



Virtual Laboratory in Mechatronics (MARVEL project)

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Content



- Introduction
- The idea behind MARVEL
- Pros and cons of different learning arrangements
- Mixed Reality Learning Space
- Conclusion

Research Center artec / artecLab



Focus of research

- Human Computer Interfaces
- Mixed and Virtual Reality
- Simulation and Games
- Learning Environments



Research projects

- MobileAuthor- Tools for Computer based Astronaut Training
- BREVIE - Bridging Reality and Virtuality with a Graspable User Interface (IST)
- DERIVE - Distributed real and virtual Learning Environment for Mechatronics and Tele-service (IST)
- Lab@Future - School Laboratory anticipating Future Needs of European Youth (IST)
- MARVEL - Virtual Laboratory in Mechatronics: Access to Remote and Virtual e-Learning (Leonardo)



Introduction to MARVEL



- **A European Leonardo da Vinci pilot project**
- **Focused on vocational training in mechatronics**
- **Special attention to needs of work process oriented e-Learning**
 - Integration of e-Learning into practical learning sequences
 - Virtual learning in combination with learning in laboratories, at work places, ...
- **Target groups of MARVEL**
 - Students in vocational education and training
 - Teachers / instructors in colleges and companies
 - Developers and providers of learning media, tools and environments

Project partners



① Technical colleges

- DEL (Germany)
- HTI (Cyprus)
- WLC (Scotland)

② Enterprises

- ZENON (Greece)
- FESTO (Germany)
- BNW (Germany)

③ Qualification authority

- SQA (Scotland)

④ Universities

- FEUP (Portugal)
- Uni Bremen/artecLab (Germany)

⑤ Associated partner

- SION/HEV (Switzerland)

Coordinator:  art
work
technology

The idea behind MARVEL



- To develop and evaluate a training concept that supports a 'mix' of virtual in combination with practical learning
- Integration of different...
 - virtual and real learning media and tools
 - learning places (school, laboratory, work place, home, ...)
 - learning activities based on experiential learning concept



Mixed Reality Learning and Working Environment

Objectives



- Development of a conceptual framework (pedagogical, technical)
- Design of courses and development of e-learning content
- Creation of learning scenarios, environments and implementation of courses
- Application of project evaluation and dissemination of project result

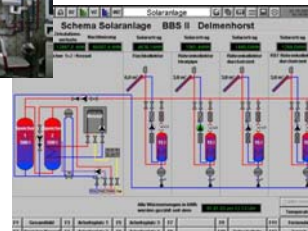
Solar Energy e-Learning Laboratory (pilot system)



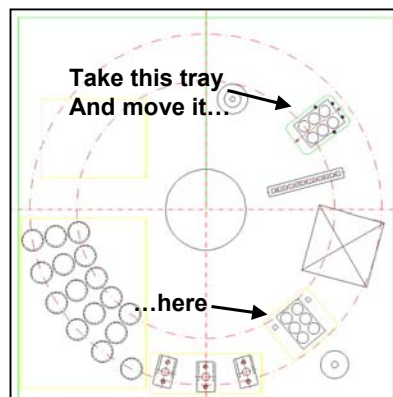
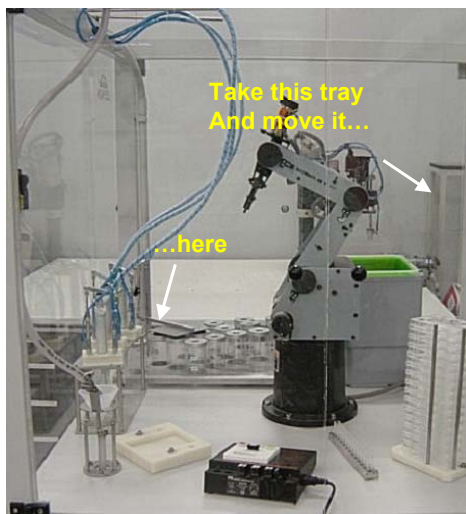
Solar Heating Laboratory (full-scale)



