



Project integration of students through open problem tasks in competence-oriented courses

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Abstract

The everyday life of academic staff is characterized by the duality between teaching and project work. Modules usually consist of lecture and practical components. These are often repeated over several semesters and are the same for all students. Research assistants or students in higher semesters supervise these without direct added value in projects, and as part of the Master's degree program in Textiles, the possibility of replacing prefabricated internships with changing tasks adapted in advance to current research projects is being evaluated. These are presented in the form of an open problem assignment at the beginning of the semester. The students work on their personal tasks during the course. The lecture content enables students to use industry-relevant software packages independently. The didactic analysis according to Klafki takes place after completion of the course [1, 2]. All participating students were able to successfully complete their assignments. The research assistants received high-quality results that could be used in ongoing projects. The practical exam task was successfully completed by all students with individual approaches.

The results of this first trial show that individual and project-related tasks lead to increased competence and at the same time provide usable results for the lecturers. Working on research projects gives students practical insights into current research.

Der Alltag wissenschaftlicher Mitarbeiter:innen wird durch die Dualität zwischen Lehre und Projektarbeit geprägt. Module bestehen meist aus Vorlesungs- und Praxisteilen. Diese werden oft über mehrere Semester wiederholt und sind für alle Studierenden gleich. Wissenschaftliche Mitarbeiter:innen oder Studierende höherer Semesters betreuen diese, ohne direkten Mehrwert in Projekten. Im Rahmen des Masterstudiengangs Textil wird die Möglichkeit evaluiert, vorgefertigte Praktika durch, im Vorfeld an aktuelle Forschungsprojekte angepasste, wechselnde Aufgabenstellungen zu ersetzen. Diese werden in Form einer offenen Problemaufgabe am Anfang des Semesters präsentiert. Die Studierenden bearbeiten ihre persönliche Aufgabenstellung im Zuge der Lehrveranstaltung. Die Vorlesungsinhalte befähigen zur selbstständigen Nutzung industrierelevanter Softwarepakete. Die didaktische Analyse nach Klafki erfolgt nach Abschluss der Lehrveranstaltung [1, 2]. Alle teilnehmenden Studierenden konnten ihre Aufgabenstellung erfolgreich bearbeiten. Die wissenschaftlichen Mitarbeiter:innen erhielten qualitativ hochwertige Ergebnisse, welche in laufenden Projekten verwendet werden konnten. Die praktische Klausuraufgabe wurde von allen Studierenden erfolgreich und mit individuellen Ansätzen bearbeitet. Die Ergebnisse dieses ersten Versuches zeigen, dass individuelle und projektbezogene Aufgabenstellungen zu gesteigerten Kompetenzgewinnen führen und gleichzeitig verwertbare Ergebnisse für die Dozenten liefern. Die Mitarbeit an Forschungsprojekten gibt den Studierenden praktische Einblicke in die aktuelle Forschung.

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1. Preparation

The working group meets for a joint brainstorming session before the start of the semester. The first step is to discuss the module content and what knowledge the students should acquire. In the next step, the research assistants present their projects with work packages and subtasks. The group identifies task packages that can be worked on with the content taught in the lecture. Corresponding tasks are then developed. There are always more tasks than students are expected to complete. The aim is to meet the expectations of academic staff and students with regard to the course and to generate added value for all parties, as shown in Figure 1.

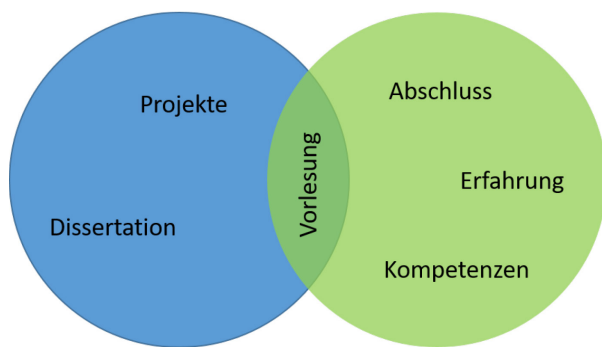


Figure 1 : Venn diagram of academic staff versus students

The selected course deals with the design of clothing using 3D CAE software. Accordingly, clothing design is the focus of the tasks, as shown in Table 1.

Table 1 : Tasks for the students and corresponding projects

Subtask	Project
Construction of a particle-filtering half mask	Project on medical protective equipment
Construction of a sports bra	Project on soft part simulation
Construction of a surgical gown	Project on medical protective equipment
Construction of trousers with integrated protectors	Project on protective equipment in the sports sector
Construction of a jacket with integrated protectors	Project on protective equipment in the sports sector

2. Course schedule

In the first course, the concept is explained to the students. They choose one of the previously presented topics.

The course provides the content required to complete the task. The students independently work out the existing requirements for their product, e.g. existing standards for particle-filtering half masks. The lecture teaches the digital construction of clothing close to the body and away from the body.

