

Langemeyer, I., Gronau, N., Schmid-Walz, S., Kotarski, D., Reimann, D., & Teichmann, M. (2021). From employee to expert - Towards a Corona-sensitive approach for data collection. In C. Nägele, B.E. Stalder, & M. Weich (Eds.), *Pathways in Vocational Education and Training and Lifelong Learning. Proceedings of the 4th Crossing Boundaries Conference in Vocational Education and Training, Muttentz and Bern online, 8. – 9. April* (pp. 226–231). European Research Network on Vocational Education and Training, VETNET, University of Applied Sciences and Arts Northwestern Switzerland and Bern University of Teacher Education. <https://doi.org/10.5281/zenodo.4590196>

## **From Employee to Expert - Towards a Corona-Sensitive Approach for Data Collection**

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### **Abstract**

In the context of the collaborative project *Ageing-appropriate, process-oriented and interactive further training in SME (API-KMU)*, innovative solutions for the challenges of demographic change and digitalisation are being developed for SMEs. To this end, an approach to age-appropriate training will be designed with the help of AR technology. In times of the corona pandemic, a special research design is necessary for the initial survey of the current state in the companies, which will be systematically elaborated in this paper. The results of the previous methodological considerations illustrate the necessity of a mix of methods to generate a deeper insight into the work processes. Video-based retrospective interviews seem to be a suitable instrument to adequately capture the employees' interpretative perspectives on their work activities. In conclusion, the paper identifies specific challenges, such as creating acceptance among employees, open questions, e.g., how a transfer or generalization of the results can succeed, and hypotheses that will have to be tested in the further course of the research process.

### **Keywords**



cross self-confrontation, recording of workplaces, corona-sensitive data collection, age-appropriate vocational training, augmented reality

## 1 Introduction

The digitalization and the demographic change challenge small and medium-sized enterprises (SME) in manifold ways. The manufacturing industry in particular is severely affected by a lack of skilled workers and a loss of experience and knowledge due to retirements, often early retirements. Taking these challenges into account, the collaborative BMBF/ESF research project API-KMU (FKZ: 02L19A010) aims to develop a digital education and training concept as well as learning modules and a tutor system based on Augmented-Reality (AR) technology for use in SMEs. The goal is to design age appropriate and needs-oriented in-company training and to support SMEs and their employees in coping with and (re)designing their daily work tasks.

In order to achieve these project goals, a structured analysis of the identified use cases in the partner companies is necessary. However, under current Corona-related conditions, this is not possible by conventional survey methods of the social science (e.g., interviewing an employee or visiting the workplace). In API-KMU, a research approach is being developed that responds to the challenges posed by Corona and enables the collection of relevant data.

The intended data collection includes both an inventory of work activities, disturbances, and corresponding possibilities for improvement with-in the work processes. Following an employee-to-expert approach, the central idea to address Corona-related challenges was to rethink data collection as a participatory and dialog-oriented process. This paper traces previous research methodological reflections, existing research challenges and open questions.

## 2 Methodical approach of API-KMU

Data collection is a question of methodological requirements to ensure reliability, validity, and objectivity of scientific research results. In addition to achieving scientific research goals (e.g. identification of age-appropriate design requirements for digital learning tools), data collection in API-KMU also aiming to translate scientific findings into usable, solution-oriented artifacts (Hevner et al., 2004). One targeted artifact is an AR-based prototype for technological and human resource development in manufacturing areas that should be usable and adaptable by other companies in the future. Therefore, the underlying design-process has to elicit and determine solutions for work processes concerning the unity of humans, organization, and technology (Hevner et al., 2004). Following this, design-oriented data collection cannot stop on the sought-for objectified solutions (e.g., manuals, equipment, and workpieces). Investigation of (tacit) characteristics, differentiated work sequences, and their quality is also necessary to understand work processes as an entity in which humans act as part of an organization. A close alignment of data collection with the work process and problem-orientation is mandatory.

The academic project team pays great attention to employees: What happens when researchers seek to get the workers involved in several tasks related to the collection of data and the development of new solutions? The workers' willingness to cooperate throughout the entire project is crucial! For this reason, a target group-specific approach and communication of the project goals is of particular importance.

