

Prof. Dr. Uta Wilkens

Human-centered AI at work - perspectives for vocational education

Expert Meeting on AI and Technical Vocational Education and Training, Magdeburg Feb. 18/19, 2025



humAIne
HUMAN CENTERED AI NETWORK

NET
HUMAIN
WORLD UNIVERSITIES NETWORK

Prof. Dr. Uta Wilkens

Human-centered AI at work - perspectives for vocational education

Background of the presentation:

Competence center HUMAINE: Transfer-Hub for human-centered work with AI

„Future of value creation – Research on production, service and work“ (10 Mio Euro)

World Universities Network NET-hUmAIN: Global network for responsible AI applications through context-sensitive operations at the interface of systems - Keep the users in the loop

UNESCO UNEVOC Centre Magdeburg, Expert Meeting on AI and TVET, Feb. 18/19, 2025



WUN
WORLDWIDE
UNIVERSITIES
NETWORK

Core challenge

“higher confidence in GenAI is associated with less critical thinking” –
“illusion of expertise”

“GenAI shifts the nature of critical thinking toward information verification,
response integration, and task stewardship”

Lee, H. et al. (2025). The Impact of Generative AI on Critical Thinking: Self-Reported Reductions in Cognitive Effort and Confidence Effects From a Survey of Knowledge Workers. In CHI Conference on Human Factors in Computing Systems (CHI '25), April 26–May 01, 2025, Yokohama, Japan. ACM, New York, NY, USA, 23 pages. <https://doi.org/10.1145/3706598.3713778>

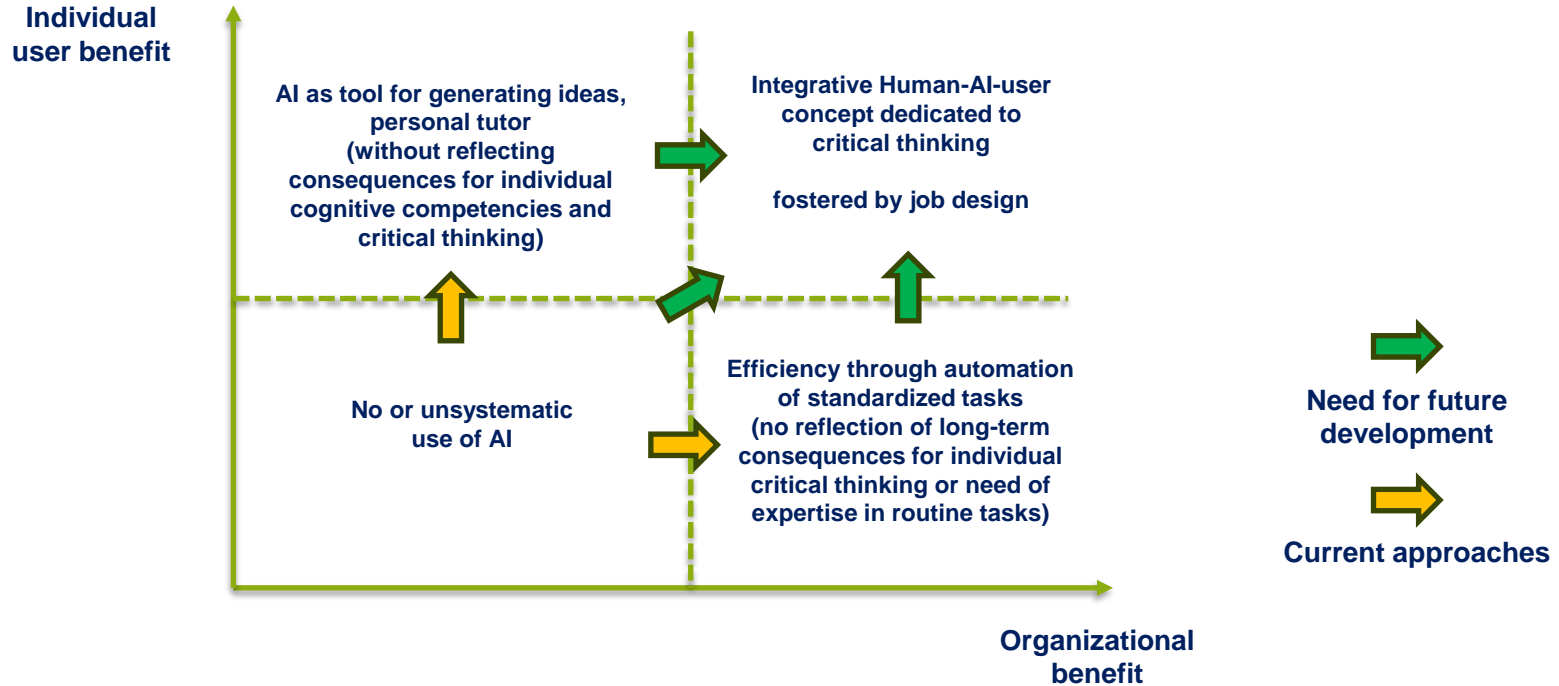
My message is

- TVET should not only train AI literacy and the effective usage of AI but foster the overall human-AI-role development while keeping critical thinking – also as an issue of group dynamics - on a high level
- And beyond: (T)VET should include knowledge in job design and ergonomics; the current neglect of the long-term consequences of GenAI usage for human creative intent is an ethical issue



