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Crafting a framework to generate personalised work instructions tailored to experienced employees

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ABSTRACT

In recent years, the role of the employee within manufacturing companies has shifted from traditional machine operating to a more supervisory and process monitoring role. This transformation, in combination with the more extensive labour pool companies must deal with these days, demands a corresponding transformation in work instructions to match with the diverse cognitive and adaptive skills and information processing capabilities of the diverse group of employees. This study aims to develop a framework for creating work instructions tailored to experienced employees within the manufacturing setting. To do so, design science research (DSR) is used, for developing a new artefact. Data for this research is gathered by conducting interviews and observations at six different companies, divided into regular and social employments provision companies (SEPs). Contrary to the common belief in literature and practice, from the regular companies it is found that experienced employees do value and use the common instructions and no different instructions are needed between experienced and unexperienced operators. This finding resulted in an efficient and complete general framework for work instructions, providing guidelines for form and content. From the SEPs it is found that these companies likely should combine verbal and written instructions, due to the high variability of capabilities among the employees. Finally, this study provided a framework for both types of companies, enabling them to generate work instructions tailored to the preferences of their operators.

PREFACE

During the last few months, I worked on my thesis, which is the final assignment for completing the master Technology and Operators Management at the University of Groningen. This period allowed me to learn a lot and address several challenges from practice with the help of research and science. During this period, lots of people supported me in different ways and I would like to thank them in this way:

First, I would like to thank my supervisor Jos Bokhorst for the support he delivered during this thesis. His feedback, tips and guidance during these months supported me through the period and made this thesis possible. Also, I would like to thank my second supervisor, Christos Emmanouilidis for the feedback he provided during our meetings and suggestions he mentioned, providing new and critical insights to this study.

Second, I would like to thank all the team leaders and operators I interviewed at the six different companies for allowing me to gather data and carry out my thesis this way. All companies organized these visits well and managed to provide me with the information. If any reader of this thesis is interested in the results of all interviews conducted, they can reach out to me via the following email provided on the first page.

Finally, I would like to thank my family and friends who supported me during this face, but also my entire study period, for their help, guidance, and support where possible.

Groningen, 21st of June 2024

Andries Holwerda

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1. INTRODUCTION

During the past few years, the role of employees working in manufacturing companies has undergone a transformation, shifting from machine operating to a more supervisory and process-monitoring role, requiring different skills and capabilities of the employees (Villani et al., 2019). This change in work responsibilities also necessitates a corresponding adjustment in how companies should instruct their employees, to ensure the desired output. A complicating factor is that employees vary in cognitive skills and information processing capabilities, resulting in a challenge for companies to maintain consistent product quality across all employees (Prasetya, 2019).

Combining this role-changing development of employees in manufacturing settings and their varying adaptation capabilities underscores the importance of effective work instructions tailored to individual employees. Work instructions can be regarded as detailed documents that offer precise information regarding relational activities, except procedural activities (Jozsef & Blaga, 2015). They fulfil a crucial role in influencing both worker and process output (Pimminger et al., 2021). The form and quality of these instructions directly influence the overall workforce performance and output of the manufacturing process (Pimminger et al., 2021). To ensure sufficient quality, it is essential to adapt instructions based on the characteristics of the individual executing the tasks, as only they can best judge whether a given solution meets their expectations (Pimminger et al., 2021). As also stated by Pimminger: “the creating and writing of instructions has to be done by people who are involved in the described processes and activities” (Pimminger et al., 2021).

However, companies consist of a diverse range of employees, including experienced, new, old, and young individuals, but also employees of different cultural backgrounds (Dike, 2013). This variety poses a challenge in developing an instruction suitable for all employees, often resulting in instructions more geared towards new employees who are in the learning phase. However, to ensure maintained quality, a suitable work instruction for experienced employees is imperative, which forms the focal point of this paper.

Adding to the relevance of effective work instruction and considering the different employees in a company, the demographic change and general increase in process and product complexity leads to a growing demand for assistance technology (Funk et al., 2015), exemplified by

suitable work instructions. Additionally, demographic developments of our society require manufacturing companies to invest in manufacturing systems accessible for aging people (Villani et al., 2019). The aging of the general workforce is recently affecting most of the Organisation for Economic Co-operation and Development (OECD) member countries, influenced by the general aging of the populations and higher average retirement age (Calzavara et al., 2020) making this a pertinent topic to address. Aging employees, having worked in the company for several years, often gathered significant experience, making them valuable assets for the company.

