



# Undergraduate Research in German Higher Education: Tradition, Policy, and Innovation

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## INTRODUCTION

Germany occupies a somewhat paradoxical role with regard to undergraduate research. On the one hand, its tradition of involving students in research can be traced back to Wilhelm von Humboldt's sketches toward a modern research university in 1809/10. On the other hand, and for reasons also dating back to Humboldt, the concept of "undergraduate research" is a fairly recent addition to the German discourse of higher education learning and teaching. Part of Humboldt's far-reaching educational reforms in Prussia, later adopted throughout Germany, was to relegate "undergraduate studies"—the Baccalaureate—to the school system. With the *Abitur*, German grammar schools were supposed to produce

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students who were mature enough and educated in the classics, arts, languages, and sciences to apply themselves to independent study in more or less any subject on offer at university at the time. For most of their modern history, therefore, German universities offered only degrees at postgraduate level—the specialized diploma for the applied sciences (4–7 years), state examinations—the *Staatsexamen*—for teachers, lawyers, and theologians as well as research doctorates for the humanities. The Magister, a broader postgraduate qualification, was introduced in the 1950s to provide increasing numbers of students in the arts and humanities with an alternative to the state exam and an exit option below the doctorate. The Bachelor as first qualifying academic degree was reintroduced into German higher education with the European Bologna-Reform process from 1999 onward and has only really begun to affect and dominate higher education discourse with the phasing out of the old Magister and Diploma degrees between 2009 and 2013. In the first part of this chapter, we provide some historical context on the relationship between teaching and research in German Higher Education leading up to and including the early implementation of the Bologna reform process in Germany (1999–2009). In the second part, we examine recent trends and developments in the linkage between research and teaching in German Higher Education (2001–2014). In the third part, we then introduce some current models and examples for the implementation of research-based learning.

## TEACHING AND RESEARCH IN THE GERMAN HIGHER EDUCATION CONTEXT

For the case of German higher education, it thus makes sense to distinguish between “undergraduate research” as a novel concept and the much richer and developed discourse around “research-based learning” or *Forschendes Lernen* (inquiry-based learning). Here, too, some historical context is in order, as the focus of the debate on the relationship between research and teaching has shifted considerably with each major wave of higher education reform and expansion. Four of these turns are worth noting in particular:

1. When Wilhelm von Humboldt developed his blueprint of the modern research university, it was partly to ward off the threat of universities being relegated to mere teaching institutions by the rival

academies of science. The *Universität zu Berlin* he helped to set up in 1809/10 was, with a total population of 52 professors to 256 students, also fairly well resourced to facilitate the ideal of a university as a small community of students and teachers, working together to advance the progress of science (Humboldt 1809/2010, p. 230).

2. A first major challenge to the Humboldtian ideal of a “unity of research and teaching” came with the expansion of the German university system at the turn of the twentieth century. Between 1891 and 1911, the number of students in higher education more than doubled from 35,200 to 73,600, reaching 119,400 by 1921 (Müller-Benedict 2016, p. 69). The foundation of a powerful and highly prestigious extramural network of research institutes in the *Kaiser-Wilhelm-Gesellschaft* in 1911 can in part be seen as a return to the division of labor between the universities (education) and the academies (research) that Humboldt was trying to fight in 1809/10. While the primary concern here was to secure the quality and quantity of research output to support Germany’s economic and political ambitions at the time, the foundation of an extramural research organization also supported the idea that teaching could be something that gets in the way of scientific progress—and a career in science.
3. The origins of the current debate around “research-based learning” as a didactical concept can be traced back to the higher education reforms of the 1970s to the 1980s. Against the backdrop of another rapid expansion of the higher education system—in West Germany student figures rose from 427,200 (1970) to 1,408,700 (1987)—concerns emerged around the degree to which a modern mass higher education system could still guarantee the scientific nature of academic training. This time, the leading voice was the *Bundesassistentenkonferenz* (BAK, Congress of University Lecturers) who demanded that students—at university at the very least—should be “trained by scientists in a scientific discipline and for a scientific occupation” (BAK 1970, p. 9); that they should be able to independently choose a research topic and develop a research question; determine a research design; experience a research process; learn to act and think as members of the scientific community; reflect critically about the relationship between hypotheses, methods, and results; and be able to present their results (cf. Deicke et al. 2014, p. 27). While the BAK’s demands for students’ involvement in

