The Teaching Factory Paradigm

Professor George CHRYSSOLOURIS
Introduction

Investment in education and training is essential to boost growth and competitiveness

Skills development can

- determine the capacity to increase productivity
- trigger innovation
- move production up the value chain
- shape the future labor market

Talent-driven innovation is key for industry

- Talent-driven innovation is the major enabler of transforming research efforts into successful products and services.
- Manufacturers worldwide keep ranking the quality and availability of highly skilled workers, as the most critical driver of global manufacturing competitiveness.²

² Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index
Skill gaps and shortages hinder industry’s innovation performance world-wide

- 38% (global average) of employers are nowadays facing difficulties in filling jobs \(^3\).
- In the US, two million positions in the US manufacturing industry will likely go unfilled due to a lack of skilled workers over the next decade \(^4\).
- Chief executives of some of Europe’s largest manufacturers predicted a possible gap of 500,000 engineers by 2025 \(^5\).

\(^3\) ManpowerGroup Talent Shortage Survey 2015
\(^4\) 2014 Skills Gap Study, Deloitte and The Manufacturing Institute
\(^5\) Financial Times, 2013, Alarm over skills shortage in Europe
Introduction

Cyber-Physical Systems & Cyber-Physical Education

Online and Digital Learning towards personalized learning content

Mass Education

Apprenticeship

Industry 4.0 & Education 4.0

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The concept of the Teaching Factory has its origins in the medical sciences discipline and specifically in the paradigm of the Teaching Hospital.
Real life changes rapidly and so does industrial practice, i.e. manufacturing technology, industrial settings, engineering problems etc. The Teaching Factory paradigm follows the developments by "bringing" the real factory to the classroom and the classroom to the real factory.
The Teaching Factory paradigm uses **advanced ICTs** and **high-grade industrial didactic equipment** to operate as a **non-geographically anchored learning “space”**.
Configuration of a TF training scenario
Students watch an augmented video from a warehouse about how raw materials are handled.

Engineers present, in a conference room, a welding operation, performed in real time at a robotic cell. Students are able to interact with the engineers from the classroom.

Asynchronous 1-to-1 session

Synchronous 1-to-many sessions
TF Pilot: Construction Equipment

Industrial problem:
- line balancing of a new production area
- planning of material kitting area

4 engineers of the industrial partner
20 LMS students
6 weeks (2h session per week)
TF Pilot: Construction Equipment

✓ In the framework of the course: “Introduction to Manufacturing Technology”
✓ 20 Mechanical Engineering Students (4 groups of 5 persons)
✓ 2nd Year of their studies
✓ With the assistance of 4-5 Research Engineers (e.g. provide details and the problem’s background, supporting the students)
✓ They provided an understanding of the optimal configuration for the material feeding process to be carried out.
✓ The students identified bottlenecks and provided suggestions to prevent such phenomena.
TF Pilot: Industrial Automation

Industrial problem:
➢ new integration and control architecture for industrial robots

5 engineers of the industrial partner
7 LMS research engineers
3 weeks (1h session per week)
TF Pilot: Industrial Automation

Engineers from industry watch the tasks carried out by the cooperating robotic cells, taking place at academia, through a simultaneous presentation of the services controlling the operation.
Skills have a major impact on the economic growth of a society, on the innovation process as well as on industry’s competitiveness.

The Teaching Factory demonstrates high-degree of modularity and can therefore be adapted to the needs of both the academia and industry.

Multiple, remotely located “factories” and “classrooms” are envisioned.

New technologies and manufacturing concepts can be exchanged.

Use of the Teaching Factory concept can encourage entrepreneurship in universities and innovation within companies, through shared projects between academia and industry.

The Teaching Factory can also be used to train suppliers/subcontractors of OEMs, in cooperation with academia.
Outlook: The Teaching Factory Network

Teaching Factory LDH
ICT technologies

Teaching Factory LDH
Modular operation

Teaching Factory Learning Delivery Hub

Network of manufacturing companies
Real life problem/learning situation

Network of universities
Learning interest / problem solving capacity

Workshop / laser cutting case
Cabinet assembly line / co-operating robots case
Warehouse / lean manufacturing case

Factory 1
Factory 2
Factory x

University 1
University 2
University x

Semester project / laser cutting
Thesis project / co-operating robots
20 h Lab exercise / lean manufacturing

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References


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