34 Inquiry-Based Learning from the Perspective of Universities of Applied Sciences

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Universities of applied sciences in Germany (*Fachhochschulen*) have a track record of success and are increasingly regarded as universities of applied research. However, they lack the right to award doctorates, have no non-professorial academic teaching staff, and, historically, their faculty members have had a very high teaching load.

These days, research is necessary not only so that future challenges can be tackled but also so that study content is kept up-to-date, the teaching and learning environment is modern and equipped with multimedia capability, and scientifically sound, (socially) critical thinking is preserved. The qualification of students as future employees in companies, public administration, and institutions must be ensured by the institutions of higher learning and adapted to the current state of scholarship. Students should have practical opportunities to implement the postulate asserting the unity of research and teaching by becoming actively involved in scholarship. Inquiry-based learning, in particular, makes this possible. Third-party funded projects, especially at universities of applied sciences, can be used as a starting point for independent initiatives to help strengthen students' practical involvement in research processes, sciences, and knowledge management. The integration of research and learning into universities of applied sciences requires further structural support on the part of both the university administration and policymakers.

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H. A. Mieg (ed.), *Inquiry-Based Learning – Undergraduate Research*,
https://doi.org/10.1007/978-3-030-14223-0_34

34.1 Historical Understanding of Research and Teaching, and Current Issues

The German university reforms initiated by Wilhelm von Humboldt led to the type of research universities that are common today and were likewise adopted by the newly founded American universities. One hundred and sixty years later, the student revolts of the late 1960s led to a series of changes at German universities. Around 1970, university reform gave rise, among other things, to concepts aimed at linking research and teaching more effectively. This included project seminars, action research, and, most importantly, inquiry-based learning. Almost 50 years ago, the Federal University Assistants' Conference (BAK) published a programmatic paper on *inquiry-based learning*. Its tenets state that the following principles apply to university learning (BAK 1970, pp. 11–12, translated):

- *A scientific education and participation in science:* "First of all, 'scientific' means training by scientists, in a science, and for a science-dependent profession, which demands systematic, independent, and critical work in a certain area."
- *Process character:* "Science is a dynamic implementation or process of research and reflection, not the static possession of certain knowledge or techniques."
- *Practice orientation:* "The validity of these goals, even for a predominantly job-related scientific education, must be explicitly determined."
- *Learners' active acquisition:* Scientific training "must [involve] participation in this implementation, and thus the cognitive process, or at least replication, but never the mere adoption of existing results."
- *Active action:* "The postulate of the unity of research and learning corresponds to the [...] postulate of the unity of research and teaching."
- *Scope of application:* "Learning as research or inquiry-based learning is therefore not simply a didactic problem for previous universities but also a didactic problem for universities of applied sciences."

Practice-oriented, scholarly training in dynamic, active cognitive processes is thus valid not only for universities but also for universities of applied sciences. For example, in its founding years, the Brandenburg State Commission for Universities of Applied Sciences recommended

> building up sufficient capacities for applied research and development at universities of applied sciences [...]. Application-oriented research and development were the original tasks of universities of applied sciences. Fulfilling these tasks is important, on the one hand, in order for practice-oriented teaching to be constantly updated, since research and development at universities of applied sciences takes place in close dialogue and task-related cooperation with the professional world and is oriented towards current problems. At the same time, research and development can contribute to the intensification of creativity and the capacity for innovation, especially in the medium-sized companies in the region (BBLF 1993, pp. 18–19, translated).

In this sense, universities of applied sciences operate in a manner that is in the tradition of Wilhelm von Humboldt. Nevertheless, the right to award doctorates – the right demanded by Humboldt for universities – continues to be denied them. Universities of applied sciences therefore have no positions for doctoral candidates as academic teaching staff in their standard set-up and are dependent on third-party funded research projects for their research structure. The activities of research associates that are funded by third parties closely relate to the work packages defined in the research projects, as a rule, and are not associated with teaching activities. Maintaining the unity of research and teaching tends to be more voluntary here or is one of the responsibilities that falls to the university professors, who, as a general rule in Germany, receive no additional monetary incentive from the third-party funded research projects and face the problem of being overburdened with a very high teaching load of 18 semester hours per week (SWS) and usually enjoy only limited reductions in their hours for research projects.