3. Learning studio

Both the lecture materials and introductions to the programs presented for digital garment construction are available in a so-called learning studio. The learning studio is an internal wiki with all the lecture materials, additional explanations and examples of how to use the software packages required for the course. Students can work on their tasks independently outside of the lecture. The interaction between the lecture and the learning studio is shown in Figure 2.

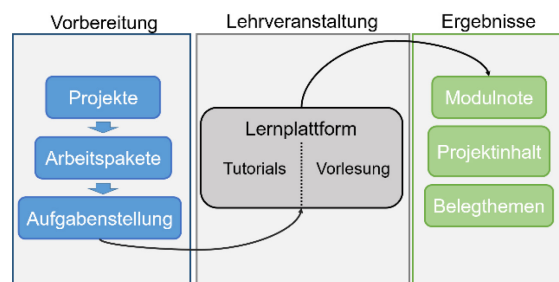


Figure 2 : Event schedule

4. Didactic analysis

The teaching topic of the lecture course is to teach students how to solve individual tasks from current research projects independently. The main objective is to provide students with the necessary knowledge, skills and abilities to work independently on their tasks. They are supported in this by individual consultations. Klafki's didactic analysis places particular emphasis on the formation of key qualifications and the teaching of values in the classroom. Klafki emphasizes the importance of general

education and the development of discernment in learners. When applied to these courses, the following categories emerge:

Professional competence: Students should develop the necessary professional knowledge and skills to understand and successfully work on their individual tasks from current research projects.

Independent work: Students should learn to work independently on their tasks and to identify problems and develop solution strategies.

Communicative competence: By using the learning studio and receiving individual support, students should learn to present their work results, give and receive feedback and communicate their ideas.

The didactic decisions made are named and justified below.

Individual and open problem assignments: Each student receives an individual assignment from current research projects. This emphasizes the relevance and practical relevance of the learning content and increases student motivation.

Individual support: Students receive individual support during the semester to help them solve their assignments. This ensures that every student receives the support they need and that individual difficulties and questions can be addressed.

Tutorials in the wiki: Students have access to tutorials in a wiki to help them work on their assignment. These tutorials provide step-by-step instructions, practical examples and resources to help students implement their solution strategies.

Examination task: The examination consists of the students applying what they have learned by means of a comparable task. This ensures that students can actually apply and use the knowledge and skills they have acquired.

5. Results

The product concepts developed by the students were used for a total of three different

products. Two of the five students who took part in the course subsequently began working on a document assignment in the corresponding projects at the professorship. The products developed are shown in Fig. figure 3 can be seen.

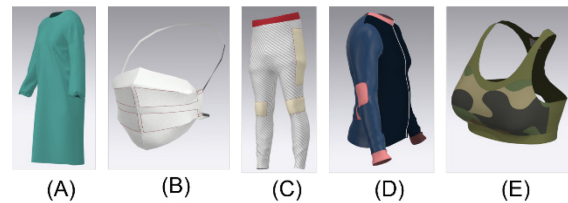


Figure 3 : Results of the project work: (A) surgical gown; (B) particle-filtering half mask; (C) cycling shorts with protectors; (D) cycling jacket with protectors; (E) sports bra

The practical part of the module examination consisted of the construction of an arm cuff. Material parameters and optical key points, such as an elbow patch, were specified. The students were all able to solve this task with individual approaches, but with very good results.

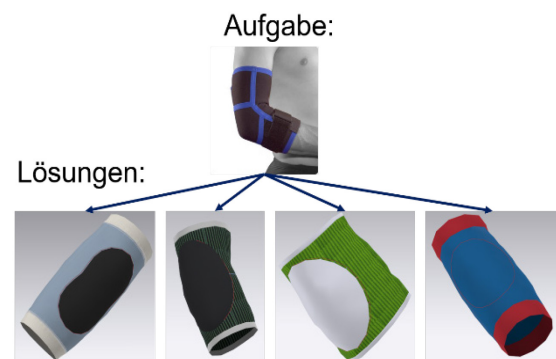


Figure 4: Results of the practical examination task

The didactic analysis according to Klafki shows that the lecture course addresses the goals of professional competence, independent work and communicative competence of the students through its focus on individual tasks, supportive supervision, tutorials in the wiki and the application of what has been learned in an examination task. This approach creates a practical and motivating learning environment in which students can successfully complete their assignments.

The approach presented here for integrating students in project work can be applied to any module with a practical component. The

course must impart knowledge that is directly applied or practiced. There must also be a framework for task-specific consultations, i.e. courses with large numbers of students will not work for this concept.

Literature

- [1] Klafki, Wolfgang: Didactic analysis as the core of preparation of instruction. In: Journal of Curriculum Studies 27 (1995), No. 1, pp. 13-30
- [2] Alfter, Georg: Didactic analysis. URL https://sts-ghrf-ruessels-heim.bildung.hessen.de/modul/unterrichtsplanung_einfue/material/Didaktische_Analyse.pdf - Review date 2023-06-28