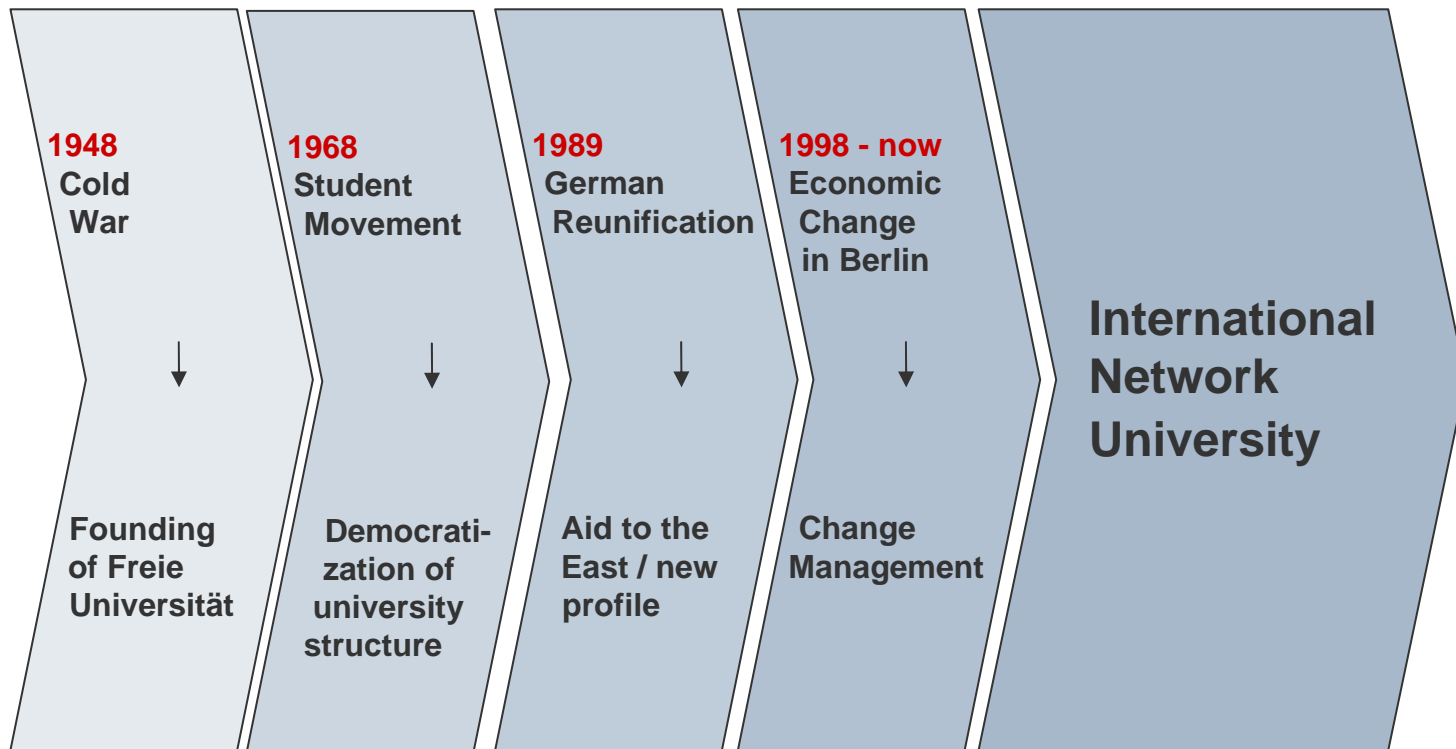


# Inquiry Based Learning of Math & Sciences in Primary Education

Christine Keitel, Vice-President of Freie University Berlin

## The Freie Universität: A Learning Institution





# **Inquiry Based Learning of Math & Sciences in Primary Education**

Christine Keitel, Vice-President of Freie University Berlin

**Necessary Reconceptualization of Teacher Education:**

**New Teaching and Learning at HEIs as Pattern and Prerequisite of  
New Teaching and Learning in Schools**

# **Inquiry Based Learning of Math & Sciences in Primary Education**

**Reconceptualization of teaching and learning at HEIs:  
Learning and teaching at university versus prior  
experiences of learning and teaching, i.e. experiences of our  
students in their pre- and school life.**

**How much are these experiences influencing and  
counteracting their perception of learning and teaching at  
university level?**

**And how do they transmit these experiences to their later  
teaching primary students in schools?**

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## How to get to know about?

How to make them aware of prior learning (and teaching) experiences by the (maybe) very different teachers in the various subjects at schools?

