Learning on the AutFab - the fully automated Industrie 4.0 learning factory of the University of Applied Sciences Darmstadt

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Topics covered

- Industrie 4.0: from requirements to competences
- I4.0 smart learning factory AutFab
- Education in the AutFab: Labs & Student Projects
- Results of student projects & Actual projects
- Conclusions
### From requirements to competences

<table>
<thead>
<tr>
<th>Crucial aspects of production</th>
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<tbody>
<tr>
<td>Productivity</td>
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<tr>
<td>Flexibility</td>
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<tr>
<td>Quality</td>
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<tr>
<td>Availability, Reliability</td>
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<td>Delivery time</td>
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<td>Inventory</td>
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<td>Commissioning time</td>
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<td>Assisted Production</td>
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<td>Remote Control</td>
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<td>Documentation</td>
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<tr>
<th>Crucial technologies</th>
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<tr>
<td>PLCs Embedded Systems</td>
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<td>Communication technology / Interfaces</td>
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<tr>
<td>Visualization &amp; Assistance Systems</td>
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<td>Sensors, Actuators, Identification systems</td>
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<td>Security &amp; Safety</td>
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<td>MES, ERP, PLM, PDM</td>
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<td>Simulation Systems</td>
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<td>Web technologies</td>
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<td>Cloud Services</td>
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<td>Big data analytics</td>
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<th>Required competences of engineers</th>
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<tr>
<td>Holistic system comprehension</td>
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<td>Problem solving abilities</td>
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<tr>
<td>Independency</td>
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<tr>
<td>Interdisciplinary expertise</td>
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<tr>
<td>Knowledge of production processes</td>
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<td>Knowledge of crucial technologies</td>
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<td>Knowledge of business processes</td>
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<tr>
<td>Project management</td>
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<tr>
<td>Communication / presentation skills</td>
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<td>Ability to abstract</td>
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Following C. Prinz et al.
Industrie 4.0 Smart Factory AutFab
Industrie 4.0 Smart Factory AutFab

- Fully automated assembly line on 50m²
- State-of-the-art production components used in industry
- Interdisciplinary supervisor and student teams: Electrical Engineering, Mechanical Engineering / Mechatronics, Optoelectronic and Image Processing, Economic Engineering of 5 faculties
14.0 learning factory AutFab: Assembly of product

- **Base**
  - 2 contacts
  - 3 contacts
  - 4 contacts

- **Protection module**
  - red LED
  - green LED

- **Relay**
  - 2 CO contacts
  - 3 CO contacts
  - 4 CO contacts

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The learning factory AutFab

- Automatic optical & weight inspection
- Automat. electrical inspection
- High-bay storage
- Pneumatic press
- Six-axis robot
- Shuttle system
- Rework station

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• **Standard lab in course „Information Systems in Industrial Automation“**
  – 3 hours, connection Matlab via OPC to PLC and to AutFab

• **Problem-based learning lab as Visualization-Lab (Teams of 2)**
  – Date 1: Introduction to software by working on an example, dedication to work station, specification
  – Date 2:
    Concept review

  – Date 2 – 5: Implementation

  – Review and grading

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• Project based learning

Tasks of students

- Choice of project
- Project planning
- Design
- Implementation
- Verification
- Validation
- Document/Poster/Video
- Presentation

Presentation project ideas ➞ Guide by side ➞ Grading

Tasks of teachers

Source: h_da, Britta Hüning

Video: „Studentisches Seminarprojekt an der Hochschule Darmstadt - Sichere Produktion“
https://www.youtube.com/watch?v=HjbybaMXtDQ
Students have to acquire new competences for Industrie 4.0

- Limited time of one semester => Limited complexity
- Solution has to fit to AutFab => Limited solution space
- Amount of guidance depends on complexity, team and preceding documentation
+ Evaluation of Education in AutFab: Very positive results
+ Students
  + are extremely motivated
  + get acquainted with new technologies for Industrie 4.0
  + link the theoretical knowledge of the lectures within this projects
  + improve: project management, ability to independently gather information and to learn the ropes of technical unknown subjects, ability to solve complex problems, ability to work in teams, communication, presentation and documentation skills
+ Teachers acquire new know-how for their lectures
+ AutFab is a good demonstrator to attract interests of possible students
+ Videos for education of people outside the university are watched very often

⇒ Project-based and problem-based learning in the I4.0 learning factory AutFab has a sustainable positive effect in the student education

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Student work in AutFab

Source: h_da, Britta Hüning
Industrie 4.0 in the AutFab: An inspiring way of education!

Questions?

Channel: CRAatHDA

http://cra.eit.h-da.de/

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