This study aims to develop a framework for work instructions for experienced employees in a manufacturing context, considering the specific needs, preferences and demands of these employees. As previous studies show, employees vary in cognitive and adaptation skills (Prasetya, 2019), which can result in differences in performance output (Katiraee et al., 2021). These variations among employees or groups of employees highlight the relevance of customizing instructions based on individual needs. Experienced employees, who are already familiar with the products and machines, likely possess enhanced adaptation skills. This familiarity enables them to understand changes in products easily, necessitating different instructions compared to new employees. However, in practice, most of the time, one form of work instruction is available for all employees, despite their differences. This results in lots of experienced employees lacking in using these instructions because these seem useless, as also stated by Li et al. (2018). However, the fact that those employees have a lot of experience, does not necessarily mean that they make no mistakes, or do not need these instructions. By developing a framework for work instructions for experienced employees, this study seeks to provide insights into how companies can create suitable work instructions for experienced employees. Furthermore, it aims to identify the key challenges and benefits of using work instructions for experienced employees. Therefore, the following research goal is formulated:

"Creating a framework for designing work instructions aligned with the specific needs of experienced manufacturing employees."

To develop this framework and align it with the needs of these employees, this study employs various research methods. First, to gain insights into the essential elements of the work instructions for experienced employees, a multiple case study was conducted including several

experienced and quite new employees from six companies. These operators are interviewed and questioned about the relevance, form, and content of the work instructions. This first phase of the study is used to define the current state of the work instructions among companies and the problem, so why or when for example the instructions are not used by experienced employees. Also, the needs and preferences regarding work instructions of these employees were investigated. In the second phase the actual framework for designing work instructions will be developed based on the input delivered by the operators. Finally, the framework will be evaluated at one or more companies.

2. THEORETICAL BACKGROUND

This section provides the theoretical background of the study. Section 2.1 describes the background of work instructions, their function, and the different forms and elements that influence them. After this, section 2.2 describes the influence of workers' differences on work instructions. Finally, section 2.3 describes the increased product complexity and its influence on work instructions these days.

2.1. WORK INSTRUCTIONS

In this section, various aspects of work instructions are examined. In the first place, the function of work instructions is discussed, followed by an exploration of the evolution of work instructions concerning their form and elements.

2.1.1 FUNCTION OF WORK INSTRUCTIONS

Work instruction are detailed documents that furnish precise information concerning relational activities, excluding procedural activities (Jozsef & Blaga, 2015). The utilization of work instructions enables employees to comprehend their tasks and, if followed correctly, empowers them to execute these tasks in a sufficient way. Over the years, work instructions have consistently served as an essential element in facilitating individuals to carry out their assigned tasks. Starting with paper-based instructions decades ago, nowadays companies still provide paper-based instructions for training and assembly tasks (Sudha et al., 2021), making this also the primary source of support of all instructions (Leder et al., 2023). Nevertheless, these instructions are undergoing a radical evolution, as evidenced by Letmathe and Rößler, stating that firms should radically switch to digital instructions (Letmathe & Rößler, 2022).

2.1.2 DIFFERENT FORMS OF WORK INSTRUCTIONS

In the context of work instructions, a transition to more advanced instructional methods is encouraged by several studies conducted in the past years (Letmathe & Rößler, 2022). Within the domain of work instructions, various forms of instructions are conceivable. Commencing with the most basic form; paper-based instructions, followed by visual instructions, oral instructions, procedure cards, digital instructions and ultimately the augmented reality (AR) instructions, providing real time support.

Paper based instructions (PBI) are formulated in response to the demand for a teaching approach that ensures the transfer of skills acquired in an educational context to practical skills required in real business or manufacturing settings (Rungwaraphong, 2021). Utilizing paper-based instructions places a significant demand on the cognitive skills of the employees using these instructions, requiring a comprehensive understanding of tasks and the ability of translating the information to real life applications. However, this form of instructions is still the most common way of instructing (Leder et al., 2023), which probably also is the reason companies are struggling to change from this main form of providing instructions.

