Humboldt's Come-Back? Approaches of research-oriented teaching validated and scrutinized on the basis of an empirical Analysis

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Whilst converting "Diplom"- into Bachelor's and Master's courses at German universities, conditions of education on an academic level have changed tremendously. This has often been described pejoratively as the tendency to bring university teaching into a continuation with forms of school instruction. Due to an increased formalised workload and the shortened length of studies to obtain the B.A./M.A. degree, negative effects of school like teaching have been articulated in terms of a loss of students' specific disciplinary competence, their personality development and their capacity of independent scientific thinking (e.g. Kühl 2011). Against this background, we are currently observing a revival of research-oriented methods of teaching and learning (cf. Clark 1997). The research project "Lehre hoch Forschung" (literally "teaching to the power of research") at the Karlsruher Institute of Technology financed from 2012 to 2016 by the "Qualitätspakt Lehre" of the German Federal Ministry of Education and Research by around 8 ½ million Euros is one example. The University of Tübingen which holds the title of 'excellence' has fostered research-oriented teaching continuously, but not within such a framework.

In this paper, we explore empirically in what ways approaches of research-oriented didactics at universities are used in classes, why and with what restrictions. Against the background of a comparison between the results at the Karlsruhe Institute of Technology (n=267) and at the University of Tübingen (the survey is currently online), we discuss the significance of the settings of using research-oriented methods for teaching. We will gain insights into the thinking and on the views of the teaching staff. Furthermore we analyse the results regarding considerations on the didactical way to transfer research-oriented methods into different subjects (cp. BAK 2009). Therefore we will align the canon of subjects within the KIT and the University of Tübingen and try to compare faculties with similar subjects. This tends to result in interesting aspects on (differing?) teaching and learning cultures.

The background of these studies shall be mentioned: 2012-13, xxxx was an interim professor for the research of teaching and learning at the KIT and obtained in April 2013 a professorship at the University of Tübingen. This revealed to be an opportunity to extend our research and to include another academic institution into the dataset. Beyond empirical data of the project at the KIT also data from Tübingen will be analysed and presented in this report.
In Tübingen, the survey on university teachers is complemented by a survey on students' perspective.

The survey does not favour among a variety of didactical approaches a particular one and therefore listed as generally 'research-oriented' elements the following items: "The introduction of a new theme according to a problem of scientific research"; "students are independently researching with regard to a certain theme"; "students contribute with their research activities to a bigger research project at the institute/chair"; "students develop independently research questions"; "students exercise independently experiments"; "students summarise independently the state

of research in one area"; "students develop and plan their own research project"; "students present linkages/interrelations of scientific knowledge and research". In Tübingen, the items were slightly changed since the KIT has obtained the financing for Big Science which is why a lot more laboratory work and participation in research projects of the university are possibilities. These opportunities enable students to get a flavour of real research and to practice some routines and methods but which are not necessarily combined with the challenge to develop independently a research question or the issue at stake on a theoretical plane.

A factor analysis shows with regard to those items that two factors can be distinguished. Items that load in the first factor are components of a didactical design which focus on highly *self-organised forms of learning* while items that load in the second factor show that teaching is not as much oriented towards self-dependency but rather on *guided forms of learning*. We can also resume the three definitions to distinguish didactical approaches (Griffiths 2004; cf. Healey 2005):

a) *Research-led* teaching which is a form of teaching based on the 'information transmission' model, that follows a curriculum structured around subject content, and which focusses on understanding research findings;
b) *Research-oriented* teaching which favours a curriculum structured around research processes as well as subject content, which focusses on understanding research processes, inquiry skills and 'research ethos';
c) *Research-based* teaching that is based on a curriculum designed around inquiry-based activities; its focus is on learning through inquiry and thus aims at minimising the teacher-student division.

If we consider these three forms of teaching, we can interpret the two extracted factors cover in the first case (factor 1) research-based elements while they include in the second case (factor 2) both research-oriented and research-led elements. This reduction can be underscored by strengthening that the distinction between a) and b) does not seem as big as between a) and c) as well as b) and c). Consequently, we drop the distinction of "research-oriented teaching" as a third version beyond "research-led" and "research-based" and use this term as we have already done as a generic term. This factor analysis will be repeated with the data from Tübingen to validate the two approaches that we inferred.

Although we do not aim at prioritising research-based over research-led teaching in general, we argue that students cannot develop their capacities of independent scientific thinking without practicing it. According to this thesis, it is impossible to make considerable judgments on a scientific plane if one is unable to pose relevant theoretical questions and apply self-dependently relevant criteria to it. Therefore, the complementary analysis of students' perspectives on the use of research-led or research-based methods of teaching is paramount.

The paper will discuss further salient outcomes from regression analyses what kind of attitudes and intentions have an effect of using these didactical approaches as well as the influence of teaching experience.