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Increasing Students' Research Interests Through Research-Based Learning at Humboldt University

Wilhelm von Humboldt and the Humboldtian ideal of the "unity of research and teaching" are frequently invoked in debates about research-based education (Healey and Jenkins 2009; Huber 2011). While the concept of the "research university" attributed to him became influential both in Germany and the United States (Boyer Commission 1998, 1; van der Wende 2011, 233), the "unity of research and teaching" largely remained an ideal — perhaps even more so in Germany than in the United States (Ash 2006, 249). Here we discuss the debate on research-based undergraduate education in Germany, outline some of the measures taken at Humboldt University to (re-)introduce opportunities for student research into undergraduate curricula, and present first results from those measures.

German Debates on Research-Based Education

Current academic debates over the link between research and teaching in Germany appear to coincide with wider attempts to reform the higher-education sector. When Wilhelm von Humboldt first mapped out his ideas concerning the idea of a modern research university in the early 19th century, he did so in an attempt to redefine the role of the university vis-à-vis the state, the school system, and the academies of science (Humboldt 2010). Humboldt famously argued that universities should be free from state interference and narrow political purpose, but still should be securely funded. With regard to the school system, he drew a clear distinction between the teaching of "secure knowledge" - known facts and received truths - that necessarily took place in schools and the transition toward self-directed, independent study that should take place in universities: "It is furthermore a peculiarity of higher education institutions that they treat science as a not yet wholly solved problem and hence stay always in research mode" (Humboldt 2010, 230). The relationship between teacher and student should be different at university, he continued, because "the former is [no longer] there for the latter, but both are there to serve science" (Humboldt 2010, 230). Humboldt's main concern, however, was with a division of labor between universities and the academies of science that, at the time, designated the academies as the true locus for the advancement of science (research) and relegated universities to the proliferation of science (teaching) (2010, 236).

Instead, Humboldt envisaged the university as a scholarly community where the proximity and overlap between teaching and research had great potential both to further the advance of science and to imbue students with the mind-set required for independent, self-guided study (2010, 230, 232). While it might seem that Humboldt wrestled with problems in 1809-10 similar to those that concerned the Boyer Commission in 1995-98, his focus was rather different. Whereas the Boyer Commission's concern was with the nature and quality of undergraduate learning, Humboldt's main concern was the advancement of science. However, as Michael G. Ash has pointed out, the German science and research system in the 19th and early 20th centuries took a very different trajectory from that envisioned by Humboldt (Ash 2006, 247-8), leaving the problem of the research-teaching nexus in Germany unresolved.

The contemporary debate around research-based learning in Germany can be traced back to the late 1960s and linked to a rapid expansion of the higher-education sector on one hand and new influences in pedagogy on the other. In 1970, the association representing non-professorial university teaching staff, known as BAK from its German initials, warned that such expansion should not come at the cost of limiting "students' participation in science" (BAK 1970, 11). To the BAK, scientific education meant "training by scientists in a scientific discipline and for a science-based occupation" (BAK 1970, 9). While the BAK did not advance a definition of research-based learning, it identified some of its defining principles. Under these, student-researchers should have the opportunity:

- To independently choose a research topic and develop a research question;
- To independently determine the research strategy (choice of methods, experimental design, etc.);
- To experience research as a process with the possibility of errors, sidetracks, and unexpected discoveries;
- To work according to the standards of the scientific community;
- To reflect critically on the relationships among hypotheses, methods, and results in their findings ; and
- To present their results in such a way that they and their significance are transparent to others (BAK 1970, 16f).

To be sure, the BAK did not see research-based learning as the only pathway to scientific training and education, but rather argued that all degree programs should—from the very start of academic training—be oriented toward research and the principles of research-based learning (BAK 1970, 11, 17f).

The BAK's ideas were never widely or systematically adopted by policymakers at the time. While it is fair to say that the debate stalled in late 1970s, the concept of research-based learning spawned some innovative and experimental degree programs, notably in teacher-training at the Universities of Bielefeld and Oldenburg (Meyer and Fichten, 2010). At the grassroots level, the BAK also influenced individual academics who sought to apply the principles it proposed to their own teaching.