Human-AI role development training laboratory at Ruhr University Bochum

Pathways to Responsible Use of GenAI



Skill Set for Industry 5.0

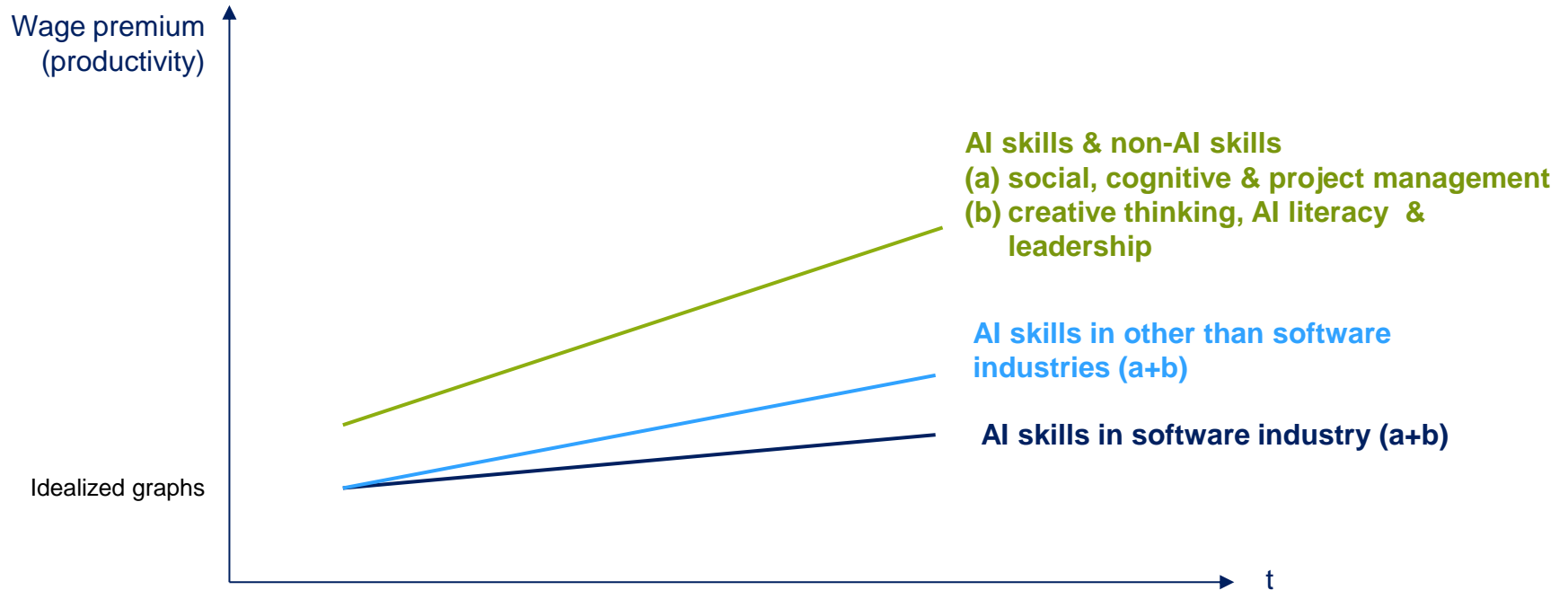


4 Skills in AI and digitalization

6 Skills in social & cognitive skills, creativity & entrepreneurial thinking

Figure 5. World Manufacturing Forum's op ten skills for the future of manufacturing
© World Manufacturing Forum

Facing AI skills & AI complement skills



(a) Alekseeva, L. et al. (2021). The Demand for AI Skills in the Labor Market. *Labour Economics*. Volume 71. 102002. <https://doi.org/10.1016/j.labeco.2021.102002>.

(b) World Economic Forum. (2023). Future of Jobs Report. [The Future of Jobs Report 2023 | World Economic Forum \(weforum.org\)](https://www.weforum.org/publications/future-of-jobs-report-2023/)

AI-initiated Transformation in the Workplace and Challenges in Vocational Education

Quantitative Perspective

Qualitative Perspective

Automation & rationalization

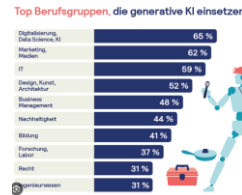
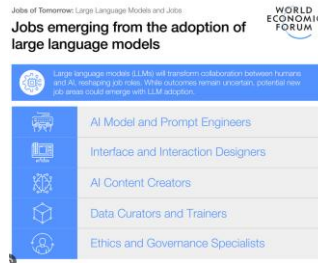
New tasks & operations (tending the machine)

Innovation & structural change

AI-assisted work

Augmentation

Amplifying & bridging



Re-training for other job families (off the job & out of the job)

training for new skills in new tasks and/or new job families with training an recruitment (near the job & into the job)

