



researchXchange

Welcome!

Industry 4.0 Activities in Higher Education

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Agenda

- ▶ Introduction
- ▶ Digitalization skills and knowledge
- ▶ Experiential Learning Space
 - ▶ Manual Assembly
 - ▶ Robot aided Assembly
 - ▶ Virtual Reality
 - ▶ Kinect Ergonomic Evaluation
- ▶ Conclusion and future work

Introduction



Tecnológico
de Monterrey

Law, Economics and
International
Relations

Creative Studies

Business

Health

Engineering and
Science

Students

94,424

Total number of

26,794

High School

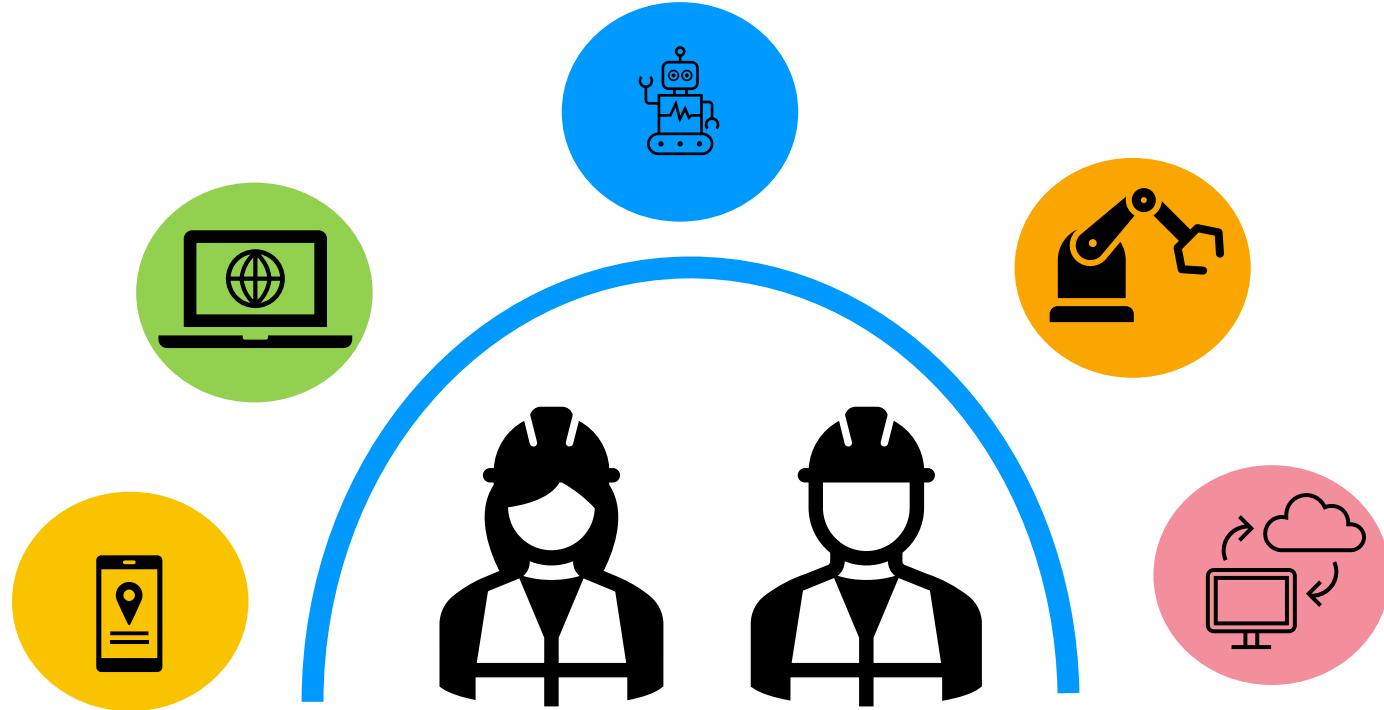
60,169

Undergraduate

7,461

Graduate

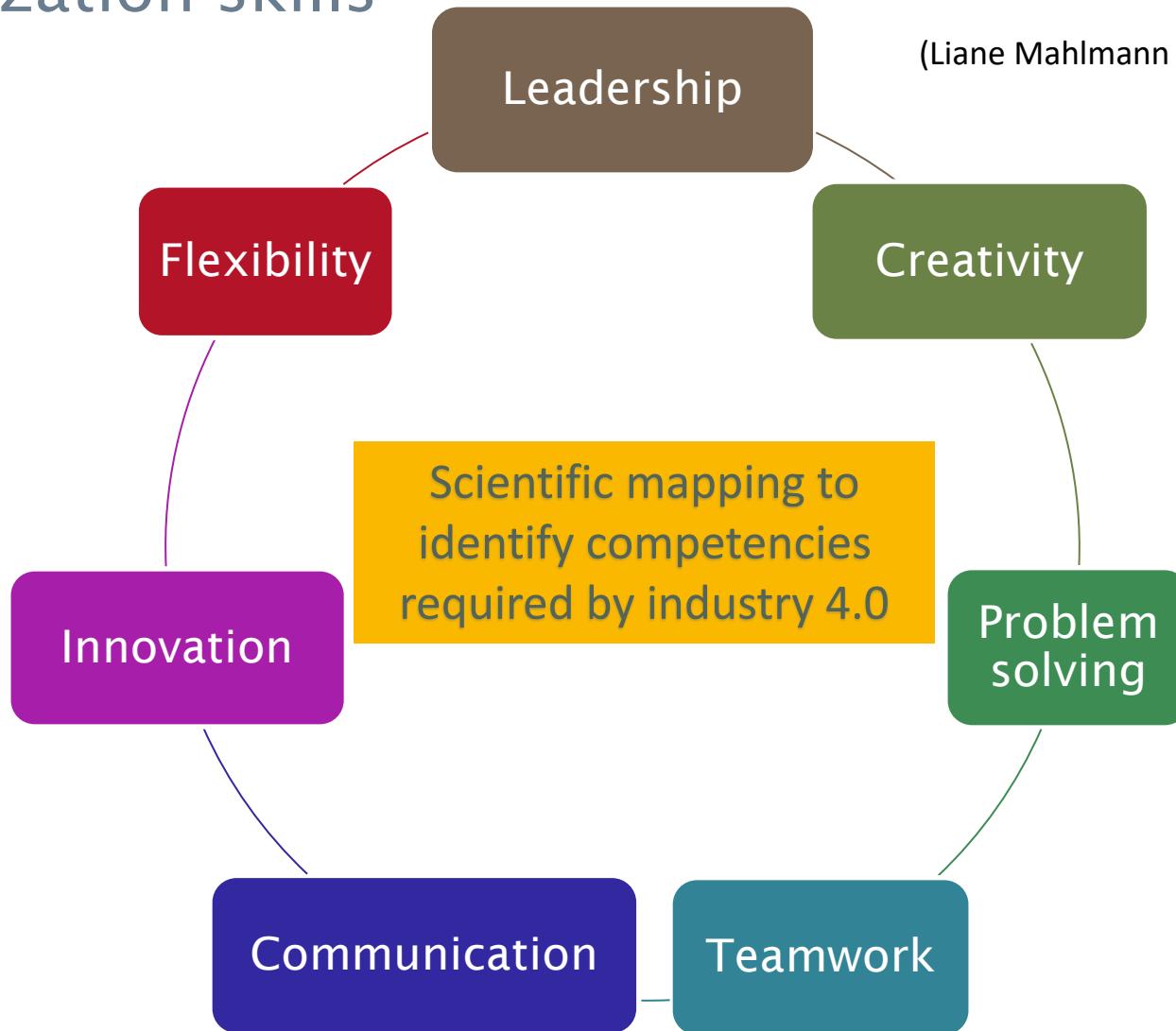
Introduction



Industrial technology collaboration

Digitalization skills

(Liane Mahlmann Kipper et al., 2021)



Knowledge

Information and
communication
technology

Automation

Software
development

Data analysis

General
systems theory

Experiential Learning Space



Skill focus in an Experiential Learning Space



communication

teamwork

Leadership

problem
solving



flexibility

creativity



innovation

Learning Space: Manual Assembly

Initial stage in Phase 1: One workstation performs the entire activity.



Hoja para Estudio de Tiempos	
Descripción	Hora
Tiempo base	%
Tiempo por fatiga	%
Tiempo suplementario	%
Tiempo estandar	
Piezas por hora	

