Designing AI Assistant for Factory Worker's Competence Development

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This position paper addresses the workshop theme 'Sustaining Human Skills in Long-Term Human-AI Interaction' by proposing personal AI assistants that prompt and support employees in maintaining and developing their competences and skills. We present early-stage concept design work that drew on interviews with 31 factory workers about their psychological needs to inform initial AI assistant concepts. Following a human-centered, iterative design and evaluation cycle, we report first-iteration results in which three skill development concepts were tested as storyboards with nine factory workers. These findings will inform the next design iteration, and we expect to share prototype testing results at the workshop. Since the results highlight the need for privacy in employee's skill development, we call for personal AI assistants that can be used personally, in isolation from the multi-agent systems in the workplace.

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1 INTRODUCTION

While early factories typically ran one product on a single production line, modern manufacturing increasingly relies on flexibility. To remain competitive, factories must cope with greater product variety, volatile demand, higher levels of customization, shorter technology life cycles, tighter delivery times, and other pressures that call for highly dynamic

factory production (Jain et al. 2013). In such conditions, automating manufacturing processes is challenging, and the need for skilled labor to orchestrate and execute dynamic factory operations has become evident (Kaasinen et al. 2020).

Human-centricity, resilience, and sustainability are cornerstones of the European Commission's Industry 5.0 vision (EC 2024). In this vision ground-breaking technologies are developed with a human-centric approach, which not only enhance individual performance and wellbeing but also contribute to a more equitable, sustainable, and humane society (EC 2024, p. 11). The human-centric goals of Industry 5.0 encompass empowering workers, promoting life-long learning, improving work-life balance, and enhancing their well-being (EC 2024, p. 19). Prior scholarship underscores the importance of addressing personal competence as part of psychological wellbeing at work (e.g. Lips-Wiersma & Morris, 2009; Rosso et al., 2010; Ryan & Deci, 2000), highlighting employees' ability to engage in work related challenges through which they can accumulate new skills and maintain their mastery (Deci & Ryan, 1985; Viljakainen et al., 2026). In addition to training programs and testing facilities for skill development (EC 2024, chapter 6.1), this position paper explores how personal AI assistants could support workers' skill development and strengthen their feeling of competence at work.

The authors are engaged in an ongoing research project on meaningful industrial work in hybrid human-technology-AI teams[1]. To date, we have studied what constitutes meaningful work for industrial workers by interviewing 31 factory workers across nine Finnish plants. Our findings indicate that the basic psychological needs of relatedness, autonomy, and competence remain central to perceived work meaningfulness (Viljakainen et al., 2026). A key challenge is how to preserve—or even enhance—these aspects when designing future work with intelligent systems. In this position paper, we concentrate on the workers' basic psychological need for competence by leveraging AI to foster skills development. Our work is guided by the following research question: *How could AI foster factory workers' sense of competence?* We address this research question by designing alternative AI system concepts and testing them with nine factory workers across two Finnish factories. The following sections present the study's methodology, results, and conclusions.

2 METHODOLOGY

We selected storyboard evaluation as our data collection method. In Van Den Hende & Schoormans's (2012) study comparing new ways to introduce technologies with108 consumers showed that storyboards presenting 'narrative text with drawn images' explain new technologies as effectively as prototypes. Therefore, our storyboards follow this same format.

2.1 Storyboard design

The development of storyboards began by analyzing recently collected interview data from factory workers (n=31) through the lens of competence experiences (Viljakainen et al., in press). Drawing on these insights, the 2nd author created six storyboards, of which three —focused on competence — are presented in this paper. Each storyboard depicts a distinct approach by which a personal AI assistant could foster a factory worker's sense of competence. In all storyboards, the AI assistant was functioning as a personal tool intended for the employee's private use.

In Storyboard A (Fig. 1), after initial task training, the AI tool supports novice workers by acting as a stand-in for a human co-worker, reminding them of task execution details. Storyboard B (Fig. 2) presents the AI as a serviceperson that provides performance information on demand. Drawing an analogy to a traditional butler, AI assists the worker without challenging or directing the worker's methods. By contrast, Storyboard C (Fig. 3) portrays a coaching-oriented assistant that offers constructive feedback and empowers the worker's development over time (for AI's roles see Roto, 2024).