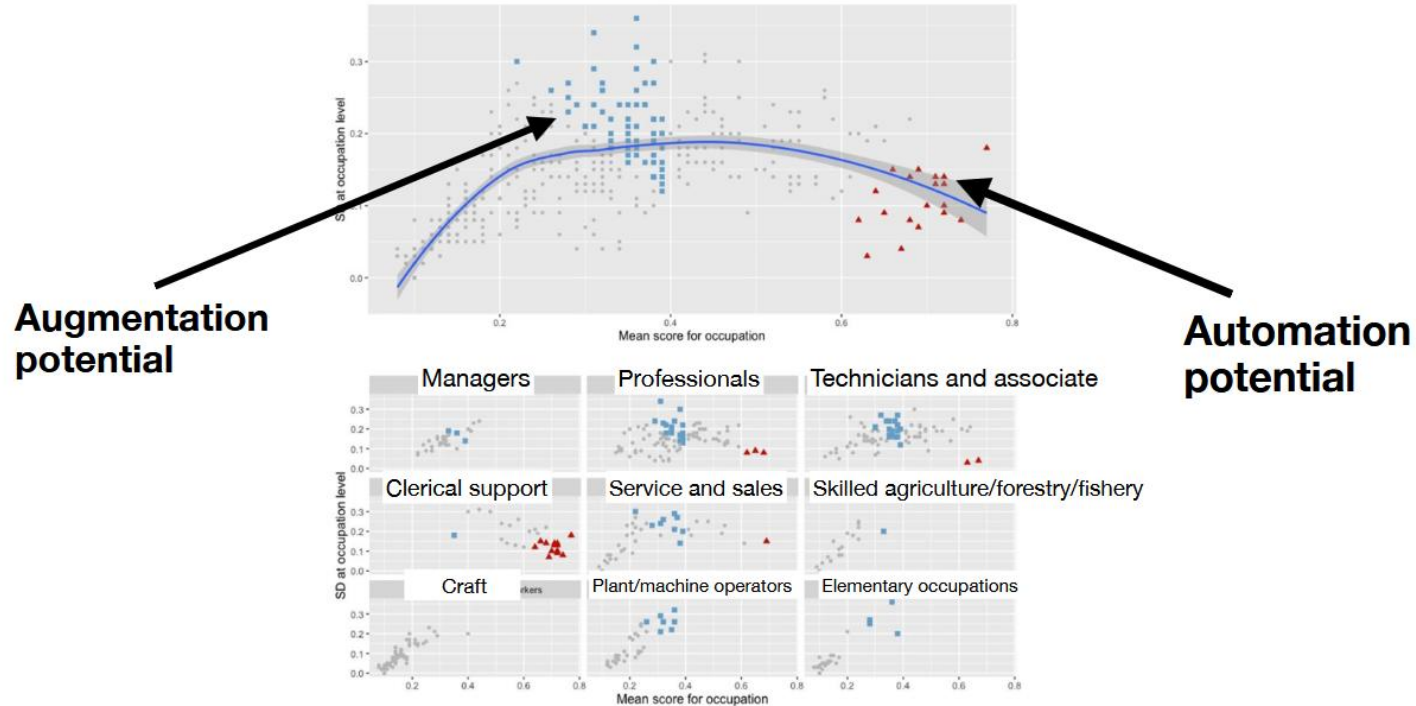
training the operational AI-interaction & user acceptance (on the job)

AI literacy & critical thinking; human-AI-role development (near the job)

Organizational development for new ways in division of labor (Expertise in job design)

⇒ Enacting the machine & critical reflection of human-AI interaction or human-human-interaction
⇒ role development at critical interfaces

GenAI with quantitative and qualitative effects

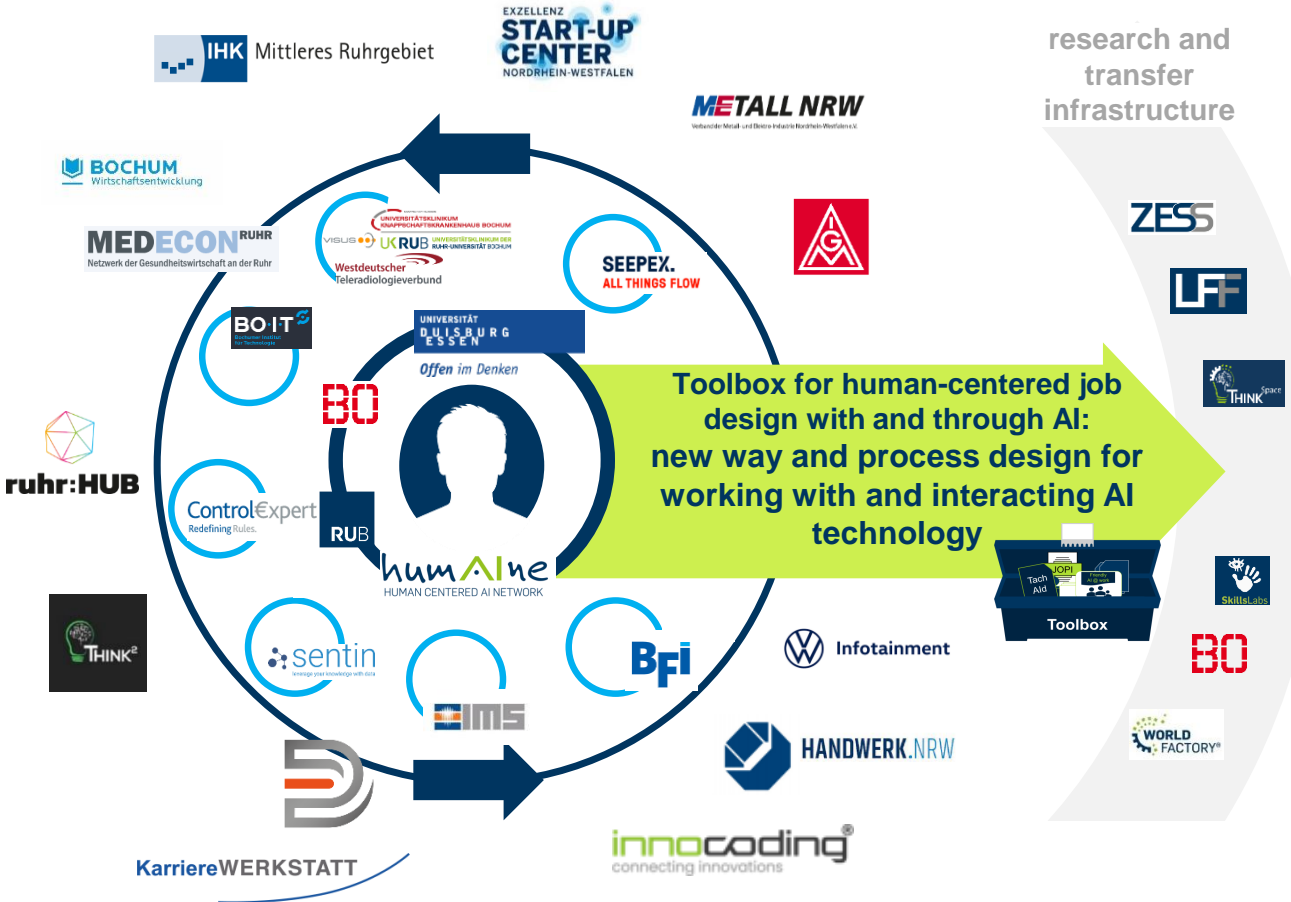


Gmyrek, P., Berg, J., Bescond, D. 2023. Generative AI and jobs: A global analysis of potential effects on job quantity and quality, ILO Working Paper 96 (Geneva, ILO). <https://doi.org/10.54394/FHEM8239>

© Oleksandra Poquet, TUM (2024): Learning Analytics for AI-supported knowledge work, Vienna-Stockholm Symposium

The competence center HUMAINE

HUMAINE Project: structure and dissemination



research and transfer infrastructure



Further development of degree courses, executive training, AI role training (lab training)



Startup activities

Process certification (Norming strategy)



HUMAINE spring's fair (practitioners, graduates), AI-developer-work group, idea lab, Innovation consult hours



humAine Network e.V.