In the 1980s, the emphasis in educational policy was very much on delivering relevant knowledge to students and reducing the duration of degree programs (Wissenschaftsrat 1986). It was another large-scale reform project, the European Bologna process, that served as a catalyst for the "shift from teaching to learning" (Barr and Tagg 1995) in German educational policy. The Bologna process aims at harmonizing the European higher-education systems by implementing consecutive degree programs (bachelors/masters), which replaced the former diploma/magister programs in Germany. The project also shifted the emphasis from "teaching content" to developing students' skills and competencies (Nickel 2011). In its recommendations for the structure of the new bachelors/masters degrees, the German Science Council suggested higher education should aim to develop broad sets of skills and competences, among them "the ability to synthesise and structure knowledge and information and to take charge of their own future learning" (Wissenschaftsrat 2000, 22) — precisely the set of skills that research-based learning claims to foster and develop (Fichten 2010; Huber 2009; Ludwig 2011). The German Science Council first explicitly mentioned research-based learning as a key recommendation for future teacher-training degrees to strive to attain by 2001 (Wissenschaftsrat 2001, 41) and recognized this learning approach as a key component of all degree-level training and education by 2006. The Council stated:

> 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 programme of studies (Wissenschaftsrat 2006, 64).

In practice, however, the transition from the "old" diploma/magister degree-structures to the new, European-wide two-cycle bachelors/masters system was not without problems. Students complained about a lack of choice, poor staff-student ratios, heavy workloads, and over-assessment in the new degree programs (Projektgruppe Studierbarkeit 2007). With regard to the research-teaching nexus, a 50,000-student survey conducted between 2007 and 2008 at 280 higher-education institutions in Germany (Bargel et al. 2009) showed that only 35 percent of the bachelor's students responding perceived their programmes as particularly oriented and relevant to research (in 2007 and 2008 the old and new degree systems still operated alongside each other). Perhaps most significant here, given the earlier recommendations of the BAK, was the perceived difference in opportunities to actively participate in genuine research among university students in the old and the new system: Whereas 25 percent of university students in the old degree programs reported such opportunities, the figure for the bachelor's students stood at a mere 18 percent (see Table 1).

In the face of protests from students and complaints by university leaders over inadequate resources (Gardner 2009), in 2010 the German government, in cooperation with the 16 federal state governments, launched the *Qualitätspakt Lehre*, a funding program aimed at enhancing the overall quality of teaching and learning in German higher education. With an overall budget of approximately $2.72 billion over ten years, the *Qualitätspakt* signalled a clear commitment to address

Table 1. Percentages of Students Perceiving Links Between Degree Programs and Research

Research-based	Bachelor (new)	Diploma or Magister (old)
Link between teaching and research in the degree program generally	35	43
Link between teaching and research in lectures and seminars	24	32
Opportunities to participate in research	18	25
Practice-based	**Bachelor (new)**	**Diploma or Magister (old)**
Link between teaching and practice in the degree program generally	41	36
Link between teaching and practice in lectures and seminars	56	55
Opportunities to gain practical experiences	50	56

Adapted from: Bargel et al. (2009, 66). Table shows percentage of respondents endorsing the respective statement.

the quality of teaching. In the first round of funding (2011-2016), more than 90 percent of all eligible institutions applied for funding. Among the 250 projects funded in the first round, more than 30 initiatives aimed at improving and enhancing the provision of research-oriented study formats and components (BMBF 2011; Huber 2013). For an overview of these projects, see http://www.qualitaetspakt-lehre.de/de/3013.php and Huber (2013).

Research-based Learning at Humboldt University

In the first round of *Qualitätspakt*, Humboldt University secured about $17.7 million for a comprehensive project called "Übergänge" ("Transitions") aimed at supporting the three transitions: from school to university, from school-type receptive learning to active independent study at the university, and from the university to postgraduate research or employment. Among a host of measures, the bologna.lab — whose name signals the university's commitment to the overall aims of the Bologna process — serves as an experimental platform for the development, piloting, and evaluation of innovative forms and formats of teaching that bring together teaching staff and students. While the bologna.lab is concerned with a host of "Bologna issues" (transdisciplinarity, student mobility, internationalization of the curricula, and increased flexibility, to name but a few), at the heart of our project is an initiative specifically aimed at the promotion of research-based learning, the Humboldt University HU-Q program. The "Q" serves as a creative cipher meaning question, query, quest, and qualification in activities in which students are encouraged to develop independent research questions, query the received wisdom of their disciplines, embark on a quest for answers, and develop new skills and qualifications in the process.

