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A blended approach to introduce students to cyber-physical production systems

InfoWare 2020

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eit Manufacturing

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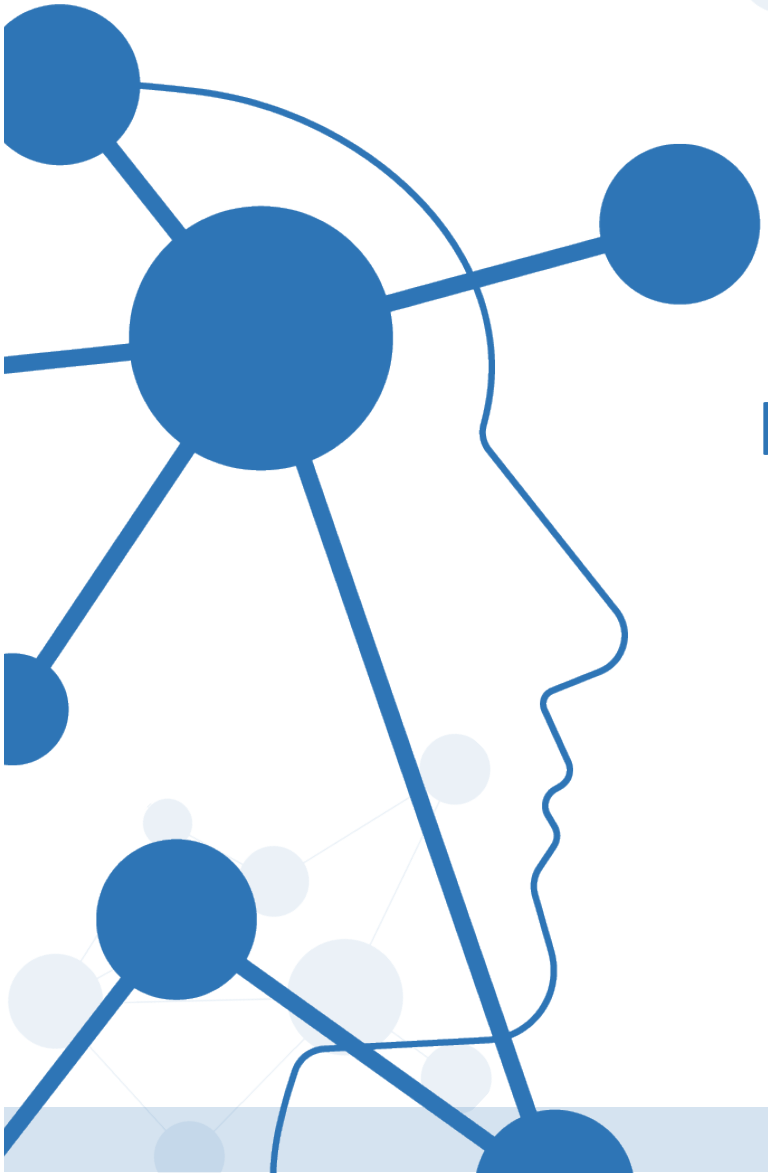