ongoing (staff or third party) research projects were never systematically implemented, outside of the new ‘reform’ universities such as Bremen or Bielefeld, they spawned a number of new teaching and learning formats—most notably the “project seminar”—which were adopted more widely throughout German higher education and attempted to realize the demands of the BAK (Fichten et al. 1978; Wildt 1981).

While perhaps falling short of the ideals of “research-based learning” set out by the BAK, the Magister and Diploma degrees at university remained at least research-informed in their content, research-oriented in training, and also contained opportunities for independent student research (cf. Healey and Jenkins 2009). In the humanities and social sciences, these would take the form of extended pieces of research writing (the *Hausarbeit*) from early on in the degree program. Most subjects also required longer final year dissertation projects. It could be argued, however, that the link of the curricula to research remained dominated by staff interest rather than student learning and that—in times of rising student numbers—“opportunities for independent research”, linked closely to summative assessment, could mean poorly supervised research in isolation.

4. A third major turn in the debate around the relationship between research and teaching came, as indicated above, with the Bologna Reform process and the reintroduction of the Bachelor into the German higher education system. Again, this coincided with a massive increase in student numbers from 1,773,956 students in 2000 to 2,844,978 by 2017 (Federal Office for Statistics 2019). The real challenge, however, was the concept of the three-year Bachelor as a first qualifying academic degree. While the rest of the world tried to shift their higher education systems from “teaching to learning” (Boyer Commission 1998), it is fair to say that—in the first round of introducing the new undergraduate degrees between 2000 and 2009—many German universities went the other way. In attempts to salvage as much content as possible from the 5–7-year-long Magister and Diploma degrees, they often went for delivery-based and highly condensed curricula with restricted student choice and a tendency toward overassessment. This, combined with the attempt to introduce student fees in a previously free public education sys-

tem in 2006–2007, predictably resulted in major protests by students (with considerable support from academic staff).

### RESEARCH-BASED LEARNING AND UNDERGRADUATE RESEARCH AFTER THE BOLOGNA-REFORM

It is at this point that the BAK's concept of "research-based learning" was rediscovered and identified as a possible remedy for many (if not all) the ills of mass higher education. If its champions in the 1970s had been the numerically strong, but relatively powerless BAK, support this time came from the very top. In 2006, the *Wissenschaftsrat* (German Science Council), the most influential advisory body on German higher education policy, recommended that research-based learning should be a key component of all degree level training:

*University training can qualify (graduates) for qualified work [...] where it aims to develop the ability to independently develop questions, to systematically engage with problems, methodically generate new insights and critically reflect on fundamental questions. This can be achieved by teaching that demonstrates and discusses the scientific process and actively involves students in this process. Research-based learning thus is essential to every (kind of) scientific program of studies.* (Wissenschaftsrat 2006, p. 64)

It is worth noting the slight shift, again, of emphasis here: Where the BAK was still very much concerned with the standard of scientific training for careers in science, the Science Council's concern shifted much more with the transfer of academic skills to a more generic, not necessarily scientific, (graduate)job market.

With regard to "undergraduate research", there is another important difference to the situation in the 1970s: This time, the German government provided funding not just to facilitate the rapid expanse of higher education, but also offered specific funding to enhance the quality of teaching. Following the Science Council's advice, programs to support and implement "research-based learning" were very prominent amongst the measures funded in the two rounds of the *Qualitätspakt Lehre* (Quality Pact for Teaching, 2010–2016, 2016–2020). Perhaps the most notable innovation that resulted from this was the university-wide, cross-faculty *Research Opportunities Programs* piloted in a number of Quality Pact

projects. The Quality Pact for Teaching has served as a catalyst for promoting and advancing research-based learning and specifically research-based learning opportunities aimed at undergraduate students.