Berufsbildende Schulen II
der Stadt Delmenhorst



Industrial training for robotics by remote experts



Experiments in Mechatronics (on-site, remote)



Robotics

PIC Controllers

Deltronics control box

Electro pneumatics

Simulation



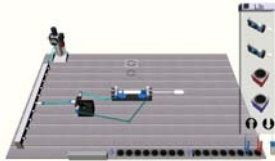
Mixed Reality Laboratory for Mechatronics



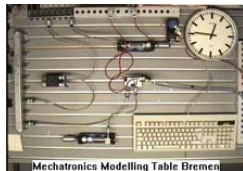
Virtual lab

Physical (,real') lab

1. Pure virtual setting (virtual lab)



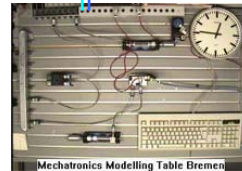
2. Pure 'real' setting (remote lab)



3. Distributed Mixed Reality setting



„air through the Internet“



Different learning arrangements – pros and cons

- Traditional classroom instruction
- Online course
- On-site training
- Remote laboratory / workshop
- Virtual laboratory (simulation)
-

On-site training at the work place



On-site training at the work place



■ Pros

- Real world tasks (community of practice)
- Learning by doing (motivation)
- Haptic experience

■ Cons

- Safety issues
- High costs
- Room for conceptual learning and abstraction ?
- Difficult to provide in distance learning concepts



Remote laboratory / workshop



Intranet
Internet



Remote laboratory/ workshop

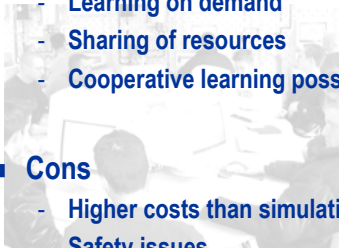


■ Pros

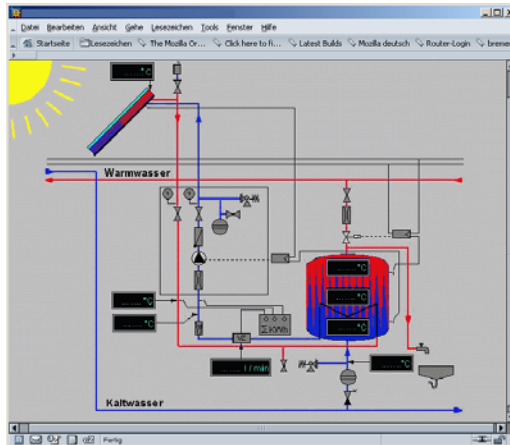
- Learning on demand
- Sharing of resources
- Cooperative learning possible

■ Cons

- Higher costs than simulations
- Safety issues
- Technology



Virtual laboratory (process simulation)



Virtual laboratory (process simulation)