Human-centered AI as a challenge especially at critical interfaces between systems – Cases from industry & medicine



AI-based damage assessment of cars from a workflow perspective



Acceptance of AI at the customer interface – Usability and explainable AI



AI-based weld inspection assistant



AI-based quality control in steel rolling processes



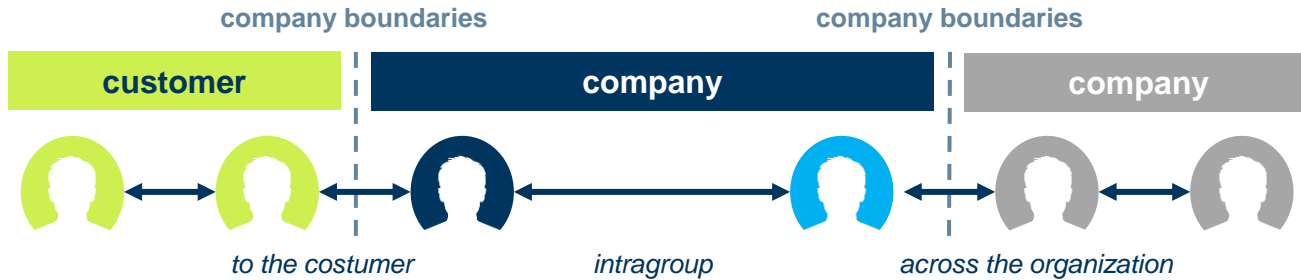
AI-based business model and role development for SD-logic



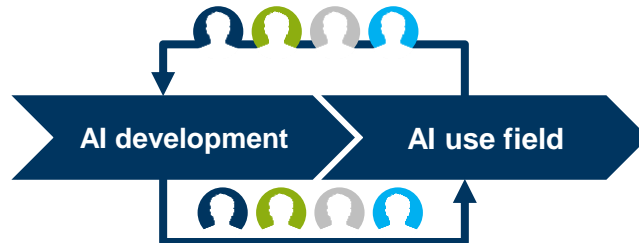
AI-based speech recognition and use system for nursing



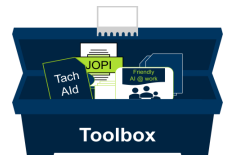
Algorithm for the identification of different therapeutic options (defacing)

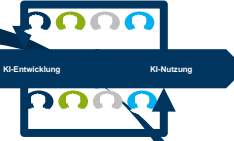


PROCESS MODEL & STANDARDS:
Human-centered job design with and through AI



integrative TOOLBOX
technological, organizational and employee development





Mahidol University

Pattanasak Mongkolwat
Tipajin Thaipisitikul

Thailand



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

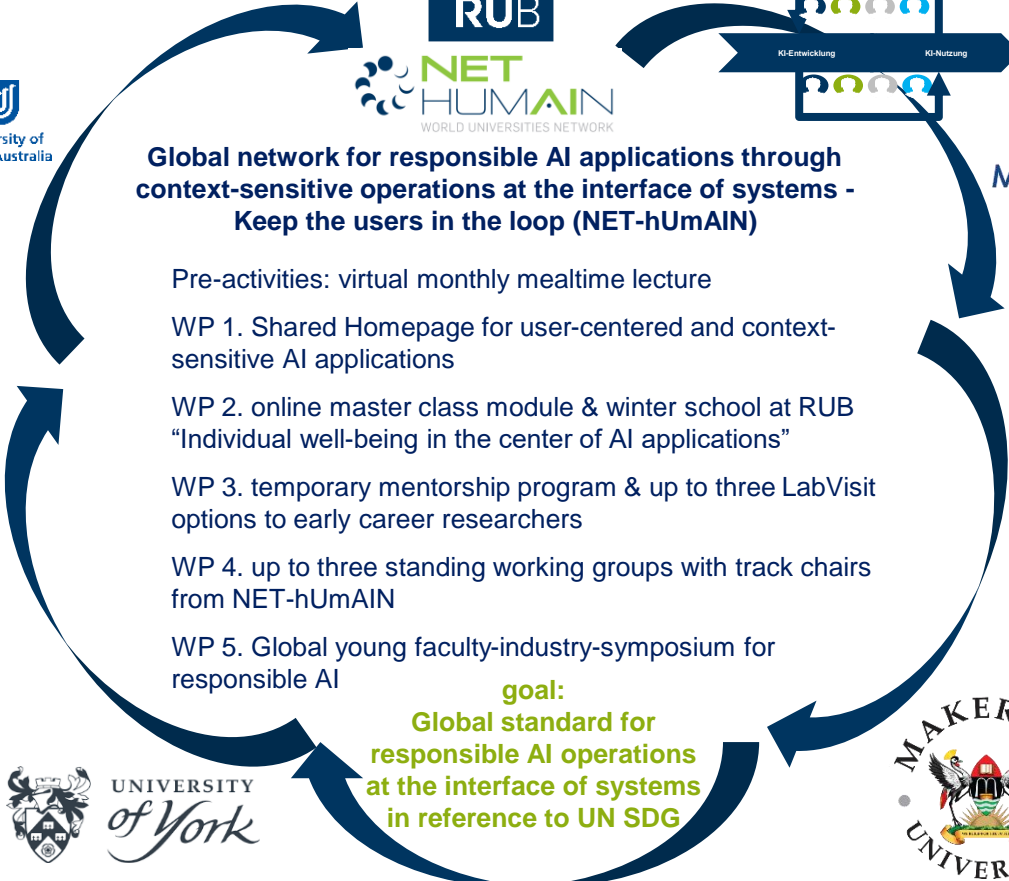
Emma Ruttkamp-Bloem

South Africa



Joyce Nakatumba-Nabende

Uganda



Global network for responsible AI applications through context-sensitive operations at the interface of systems - Keep the users in the loop (NET-hUmAIN)