blended learning & TLFs

introduction

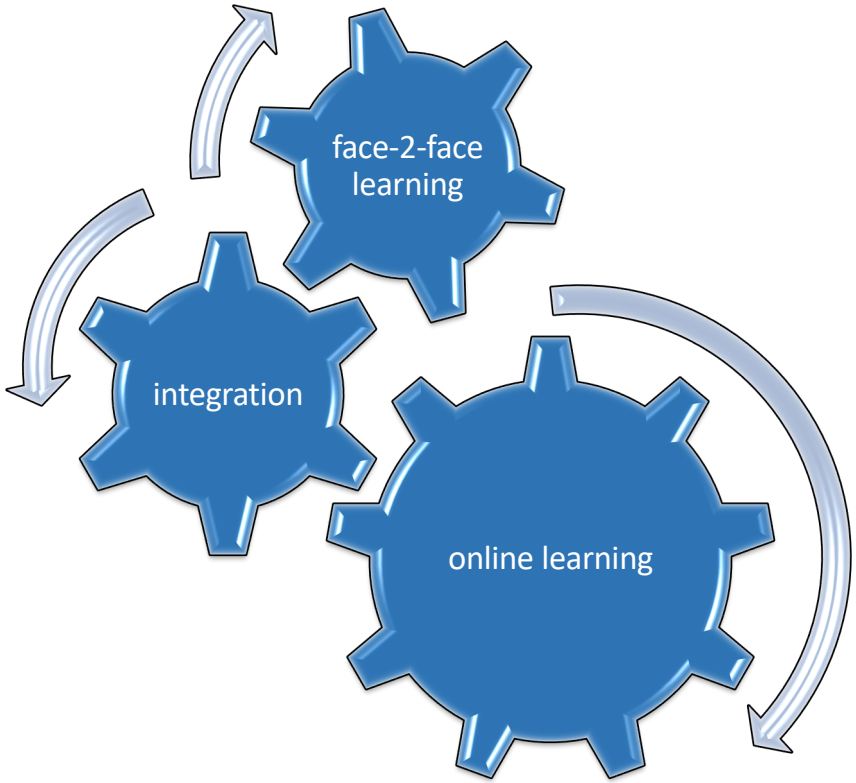
Blended learning

"a style of education in which students learn via electronic and online media as well as traditional face-to-face teaching" (Oxford Dictionary)

Blended learning is an approach to education that combines online educational materials and opportunities for interaction online with traditional place-based classroom methods.

It requires the physical presence of both teacher and student, with some elements of student control over time, place, path, or pace.

Ideally, each (both online and off) will complement the other by using its particular strength.



Teaching & Learning Factory (T&LF) concept

Learning Factory: concept whereby in the facilities of the university equipment that resembles manufacturing facilities is installed and people from both academia and industry can participate in specified courses that have as a purpose to acquire manufacturing concepts, trends and knowledge in the academic environment.

[Chryssolouris et al. 2008]

Teaching factory: "two-way street", where from the factory, practitioners teach students and from the classroom, students and faculty teach practitioners. This two-way street is realized via internet and is a continuous process over a lengthier period of time, with regular sessions and continuous interaction between the factory and the classroom.

[Rentzos et al. 2015]

The use of Learning Factories has been increased, particularly in Europe

[Chryssolouris et al. 2008],[Antoniou et al. 2016]

In the last years, numerous Learning Factories have been built up

[Wagner et al. 2013], [IELF GA 2012], [Abele et al. 2015]

Manufacturing education is integrated with industrial practice, using the Teaching Factory paradigm

[Rentzos et al. 2014]

Teaching Factory paradigms can empower SMEs by introducing them to new technologies and research approaches of Industry 4.0 environments

[Mavrikios et al. 2013]

T&LF concept

… industrial practice to the classroom

- ✓ Classroom → Students are the knowledge "Receivers"
- ✓ Industry side → Engineers introduce & present real problems from the shop floor, Knowledge "Transmitters"
- ✓ The communication and interaction is done on a Virtual Operation Scheme

[Papacharalampopoulos et al. 2020]

T&LF concept

- ✓ Test-beds for presenting new **manufacturing concepts to industry**
- ✓ Facilities with **high-grade industrial didactic** equipment
- ✓ Industry learns and tests concepts that are **expensive and time-consuming** to be research on real production
- ✓ Knowledge communication using **both physical and virtual operation schemes**

[Papacharalampopoulos et al. 2020]

… "new" knowledge to the factory

EIT Manufacturing

A new member of EIT's Innovation Community

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Speaker | Event | Date

EIT Manufacturing is an Innovation Community within the **European Institute of Innovation & Technology (EIT)** – that connects the leading manufacturing actors in Europe. Fueled by a strong interdisciplinary and trusted community, we will add unique value to European products, processes, services – and inspire the creation of globally competitive and sustainable manufacturing.

EIT Manufacturing's approach is designed to immediately and forcefully address specific economic and societal challenges, leveraging opportunities to maximise the impact for a successful European manufacturing.

Our **vision** is that the global manufacturing innovation is led by Europe.

Our **mission** is to bring manufacturing actors of Europe together in innovation ecosystems that add unique value to European products, processes, services – and inspire creation of globally competitive and sustainable manufacturing.

