

# Guidelines: Research-oriented Teaching

## Definition and Possibilities of Implementation at KIT

PERSONNEL DEVELOPMENT AND VOCATIONAL TRAINING (PEBA)



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The merger into the Karlsruhe Institute of Technology (KIT) resulted in the double mission: The KIT is a university of the State of Baden-Württemberg fulfilling tasks in the areas of teaching and research and it is a large-scale research center of the Helmholtz Association, which conducts program-oriented preminent research on behalf of the Federal Republic of Germany. When pursuing these missions, the KIT acts along the three strategic lines of research, teaching, and innovation.

The KIT is the only institution in Germany that combines the strengths of a research center with those of a university. As a university of the State of Baden-Württemberg and National Research Center of the Helmholtz Association, KIT is committed to creating, disseminating, and preserving knowledge and consistently applies the principles of the unity of research and teaching.



## Excerpt from the Studying and Teaching Mission Statement – What Characterizes Teaching at KIT?

*“Teaching at KIT is aimed at qualifying young people by extensive scientific and research-oriented education and imparting interdisciplinary competencies. At the end of their studies, students are to be able to autonomously identify current and future problems, work on complex tasks, and develop sustainable solutions with the help of scientific methods. To reach this objective, KIT pursues the strategy of research-oriented teaching in line with the standards of the (classical) disciplines.*

*Teaching and studies at KIT are characterized by a student-oriented teaching and learning culture in an open and creative teaching and learning environment. This culture is the result of broad international exchange of knowledge between students and teachers as well as of extensive integration of research projects and also large-scale research projects in education.”*

*(Translated excerpt from the Studying and Teaching Mission Statement of KIT:  
<http://www.pst.kit.edu/452.php>).*

In line with this mission statement for teaching at KIT, all students are to be given access to current research topics and the necessary resources in the first semesters of their bachelor programs already. This teaching strategy is aimed at integrating students actively into research projects and at interlinking research and teaching for the complete duration of the studies (bachelor and master programs).

### Graduates of KIT are enabled

- ✓ to autonomously identify future problems;
- ✓ to derive the corresponding tasks;
- ✓ and to develop sustainable solutions with the help of scientific methods.

To reach these objectives, KIT pursues the strategy of research-oriented teaching in line with the standards of the (classical) disciplines.

## What Are the Objectives of Research-oriented Teaching?

Research-oriented teaching provides students with lectures and courses that directly refer to research. Based on current research topics and research results, students are given insight into scientific work in their discipline. In addition, students gather theoretical knowledge about their subject, realize the practical relevance of this knowledge, and are enabled to derive new, own findings by applying this knowledge. Research-oriented teaching interlinks the theoretical and practical parts of scientific knowledge acquisition. This helps the students develop specialized know-how and enhance their multidisciplinary competences. Students are prepared for a career in science, research, economy or industry by the development of a scientific and reflexive competence to act.

### Objectives of Research-oriented Teaching

- ✓ Acquisition and further development of specialized know-how and multidisciplinary competences.
- ✓ Development of a research attitude: Enhancing curiosity and the capability of scrutinizing things, asking questions, and developing solution options.
- ✓ Development of research methodologies.



## General Definition: What Is Research-oriented Teaching/ Research-based Learning?

Research-oriented teaching combines two major fields of action of a university. “Research” and “teaching” are to be pursued together and to be combined in practice. Activities typical of research are to become integral constituents of the learning process. Students are to be given deep insight into current research topics of their subject as well as into core elements of scientific work.

Meanwhile, research-oriented teaching has become a widely used concept, which has resulted in a variety of definitions and conceptions and various ways of implementation. Apart from “research-oriented teaching”, many German universities also practice “research-based learning”. **These conceptions differ in the extents of active participation of students in research.**

### Research-oriented Teaching

- is based on current research results and topics;
- integrates students into research activities;
- the activity lies with the teacher rather than with the student.

### Research-based Learning

- The students actively pass a complete research process.
- Students autonomously conduct research and learn on the basis of this research activity.

**Definition of “Research-based learning” according to Huber:** In research-based learning, students can “(co-)design, experience, and reflect the process of a research project [...] in its major phases – from the development of questions and hypotheses to the selection and application of methods to the review and presentation of results - by autonomous work or active participation in a comprehensive project.” (Huber 2013, p. 11)

### Common Elements of Both Conceptions

- Vicinity of learning to research, generation of “new knowledge” as a driving force.
- Acquisition of knowledge along the individual stages of a research process.

