Concepts for learning location cooperation 4.0

Ethical Aspects

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In my contribution, I can only give a few aspects of the very complex and extensive topic.

So I have prepared some slides, which I cannot present all (due to time constraints), so that I focus and concentrate on the essentials.

Otherwise, I refer to my multi-page elaboration in the final report. Further details and background information can be found here.

The article
- **deals with a seemingly small aspect in the extensive discussion about Industry 4.0**
- **The contents of which are generally not mentioned or are only mentioned in passing**
- **the new challenges and burdens with consequences for people and, as a result, for society**
- **Demand answers and confrontations with the topic. With the increased use of collaborative robots (cobots)**
- **man and machine are moving closer together in a "collegial" manner**
- **The question of ethical aspects arises when "sentient robots" reach out to humans and give them a helping hand**

Der Beitrag

- scheinbar kleinen Aspekt in der umfangreichen Diskussion rund um Industrie 4.0

- Inhalte im Allgemeinen unerwähnt bzw. immer nur am Rande angesprochen

- Gleichwohl fordern die neuen Herausforderungen und Belastungen mit Folgen für den Menschen und in Folge für die Gesellschaft quasi Antworten

- Vermehrten Einsatz von kollaborativen Robotern (Cobots) rücken Mensch und Maschine „kollegial" näher zusammen.

- Spätestens hier stellt sich die Frage nach ethischen Aspekten, wenn „fühlende Roboter" dem Menschen die Hand reichen und ihm unter die Arme greifen.

- **Wieviel Gefühle und Zuneigungen bringt der Mensch dem „neuen" Kollegen entgegen**

- **bzw. will der Mensch oder soll der Mensch ihm Gefühle entgegenbringen?**

- **Oder führt der verstärkte Umgang mit Robotern zu mechanisierten Gefühlen beim Menschen?**

- **Es gibt derzeit für diese drängenden Fragen keine abschließenden Antworten mit „richtig" und „falsch"**

- **Wir stehen erst ganz am Anfang der Entwicklung**

- **Gleichwohl ist eine rechtzeitige Auseinandersetzung bzw. eine zielgerichtete Planung für Lernsituationen bereits jetzt schon absolut notwendig**
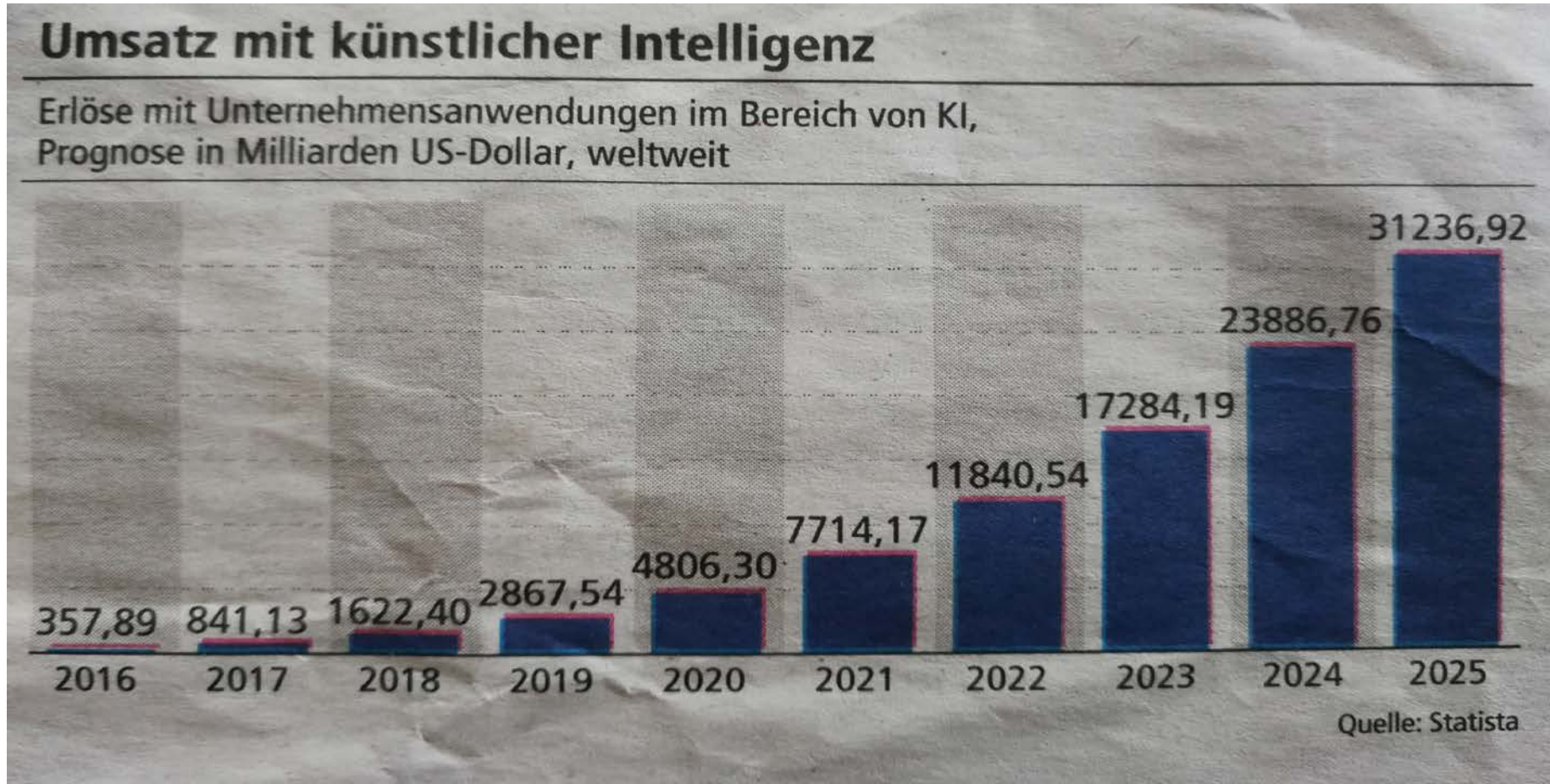
- How many feelings and affections does the person have towards the "new" colleague
- or does the person want or should the person have feelings towards him?
- Or does the increased use of robots lead to mechanized feelings in humans?
- There are currently no conclusive answers to these pressing questions with "right" and "wrong"
- We are only at the very beginning of the development
- Nevertheless, timely discussion or targeted planning for learning situations is already absolutely necessary