Around these programs, an active network of institutions, QPT-projects and individuals has formed. To date, the network generated successful bids for two funded research projects into how research-based-learning works in different formats and disciplines (“ForschenLernen”, 2014–2018, cf. Gess et al. 2017; Ouelette et al. 2017; Wessels et al. 2018; Gess et al. 2019; Mieg 2019a) and how it can be used in the crucial first year of study to enhance the student experience and strengthen retention (“Forschendes Lernen in der Studieneingangsphase (FideS)”). In 2016, members of the network established an interdisciplinary national conference for student research (Twitter hashtag #stufo20xx) that is now entering its fourth year. Carl-von-Ossietzky Universität, Oldenburg, was also selected to host the Second World Conference for Undergraduate Research in May 2019. Comprehensive overviews of the range of institutions and projects involved in the network and the type of issues they wrestle with can be found in the volumes edited by Mieg (2019b), Lehmann and Mieg (2018), and Mieg and Lehmann (2017).

While there is, to date, no national organization focused on the promotion of research-based learning, a large number of individuals from the RBL-community are organized in a standing group within the *Deutsche Gesellschaft für Hochschuldidaktik* (DGHD, German Association for the Professionalization of Teaching in Higher Education), the so-called AGFL (Working Group Research-based Learning). The group was initiated by Harald Mieg and Ludwig Huber in 2014 and—with 130+ active members from 57 institutions—is today one of the largest and most active working groups within the DGHD. The group holds regular meetings and workshops 2–4 times a year, with smaller subgroups collaborating digitally on selected themes. It has established a working papers series and is working on a collection of materials of use for preparing researchers, teaching staff, and students for research-based learning. Since 2013, the DGHD’s annual conference has included a strong stream of contributions (empirical papers, SoTL cases studies, workshops) on research-based learning. Member institutions have hosted several research conferences around student and undergraduate research, the latest being the focus URE Conference at Universität Hohenheim in June 2019.

## CURRENT TRENDS AND DEBATES ON RESEARCH-BASED LEARNING

The focus of the theoretical/conceptual debate in Germany between 2012 and 2016 was very much on matching the established German discourse around “Forschendes Lernen” (inquiry-based learning) to the new contexts of Bachelor and Master degrees and mapping it against the host of concepts emerging from the Anglo-American debates around the research–teaching nexus and other formats of active, student-centered learning and teaching. The concept of “undergraduate research” and the “undergraduate research experience” have so far played a subordinate role in these discussions.

While there are a number of competing German approaches to research-based education, two main paradigms can be identified: On the one hand, a competencies- and outcomes-based approach rooted in empirical educational psychology that tends to prefer “research-oriented teaching” (e.g. Reiber 2007; Schneider and Wildt 2009), and, on the other hand, a more pedagogically informed and process-oriented approach that tends to refer to “research-based learning” (Huber 2009, 2014; Tremp and Hildbrand 2012; Sonntag et al. 2016). While these differences in approach can lead to differences in the implementation of student research opportunity programs (e.g. opportunities to acquire or deepen specific sets of methodological skills and theoretical competencies vs. opportunities to develop or participate actively in actual research projects), there is a pragmatic consensus within the UGR/RBL-community that research and teaching can and must be (more) actively linked at all levels of under- and postgraduate degree programs.

There is also considerable convergence between the German and the international debates surrounding student and undergraduate research. Building on the works of Beckman and Hensel (2009), Brew (2006, 2013), Healey (2005), and Healey and Jenkins (2009), the German debate has produced several models for mapping the research–teaching nexus (Tremp and Hildbrand 2012; Rueß et al. 2013) and planning for research-based learning (Lübcke et al. 2017).