**And how do these experiences shape or even determine their conceptions of teaching and learning science and mathematics later in schools as teachers?**

Why are some subject teachers more appreciated or accepted than others?

What about their special experiences with **math and science teachers?**

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## Conceptualization of teaching and learning at HEIs

### Example 1:

- „**Mathematical Biographies**“ of newly incoming students that describe and reflect their school experiences of learning and teaching mathematics,
- expose teacher students perceptions of learning and studying
- to know the pre-university-experiences and perceptions of learning and teaching of students became an urgent need.
- a necessary prerequisite of planning for teaching activities offered as learning activities and special opportunities for reflection of teacher students

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**Conceptualization of teaching and learning at HEIs:  
To learn about students' perceptions of teaching and learning**

- What kind of **experiences with mathematics and sciences** have they made during the course of your life – in the various types of schools
- Which particular events do still occupy your thoughts in the context of mathematics education? What particular questions are still bothering you concerning mathematics and/or sciences?

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**Conceptualization of teaching and learning at HEIs:  
To learn about students' perceptions of teaching and learning**

- What does differentiate mathematics and natural sciences in a characteristic way from other disciplines, content areas or sciences? Why is it important that you - as future teacher for primary or secondary schools - are asked to study mathematics and science as a discipline?
- Please report about your specially appreciated or favored math and science teachers: Which were their extraordinary signs of quality that made a difference to other teachers? What characteristics are typical for an inappropriate or disliked math teacher?

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**Conceptualization of teaching and learning at HEIs:  
To learn about students' perceptions of teaching and learning**

- On the base of your personal experiences with mathematics education: Which are the most important and essential questions of mathematics teaching and learning? What do you first at all really want to experience, learn and know about in your mathematics seminars?
- What makes some teachers so successful that they are easily accepted - at university and by their students and what perception of teaching and learning do they apply?

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## Conceptualization of teaching and learning at HEIs:

- One major lack of experiences in school life refers to **learning as researching and problem solving** and **teaching as encouraging and facilitating problem solving activities** including **critical reflection**.

Teaching is often experienced as just “telling” and “examining”.

- One reason is often quoted: We have to focus on learning certain subject areas/topics and procedures as there are so **many “facts” to know in order to pass exams or tests!**

And this has to be applied to school teaching as well.

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**Conceptualization of teaching and learning at HEIs:  
To learn about students' perceptions of teaching and learning**

- How could we as university teachers show that learning and teaching is different? It is not the range of facts to know, but the challenging and intelligently formulated questions and the eager pursuit of (re)search interests and questions that make a successful scientist and mathematician.
- To build upon already existing experiences and knowledges respecting first of all urgent questions that eager students bring with them at the beginning of their studies

**Show us how to do it ourselves and to learn differently!**

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**To learn about students' prior perceptions of teaching and learning**

How do teacher students react to a challenge by a primary student:

**The story about dealing with ZERO in grade 3**

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Teaching and/ or Learning?

How to change perceptions of traditional school teaching?

An important metaphor to perceive teaching and learning in new ways is provided by referring to the organization and prosecution of research activities:

- **as successful researchers we are successful learners**

as we learn by our research what has been unknown and unexpected by us so far and go beyond

How to make use of **the ways and kind of activities** that are **characteristic for scientific research** and allow to **perceive and organize learning at university - as well as in schools as teachers - a research activity?**

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**Organize teaching to facilitate learning as a research activity in schools as well:** how much freedom, how much advice and support is necessary? This is a question of research on learning and teaching mathematics and sciences.

**Design a new learning culture:** Learning is for **teachers and students**, their **responsibility as well as obligation**, to create **acceptance by teachers**, provide **appropriate opportunities as well as good examples by their own researching activities and outcomes**; encouraging students to experiment with their own capacities, formulate problems and undertake appropriate related activities.

**“Result of a problem is 25, what was the problem?”**

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## Teaching and/ or Learning?

- Leading teachers to new thinking about learning by creating a new culture of teaching publicly **acknowledging teaching as a major and important part of university life** (it should not be only research that counts as criterion of success!)
- Change the **imbalance of appreciation for research** (getting awards, research money, prizes) **and for teaching** (perceived often as a burden, time-consuming, not acknowledged by others than maybe students only...).

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Teaching and/ or Learning?

- Teaching is **THE** very important part of university life
- **Successfully learning and researching students are our future!**

However we have to necessarily change attitudes and behavior on the side of the **professorial teaching staff** - and the **external conditions** of being **respected and awarded equally as teachers and as researchers.**



**Thank you for your attention!**