To tackle main challenges of European manufacturing, EIT Manufacturing has defined six strategic objectives:

1. Excellent manufacturing skills and talents: adding value through an upskilled workforce and engaged students.
2. Efficient manufacturing innovation ecosystems: adding value through creating ecosystems for innovation, entrepreneurship and business transformation focused on innovation hotspots.
3. Full digitalisation of manufacturing: adding value through digital solutions and platforms that connect value networks globally.
4. Customer-driven manufacturing: adding value through agile and flexible manufacturing that meets global personalised demand.
5. Socially sustainable manufacturing: adding value through safe, healthy, ethical and socially sustainable production and products.
6. Environmentally sustainable manufacturing: adding value by making industry greener and cleaner.

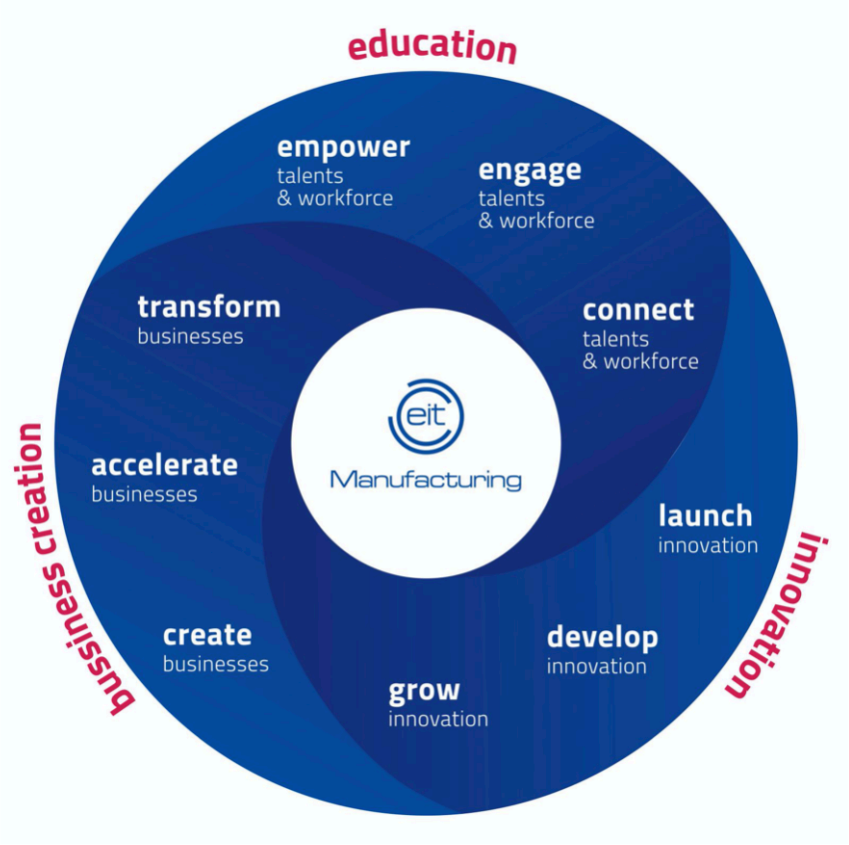
Our Programmes

We are currently experiencing the fourth industrial revolution, which brings us new challenges and opportunities. EIT Manufacturing's aim is not only to adapt to this global revolution, but to lead it. To do so, it will deliver nine powerful programmes that cover the Knowledge Triangle — Education, Innovation and Business Creation — for Added-Value Manufacturing:

- **Education:** "Empower", "Connect" and "Engage" talents and workforce
- **Innovation:** "Launch", "Develop" and "Grow" innovations
- **Business Creation:** "Create", "Accelerate" and "Transform" businesses

The programmes will address these challenges in a unique way:

1. Adapt to exponential technological progress. Success is no longer determined by a narrow technology focus, but by a clear vision and the capacity to adapt.
2. Make manufacturing a powerhouse for social impact.
3. Overcome value network fragmentation in Europe.
4. Transform knowledge into value more efficiently.



Please click here for detailed information

Guided Learning Platform (GLP)

The Guided Learning Platform (GLP) will be available soon.

The GLP will deliver digital learning content based on learning nuggets, allowing students and workers to get fast access to the latest manufacturing knowledge and to support learning as and when needed without having to enroll in a long term program. The learning nugget is the smallest learning object relying on different kind of didactic media like e-learning units, practical task lessons, AR/VR sessions and learning assessments to achieve and to verify desired competencies. Hereby, the GLP will complement theoretical with practical learning by connecting people with other people who share similar interests, learning content, Learning Factories and real working environments, through the Teaching Factory training projects. All of this is possible due to learning nugget combinations tailored to each user's needs, creating an individual learning path.
The GLP will ultimately allow the up-skilling and re-skilling of the next generation of European manufacturers, contributing to the democratization of learning.