Despite the earlier criticisms of increasingly condensed undergraduate curricula, it is fair to say that German higher education has maintained very close links to research. While there are differences between academic subjects, this most certainly applies to all universities, which consider the link to research and—at the very least—research-informed and -oriented

curricula to be the very feature that distinguishes them from the more applied universities and colleges of higher education. Here, and with many of the technical universities, the answer depends on whether, or to what extent, we count creative (Arts, Design) and constructive processes (Engineering) as research. In general, data from the national student surveys 2001–2013 (Ramm et al. 2014, pp. 38–9, cf. Table 12.1) appears to suggest two things: One that the link between research and teaching is becoming stronger across all types of institutions; and two, that the gap between university and more applied subjects appears to be shrinking and German higher education as a whole appears to be back on the track to shift from “teaching to learning”.

If differences between types of higher education institutions appear to be diminishing, data from the national student survey shows that differences in research training (research-oriented teaching and learning opportunities) and opportunities for undergraduate research between the disciplines remain. The most recent data available comes from Bargel and Multrus’ (2012) analysis of national student survey data from 2009–2011. According to this, links to research are considered most important in the natural sciences at university and least pronounced in law and economics at both levels, with the (mostly administrative) law-related degrees in the

**Table 12.1** Students’ perceptions of links between research and teaching 2001–2013 (percentages, by type of institution)

	<i>Strong links</i>	<i>Links exist</i>
<b>Universities</b>		
2013	31	44
2010	24	47
2007	22	47
2004	19	46
2001	18	44
<b>Applied universities/Colleges of higher education</b>		
2013	22	45
2010	15	43
2007	14	44
2004	10	42
2001	6	36

Data source: Studierendensurvey 1983–2013, AG Hochschulforschung Universität Konstanz

Adapted from: Ramm, Multrus, Bargel and Schmidt (2014, p. 39)



Applied Universities and Colleges of Higher Education taking the bottom spot. There is, at least in economics, a difference between more research-oriented pure economics (*Volkswirtschaftslehre*) and more applied business studies (*Betriebswirtschaftslehre*) degrees and some interesting attempts to remedy the lack of research opportunities in the latter (cf. Müller-Christ 2019). What was interesting to note here is that the links between research and teaching appear less pronounced in degrees in medicine at university than they are in the newly academicized nursing and health science degrees in the applied institutions. It seems that these professions have benefitted most from the initial wave of the Bologna reforms and the switch from vocational to academic training (Table 12.2), with university-based medical training programs—for example, at Charité Berlin or the Ruhr-Universität Bochum—now following up with new model degrees (cf. Schäfer 2019).

**Table 12.2** Students' perception of the importance of links between research and teaching in Bachelor degrees at University and in Applied Colleges of Higher Education (percentages, by disciplines)

<i>The link between research and teaching is important</i>	<i>Cultural science</i>	<i>Social science</i>	<i>Law</i>	<i>Economics</i>	<i>Health sciences</i>	<i>Natural sciences</i>	<i>Agri-cultural science</i>	<i>Engi-neering sciences</i>
<b>Universities</b>								
In class	56	62	39	45	58	<b>70</b>	68	65
Specialized classes	48	51	34	40	49	<b>58</b>	57	53
Own participation	51	55	31	37	44	<b>69</b>	68	60
<b>Applied universities</b>								
In class	47	58	30	41	<b>68</b>	54	63	55
Specialized classes	43	51	33	37	<b>63</b>	49	55	49
Own participation	42	49	29	34	57	54	<b>64</b>	56

Data source: Studienqualitätsmonitor 2009–2011, HIS Hannover & Universität Konstanz

Adapted from: Bargel and Multrus (2012, p. 14), **top ranks** highlighted in, bold

## RESEARCH-BASED LEARNING IN PRACTICE: EXAMPLES AND MODELS

While the data generally reflects our own curricular analysis at Humboldt-Universität zu Berlin, they obscure another important dimension of undergraduate research: the degrees of freedom that students are granted in developing and carrying out independent research projects at the undergraduate level. While opportunities to participate in research may be most plentiful in the natural sciences, it is less likely for undergraduate STEM-students to be allowed to develop their own research questions, choose a research design or method than it is in the social sciences. Undergraduate students in the natural sciences will more likely be assigned a problem, question, or experiment to conduct, analyze, and report on for their final year project (cf. Ruf et al. 2019, pp. 200–1).