Human Being or machine ?
"First we design our tools, then they shape us"

Revenue AI

Umsatz mit künstlicher Intelligenz

Erlöse mit Unternehmensanwendungen im Bereich von KI, Prognose in Milliarden US-Dollar, weltweit

| Jahr	Umsatz
2016	357,89
2017	841,13
2018	1622,40
2019	2867,54
2020	4806,30
2021	7714,17
2022	11840,54
2023	17284,19
2024	23886,76
2025	31236,92

Quelle: Statista

Work 4.0

The bolero of the world of work.

After the French composer Maurice Ravel in 1928 the Long "Bolero" as a ballet piece.

- Quietly and imperceptibly begins

- increasingly increasing into the perceptible increase

- and culminating in an unmistakable finale.

Such a bolero is currently moving towards the world of work. (Source: Welf Schröter)
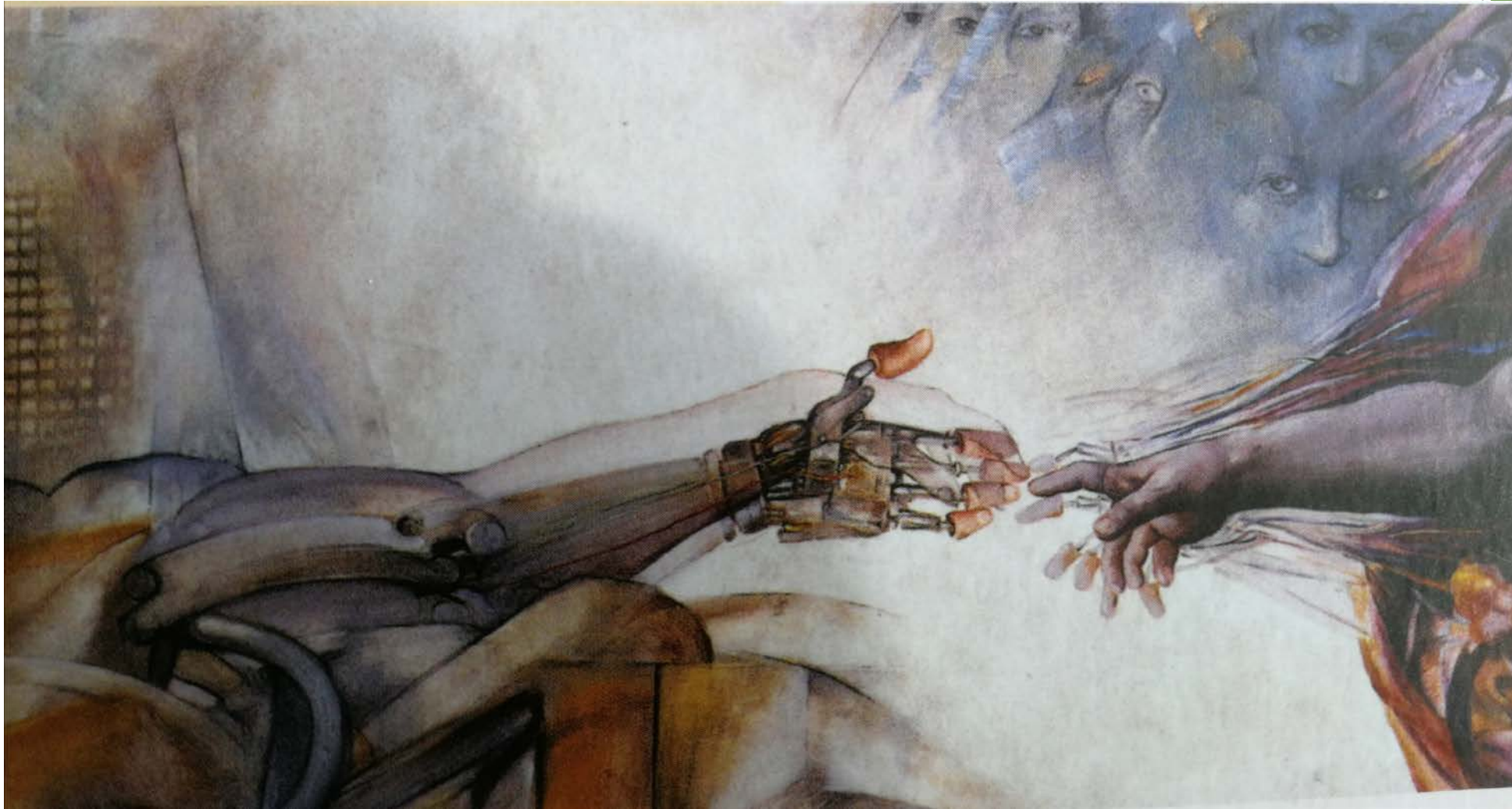
In the world of work, 2 dynamics of automation overlap:

1. **Automation of physical machines** with the help of modern control software (in the tradition of "lean production")
2. **Automation of the virtual work and business space** with the help of modern delegation techniques and autonomous software systems

The concept "Industry 4.0" is not
a new generation of technology, not a corset, not an "off-the-shelf costume" for the company.

- It is much more a different combination (flexible integration) of existing techniques from the customer's perspective „in batch size 1"
- Components: Digitalization, virtualization, cloud computing, fast networks, Internet of Things (RFID, CPS), organic electronics, humanoid robotics and others (Source: Welf Schröter)

Quote from the project application round 2020:

"The digitization of the world of work, especially in the context of Industry 4.0 and **a new digital learning culture**, requires enhanced skills among learners.

- In addition to specific professional core competencies, skilled workers must also have broad, **interdisciplinary competencies** in order to successfully meet changes in industrial production and society.

- This implies appropriately **professional teachers** who prepare young people for professional requirements in the best possible way within the **framework of education and training."**

Digitization more burden on workers

The situation after corona pandemic: more digitization of the world of work i.g. video conferencing, more home office and more mobile work. **Advancing digitization is burdening more and more employees in their jobs**, according to a sobering finding by the DGB boss, Yasmin Fahimi, after a survey at the beginning of December 2022.

Legende DGB: Deutscher Gewerkschaftsbund – German Trade Union Confederation

Designing the future humanely,
Prof. Dr. Ulrike Buchmann University of Siegen

"The transformation processes around **digitization require a high degree** of

- factual, self and social competence,

- communication,

- action and decision-making skills,

- abstraction, creativity and frustration tolerance.

In this respect, vocational education and training has a comprehensive educational mandate in a **historically unprecedented form**," Prof. Buchmann continued.

Learning location cooperation 4.0

Employees are experiencing a **fundamental change** in their working conditions

- **What role do people play** in digital transformation?
- **How does education respond**?

The main question:

- How should education react to this?
- **No question of technology alone or controllable by financial means !**

"The contribution of vocational education and training is to make the complex interrelationships, which are often summarized in simplified form under the term digitization, understandable and thus shapeable – in all vocational education and training courses and across all subject-related focal points".

Prof. Dr. Ulrike Buchmann University of Siegen, on the occasion of the 20th University Days in Germany (2019)

Employees will need completely different skills and qualifications in the future:

The effects of Industry 4.0 on workplaces in the factory

Part 1: Big data-driven quality control, Robot-assisted production, Self-driving vehicles in logistics, Production line simulation,
Part 2: Predictable maintenance and servicing, Machines "as a Service", Self-organizing production, Additive production of complex components, Augmented Work, Maintenance and Service

1. **Big data-driven quality control.** Algorithms identify quality problems from recorded data and thus reduce product errors

2. **Robot-assisted production.** Flexible humanoid robots take over tasks such as manufacturing and packaging

3. **Self-driving vehicles in logistics** Intelligent, fully automated transport systems navigate within the factory

4. **Production line simulation.** New software enables simulation and optimization of the assembly process

5. **Smart Supply Network .** Smart networking of production inventories and suppliers enables better purchasing decisions

1. **Predictable maintenance and servicing** . Remote monitoring of all machines and equipment enables repairs before failures occur

2. **Machines "as a Service"** .   Manufacturers no longer sell machines, but provide them as a service, including maintenance and repair.

