical system works.

Finally the students write down their planning and the arguments of their decisions to plan the complex learning situation in an essay. The arguments include the decisions relating aims, content, methods and media.

The essay also contains the description of the empirical methods, their results as well as suggestions how to improve the complex learning situation.

TESTING OF COMPLEX LEARNING SITUATIONS IN LABORATORIES OF TECHNICAL VOCATIONAL SCHOOLS

In this paragraph I describe selected examples of student research work. All examples are developed, tested and presented to the professional community by the students themselves.

All students use technical environments for their lessons. In one case the student uses a technical system, which is produced for the use in private buildings. In two other cases the students used systems which are especially developed to be used in school lessons. All students developed a complex learning situation in which trainees could learn to put the technical system into operation or to maintain the system. In all cases the learning system is prepared to support the ability for self regulated learning of the trainees.

The complex learning situation "Maintaining the lightning engineering of the Volkswagen Golf V" was developed for the apprenticeship of car-mechanics. To give trainees the opportunity to learn how the complex lightning system works a learning-model was prepared. The model is designed to use in classrooms. It makes it possible to do the training without a real lightning system in a car.

The starting-point for the lesson is a defect in the system. One of the brake-lights is out of work. Supported by a textbook the trainees learn the structure of the technical system, the function of the whole system and the function of the system-elements. The student wrote the textbook especially for that complex learning system. The trainees can learn in which way the system shows defects and which measuring-system can be used to locate the defect. To maintain the system the trainees develop a work plan to eliminate the defect.

Matthias Ellermann has projected this complex learning system during his work for the master-thesis. He could furnish proof of the usability of the classroom-model lightning system. [3]

For the complex learning situation "maintaining a hot water supply" the system *Vaillant VCW 204 XEU* was selected. The system is used for water heating and for heat technology in private buildings. The complex learning environment was developed by *Daniel Dalinghaus* although during his work for the master-thesis. He could test his learning system with the support of the teachers of the Technical Vocational College No. 3 of the Hanover Region. The learning system was developed for trainees in the second year of their apprenticeship. They learned in a 31/2-programme the profession of a mechanic for heat-systems. Also in this case the student developed a textbook for self regulated learning of the trainees. [4]

The complex learning situation "Installation of a drinking-water-circulation-system" could be presented at the IGIP-regional-conference 2009 at Biel/Bienne in

Switzerland. A group of four students projected during their studies the learning situation. The lesson is about a drinking-water-circulation in a detached family house. To have hot water in the bathrooms of the first floor a circulation system with a water-pump is embedded. The pump can be started by a button near the wash-basin, by a timer or by a programmable control system. The learning situation was developed for and tested in a 1-year programme for trainees without an apprenticeship contract. For the lesson the students have developed a classroom-model of the circulation system. All control-systems that are used in this learning situation represent a practical standard.

Also in this case the students could prove that the work with the classroom-model in combination with the work with textbooks is accepted by the trainees. On the other hand the self-made classroom-model of the circulation-system is rough enough to be used in learning situations. [5]

SUMMARY

In addition to the presented complex learning situations a number of student essays and master-thesis document the student's research. Combining practical studies in technical vocational colleges, projecting of innovating learning situations, and reception of scientific literature of the relevant sciences with producing knowledge for the technical didactics the students develop the ability to reflect their own professional work. On the other hand they learn how to solve problems by developing methods for problem solving and methods for testing the effectiveness. [6]

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