[1] https://hifive.fi

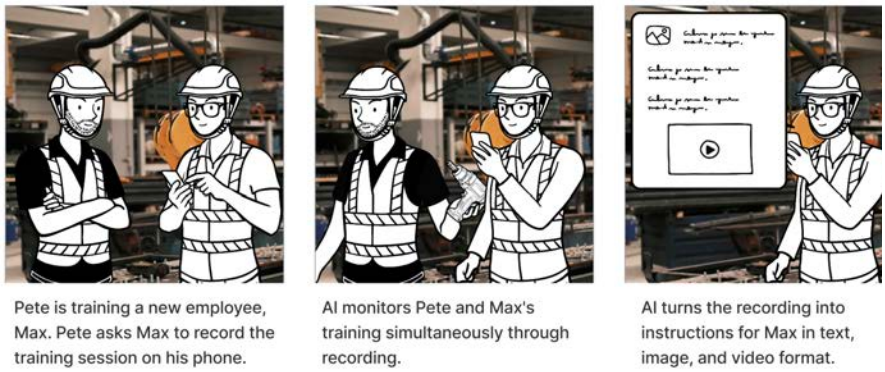

Figure 1: Storyboard A illustrates using an AI tool to support training a new worker, Max. After a human co-worker demonstrates the task, Max can use the AI assistant to review the instructions as needed.

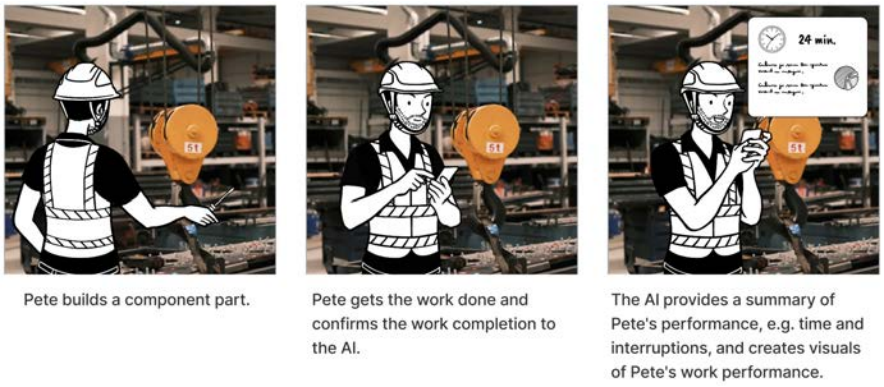

Figure 2: Storyboard B depicts Pete focusing on an enjoyable manual task without using AI. After completing the task, the AI assistant provides concise evaluation feedback to help Pete assess his work.

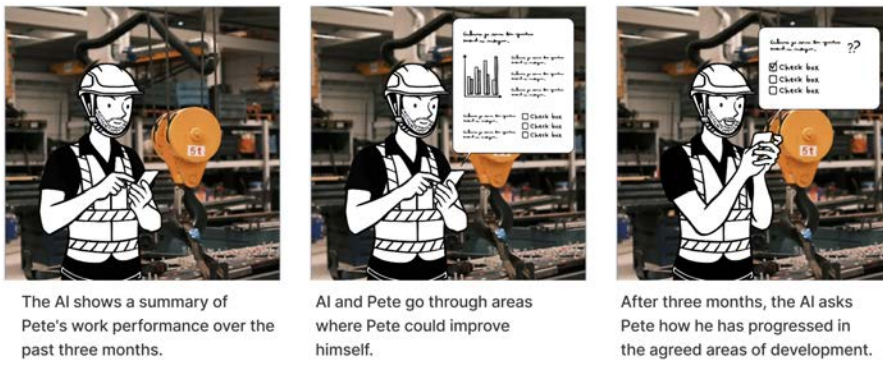

Figure 3: Storyboard C portrays a personal AI assistant that coaches Pete to develop his skills over an extended period.

2.2 Storyboard evaluation sessions

Participants were recruited via factory managers at two industrial factories in Finland. In total, nine workers took part in the evaluation sessions. They volunteered during work hours and received no compensation for participating.

Interviews were conducted individually and lasted 45-60 minutes, with one exception: a joint interview with two participants was organized at the factory manager's suggestion. All interviews were held in person in designated factory meeting rooms, and each participant provided a written consent. Sessions were audio-recorded for later analysis. During the interviews, each storyboard was described verbally, and participants could follow the storyboard texts (Figures 1-3).

Each session began with background questions about participants' industrial work experience and their familiarity with GenAI tools in both professional and personal contexts. The storyboard phase of the session then conversed on an open-ended prompt: "What are your thoughts on using GenAI in this type of work scenario?". Follow-up questions probed participants' views on potential opportunities and challenges in greater depth. They were also encouraged to suggest additional GenAI use cases not depicted in the storyboards. Finally, participants completed a Likert-scale questionnaire. In the joint interview, the two participants discussed each item and submitted a single shared response. Consequently, qualitative data were collected from nine participants, while we obtained eight questionnaire responses.

2.3 Storyboard evaluation analysis

For this paper, the interview data was analyzed using inductive thematic analysis for each storyboard separately, with coding focus on the competence dimension of meaningful work. Based on the second author's interpretation, individual codes were aggregated into broader themes. The outcome of this process was a set of themes that inform how industrial workers perceive the use of an AI assistant in developing their skills and competences.