3. **Self-organizing production** .   Machines communicate and coordinate with each other, thus optimizing their use and output

4. **Additive production of complex components** . 3D printers create complex components in one step and eliminate the need for assembly line work.

5. **Augmented Work, Maintenance and Service.** Virtual reality glasses and robots will simplify the operation, remote control and maintenance of the digital factory

Soft Skills

1. **Methodological skills:** comprehension, self-management, discipline,
Frustration tolerance, problem solving

2. **Social skills:** ability to work in a team, empathy

3. **Personal competence:** self-reflection, curiosity, passion, self-confidence, goal orientation, willingness to learn, flexibility and creativity

Hard Skills

1. Professional competence (expertise)
2. Professional qualification
3. Experiences
4. Language skills

Process thinking

1. What are processes?
2. What are the dependencies and influencing factors?
3. Linking sub-processes to overall processes
4. process modelling techniques, evaluation of processes and their ability
5. Measure process performance

Analysis of conditions of success for sustainable learning location cooperation

1. Good organization to combine practical and theoretical learning content
2. Placement in operational personnel development = sustainability
3. Open and honest dealings with each other
4. Assistance and mutual support
5. Continuous further training and qualification of educational staff in schools and companies

Ethical aspects of the use of technology

- **The development of Industry 4.0 in extension to Work 4.0 up to Living Environment 4.0 (IAL 4.0) - Manfred Becker in: Personalmagazin 12/15- forms the basis of the aspects of ethical aspects.**

- **"For example, it has not yet been clarified what demands digitization places on employees**
- **and what contribution the education system and personnel development must make to ensure that people accept the new challenges without fear and motivation." (Becker)**

- **An important lever lies in the design of a machine-compatible ethics that is both oriented towards the nature of AI and takes into account the interaction between "man and machine"**
- **The freedom must be created so that intelligent machines can develop their potential for the benefit of society.**
- **At the same time, however, areas must also be defined that are reserved only for humans because of the potential danger. (N.H. Müller Springer 2022)**

The working world of the future - between the "digital assembly line" and the new Humanization (Boes, Kämpf et al. 2015)

- "Workplace of the Future – Unculture of Permanent Availability or New Time Sovereignty?"
- Digitization is changing the traditional space-time structure of work. With the Internet and mobile devices, it is possible to work from any place and at any time.
- The strict separation of work and life, but also the importance of the company as a central place of production, is eroding. (see IAL 4.0)

Workplace of the future

- "**Liquefaction of the boundary between work and private life with an extension of work into the private sphere."**
- **What is initially seen as a gain in flexibility for employees (working from home, interrupting work for two hours for private purposes, gaining a piece of sovereignty to adapt work to the needs of private life) is seen differently by employees.**

Plea for a new humanization of work

- **Companies are at a crossroads; a negative scenario is a digital assembly line that standardizes and devalues highly qualified work.**

Vocational Education and training 4.0

- **In the world of work, which is characterized by digitalization, education and qualification play a key role.**
- **The new quality of vocational education and training in the logic of Industry 4.0 is called "Vocational Education and Training 4.0" (IG Metall Kaßebaum/Ressel**

- In this sense, "Vocational Education and Training 4.0" is even more of a programme than a finished concept.
- In human-machine interaction, it leads to new requirements in interaction and cooperation, but also to new qualification requirements for the workforce.
- The qualification requirements in the digitized world of work consist of the increasing importance of interdisciplinary competencies and work content such as active problem solving, IT skills, working in networked systems, mastery of complex work content, control of communication and the coordination of processes.
- In terms of education policy, the temptation to conclude from digitization that real production experiences are losing importance must be resisted.

With regard to the **interdisciplinary qualifications considered necessary, such as the ability to work in**

- **a team,**
- **willingness to cooperate,**
- **reliability,**
- **mobility**
- **willingness to learn,**
- **it can be stated that they are already "an integral part of metal and electrical professions (Ahrens/Spöttl 2015).**

- "**The further development of a concept for vocational education and training 4.0 is an indispensable requirement." (IG Metall "Good Work")**
- **If no ready-made concepts can be offered at present, sensitization of learners must be promoted as a minimum approach in future cooperation between learning venues.**
- **The examination of ethical aspects must become an integral part of technology lessons**

Thank you for your attention