This is also reflected in the predominant models of research training. Insofar as Humboldt-Universität can serve as a typical example for a research-active university, laboratory training and the apprentice model are the most common modes of training in the natural sciences. Here, undergraduate students can apply for paid positions as student assistants in third-party-funded research projects. They are usually assigned to particular tasks in the project and can write their undergraduate dissertation or a research paper under the guidance of a junior researcher and/or the supervision of a principal investigator.

Research projects embedded in the curriculum tend to be more common in the social sciences and humanities. These are often structured as social, rather than individual projects. A key example from Humboldt-Universität would be the compulsory year-long final year fieldwork project, in which groups of students assign themselves to one of a number of set fieldwork projects, begin to explore the field, and gain practical experience of a range of ethnological research methods under the supervision of an experienced academic and then begin to develop their own questions and approaches to a particular aspect in that field. Ideally, the joint project (and the data produced through it) and/or the methodological skills acquired are then used or followed up in the students' individual BA-dissertations.

With the notable exceptions of Leuphana University, Lüneburg (cf. Lang and Wiek 2013) and the University of Bremen (cf. Huber et al. 2013), community-based research is still relatively rare in German universities. Projects like the several Quality-Pact funded law clinics at

Humboldt-Universität (Human Rights and Citizenship Law, Consumer Rights, Internet Law, and the student-initiated and -led Refugee Law Clinic) indicate, however, that this is changing and that subjects perceived as not having strong active links between research and the curriculum are particularly open to exploring these “novel” ways of linking professional training with research activities. Community-based research and service-learning models tend to be more common in the social sciences and health sciences programs in Universities and HE Colleges of Applied Science (Schmidt-Wenzel and Rubel 2019). Among the Quality-Pact funded Student Research Opportunities Schemes, there are several creative attempts to bring the research from Germany’s extramural research institutes back into teaching. A good example for this is the Q-Teams created by Humboldt-Universität’s *bologna.lab*. In this format, junior researchers in one of Berlin’s 70+ extramural research institutes can apply for funding for a small student research team to work on a particular aspect of one of the institute’s ongoing research projects on the understanding that they are not considered “cheap additional labor”, but trained and mentored as future researchers. In addition to a paid temporary teaching contract, the junior researchers receive didactical training and support in planning the project and acquire additional skills both in teaching as well as in leading a (student) research team, which are useful for their next steps in postdoctoral careers in teaching and/or research (cf. Deicke et al. 2014).

An additional model, far more common in universities of applied science, is the dual career degree, which combines vocational/professional training in the workplace with degree level studies (the combination of vocational schooling and workplace training has always been a general strength of the German education system). The leading German exponent of this is the *Duale Hochschule Baden-Württemberg* (2019) and a number of private Universities such as *Steinbeis Hochschule Berlin* offer dual-career degrees. However, while German research universities would have turned their nose at the mere idea of “application” a decade ago, there are signs that the (faux) distinction between research and practice is softening here, too. At Humboldt-Universität, the introduction of research-based project work in undergraduate teacher training degrees now goes hand-in-glove with the introduction of a dual-career postgraduate teaching qualification (Master of Education) for graduates and applicants with advanced vocational/professional training and/or substantive work experience. Similarly, many higher education institutions now support their researchers and students in taking the products, innovations, and designs from their research

to the market. At Humboldt-Universität, this is facilitated through Humboldt Innovation, a private company founded in 2005 and owned 100% by Humboldt-Universität (a public institution). Humboldt Innovation provides grants, legal and financial advice and office space to students, graduates, and researchers from Humboldt-Universität who have an idea or product ready for taking to the market. While not primarily aimed at undergraduate students and more likely to be used by graduate and researchers between master's level and postdoc, it has supported a number of start-ups by undergraduate and graduate students from different faculties and successfully involves undergraduates in its information sessions and social events (Humboldt Innovation 2019).