- Pre-activities: virtual monthly mealtime lecture
- WP 1. Shared Homepage for user-centered and context-sensitive AI applications
- WP 2. online master class module & winter school at RUB "Individual well-being in the center of AI applications"
- WP 3. temporary mentorship program & up to three LabVisit options to early career researchers
- WP 4. up to three standing working groups with track chairs from NET-hUmAIN
- WP 5. Global young faculty-industry-symposium for responsible AI

goal:
Global standard for responsible AI operations at the interface of systems in reference to UN SDG

Wolfgang Mayer
Australia
University of South Australia

David Widder
USA
CORNELL TECH

Shahid Bashir
Mexico
Tecnológico de Monterrey

Tom Stoneham
United Kingdom
UNIVERSITY of York



When and why does **human-centricity** of AI and its integration in the workplace make a difference for vocational education?

⇒ **Pathway to Augmentation:**

using AI-based tools for making quality decisions by reflective and informed decision makers (Fischer, 2022; Bankins & Formosa, 2023)

Definitions of AI

Artificial intelligence (AI) is an umbrella term to “a broad range of technologies that allow computers to perform tasks that would conventionally require human cognition and decision-making” (Prikshat et al., 2023b, p. 1)

	Single-purpose AI	Generative AI
Definition	Algorithms based on machine learning using data from images, voice, or sequence of number which are pre-trained and fine-tuned for performing one specific task in high speed and high precision	Algorithms based on large language models dedicated to perform multiple functions in terms of writing, interacting, and programming
Typical example	detecting anomalies from X-ray imaging in medical diagnoses or industrial quality control	ChatGPT   Copilot
Ethical challenges	Trustworthiness of data (privacy, not free from discriminating minorities)	Hallucination; missing reliability, emergent systems with unintended systems dynamics
	Substitution of labour, downgrading individual skills	Reduction of individual critical thinking or creative intent through malpractice user behavior
Ethical goods	Augmenting individual expertise	Augmenting individual expertise

Human-centered AI:
systems that are reliable, safe & trustworthy and enhance & augment human performance and decision making (Shneiderman, 2022; Wilkens et al., 2023)

⇒ **human-centered sociotechnical system design and related training**

Meanings of human-centered AI (at work)

8 perspectives explored from systematic cross-disciplinary literature review (n=101)



WILKENS U., LUPP, D., & LANGHOLF, V. (2023). Configurations of human-centered AI at work – Seven actor-structure engagements in organizations. *Frontiers in Artificial Intelligence. AI in Business*, 6. doi: 10.3389/frai.2023.1272159

Employee survey at radiology 2019; n=128 => Profile analysis

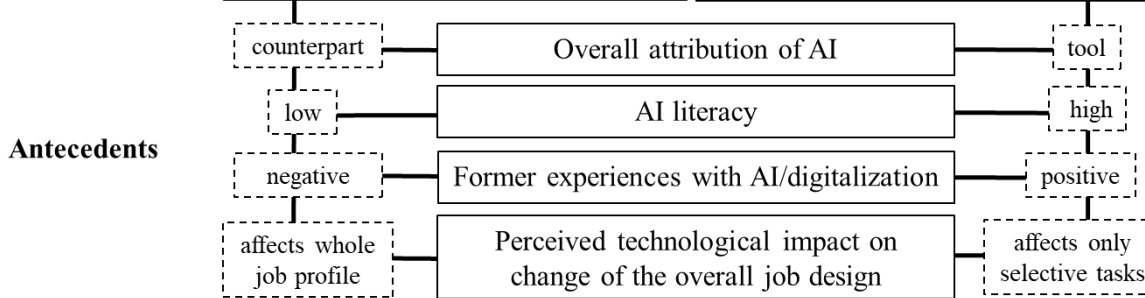
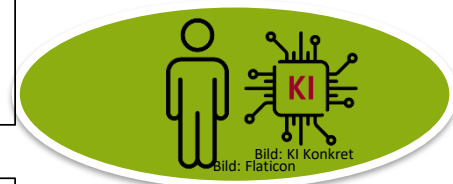
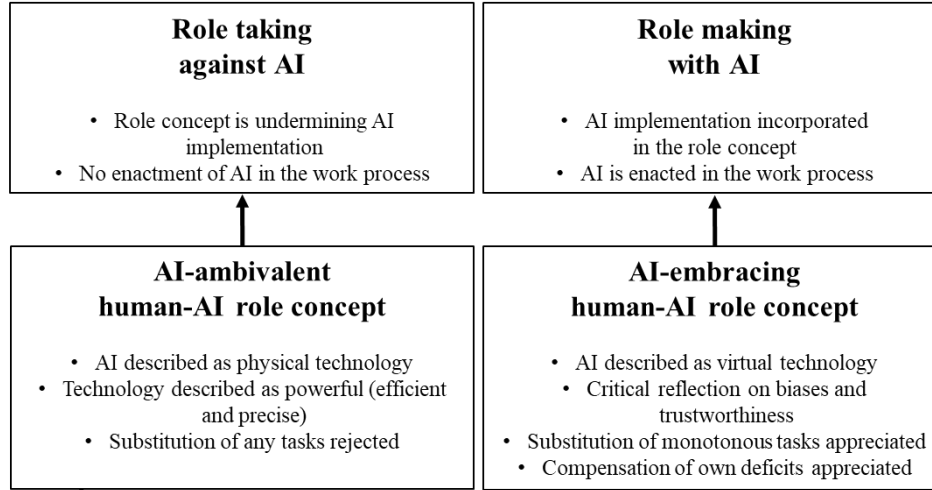
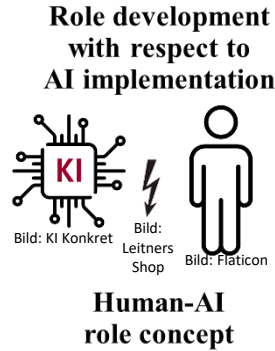
Interview study with radiologists & radiographers in 2021 (via ZOOM) = structured content analysis (Gioia et al. 2013)