At present, we are running four different projects under the HU-Q label:

Q-Tutorials. In German universities the term "tutorial" usually refers to teaching conducted by students. Thus, the Q-Tutorials are student-initiated and student-led research projects primarily involving undergraduates. With the support of their departments, students from the second year of their bachelors' programs up to the masters' level competitively bid for research funding (effectively, one-year student research stipends worth about $8,100). The bids are reviewed by an interdisciplinary commission of teaching staff and students. Successful bidders are then employed as "tutors" and lead a student research team. To prepare them for this task, they receive training in moderating group processes and are taught project-management strategies. The bologna.lab also supports them in the process of adapting their projects to the principles of research-based learning. The participants in the research teams receive academic credits for their work. The degree of autonomy the teams have in exploring their research questions and the methods they use differs among the Q-Tutorials depending on the overall research questions and the way the research is conceived by the Q-Tutors. However, the Q-Tutors are urged to grant team members as much autonomy as possible. Each Q-Tutorial ends with a written report on the teams' research results. Since January 2012, the bologna.lab has supported 45 Q-Tutorials with approximately 550 participants.

Q-Teams. These teams are aimed at creating opportunities for junior research staff, in particular from the university's clusters of research excellence (DFG 2013), special research projects, and associated research institutes, to translate their research interests into teaching, thereby bridging the chasm between cutting-edge research and teaching (Hartmann 2006). The idea is to create first opportunities for undergraduate and postgraduate students to participate in "real life" research projects by working in small groups or individually on a particular aspect of a research project. The role of the Q-Team leaders is to coach the student-researchers through the research process. Ideally, the participants will develop their own research question, leading to project-related BA and MA dissertations. Junior research staff, usually employed on part-time contracts, can bid for funding of 1,000 Euros or about $1,370 per semester in the form of supplementary teaching contracts. As with the Q-Tutorials, the bids for funding are reviewed by an interdisciplinary commission. The target audience, again, is students from the BA-level onward, but the decision over necessary theoretical or methodological requirements rests with the Q-Team leaders. The bologna.lab finances up to nine Q-Teams each semester. To date, it has sponsored 25 Q-Teams with around 200 participants.

Q-Kollegs. These projects are aimed at providing opportunities for students to gain first experiences in collaborating on a research project with students from an international partnering institution without having to spend a whole semester (or year) abroad (DAAD 2013). The initiators usually are established academics who already have good research contacts in a partnering institution. The research project usually runs for an entire year, with local team meetings supported by bi-national research-tandems (pairs of students from both institutions), regular video conferences and other exchanges via online learning platforms, and two week-long working visits by both teams to the partnering institu-

tion. We are presently piloting one such collaboration between the Winckelmann Institute for Archaeology at Humboldt University and the Department of Classics at Nottingham University with 12 participants per year. For the 2014-15 academic year, three further pilot projects are planned with support from the university's International Office. Support at Humboldt comes in form of a teaching contract to junior research staff to support the student-researchers in the early stages of the project and funding (up to 3,000 Euros or $4,100) for the travel costs of both teams.

Q-Modules. These modules are designed to create opportunities for students in the advanced stages of their bachelor's or master's programs to complete an existing academic module by conducting research without regularly attending scheduled classes, but working under the guidance of subject specialists and supported by seminars or work-in-progress workshops. In the 2013 summer semester, a first pilot module was run with 24 students in the final stages of the magister program in European ethnology. For the 2014 winter semester, a longer-term project is planned in the Slav language program, aimed at native speakers of Polish who previously had to enroll in language classes aimed at non-native speakers. The goal here is to give them the opportunity to add a research angle to their language learning by, for example, engaging with the challenges of language acquisition for their non-native speaking peers or researching specific patterns of language use of second- and third-generation Polish-speakers in Berlin. The bologna.lab provides financial support for the development of suitable teaching materials and additional teaching contracts for faculty supervising the pilot phase.

Another distinctive feature of the HU-Q Program is its own, built-in research component. Rather than just promoting and facilitating research-based learning, the HU-Q initiative is conceived as a "live" research program. The aims are threefold: (1) to get a better understanding of the research-teaching nexus in different subjects and develop tools for curriculum planning and development (Healey and Jenkins 2009; Rueß, et al. 2013); (2) to identify "successful" formats for research-based learning and to continue to develop our own formats (Gess et al. 2014); and (3) to contribute to the scientific debate over the effects of research-based learning. Here we will focus on the third aim.