CPPS 101

The Smart Manufacturing Paradigm

A Tutorial Introduction on Cyber Physical Production Systems

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INESCTEC TECHNOLOGY & SCIENCE

LMS Laboratory for Manufacturing Systems & Automation

TU Delft

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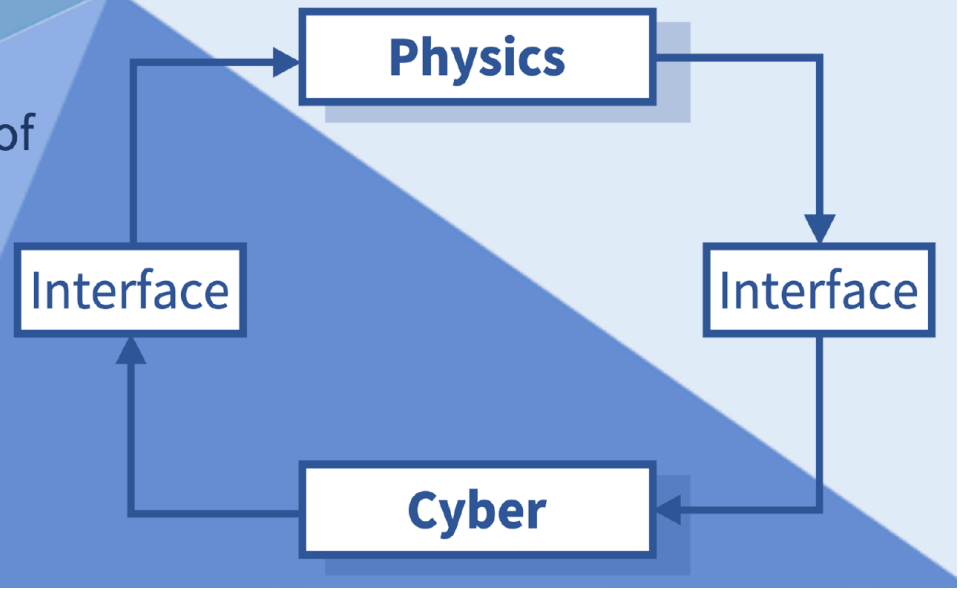
What are Cyber Physical Production Systems?

❖ CPPS

A **C**yber **P**hysical **P**roduction **S**ystem is a combination of **physics** with **cyber** components tightly networked.

- Real-time data acquisition from the physical world and information feedback from the cyber space.
- Big data analysis and computational capability that constructs the cyber space



What is CPPS 101?

❖ Project

This project aims to make available to students and young researchers didactic materials through an end-to-end **online course** regarding **CPPS** to educate them about the challenges of the new technologies of **Industry 4.0** .

❖ Objective

A GLP course regarding CPPS topics, where each topic is covered in a module. The course will be based in **video tutorials** for theoretical presentation of topics, and practical **hands-on exercises**, for code management, deployment and testing.

❖ Topics

❖ Expected Impact

- ✓ Students with developed skills in these topics.
- ✓ Motivate students to develop applications to tackle real problems in current industrial scenarios.
- ✓ Students with good practices regarding source code management.