	Radiologists	Radiographers
1	27 years; male	24 years; male
2	28 years; male	39 years; female
3	28 years; female	39 years; female
4	30 years; female	40 years; male
5	31 years; male	48 years; female

Table 1: Sample interview study

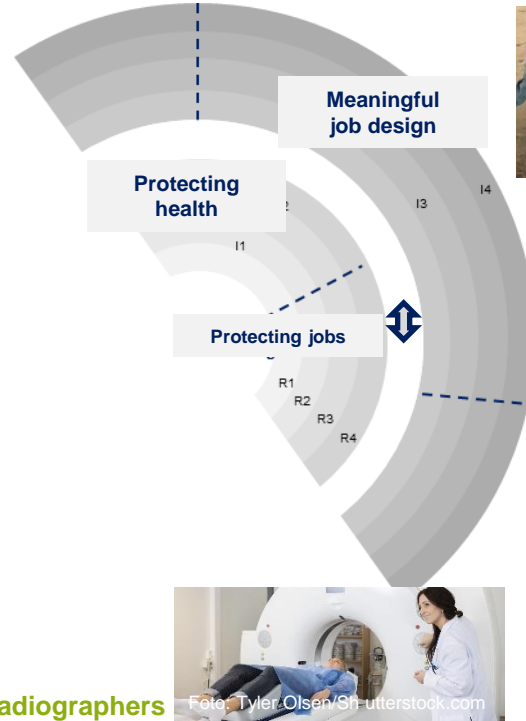
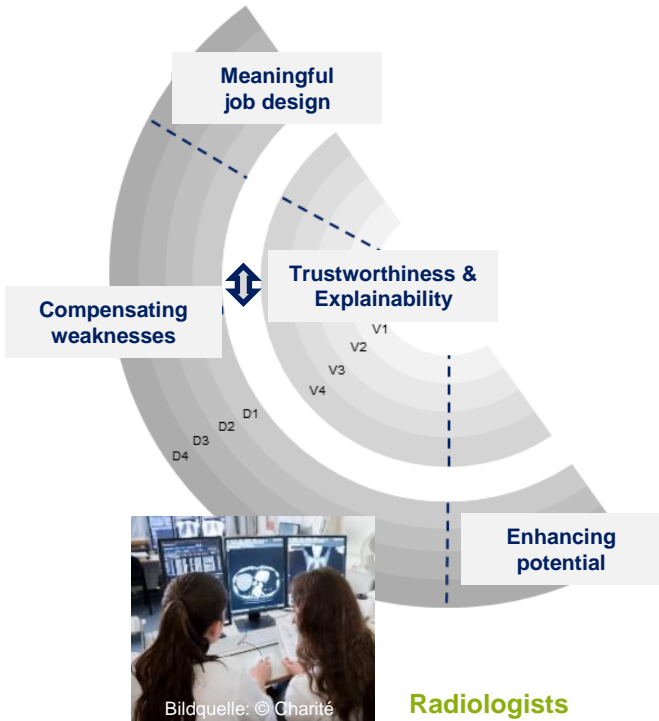
WILKENS, U., LANGHOLF, V. & DEWEY, M. (2024). Types of human-AI role development - Benefits, harms and risks of AI-based assistance from the perspective of professionals in radiology. *Journal of Competences, Strategy and Management*, 12, 1–26. (Special Issue Transformation & Technology, edited by Danner-Schröder, A., Gersch, M., Güttel, W.H., Müller-Seitz, G. & Schulz, A.-C.), <https://doi.org/10.25437/jcsm-vol12-105>

Human-AI role development in radiology



<= issue of sociotechnical job design

Contextualized responsibility – Criteria of human-centricity matter in dependence of the use field