Método R.E.B.A. Hoja de Campo

Grupo A: Análisis de cuello, piernas y tronco		
CUELLO	Movimiento	Puntuación
0°-20° flexión	1	Adelante + 1 si hay torsión o desviación lateral
>20° flexión o extensión	2	
PIERNAS	Movimiento	Puntuación
Soporte bilateral, andando o sentado	1	Adelante + 1 si hay rotación de las rodillas entre 30° y 60°
Soporte unilateral, soporte ligero o postura inestable	2	Adelante + 2 si las rodillas están flexionadas > de 60° (salvo postura sedente)
TRONCO	Movimiento	Puntuación
Erguido	1	
0°-20° flexión (0°-20° extensión)	2	Adelante + 1 si hay torsión o desviación lateral
20°-60° flexión >20° extensión	3	
>60° flexión	4	
CARGA / FUERZA	Movimiento	Puntuación
0	1	2
< 5 Kg. 5 a 10 Kg.		> 10 Kg.
		Instauración rápida o brusca
PIEZAS	Puesto de trabajo:	Realizó:
PUNTUACIÓN A	=	
Resultado TABLA A		
Corrección: Adelante + 1 si: - Duración de la postura permanente excesivas, por ej. agujadas más de 5 min. Movimientos repetitivos, por ej. repetición superior a 4 veces/minuto. Cambios posturales importantes o posturas inestables.		
PIEZAS		
PUNTUACIÓN B		
NIVEL DE ACCIÓN: 1 = No necesario; 2-3 = Puede ser necesario; 4 a 7 = Necesario; 8 a 10 = Necesario pronto; 11 a 15 = Actuación inmediata		
AGARRE		
+ 1-Bueno 1-Regular 2-Malo 3-Pésimo		
Buena aggr. e fuerza adecuables Agarré acceptable Agarré posible pero no aceptable Incómodo, sin agarr. ni fuerza adecuables. Acceptable u desagradable para partes del cuerpo.		
= PUNTUACIÓN B		
PUNTUACIÓN FINAL		

Learning Space: Robot aided Assembly

1) Collaborative robotic arm



Assembly products used in the case of study: three different models of car side lamps.

This process is carried out through the implementation of a collaborative robotic arm and a digital Andon system.

Learning Space: Robot aided Assembly

<p>Station 1. Identification card cutting</p> 	<p>Station 2. Product assembly</p> 
<p>Station 3. Box assembly and packing.</p> 	<p>Station 4. Batch stamping in box packaging-collaborative robot arm station.</p> 

Learning Space: Robot aided Assembly

2) Secondary process through Cobot



Learning Space: Robot aided Assembly

Station 1: Assembly the products



Station 2: Pick and place / Cobot



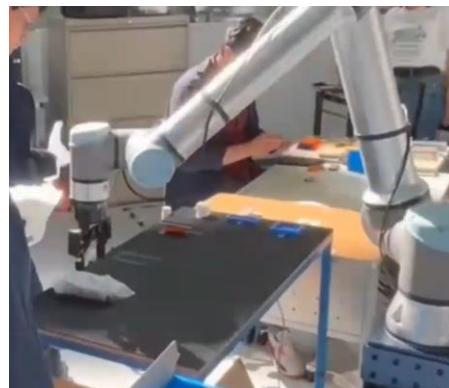
Station 3: Bagging the product



Station 4: Carton box assembly



Station 5: Pick and place / Cobot



Station 6: Box closing

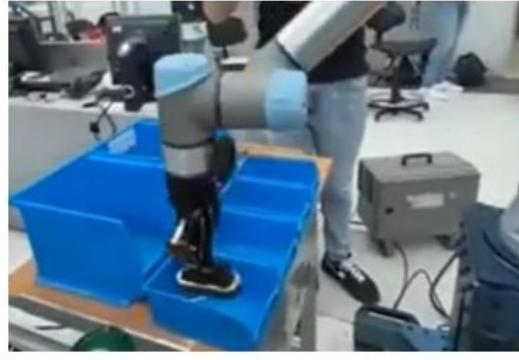
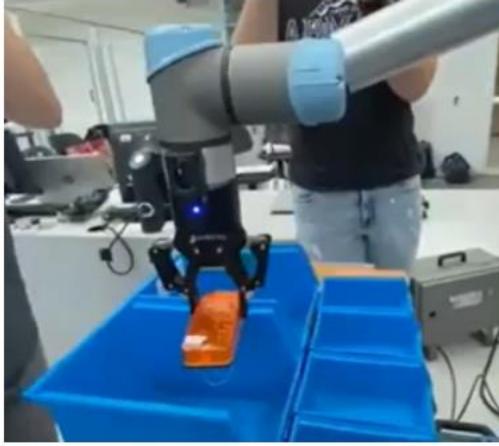