3 RESULTS & CONCLUSION

Based on the participants' feedback on *Storyboard A* (n=9), AI could help workers build task-related skills more systematically (n=6) and free up time for tasks they consider important (n=3). For example, the AI assistant could generate onboarding materials after a training session, reduce the need to search information across multiple systems, and lessen the manual effort of creating instructions (n=3). In this storyboard, using a personal AI assistant for self-development could also enhance workers' sense of competence (n=5) and, over time, reinforce their identity as industrial professionals. However, participants also expressed uncertainty about AI-generated content, which could negatively affect the worker's skill development. Three participants stressed the need for human feedback, since impersonal technology-only feedback can potentially diminish feelings of accomplishment and professional identity. Participants also raised concerns about data privacy (n=3) and performance pressure (n=3). They noted that the AI tool could intensify a sense of surveillance, negatively affecting the joy at work. In the questionnaire, 6 out of 8 respondents agreed or strongly agreed that an AI assistant could help them develop or maintain professional skills in this context.

Feedback on *Storyboard B* indicates that the AI tool would mainly appeal to workers already motivated to develop their skills (n=5). Participants also emphasized workers' autonomy in the use of the tool (n=3). This suggests that if the AI tool

aims for self-development, it must also satisfy the basic psychological need for autonomy. Participants also worried that performance-tracking AI could foster counterproductive comparisons among workers (n=4), potentially undermining their perceived competence and professional standing. Therefore, the tool should clearly signal its personal and private character. Questionnaire results on Storyboard B showed that 7 out of 8 respondents (3 agreed and 4 strongly agreed) felt an AI assistant could help them develop their professional skills, while one disagreed. The discussion revealed uncertainty regarding the performance evaluation criteria in the AI tool, as the organization and the worker can hold differing interpretations of performance (n=3). Participants emphasized the importance of human feedback, since receiving technology-based feedback alone might feel distant (n=3). Concerns were raised regarding privacy and the potential performance-related pressure (n=6). An AI tool could intensify the feeling of surveillance, which could have a negative impact on work performance.

Feedback on Storyboard C indicates that an AI tool could support competence development when it functions as a coach. Participants mentioned the usefulness of guidance and structured learning (n=3). They also noted that AI-generated summaries of achievements and learning progress could be useful in performance reviews with supervisors (n=3) by providing evidence of work skills. Participants also emphasized workers' autonomy in the use of the AI tool (n=3). This suggests that if the AI tool aims for self-development, it must also satisfy the basic psychological need for autonomy. Participants also worried that performance-tracking AI could foster counterproductive comparisons among workers (n=4), potentially undermining their perceived competence and professional standing. Therefore, the tool should clearly signal its personal and private character. Questionnaire results on Storyboard C showed that 7 of 8 respondents (3 agreed and 4 strongly agreed) felt an AI assistant could help them develop their professional skills, while one disagreed. The discussion revealed doubt regarding the performance evaluation criteria in the AI tool, as the organization and the worker can hold differing interpretations of performance (n=3).

We conclude that using AI to support skill development is a sensitive matter and hinges on employee trust. Several findings address our research question on how AI can foster factory workers' sense of competence. One interesting finding was that AI systems should not only accurately interpret tasks and performance and provide feedback in an interesting form, but also rigorously protect sensitive performance data. In the studied factory contexts, employees might trust the AI app's privacy most when using the app on their own mobile phone, which they can control like any other app. They could choose whether to connect the AI app to the workplace systems—making it easier for the AI to understand performance and development needs — and decide if and when to share performance information with colleagues or managers. Naturally, this kind of a personal, private app would require a personal, private AI model.

3.1 Limitations

A key limitation of this study is the small sample size: with fewer than ten participants, theoretical saturation may not have been reached (Kuzel, 1992). We consider this study as an exploratory study of factory workers' attitudes towards our initial ideas for AI-enabled skill development, based on which we can implement prototypes that are better in line with users' needs and values. Therefore, we do not require the highest information power[2] from this study.

[2] According to Malterud et al. (2016), the more relevant information the sample holds, the lower number of participants is needed. In this study, the dimensions of information power were met as follows: the study aim was limited to specific scenarios (narrow), and the study was conducted with relevant participants for the context (dense). Also, the study utilizes specific theories in practice (applied). In the study, a strong and clear communication was supported by prepared and thorough interview protocol, and few conflicting views took place in interviews (strong dialogue). Finally, the study focused on individual cases and narratives that were not compared one to another (case). All these factors point to higher information power, which Malterud et al. (2016) see a more adequate measure than saturation or sample size.

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