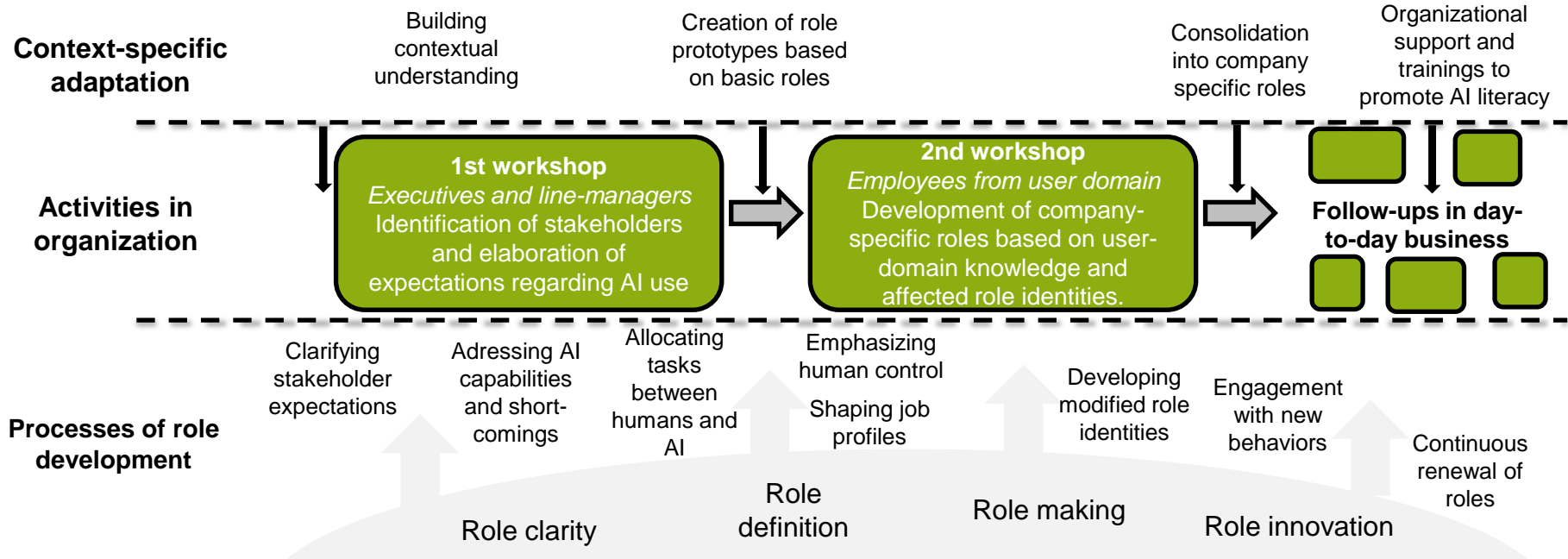
Quality control



Speech therapists

WILKENS, U., LANGHOLF, V., ONTRUP, G. & KLUGE, A. (2021). Towards a maturity model of human-centered AI – A reference for AI implementation at the workplace. In: Sihm, W. & Schlund, S. (Eds.): Competence development and learning assistance systems for the data-driven future, GITO-Verlag, S. 179-197.

The cIAr approach for developing AI-augmented roles



LANGHOLF, V., MAZAROV, J., & WILKENS, U. (2024): Rollenentwicklung bei der Einführung digitaler Services und künstlicher Intelligenz – Erprobung eines Rollenentwicklungskonzeptes in einem Maschinenbauunternehmen. GfA Frühjahrskongress 2024: Arbeits-wissenschaft in-the-loop: Mensch-Technologie-Integration und ihre Auswirkungen auf Mensch, Arbeit und Arbeitsgestaltung

Roles in customer service at SEEPEX

=> Implications for job design



AI business models and role development



Job design to promote external status: customer perspective and problem orientation

Offer the customer the best (digital) product for their problem/application

Mediator of customer needs-oriented solutions

Smart salesperson for spare parts & maintenance

Offer the customer demand-oriented spare parts and maintenance services (especially in good time and taking into account the state of wear)

Expert for digital services

Data-driven problem analyst

Job design to increase AI literacy when using technology: opportunities through AI and strengthening individual competence

Form a communication bridge between the customer and the rest of the company with regard to digital products

Communicator of needs (to SEEPEX customer/ internal departments)

Provider of infrastructure & framework conditions

Job design to promote internal status: communication and collaboration within the organization

- Collaboration between humans and AI also affects work without AI and human-human interaction & collaboration in team development

1. Example for TVET: Human-AI role development training laboratory at Ruhr University Bochum

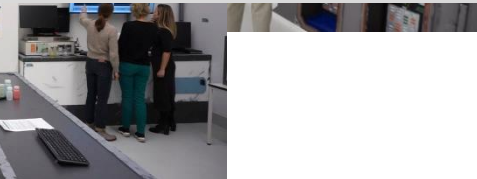


Simulation: Laboratory for second medical opinion

- Phase 1:** workday with non-AI assisted medical diagnoses (conventional workflow)
- Phase 2:** Implementation of AI assistance while training the AI (classification of data)
- Phase 3:** AI-assisted workflow: new role development, experiencing efficiency & augmentation
- Phase 4:** digital blackout: re-activating conventional expertise and workflow while benefitting from role development of phase 3
- Phase 5:** Routine in working with AI while reflecting AI shortcomings in some cases => benefitting from efficiency for spending more time on challenging medical cases => continuous reflection & further development of human expertise



Half day training with simulated workday actions (5 phases à 20-30 min) & after action reflection about group efficiency, role development within the group, experience of own expertise and lessons learned for optimizing the workflow (3 x 15 min; 1 x 30 min final)
⇒ Training and research laboratory



2. Example for TVET: AI-assisted Training of Soldering in the Dual Apprenticeship

- Demonstrator for checking the solder connection (AI-based image recognition)
 - Fault detection
 - Communicating fault reasons
- Class room training
 - Basics of AI & machine learning
 - Use fiefs for AI-based quality control
- Learning aims
 - Experience-based access to AI and its usage
 - Direct integration of AI-based training in the dual apprenticeship
 - Motivation for learning more about AI and for developing related expertise
- Further effect
 - New role constellation between supervisors & AI-empowered trainees



QUALITÄTSSICHERUNG VON LÖTSTELLEN

Erhitzen

Ziel: Arbeiten von Bauteilen, z.B. von Widerständen oder Transistoren, werden. Folgebegriffen (Folienablenkungsmaschine) überprüfbar.

Die Erhitzung besteht aus einem Aufwärmstadium mit einer Solderpaste aus wärmeleitendem Material (SMT) oder Solderpaste in Form von Pastenring. Nach dem Erhitzen der Lötstelle ist vom Lötlot zu erwarten, dass es sich an der geschweißten Stelle verfestigt und das Bauelemente angeschlossen. Durch das Verfestigen wird das Lötlot vom Bauelement über der Lötstelle abgezogen.