Corona does not necessarily lead us to lower our ambitions. We see the extraordinary situation of social distancing as a chance that workers are more willing to cooperate with the project team by using digital devices such as mobile phones or cameras for the data collection and AR-devices for instruction and training later on. Especially employees who primarily work with their hands are often not familiar with explaining to outsiders how and why work processes, tasks, and movements work - or not. They cannot explicate the underlying tacit knowledge (Polanyi, 1967). The visual data is beneficial for identifying options to enhance work processes located on this tacit or experienced-based knowledge (cf. Clot, 2009; Clot et

al., 2000). A combination of video- and audio-recordings compared to regular interviews are more advantageous to receive more tacit-knowledge of work processes from the workers. According to Clot et al. (2000), recordings of work processes are usable as a method of self- and cross-confrontation: A researcher invites one worker to comment on some selected video-sequences that show operations, procedures, or failures of interest. He or she describes the work process and, conceivably, what went wrong. In a second step, workers from the same work process are invited to evaluate the commented record. A confidential relationship between interviewer and interviewee is therefore necessary. Taken together, in API-KMU, we introduce a paradigm shift where employees become participants in the research process and thus experts in transforming and improving their work activities. For this purpose, we adapt the mix of data collection methods according to the outlined conditions (Tab. 1):

**Table 2**  
Method mix of API-KMU

Step	Method	Methodical approach	Goal	Tool/Requirement
1	- Preparatory workplace inspection	-	- Creating acceptance among the employees by rerouting to the project - Dialog-oriented use-case identification - First insight into research environment	- Privacy agreement - (Low-threshold) Information documents - Camera/Smartphone
2	- Recording of workplace videos by employees	- Relevant process selection	- Insights into relevant work processes - Insights into the activities performed at the workplace - Preservation of processes and activities	- Privacy agreement - (Low-threshold) Information documents - Camera/Smartphone
3	- Interview-based video sequence analysis	- Relevant activity selection - Cross self-confrontation - Retrospective interviews	- Identification of: - Tacit knowledge - Training needs - Enhancement potential - Mappable process steps for the AR-based prototype - Mutual exchange of experience - Stimulation of individual and collective reflection processes	- Definition of a responsible contact person in the company - Training material for the contact person - (Low-threshold) Video recording kit
4	- Interviews with bosses, managers	- Semi-structured guided interviews	- Identification of: - Required formal qualifications - Attitudes towards further training - Company-strategic training needs	- Interview-Guidelines - Recorder

### 3 Methodical reflection

In the following chapter, we summarize the underlying reflection process of the presented methodical approach. The start of the project was in October 2020 where policy issuing decrees of another lock-down. Moreover, the challenge to organize these critical research aspects was now restricted by the current rules to prevent COVID-19-infections. As a result, reflecting and rethinking the original mix of data collection methods was mandatory.

Systematically, the reflection was guided by **three** main questions:

1. **Definition of the starting situation:** What type of work situations in the cooperating companies (*practical perspective*) we expect to find as a starting point to ensure long-term cooperation between the research team and the workers? (*research perspective*)
2. **Definition of the empirical data kind:** What kind of empirical data will be necessary to specify practical problems of the particular manufacturing and their solutions and how is it obtainable? (*methodical perspective*)

3. **Possible potentials for the company and the employees beyond the project scope:** What effects are expectable on the company as an organization in which people work as part of work processes in a community of practice when the employees become researchers? What is learnable for new use-cases in the future? (*transfer perspective*)

### 3.1 Practical perspective

Against the backdrop of conversations with the owners and employees of two cooperating medium-size enterprises, we get informed that the manufacturing poses the following challenges:

- The manufacturing encompasses fragile goods such as glass and natural stone slabs and the produced goods are also quite heavy, so that clumsiness and ineptitude might cause great damage and financial loss.
- The average age of the employed workers is high. Especially because of the necessary weightlifting, open positions are difficult to fill. Many times, newly recruited workers quit their job.
- The work organization is flexible. Workers often need to organize themselves how to get a job done. Time pressure likely emerges when forward planning isn't possible.