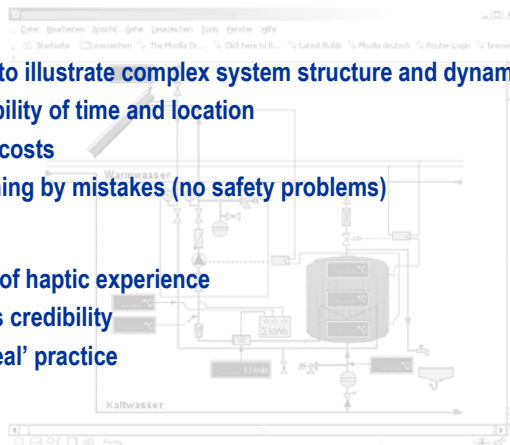


■ Pros

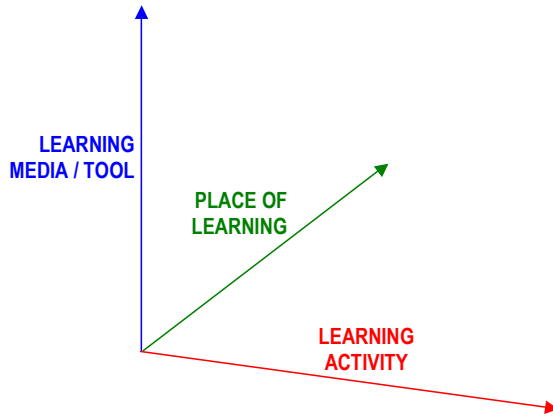
- Ideal to illustrate complex system structure and dynamic behaviour
- Flexibility of time and location
- Less costs
- Learning by mistakes (no safety problems)

■ Cons

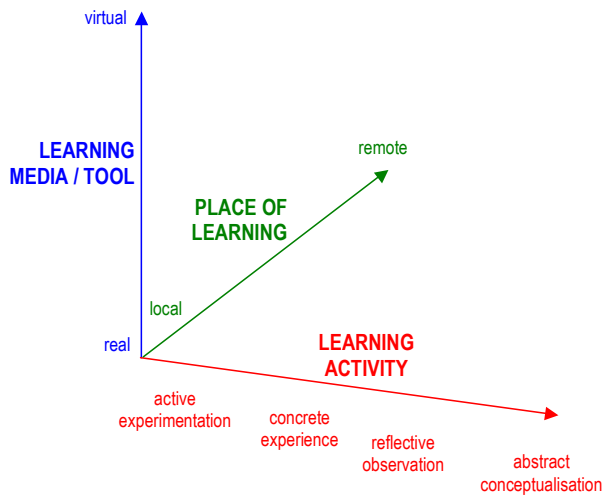
- Loss of haptic experience
- Lacks credibility
- No 'real' practice



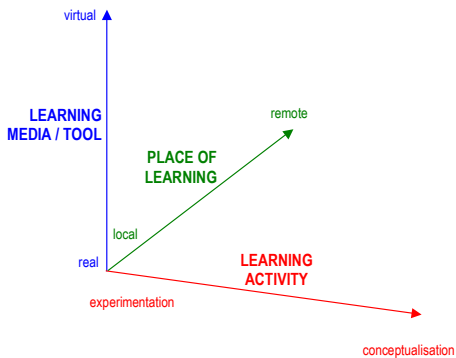
Mixed Reality Learning Space



Mixed Reality Learning Space



Mixed Reality Learning Space

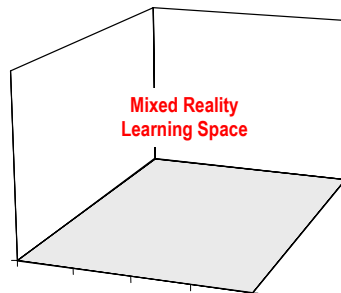


- **Online Course**
 - virtual, remote, abstract
- **On-site Training**
 - real tools, active and concrete
- **Remote Laboratory/workshop**
 - Virtual media, remote real resources, active experimentation,
- **Virtual Laboratory**
 - virtual, local or remote
- ...

Conclusion



- There is a role for different learning arrangements in the learning process
- A 'mix' of virtual learning in combination with practical learning brings an added-value that justifies the creation of institutional networks
- The creation of Mixed Reality Learning and Working Environments enhances learning



Thank you for your attention



MARVEL

Virtual Laboratory in Mechatronics :

Access to remote communication

and virtual e-learning coordination

www.marvel.uni-bremen.de

cooperation

Leonardo da Vinci
Pilot projects

The graphic features the MARVEL logo at the top, followed by the text "Virtual Laboratory in Mechatronics :". Below this, there are three small images: a person at a computer, two people working at a table, and a person working at a computer. The text "Access to remote communication" and "and virtual e-learning coordination" is overlaid on the images. The website address "www.marvel.uni-bremen.de" is also present. At the bottom, there is a logo for "Leonardo da Vinci Pilot projects" with the European Union flag.

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