Learning Space: Robot aided Assembly

- ▶ Production line - Cobot

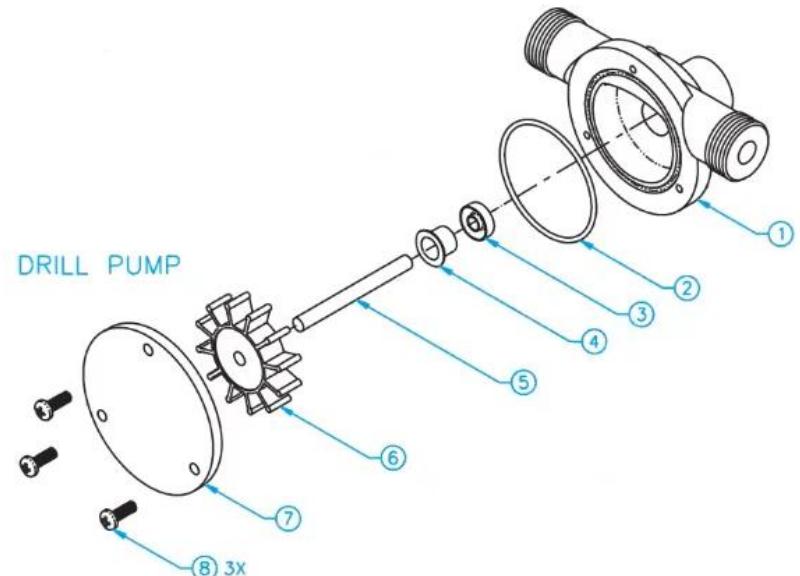


Learning Space: Robot aided Assembly

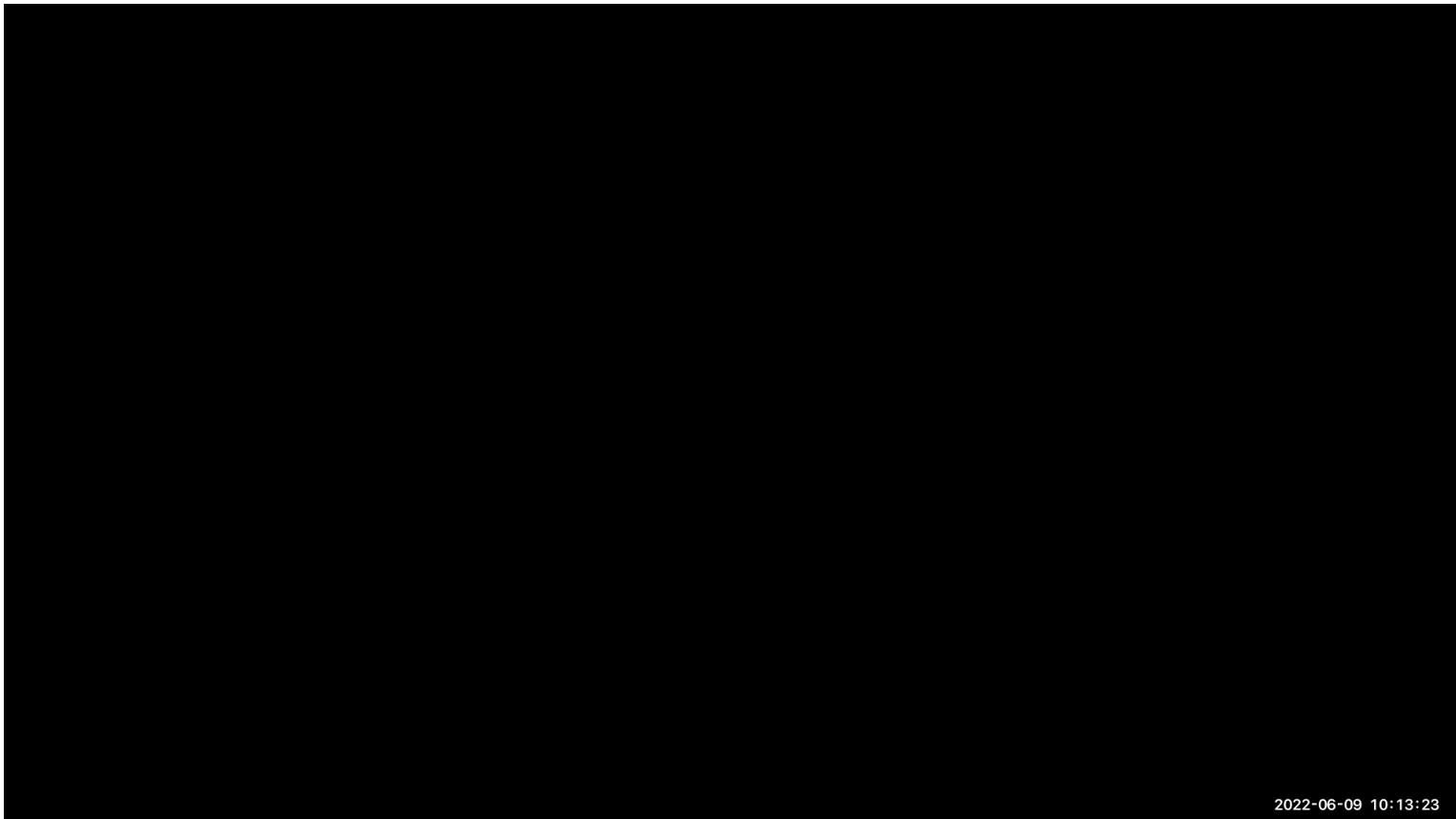
<p>Pick</p> 	<p>Place in the box nr1</p> 
<p>Pick</p> 	<p>Place in the box nr2</p> 