## General Definition: Orientation of Learning to the Research Process

Close-to-research teaching formats are to make the individual stages of a research process an integral constituent of the learning process and to provide students with insight into current research topics of their subject as well as to familiarize them with scientific work. By way of example, the flowchart below illustrates implementation options along the phases of a research process. While research-based learning covers all phases and

makes the students participate in the complete research process, research-oriented teaching specifically concentrates on some phases and makes them subjects of the studies. These individual phases may be interconnected or overlap. However, tasks and learning options may be defined for all elements of the research process and research topics and approaches can be integrated into teaching in various ways.

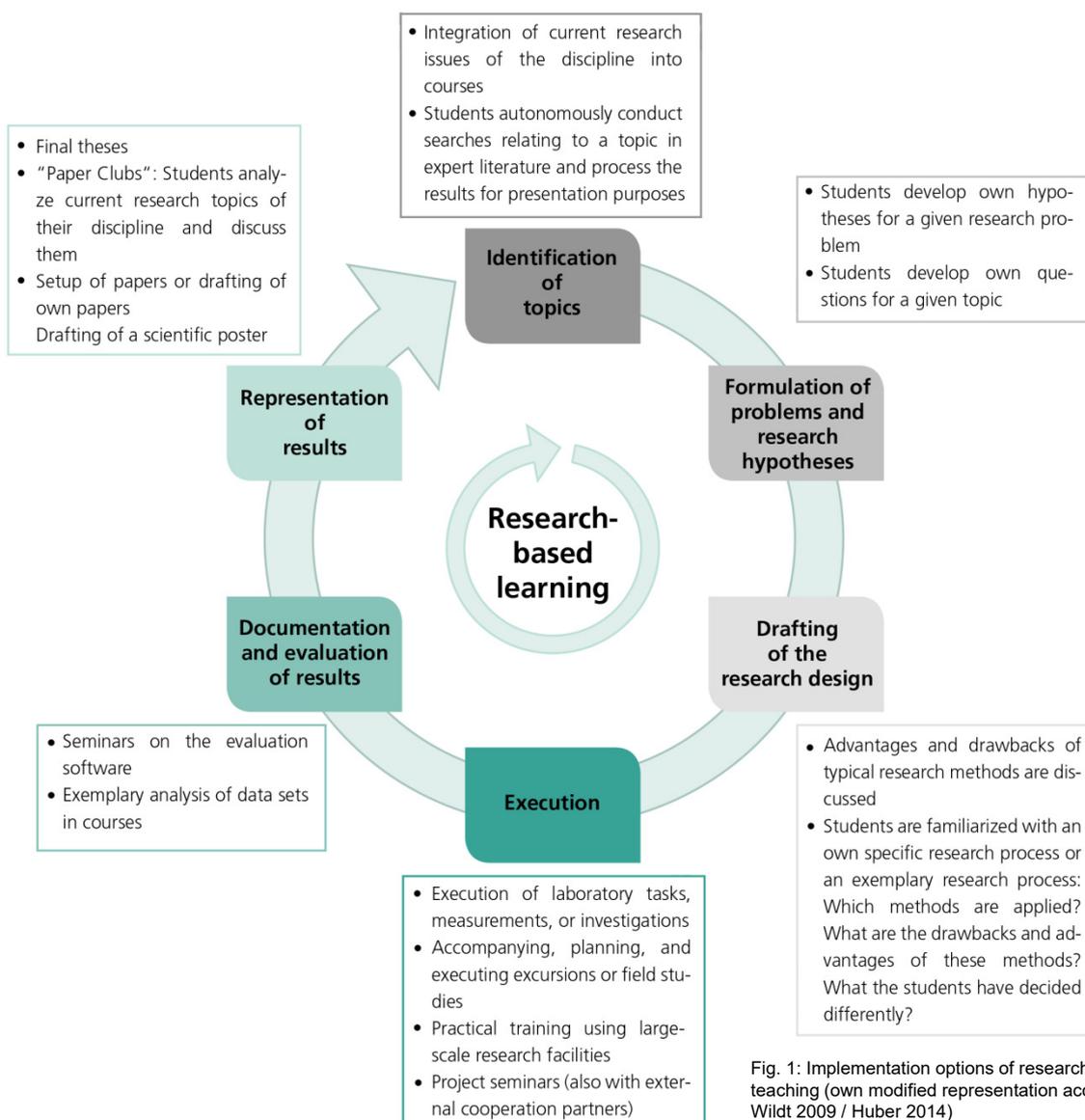


Fig. 1: Implementation options of research-oriented teaching (own modified representation according to Wildt 2009 / Huber 2014)

## Definition: What Does Research-oriented Teaching Mean at KIT?

Research-oriented teaching is an integral constituent of KIT's teaching mission. On this basis, the research-oriented teaching strategy is to be incorporated in all study courses and modules and to be applied to an increasing extent throughout the KIT.