34.2 Modern Instruction at Universities of Applied Sciences: Requirements for Instructors and Learners

Within this context, we must again raise the question of what exactly good teaching is, and the extent to which it is also geared towards occupational qualification and a focus on the students aligned with the Bologna reform and the acquisition of competencies (cf. Hannemann 2012). In 2000, the German Rectors' Conference *(Hochschulrektorenkonferenz)* found that a new quality initiative was needed in project-oriented teaching and forms of learning, problem-centered learning, variable forms of support, and competency-oriented forms of examination. New forms of instruction and learning therefore mean that learners must adapt to changing demands. Mandl and Reinmann-Rothmeier (1998, p. 198, translated) summarize the additional burden that modern teaching places on instructors and learners as follows:

- Situated learning on the basis of authentic problems: i.e. the starting point for learning processes is authentic problem situations that, owing to the realistic nature of their content and their relevance, motivate students to acquire new knowledge or new skills.
- Learning in multiple contexts: in order to prevent newly acquired knowledge or skills from remaining fixed on a particular situation, the same content is learned in several different contexts.
- Learning from multiple perspectives: in the learning context, the fact that it is possible to view individual content or problems from different perspectives, or that it is possible to explain them from various angles, is taken into account.
- Learning in a social context: [...] learning together and working with learners and experts within the context of situational problems are part of as many learning phases as possible.

Combined with modern media, the modern teaching and learning environment catering to different group strengths requires intensive and time-consuming preparation, which, as a rule, is carried out by the professors themselves at universities of applied sciences. A change in the roles of instructors and learners will also be a part of this change in higher education instruction. Learners should learn much more actively and in a more self-organized manner and should be able to solve problems in a variety of contexts. Instructors are therefore developing into *learning facilitators* and are experimenting with new didactic concepts and online learning materials in their (subject-related) teaching. This can only succeed if instructors receive practical help and support by means of an organizationally embedded didactic infrastructure. The prerequisite for this is their nationwide institutional involvement in the university of applied sciences, which creates space for the accompanying development of more far-reaching strategies. A *strategy for good teaching at universities of applied sciences* should be developed in a transparent and participatory way, providing concrete support measures with human and financial resources and addressing the question of the credibility of new methods in a manner that is motivating for instructors (Box 34.1).

Box 34.1: Third-Party Projects as an Opportunity for Universities of Applied Sciences

The project, entitled "InterKomp KMU 2.0," aimed to develop modular continuing education courses for small and medium-sized companies (SMEs) at the interface of engineering and culture on the subject of "international IT-based project and knowledge management in a multicultural environment." It was implemented as a joint project by TH Wildau and HWR Berlin and corporate partners from Berlin and Brandenburg (Scholl 2013) and funded by the Federal Ministry of Education and Research (BMBF). As a result, two training courses were developed by the project team of the TH Wildau and put online for free use by employees of very small, small, and medium-sized companies and trainers under Common License 3.0 for non-profits (InterKomp KMU 2.0, 2013). The online course, "Interkulturelles Arbeiten" ("Working interculturally"), also includes two role-playing games that were developed by students and converted into videos, each presenting a positive and a negative variant on the topic of intercultural collaboration in companies from Bulgaria and Germany. The student contribution was created as a project assignment

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in the course “Verwaltung und Recht” (“Administration and Law”) on the subject of “Verwaltungsinformatik/Projektarbeit” (“administrative informatics / project work”) in the winter semester of 2012/2013. This includes, among other things, the recognition of behavioral patterns and the backgrounds for such patterns. Examples are given for the individual problems of the users by way of support. Role play involves a freer, more relaxed engagement with relevant situations. In the case of genetic learning, the topic and timing were broadly specified, especially as co-workers from the actual project were available to provide voluntary (unpaid) help and advice to the project team, which consisted of three students. Challenges were also based on formal and organizational issues. For evaluation purposes, the learning scenarios were independently designed and filmed by the students; many problems and errors had to be dealt with independently, which is why a degree of inquiry-based learning was included.

Seventy-five percent of another research project, “TEDS@wildau,” was funded by the Ministry of Science, Research, and Culture of the State of Brandenburg through the e-learning and e-knowledge program of the European Regional Development Fund (ERDF) and 25 percent was financed by the TH Wildau. The project is based on the idea of comprehensively involving user needs in the development of online information systems and learning platforms. In order to achieve this goal, the highly flexible analysis and survey system, referred to as the TEDS framework (cf. Scholl and Eisenberg 2011), was developed electronically as a product, “TEDS*MOODLE,” and implemented as an activity in Moodle. It was made available to users (Scholl et al. 2014) in order to obtain sound evidence that could be used as a basis for improving the Moodle learning platform and its various virtual course “rooms.” There were underlying questions about whether to standardize or differentiate the design based on target groups, and about the user experience or user expectations when dealing with Moodle. Students were first included in the 2013/2014 winter semester as part of their fifth semester (subject-related project work) and the first semester (subject-related empirical methods) while “TEDS*MOODLE” was still in development. As a result (Wiesner-Steiner et al. 2014; Scholl 2014; Scholl 2015), students have been actively involved in and experiencing the practical side of scientific work from the very first semester, motivated by their own choices.