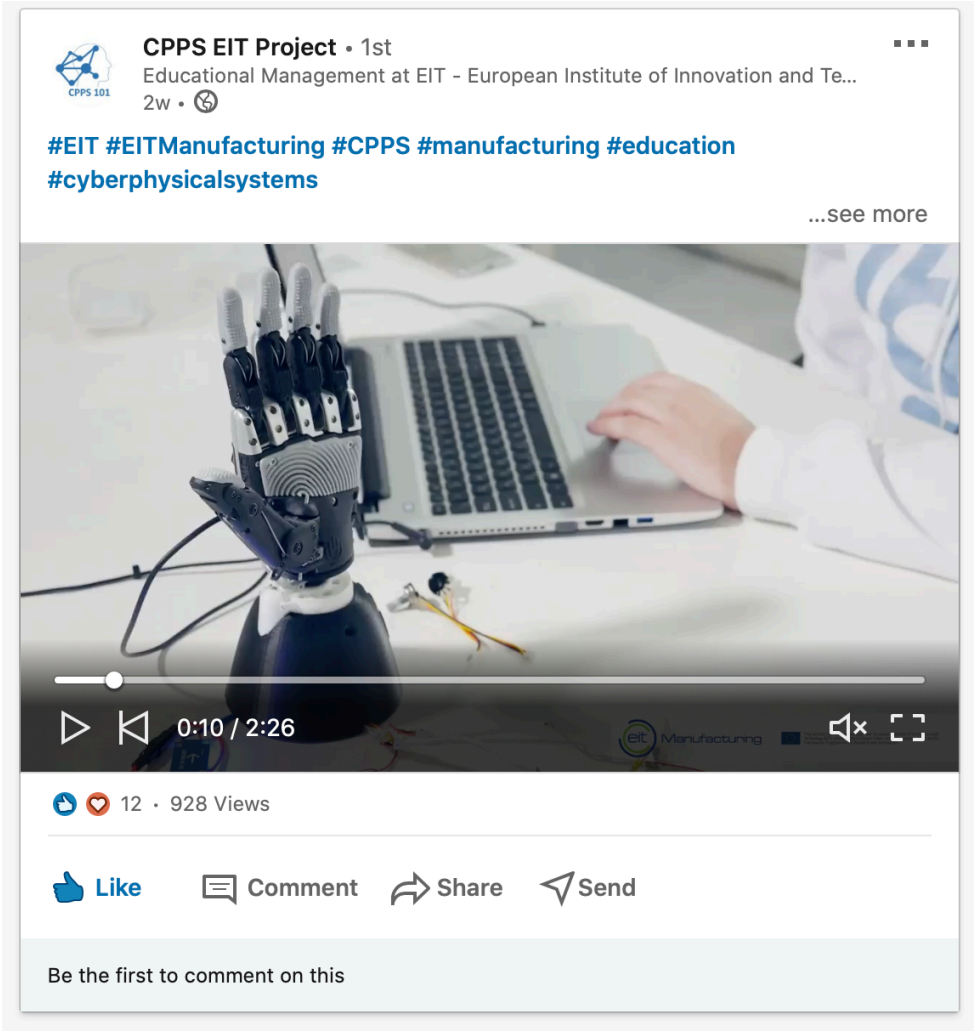
CPPS 101

online course on Cyber Physical Production Systems (CPPS) based on vid eo tutorials for theoretical presentation of topics, and practical hands-on exercises, for code management, deployment and testing.

GLP course regarding CPPS topics, where each topic is covered in a module, and each module contains several nuggets;

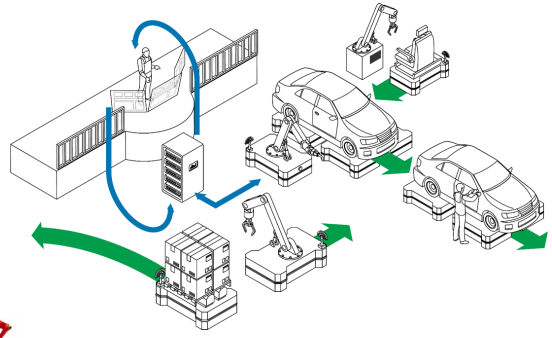
CPPS Testbed to be used remotely for the deployment/testing of developed applications during hands-on tutorials regarding real problems;

Git infrastructure, to motivate users to good practices regarding source code management.



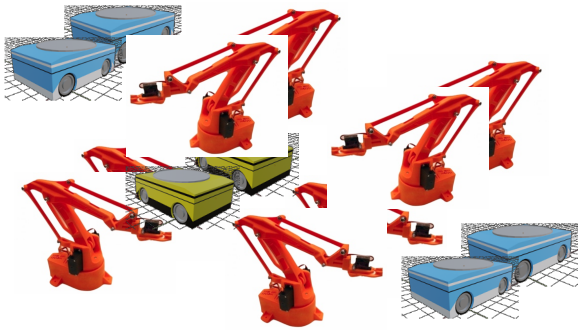
CPPS technologies as a catalyst of education

classroom



scenario

factory



testbed

testbed

e-learning

Cloud Computing

Internet of Things

Intelligent Machine Control

Advanced Data Analytics

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A BLENDED APPROACH TO INTRODUCE STUDENTS TO CYBER-PHYSICAL PRODUCTION SYSTEMS

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