Research-oriented teaching at KIT covers a variety of ways of interlinking research and teaching. The wide definition includes both research-oriented teaching formats as well as formats of research-based learning.

At KIT, various research-oriented teaching formats can be implemented in various ways. The central

idea is to familiarize students with current research topics and processes of their discipline during the early study phases already and to provide them with scientific methods to solve problems and generate results. Eventually, students are to be enabled to autonomously plan, execute, and reflect own research projects.

Implementation options of research-oriented teaching at KIT are illustrated by the flowchart below (Personnel Development and Vocational Training in cooperation with the Presidential Committee according to Haley/Jenkins 2009).

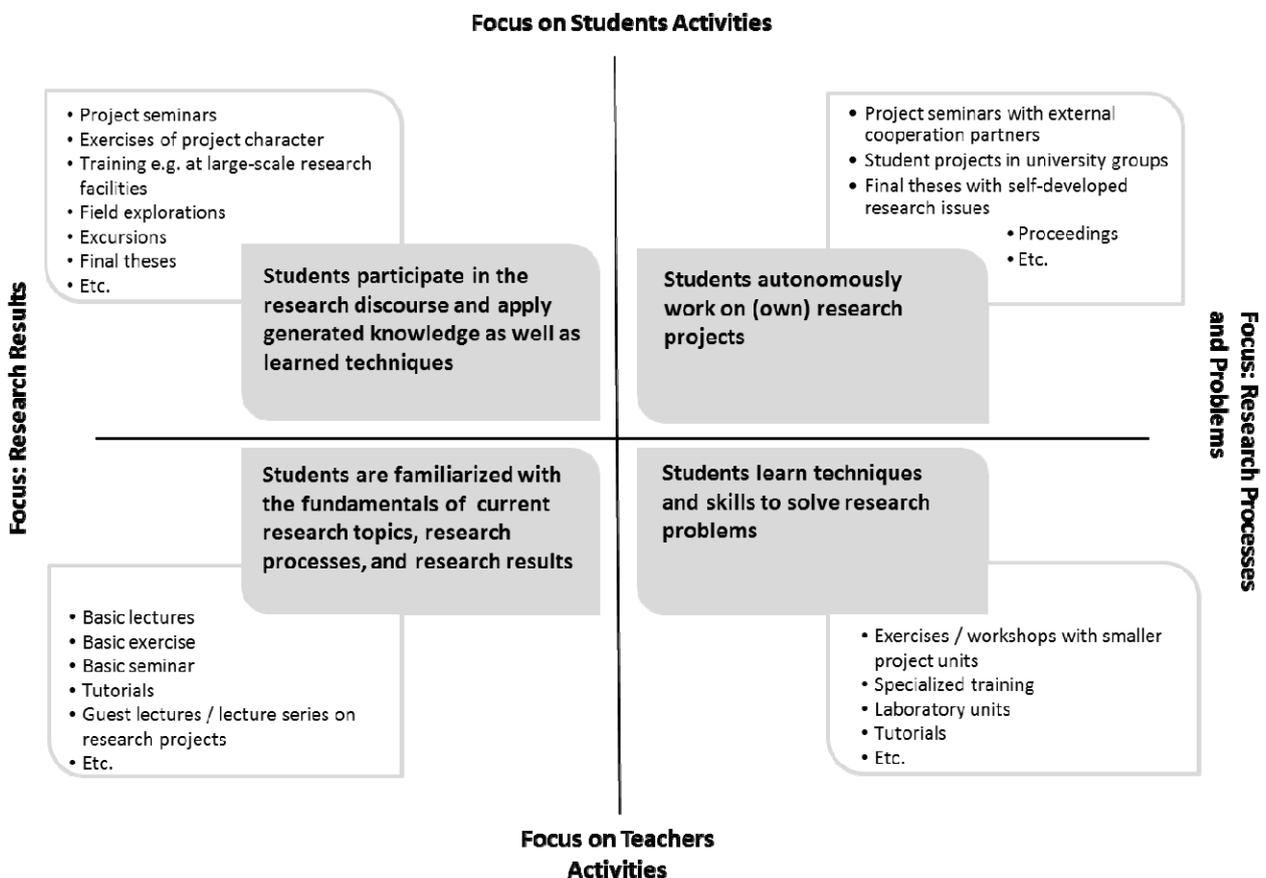


Figure. 2: Implementation options of research-oriented teaching at KIT

Between the teachers' and students' activities and between the focuses on research results and on research processes / problems, all teachers of KIT can apply various teaching formats to implement various aspects of research-oriented teaching.

The ways of interlinking research and teaching extend from basic lectures to familiarize students with the fundamentals of current research topics, processes, and results to active participation in the research discourse to autonomous work on

(own) research projects (final theses, project seminars).

