

# Transforming Traditional Lecturing in Physics to Interactive Teaching



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PRO-Aktiv  
Physik in Rosenheim – Aktiv und  
kontinuierlich just-in-time verstehen  
[www.th-rosenheim.de/pro-aktiv.html](http://www.th-rosenheim.de/pro-aktiv.html)

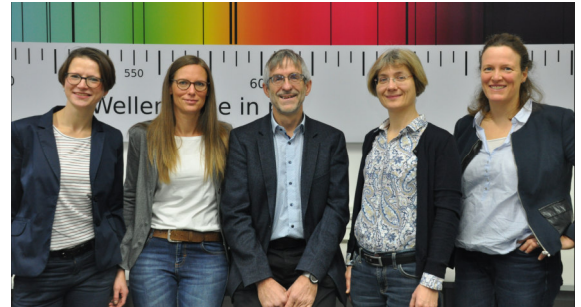


## Outline

- ◆ Background for the Change Process
- ◆ Methods PI / JiTT / Tutorials (McDermott)
- ◆ Our way
- ◆ Impacts



- ◆ started with traditional lectures
  - like we were taught
- ◆ were unsatisfied with results
  - share similar attitudes → teaching team
- ◆ 2012 started changing to JiTT/PI/tutorials
  - learned from Christian Kautz, Peter Riegler, Cynthia Heiner



PRO-Aktiv-Team:  
coworkers F.Graupner, M.Weber,  
lecturers: E.Junker, S.Stanzel, C.Schäfle

# A dream ...



Students  
... arrive prepared to the lessons  
... work continuously and actively during the lessons

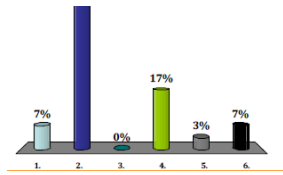
Instructor  
... knows students' difficulties



# Methods

## Peer Instruction (PI): Procedure

### Concept Question



individual, anonymous answer

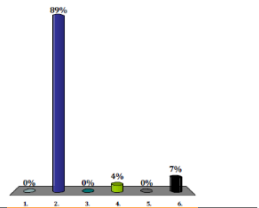
### Peer Discussion Phase



<http://blog.pearinstruct.net/2012/08/21/how-to-measure-if-your-students-are-learning-in-a-flipped-class/> 11.10.2015

Discussion in peer-groups

*teacher listens to find misconcepts*



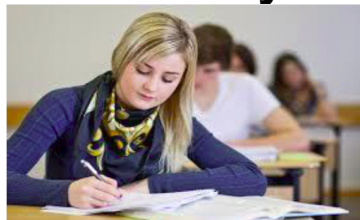
new answer

ensure correct comprehension

# Methods

## JITT (Just-In-Time-Teaching): Procedure

### Self-study



Study assignment & online pre-quiz

### Classroom presence



Lesson tailored to students' quiz answers and questions

More ambitious online post-quiz

Taking up of still open questions



## Self-study Phase

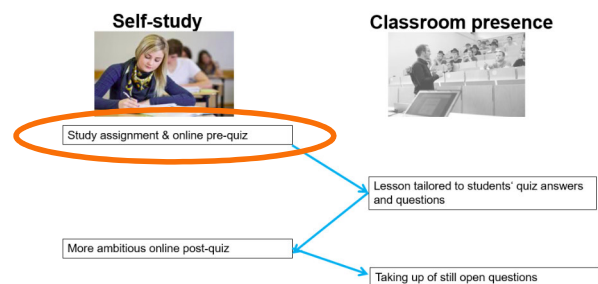
### Instructor:

gives

- ◆ learning objectives
- ◆ study assignment
- ◆ literature recommendations

### Students:

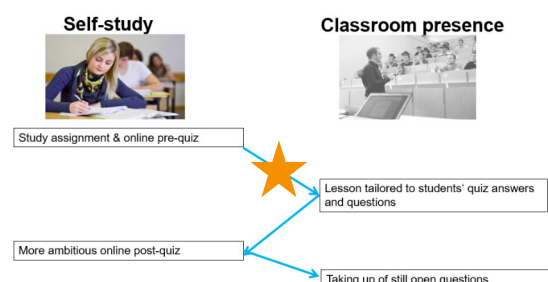
- ◆ prepare self-study-unit (i.e. connect to subject)
- ◆ do online-quiz



## ★ Preparation of 'lecture' „Just-in-time“

### Instructor:

- ◆ Evaluates answers of quiz (statistics)
  - abundance of missing right answers
  - abundance of wrong answers
  - answers on 'question to ask a question' (with e-mail feedback)
  - students tell what teacher should cover
- ◆ Prepares the classroom phase
  - lecturing parts
  - PI-phases
  - interactive phases





## Classroom-presence Phase

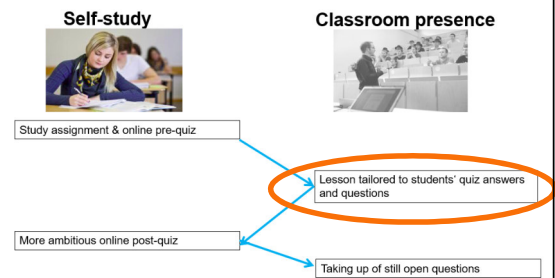
### Instructor:

- ◆ visualize central theme
- ◆ fast presenting the highlights, traditional lecturing part
  - *interwoven: addressing students' difficulties with the subject:*
    - „I saw, many had problems with ... “
- ◆ addressing questions and answers from students (from quiz & live):
- ◆ working through parts of the online-quiz