### 3.2 Research perspective

Assumptions of the project team about measures to be taken to initiate long-term cooperation with the workers are the following:

- Convincing workers to contributing to the research and development project if they see advantages and acceptable solutions for their work.
- However, workers might feel intimidated or overwhelmed requested to cooperate as co-researchers. They are likely to repudiate extra-work and ill-defined tasks like experimenting with preliminary solutions and ideas.
- Nevertheless, they might be willing to video-tape work processes for the research team because acknowledging the pandemic as a constraint.
- The planned self- and cross-confrontation interviews with selected video sequences and the invitation to reflect might be accepted because of missing alternatives.
- Interviewers support the reflection by asking questions about possible improvements. Thus, the research team might find the right solutions to a potentially premature work organization, technological enhancements, and innovative didactics.

### 3.3 Methodical perspective

The method-mix thus needs to be evaluated systematically based on the research and design goals. We developed the following evaluation categories and reflection questions based on circular expert discussions with members of our scientific environment.

**Table 3**  
Evaluation categories and reflection questions

Methods and data	Acceptance	Specificity and relevance of data	Generalizability
- Recording of workplace videos by employees	- Are workers willing to take video recordings of their workplace they are responsible for? - Is this better compared to researchers taking care of the recording?	- The selection of work processes filmed needs to be reflected: What is specific or relevant for what in a certain context? - How many cases are to select? Are insights comprehensive with regard to cases?	- To which extent is it possible to generalize from the observed cases to possible cases in the future?
- Interview with workers - Cross self-confrontation - Retrospective interviews	- Are workers willing and capable to reflect in an interview on work processes, their risks and their errors? - Are there limits of quality due to social distancing?	- Is the scarcity of certain extraordinary skills of manufacturing-specific problems in the work organization? - How do inter- or intrapersonal conflicts emerge? - How do workers organize their work collaboratively?	- To which extent is it justified to interpret the standpoint of the interviewed worker as relevant for workers in other companies/shop floors? - Is it necessary to distinguish types of workers?
- Interviews with bosses, managers	- Do bosses/managers have enough insight into specific processes and their failures? - Are there limits of quality due to social distancing?	- In what ways are aspects of the management relevant to problems or failures? - How does the level of management interrelate with the action level of workers?	- To which extent is it justified to interpret the standpoint of the interviewed boss/ manager as relevant for bosses/ managers/ in other companies/ shop floors?

### 3.4 Transfer perspective

From our proposed mix of methods and the considerations presented, we suspect sustainable changes in the organization. The employees themselves will also be affected in terms of integrating their shaping competence into the process. Furthermore, we derive the following hypotheses, which we will test in the course of the research project:

1. The process of data collection is itself to be understood as a process of cognition for the employees, developing various competencies.
2. The positioning of employees as researchers can, in perspective, initiate a change to a "research-based learning" oriented vocational training approach in a company.
3. The paradigm shift dissolves culturally entrenched barriers for employee participation.
4. By directly involving employees in the research process, it is possible to identify learning needs that are not identifiable by a top-down-oriented vocational training approach.
5. Involving employees can lead to the discovery of the tacit potential for efficiency-oriented process modification.

### 4 Next projects steps and outlook

The research team already carried out the workplace inspection, identifying several use-cases with employees of one cooperating enterprise (e.g., gluing natural materials, working on new milling machines). Addressing the recording of workplace videos as the next step, on the one hand, selection of relevant work processes and activities are necessary. For that, we plan further talks with employees. On the other hand, we prepare the low-threshold video recording kit (consisting of three cameras and a user-manual for the responsible contact person). A high usability is ensured by a pre-configuration of the cameras (e.g., file location). The contact person only needs to establish two cameras on two predefined areas in the workplace and hand over the last body-camera to the worker. In perspective, the interview-based video sequence analysis

will be carried out based on as relevant classified activities. Although self-confrontational interviews are the main research tool for investigating work practices, other perspectives, such as those of other employees and also of company management, need to be considered for a comprehensive understanding of the various work contexts. A full survey guided by questionnaires' will also enable a more accurate picture of the workforce, work processes, work activities, continuing education activities, and attitudes toward in-company continuing education to emerge. To this end, surveying both employees and company management is indicated.

From a scientific perspective, the hypotheses set out in section 3.4 will be tested. From the design-oriented perspective, we plan to integrate workers' (tacit) knowledge of work processes, activities and therein located potential for process enhancing and competence development into a first AR-prototype. The analysis and implementation of further use-cases will follow.

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