Interactive Teaching in Engineering Studies

Action-oriented teaching of technical content

Birgit Rabel & Sabrina Romina Sorko

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FH JOANNEUM
UNIVERSITY OF APPLIED SCIENCES

Location

APPLIED COMPUTER SCIENCES BUILDING, ENERGY & SOCIETY ENGINEERING
HEALTH SCIENCES MANAGEMENT MEDIA & DESIGN

12,000 Graduates
4,300 Students

6 Departments

Industrial Management (IWI)

- Bachelor IWI full time
- Bachelor IWI part time
- Master IIM full time
- Master IIM part time
- Master ISM part time

= Industrial Engineer-Study Degree

- Economy
- Engineering
- Applied Informatics
- Practical Experience
- International

1.200 Graduates
350 Students

Smart Production Lab
Why do we need...?

/ Institute Industrial Management – focus on technical and economic competences in an applied way
/ Bad evaluations and high drop out rates especially in technical classes
/ Various initiatives to improve technical classes and make them more hands on oriented for the students
/ Scientific focus on didactics for technical content – orientation mainly on the DACH (german speaking region)
/ Forcing not only traditional technical competences but also taking new technological developments into account (especially regarding digital transformation)
Technical didactic...What’s that?

/ Teaching and training technical content in a hands on way in order to master also complex situations

/ Complex situations are embossed by the digital transformation, thus new areas of competences are required from the employees

/ New requirements also for education:
  • Hands on training
  • Diversity of teaching- and training methods
  • Problem based training
  • Training the ability to think in a networked way

/ attainable through multidimensional didactical concepts especially for technical content
... but how does that work?

**Technical Content**

- Literature based
- State of the art
- Practical examples

**Competence Matrix**

- Covers technical content
- Defines competences on three levels
- Based on Blooms taxonomy

**Method Fact-Box & Description**

- Ressources needed (time, material...)
- Suitable training goals

**Method Example**
I hear and I forget.
I see and I remember.
I do and I understand.

KONFUZIUS
551-479 B.C.
think it. make it. share it.
Are you ready for the action?
Running Lights — understand and apply

**Competences**
- Built an electric circuit
- Understand the functionality of electronic components
- Apply Codes for a project
- Transfer the knowledge to a sample project

**Content**
- Functionalities of Arduino IT Infrastructure (Hardware, Software)
- Connecting Hardware and Software
- Electronic Components (resistor, LED)
- Program code
- Electric Circuit

**Method**
- Presentation Lecturer (Hardware Functionalities)
- Existing Codes „Blink“
- Change Codes „Morse Code S.O.S“
- Incomplete Codes

- Repetition: www.tinkercad.com
- Repetition: www.kahoot.it
- Extensions/Evaluation Matrix: FOR-Loop, Sound...

Setting:
- Groups of 2
- Duration: 3 course units

**Method**

- Functionalities of Arduino IT Infrastructure (Hardware, Software)
- Connecting Hardware and Software
- Electronic Components (resistor, LED)
- Program code
- Electric Circuit
Practical experience

/ cost-effective open source solution
/ easy to handle – also suitable for beginners
/ Training of IT skills, personal and social competences
/ Many examples and answers on the Internet available
/ Many methods contribute to a rich and stimulating learning process (www.kahoot.it)
/ The combination of real and virtual world shows immediately results
/ Trial-and-error approach needs time
References

Implementation of several projects and studies that led to a volume, published in 2019 in Springer.

2 Sections within the book:

- *Basics of technical didactics*
  state of the art concepts such as hands-on approach, goal-oriented teaching but also digital competences

- *Technical teaching and practice catalog*
  part I – (scientific) technical content
  part II - interactive exercise part that refers to the technical content