### Students:

- ◆ Interacting with teacher: questioning and answering
- ◆ Peer Instruction discussions

➔ much more lively teaching (20/40 instead of 2/40 voices in the room)



# Our Way Obstacles and Solutions



- ◆ No affordable “Ready-made-materials” available like ‘Mastering Physics’
  - we develop our materials ourselves
  - → materials are well adapted to (special) courses
    - we discover new misconcepts and wrong thinking
- ◆ There are formal restrictions about midterms and bonus systems
  - 3, 5 or 10 % bonus to end-of-term exams sufficient for high student motivation
- ◆ Only discussing student problems is not sufficient
  - presentation of chapter highlights interwoven with problems much better.
  - self-reliance and independency of students can be developed

➔ successful results



## Important communication to students before & during teaching:

- ◆ Why study assignments?
  - ◆ Use 'lecture' time more efficiently to...
    - ... clarify understanding problems
    - ... gain time for PI-questions
    - ... activate students
  - ◆ good 'lecture' preparation  
= good exam preparation
- ➔ i.e. learning to study

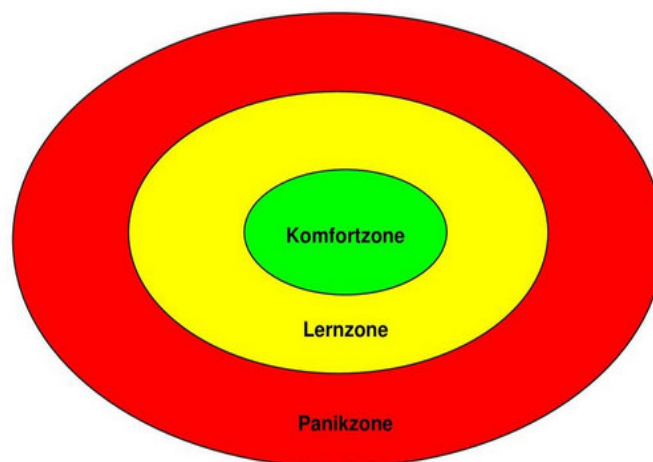


Cynthia Heiner, CC-BY-NC

# Framing Learning ≠ Comfort



- ◆ Learning Zone Model (Michl 2009)
  - Learning = Growing beyond Comfort Zone
    - but avoiding panic zone



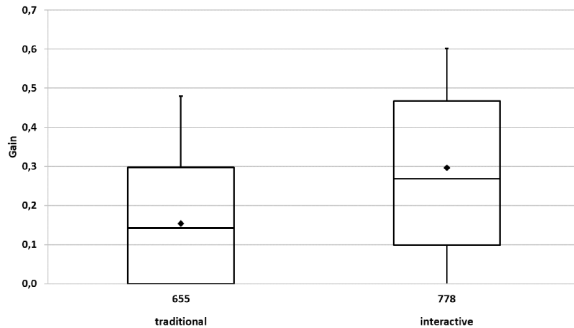
<http://docplayer.org/19719757-Kreative-aktive-erlebnispaedagogik-in-der-schule.html>  
<https://de.wikipedia.org/wiki/Erlebnispaedagogik#Lernzonenmodell> 12.06.2019

# Impacts

## Examples of our findings

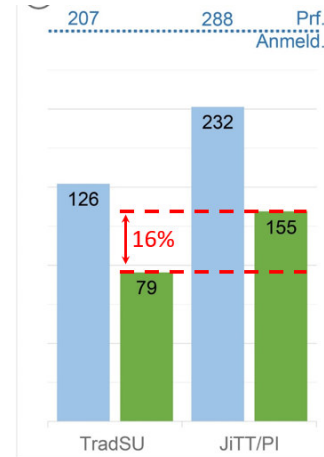


- ◆ FCI gain doubles 0,13 → 0,28
  - traditional vs. interactive



Publication (Stanzel, Junker, Schäfle) PTEE-Proceedings Delft 2019  
(PTEE= Physics Teaching in Engineering Education) <http://www.sefiphysics.be/conferences/index.html>

- ◆ 16% more exams passed at first possible date
  - traditional vs. interactive



Publication (Graupner, Junker, Stanzel) Proceedings MINT-Symposium Nürnberg 2019  
Download Oct 19: <https://www.diz-bayern.de/publikationen/dina-und-tagungsbaende>

## Summary



- ◆ Interactive Teaching and Learning is
  - .. more fun
  - .. more efficient
- ◆ Try it!
  - .. e.g. one interactive unit per month
  - .. asking and listening to the students is essential
  - Adapt to your personality as teacher and to your students
- ◆ JiTT saves times and gives room for PI.
- ◆ The classroom is your didactical lab! Experiment!

# Thanks for Joining Our contacts



Receiving national teaching award  
„Ars legendi-Fakultätenpreis Physik 2017“  
Humboldt University Berlin 30.03.2017  
(l.to r. E.Junker, S.Stanzel, C.Schäfle)



◆ [www.th-rosenheim.de/pro-aktjv.html](http://www.th-rosenheim.de/pro-aktjv.html)

- [www.th-rosenheim.de/junker.html](http://www.th-rosenheim.de/junker.html)
- [www.th-rosenheim.de/stanzel.html](http://www.th-rosenheim.de/stanzel.html)
- [www.th-rosenheim.de/schaefle.html](http://www.th-rosenheim.de/schaefle.html)