Early Research Findings

While research-based learning has been credited with an array of broad positive effects (Brew and Jewell 2012; Clark 1997; Seymour et al. 2004), there are still relatively few empirical studies on its impact on individual learners. Our main focus here is on the effect that participation in research-based learning has on the students' general interest in doing research, on self-efficacy regarding research activities, on interest in their academic subject, and on the epistemological beliefs of learners. We will focus our assessment on one dimension per year in order to keep the questionnaire and the time demands on the learners manageable. Each semester, learners enrolled in the HU-Q formats will receive a questionnaire prior to the start of their project (the pre-test) and again after the completion of the project (the post-test). Our aim here is not simply to establish *whether* participation had particular effects on the learner, but rather to identify *how* effects can be achieved; this is crucial as research-based learning is not a monolithic concept and can be realized in different ways. The results for the first round of the survey (Winter semester 2012/13: October 2012 to March 2013) will be discussed here with "research interest" as the main focus of the analysis.

Given that the aim of the HU-Q program is to increase the general interest of students in doing research, our general hypothesis (H1) was that learners' research interest will increase through participation in research-based learning. With regard to the mechanisms at work, we assumed that interest in research activities would increase through participation in such activities (H2, H3, cf. Krapp 2010) and, according to Deci and Ryan (2000), that interests are positively reinforced when individuals experience themselves as socially included (H4) and autonomous in their decisions (H5). Empirically, earlier findings by Hänze and Moegling (2004) regarding high-school students suggested that the effects of research-based learning depend on the learner's orientations toward learning (H6) and intrinsic motivation (H7), whereas Köller et al. (2000) suggested a reciprocal relationship between a learner's pre-existing knowledge and abilities on one hand and their interest on the other (H8). Accordingly, we developed and tested a number of hypotheses involving characteristics of the intervention, as well as personal factors. As far as the personal factors are concerned, it should be noted that our sample might be self-selective, as students with greater initial interest in research might be more likely to choose to participate in research projects.

In all, approximately 300 students were enrolled in HU-Q projects in the winter semester of the academic year 2012-13 (23 Q-Tutorials with around 260 participants; 6 Q-Teams with 40 participants). Of these, 106 students completed both the pre-test and the post-test, with the return rate being slightly higher for the Q-Team members (n=21, 53 percent) than that for the Q-Tutorials (n=91, 35 percent). For the test, we developed a new instrument to measure students' interest in research. Students were asked how interested they were in

Table 2. Results of Hypotheses Regarding Students' Interests in Research

Global Hypothesis		n	T	z	r	p	
H1	Research interest increases through participation in research-based learning.	106	2737.5	1.50	.15	.133	
Factors Related to the Intervention		**n**	**U**	**z**	**r**	**p**	
H2	The more research activities were carried out, the greater the increase in research interest	88	615.0	2.96	.32	.003	**
H3	The increase in research interest depends on the type of research activities carried out	(see Table 3)					
H4	The better the climate in the group, the greater the increase in research interest	56	363.0	0.47	.06	.638	
H5	The more opportunities learners have to actively shape the project, the greater the increase in research interest	67	450.5	1,36	.17	.175	
Personal factors		**n**	**b**	**F**	**R^2**	**p**	
H6	The more oriented the students are towards learning, the greater the increase in research interest	106	0.59	3.47	.03	.065	
H7	The higher the students intrinsic motivation, the greater the increase in research interest	64	0.33	4.01	.06	.050	*
H8	The higher students judge their prior knowledge of the subject, the greater the increase in research interest	106	0.75	2.65	.03	.106	

*The dependent variable analyzed is the change in research interest (Δ = post-test — pre-test); r denotes the effect size (Cohen, 1992); R^2 denotes the amount of variability in the change of research interest that is shared by the independent variables (Field et al., 2012); p denotes the probability of obtaining the test result under the premise that the null hypothesis is true; *significant at the α = 0.05 level; ** significant at the α= 0.01 level.*

specific research activities, based on a five-point Likert scale. They were asked to rate nine research-related activities. For testing our first five hypotheses, we used a non-parametric Wilcoxon signed-rank test (H1) and non-parametric Mann-Whitney (U-Test) tests (H2, H4 and H5) instead of t-tests, as the data did not meet the assumptions required for a parametric test. For these hypotheses, we compared the change in research interest between two groups: those within the lowest quartile of the independent variable and those within the highest quartile. For testing our third hypothesis (H3), we conducted five separate tests, as we wanted to establish the effects of different types of research activity. Again, Mann-Whitney tests were used for comparing changes in research interest between two groups: (1) students of Q-Teams or Q-Tutorials who reported to have performed a specific research activity and (2) students of Q-Teams or Q-Tutorials who reported to not have performed this activity.