Learning Space:Virtual reality

Virtual Reality



Learning Space: develop a VR environment



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Learning Space: Kinect Ergonomic Evaluation

Ergonomic assessment with Kinect



Learning Space: Kinect Ergonomic Evaluation

TARGET DETECTION

Conclusion

- Cobots have been used for student activities since 2015

BFH



- Cobots have been used for student activities since 2021

MEX



- At our university we continue our effort to teach our students the benefits and solutions that Industry 4.0 is offering.
- We .

Future work Collaboration BFH – Tecnológico

- ▶ Global Shared Learning
- ▶ Sommer / Winter semester (5 weeks) in BFH
- ▶ International Conference papers
- ▶ Scopus Papers
 - ▶ Professors of BFH and Tecnológico de Monterrey

Next seminars

Biel / Bienne Quellgasse 21, Aula

2.3.2023 | I4.0 Activities in Higher Education Gabriela Reyes-Zárate, Associate professor, ITESM, Dept. of Industrial Engineering

16.3.2023 | Shaping Participatory Health Informatics Prof. Dr. Kerstin Denecke, Institute for Medical Informatics I4MI, BFH-TI

30.3.2023 | Mit dem Handy das Auto aufschliessen? Hardware Protected Confirmation macht es möglich
Prof. Dr. Benjamin Fehrensen, Institute for Cybersecurity and Engineering ICE, BFH-TI

6.4.2023 | Von der Laborbank zum Patienten – Erste klinische Resultate zur selektiven Netzhauttherapie Christian Burri, Institute for Human Centered Engineering HuCE, BFH-TI

Biel / Bienne Quellgasse 21, Aula

13.4.2023 | Intégration d'un ensemble complet de logiciels pour la conduite autonome Ahmed Hanachi, Institut pour la recherche sur l'énergie et la mobilité IEM, BFH-TI

27.4.2023 | Die digitale Transformation des Exportgeschäfts Prof. Dr. Paul Ammann, Institute for Data Applications and Security IDAS, BFH-TI

11.5.2023 | The Relevance and Hands-on Application of Biomedical Record Linkage in the Big Data Era Prof. Dr. Murat Sariyar, Institute for Medical Informatics I4MI, BFH-TI

1.6.2023 | Averaging Model for Feedback Control of Ultrasonic Transducers Diego Stutzer, Institute for Human Centered Engineering HuCE, BFH-TI

Burgdorf / Berthoud Pestalozzistrasse 20, E013

9.3.2023 | From Sub-nanometer to Micrometer Films, or how to Combine ALD with PVD Dr. Carlos Guerra, CEO, Swiss Cluster AG

23.3.2023 | Recycling von Traktionsbatterien aus Elektrofahrzeugen bei Librec
Denis Werner, Technischer Leiter, Librec AG

20.4.2023 | How Data Analysis Can Help to Better Understand the Degradation in PV Modules Prof. Dr. Jasmin Wandel, Institute for Optimisation and Data Analysis IODA , BFH-TI and Sara El Hassani, Institute for Energy and Mobility Research IEM, BFH-TI

4.5.2023 | TPV 5000 – Beitrag zur Defossilisierung des Verkehrs Dr. Albrecht Tribukait, CEO ad int., Silent-Power AG

25.5.2023 am Jlcoweg 1 | What is High Voltage Engineering about? Prof. Dr. Roman Grinberg, Institute for Energy and Mobility Research IEM, BFH-TI

8.6.2023 | Waghalsige Holzkonstruktionen unter Anwendung moderner Technologie neu denken Matias Penroz, Institut für digitale Bau- und Holzwirtschaft IdBH, BFH-AHB