At KIT, all implementation options are summarized under the strategy of "research-oriented teaching". The flowchart below contains both formats of research-based learning according to Huber as well as formats of research-oriented teaching and shows where these concepts (described on page 5) can be found at KIT.

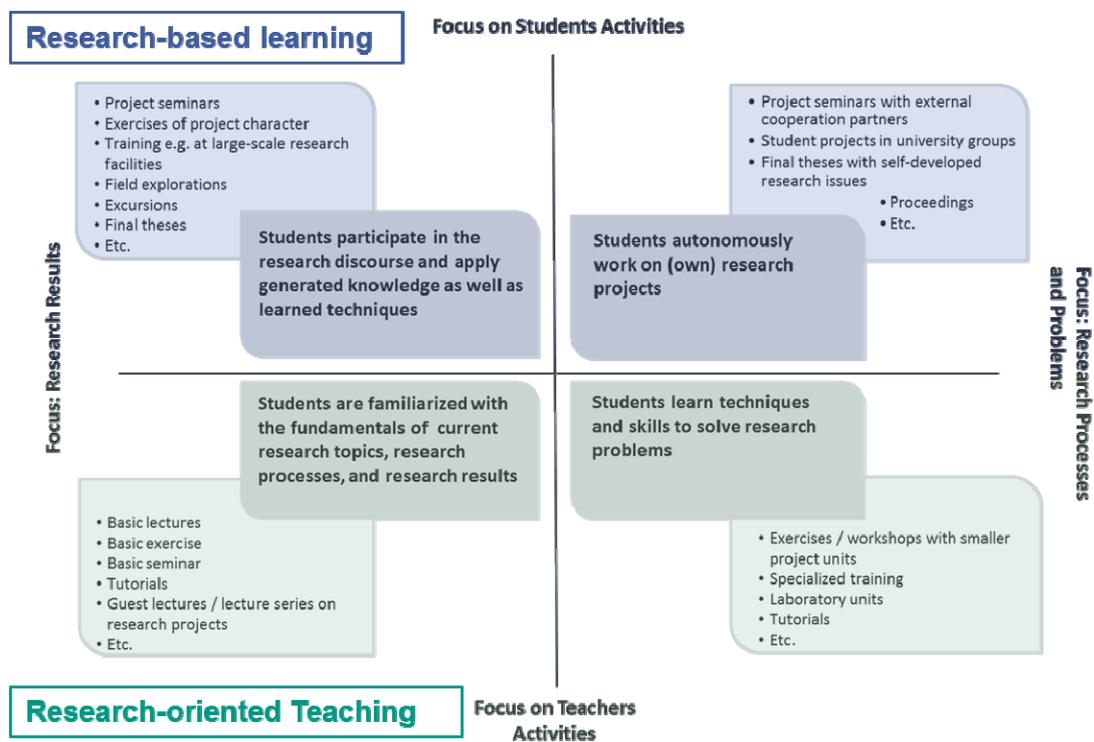


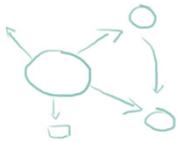
Figure. 3: Research-oriented teaching at KIT in the context of the general definitions

*Our tip:*

Concrete possibilities and examples of research-oriented teaching at KIT can be found here: [HIER LINK ZU ENGLISCHEM SCHAUBILD EINFÜGEN](#)

## How Can Research-oriented Teaching Be (Increasingly) Integrated into Your Regular Teaching Practice?

Most probably, current research results and topics are already integrated into your lectures in certain ways. Hence, you are implementing the teaching strategy of KIT deliberately or without even knowing it. In general, we would like you to make research visible and tangible for your students!



**Do not only visualize the research results, but also the process of finding these results.**

- Make the students realize how new knowledge is generated, how scientific problems are handled, and setbacks can be overcome.



**Allow for an analysis from various perspectives, encourage students to scrutinize existing constructs and results.**



**Do not determine “right” and “wrong” in advance, but permit alternative solution paths.**



**Do not only impart solid expert knowledge, but also leave room for the development and testing of own ideas and approaches.**



**Have the courage to enhance and implement research-oriented teaching in big events as well, e.g. by:**

- Presenting own research and the associated studies, setbacks, and methods applied
- Interactive discussion of current research results in the respective discipline
- Presentation of small exemplary experiments
- Indication of limits of science and research
- Giving the students time to exchange information on a specific research topic/a certain hypothesis



**Give the students the opportunity to practically immerse into specific research.**

- Prepare authentic, up-to-date, real, or close-to-reality problem situations in the respective disciplines for autonomous study by students.
- Support the students by providing advice, appropriate material, and specific theoretical input during work on the problem/project.
- Support the exchange of information between you and the students and among the students.

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