In order to visualize and compare the effect sizes of the relations analysed in the first five hypotheses, we used Pearson's r (Field, Miles, and Field 2012). Pearson's r of .10 denotes a small effect, .30 denotes a medium effect and .50 denotes a large effect (Cohen 1992).

The last three hypotheses (H6, H7, and H8) were analysed using bivariate regressions. For these regressions, R^2 was used to visualize and compare the effect size as it indicates the variability in the change of research interest that is shared by the independent variables (Field et al. 2012). Table 2 shows the hypotheses and findings.

Three of the initial hypotheses were supported in the responses. Surprisingly, the findings did not support the general hypothesis that participation in research-based learning per se increases students' research interest. Returns from the pre-test showed average interest levels of 31.5 points (median) on the summed scale of the nine five-point Likert items. The results for the post-tests were not significantly higher at 33.0 points average (p = .13). However, the second hypothesis (H2), that more research activities lead to a small to medium (Field, 2013) increase in research interest, was supported. In the post-test, results for participants who reported low levels of research activity were significantly lower (median of 30) than those of participants who reported higher levels of research activity (median of 34.5).

As the number of research activities plays a vital role in the effectiveness of research-based learning, the immediate follow-up question is *which* of these activities are most important. Our non-parametric bivariate analysis indicates that working with research literature (p = .01), developing a research design (p = .01) and carrying out empirical research (p = .05) leads to a larger increase (or lower decrease) in research interest compared to students who did not have the opportunity to conduct these

Table 3. Bivariate Analysis of Effects of Type of Research Activities

Research activities		n	U	z	r	p	
H3	To develop a research question	106	1125.5	1.48	-.14	.14	
	To work with research literature	106	841.0	2.49	-.24	.01	*
	To develop a research design	106	862.0	3.18	-.31	.01	**
	To carry out empirical research	106	1082.5	1.97	-.19	.05	*
	To write scentific texts	106	488.5	1.12	-.11	.26	

*The dependent variable analyzed is the change in research interest (α = post-test — pre-test); r denotes the effect size (Cohen, 1992); p denotes the probability of obtaining the test results under the premise that the null hypothesis is true; *significant at the α = 0.05 level; ** significant at the α =0.01 level.*

research activities (see Table 3). The effect size is small (literature and empirical research) and medium (research design).

Interpreting these results on a more general level, research-based learning does not seem to increase learners' interest in conducting research per se. However, research-based learning works if the students can engage in reading research literature, developing a research design or undertaking empirical research. It appears, though, that some activities prized in the theoretical literature on research-based learning (development of a research question, writing scientific texts) have less impact than previously thought. In our view, this does not mean that these aspects should be neglected in designing research-based learning projects. This is, after all, still work in progress. Based on these findings, we adjusted the HU-Q program slightly. Both in the calls for proposals and in the training program, greater emphasis was given to research activities, mainly giving students the opportunity to develop the research designs. In selecting proposals for funding, the commission was asked to pay more attention to whether the proposals allow for (independent) student empirical research.

Concluding Thoughts

As we have demonstrated, the debate about the relationship between research and teaching in Germany is in full flow. While the concept of research-based learning has, at long last, achieved official recognition (Wissenschaftsrat 2006), the challenge now is to develop strategies for its systematic implementation in the curricula. While not aimed at research-based learning exclusively, the *Qualitätspakt Lehre* is a first important step in this direction. Over and above the financial support provided, the *Qualitätspakt* has made research-based learning initiatives more visible and provided the first seeds for the formation of a wider community of practice across all sectors of German higher education (see Fachhochschule Potsdam 2013).

The HU-Q program is one of these attempts to implement research-based learning in a university-wide approach. The main building block of the program is to give students opportunities for independent research or research in small teams. Early research results indicate that actively engaging in research activities tends to increase the general interest of students in doing research. However, the effectiveness of research-based learning seems to be greatly associated with how it is implemented. Based on our findings, we argue that in environments of research-based learning, students need to have the opportunity to work with actual research literature, develop research designs, and embark on empirical research in order to increase their interest in research.

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