The federal government's strategy and support for undergraduate research is rather more difficult to assess. While there is a lot of public funding for research and development, the bulk of it (still) goes to independent research societies such as the *Max Planck Gesellschaft*, the *Leibniz Gesellschaft*, the *Helmholtz Gesellschaft*, and the *Fraunhofer Institutes*, and therefore straight past the bulk of the undergraduate students. University professors can apply for funding to the *Deutsche Forschungsgemeinschaft* (DFG, *German Research Society*), but usually use the funding they receive for a teaching "buy out". In the first two rounds of the German high-profile *Excellence Initiative*, universities could include graduate schools and structured PhD programs in their proposal but were not allowed to use any of their research funds to support undergraduate initiatives. While this rule was relaxed for the most recent round of applications and research-based teaching was mentioned in both the calls for research clusters as well as bids for the status of *Excellence University*, the DFG's and German Science Council's Call for Submissions in 2016 tellingly still described teaching as "(one) of the other ancillary functions of universities" (DFG 2016, p. 3). Consequently, the Berlin University Alliance's successful bid for funding includes a research-based component modeled on Humboldt-Universität's HU-Q program and aimed predominantly at undergraduate students, but with an annual budget of just €1.5 mn out of €25 mn in total.

For Universities of Applied Sciences, there have been several federal funding lines for research infrastructure and the development of research profiles since 1992, currently grouped under the umbrella of *Forschung an Fachhochschulen* (research in universities of applied science). The increase in funding under this umbrella—from €10.5 mn in 2005 to €48 mn in 2016 (BMBF 2016, p. 6)—may in part explain the changes in the

perceived linkage between research and teaching in the applied universities and colleges of higher education. While the applied universities have been very successful in attracting third-party funding, their figures pale into insignificance compared to the annual budget of the *Deutsche Forschungsgemeinschaft*, which stood at €3.4 bn per annum in 2018 (DFG 2018, p. 2). Tellingly, too, a recent program evaluation of the funding line *Forschung an Fachhochschulen* (Geyer et al. 2016) covers many dimensions of research in applied universities, but completely omits teaching—suggesting that the federal and state governments as well as many institutional leaders—are missing out on something important by aspiring to become more like universities, who in turn aspire to become more like the independent research institutes.

## CONCLUSION

Despite these misgivings, we would conclude that research-based learning and—to a lesser extent—undergraduate research have taken a strong hold in German higher education discourse and policy. While there are still massive disparities in esteem and importance between teaching and research, research-based learning has the potential—as its (marginal) inclusion in the *Excellence Strategy* and funding through the Quality Pact have demonstrated—to somewhat redress this gap.

For the reasons outlined above, there are, at present, very few days or events aimed at celebrating undergraduate or student research for its own sake. There are student-organized and university-funded research conferences (such as the Sustainability Conference in Berlin), but these tend to be subject-focused rather than aimed at creating visibility for student research as an end in itself. The closest equivalent we have at present is the annual conference for student research, established in 2016. This is a multidisciplinary, national conference aimed at providing a platform for student research and has to date been hosted by Carl-von-Ossietzky Universität, Oldenburg; Humboldt-Universität zu Berlin (2017); Ruhr-Universität Bochum (2018).

The main challenge at present arises from the temporary nature of the Quality Pact for Teaching and chronically underfunded Higher Education Institutions. The per capita funding HEIs receive per student has not kept up with the rapid increase in student numbers since 2000. This means that, when the current Quality Pact funding period ends in December 2020, many universities will be faced with tough choices regarding the

allocation of resources. On the whole, it seems fair to conclude that German higher education has overcome the temporary setbacks and problems linked to the implementation of the Bologna reform process. As always in politics or education, change takes time and will only be complete in this instance once the academic CV of the next president of the German rectors' conference reads BA, MA, PhD habil.

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