Die Lötstellen können aus einer Abflussschicht abgedeckt sein. Dies wird durch Erhitzen erreicht. Lötstellen sind nach dem Erhitzen zu prüfen. Die Prüfung erfolgt durch das Erhitzen der Lötstelle. Das Erhitzen ist ein wichtiger Schritt in der Lötstelle. Es kann für weitere Bauelemente und eine bessere Qualität sorgen.



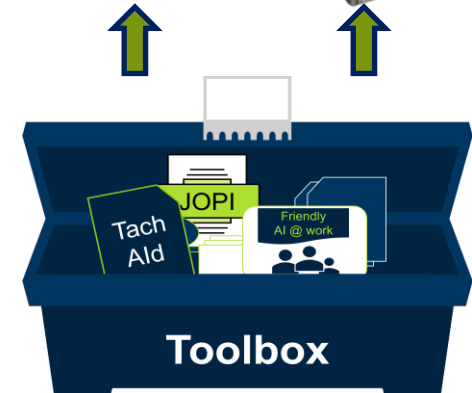
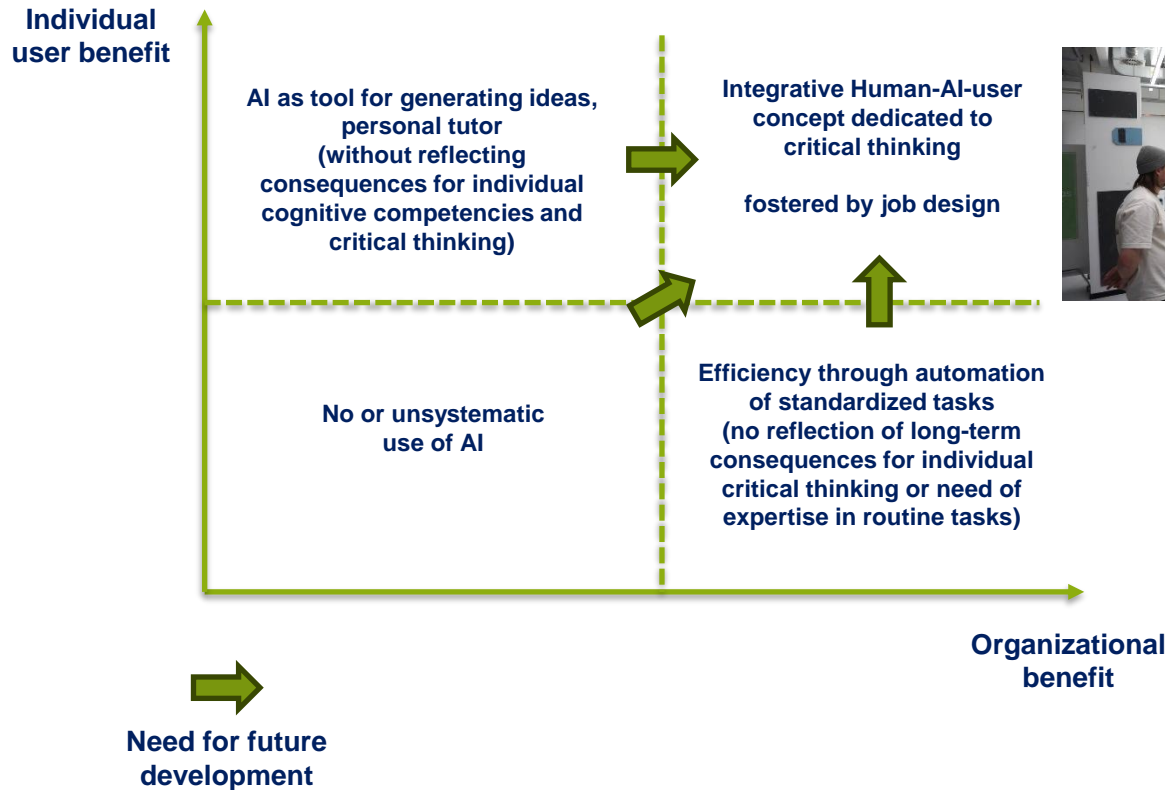
Fachfragen beim Löten

Manchmal gelangen Lötstellen nicht so, wie man sie gerne hätte. Oft ist es gut wenn man weiß, was die Ursachen sind und wie man sie vermeiden kann. Hier sind einige Fragen, die bei der Lösung des Problems oft auftauchen.

Erkenntnis	Mögliche Ursache	Lösung
Lötstelle besteht aus	Lötstelle besteht aus	Lötstelle besteht aus
Lötstelle besteht aus	Lötstelle besteht aus	Lötstelle besteht aus
Lötstelle besteht aus	Lötstelle besteht aus	Lötstelle besteht aus
Lötstelle besteht aus	Lötstelle besteht aus	Lötstelle besteht aus
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Lötstelle besteht aus	Lötstelle besteht aus	Lötstelle besteht aus
Lötstelle besteht aus	Lötstelle besteht aus	Lötstelle besteht aus
Lötstelle besteht aus	Lötstelle besteht aus	Lötstelle besteht aus

Zurück zur Prüfungsicht

Different pathways to integrative human-AI work roles



Summary & Discussion

- AI literacy is a necessary but not a sufficient prerequisite for responsible use of AI in the workplace
- AI skills and AI complementing skills have to be considered as a bundle of competencies and trained in TVET in a comprehensive approach
- From an ethical perspective on AI usage there should be prior emphasis on augmentation towards integrative human-AI work roles
- Augmentation results from responsible and meaningful job design & related training of role behavior
- TVET should not only train AI literacy and the effective usage of AI but foster the overall human-AI-role development while keeping critical thinking – also as an issue of group dynamics - on a high level
- And beyond: (T)VET should include knowledge in job design and ergonomics; the current neglect of the long-term consequences of GenAI usage for human creative intent is an ethical issue

Thank you and Greetings from

humAine
Network e.V.

- Founded in April 2024
- 26 members (corporate and individual membership)
- 7 members elected for executive board



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