34.3 Inquiry-Based and Genetic Learning Through Third-Party-Funded Projects

With regard to teaching and research, the BAK criticized the conditions prevailing at the time, which in many cases still pertain, in that many degree programs are structured in such a way that conducting research or participating in these programs only becomes possible after certain basic systematic knowledge has been acquired and certain courses in auxiliary disciplines have been completed (BAK 1970, p. 12). The BAK (1970, pp. 13–15) distinguished between three related but differentiated forms of university learning:

- "Inquiry-based learning as participation in the current research in the discipline or as the realization of potential research tasks, in some circumstances, beyond the previous framework, with all the disappointments, risks and hardships that are involved in research."
- "Genetic learning as a reenactment of important cognitive processes from the initial questions, through the difficult stages, to the result." The main way this differs from inquiry-based learning is that "from didactic points of view, the choice of problem, hypotheses, and methods is, to a certain extent, controlled by the instructor."
- Critical learning as "a course of study with specific research-oriented attitudes and behaviors that prompt an awareness of significant questions and problems in the discipline by means of special courses and experiences."

In my many years of teaching practice through real student projects based on third-party-funded projects, learning has primarily occurred to date as a mixture of inquiry-based, genetic, and critical learning. On the one hand, there is not enough time available for me to avoid intervening in the projects in a supervisory manner. In this respect, the situation has changed significantly over the course of the Bologna Process and as compared to the 1970s. On the other hand, most students at universities of applied sciences expect guidance as well as intensive support from instructors and express their displeasure when their expectations are not met. As the BAK (1970) explained, the advantages of genetic learning over a mere transfer of knowledge are obvious: motivation, problem awareness, skills, retention, and attitude. In contrast to pure inquiry-based learning, the drawbacks are that "the independence of students can unfold only within an arranged or simulated situation, while their maturity, frustration tolerance, and motivation are not radically put to the test" and "the psychological situation of the group is not optimal because of the difference in information on the one hand, and the difference in risk on the other, and the potential team leader again primarily plays the role of instructor." (BAK 1970, p. 25, translated). The actual student projects are very risky for an instructor.

34.4 Conclusion and Outlook

In summary, inquiry-based learning means *independent* project work with an unlimited, or at least a high risk of errors and detours, which is why the intensive, academic support of professors and lecturers as learning consultants or mentors is necessary: an individual with extensive teaching and research responsibilities can scarcely manage this. On the other hand, there were signs that were "much more distressing than encouraging" (BAK 1970), with regard both to the students – their indifference, unreliability, lack of consistency, and low demands – and to the academic tutors, who are regarded as indispensable for inquiry-based learning, but whose cooperation can only be secured through payment: additional challenges that still apply today.

Real third-party funded projects can be used as a starting point for independent student projects in order to reinforce the practical integration of students in research processes, scholarship, and knowledge management. Research or genetic learning can be carried out through student projects with real implications, but this presents a huge challenge in terms of effort and time for all involved, both learners and instructors. Inquiry-based learning and genetic learning both require the instructor to develop a clear didactic concept, organize the students into small groups, and provide multimedia materials, all in advance. The official subdivision of the students into small groups ties up additional capacity and often fails, owing to the curricular nature of a degree program. Instructors receive no credits for unofficial subdivisions.

The success story of the universities of applied sciences in Germany is qualified by the dilemma of their professors: if they take the demand for the unity of research and teaching seriously, then they need to be active and innovative in both areas at the same time. As a general rule, professors at universities of applied sciences only have access to non-professorial academic teaching staff and no academic support. Moreover, they are often restricted to a research team financed by third-party-funded projects that has no teaching function. Similarly, professional, outward-oriented, and internationally recognized research with prestigious scientific publications is mostly only possible through third-party funding. This is laborious and exhausting: national, EU-wide, or international project applications must be written, calculated, and submitted on time. Authorization is not guaranteed. In addition, the current funding rate for BMBF development programs, for example, is perhaps only 5 percent to a maximum of 15 percent. The projects approved after a month-long assessment (sometimes more than a year) are not easy to manage with what are usually scarce human resources. Voluntary support for ensuring the unity of research and teaching in the sense of exploratory or genetic learning currently involves self-exploitation in many cases. Moreover, the academic staff in third-party-funded projects regularly make use of the possibility of a cumulative dissertation – i.e. obtaining a doctoral degree by having pieces published in a variety of prestigious journals – and this is also often done outside paid working hours.

Challenges in the future will be determined by considering past experience: inquiry-based learning must be explicitly included in the module descriptions at the universities of applied sciences. Important requirements remain: there should be a significant reduction in the high teaching load at universities of applied sciences; consideration should be given to the idea of working in smaller groups; the time-consuming nature of inquiry-based learning should be recognized in the curriculum through sufficient semester hours per week (SWS) and ECTS, as well as the introduction of non-professorial academic teaching staff at universities of applied sciences. The integration of research and learning at the universities of applied sciences thus requires structural support from policymakers, which will involve extra funding, and from the universities of applied sciences themselves, which must develop a research infrastructure and culture. In addition, the right to award doctorates, which these institutions have hitherto been denied, would provide important impetus for ensuring future-oriented research and the unity of this research with teaching.

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