Another method of delivering instructions is by visual instructions, or so-called instructional videos. Instructional videos can convey course content, provide illustrations of the discussed aspects, and, if feasible, feature external subject matter experts or incorporate film segments into the instructions (Pohl & Walters, 2015). In recent years, services like YouTube made a widespread of dissemination of instructional videos in all sorts of concepts possible (Pohl & Walters, 2015). Delivering instructions by using video technology has shown a positive impact on the learning enhancement, engagement, and commitment, illustrated by research in which the use of video technology on the learning abilities of a group electronical students was tested (Dieck-Assad et al., 2020). However, using videos could be considered less flexible, as altering an entire video requires more effort than modifying a written work instruction.

The ultimate and most advanced approach of providing instructions to employees involves the utilization of augmented reality (AR) technology. AR is a technology that allows text elements, graphics, or other types of subjects to be superimposed over images or even real contexts (Malta et al., 2023). By using AR technology, a human / operator can feel and act in a virtual environment as in real life, ensuring perceptual relations between the user and its environment through highly realistic simulations based on augmented and virtual reality (VR) (Violante et al., 2019). Augmented reality has demonstrated significant potential in delivering work instructions over traditional methods (Macallister et al., 2017), such as paper-based instructions. As mentioned before, an increasing number of studies encourage the shift to more advanced work instructions (Letmathe & Rößler, 2022). However, most studies do not differentiate their analyses based on worker experience, which could be intriguing to explore, given that new employees typically rely on work instructions for learning purposes, in contrast to experienced employees who may perceive instructions as lacking value to their performance.

A technology which could support the use of work instructions is the concept of personal tracking, which has been studied in various domains, including health, personal informatics, and productivity. Rooksby et al (2016) discuss the development of personal tracking applications. This technology could also be an option to add to work instructions to check the use of work instructions in practice. Rooksby et al (2016) emphasizes the growing interest in personal tracking for disciplined device use and productivity improvement.

2.1.3 DIFFERENT ELEMENTS / LEVELS OF DETAIL OF WORK INSTRUCTIONS

All sorts of forms of work instructions come with certain cons and pros, posing a challenge for companies to determine the most suitable format. Deciding which form is best to use also depends on which elements are used in the instruction. Besides the different forms that are available to create a work instruction, also the elements within the instructions can highly differ. Within work instructions several elements can be considered or be left out, making the instructions clearer or vaguer. Elements that can be considered are for example level of detail, degree of specificity, warnings, point of extra notice, quality checks and examples.

The level of detail can vary, ranging from step-by-step specific instructions on task execution to more general outlines focussing on the desired outcome. While detailed instructions provide a lot of detail, they also take more time to read, leading to frustrations for experienced employees seeking specific elements. The level of detail also influences the performance of the operations performed, as investigated by Vanneste et al. (2023), who investigated the influence of high level of detail against low level of detail for AR instructions. This research showed that participants found tasks less complex when the level of detail from instructions was high Vanneste et al. (2023).

Including warnings and points of notice can be beneficial in instructions, as it informs employees about potential risks during operating procedures. This awareness allows them to focus more on these steps, potentially reducing errors and nevertheless ensuring employees safety. However, where to place the warning is an interesting factor to investigate, as also mentioned by Wogalter et al. (1987), stating that a warning placed before the instructions lead to more compliance than warnings that follows the instructions.

Another valuable element could be indicating the average throughput time for each task. Providing a target time for the employees to aim for during task completion. Accomplishing

these time frames can provide a sort of satisfaction from their work, enhancing motivated. Conversely, if the throughput time added on the instructions are unrealistic, adjustments can be made, leading to a more realistic process and probably higher quality.

Incorporating quality checks during task execution ensures both quality of the products and reassures employees that they are performing tasks correctly. Checking the quality is the process of providing feedback about the tasks and operations involved in creating and assembling the product and eventually problems occurring after finishing the product (Anton et al., 2014). Products could be checked randomly, for example on their most crucial element, to ensure that the tasks are performed in the right way. These checks can be done by hand, for example by specialized operators using tools such as light or magnification tools. But the quality checks can also be done by automatic visual quality control if this method suits the products and manufacturing process (Anton et al., 2014). This last method will boost the productivity of the process, for the checks do not need to be performed by hand, also decreasing the total production costs as stated by Anton et al. (2014).

Lastly, using examples in the instructions can be beneficial. Examples aid in understanding what the product should be or look like, making the instructions more comprehensible. This way the instructions are easier to understand, probably increasing the use of instructions and increasing the quality of the products.

2.2. INFLUENCE OF WORKERS' DIFFERENCES ON WORK INSTRUCTIONS

Numerous studies have highlighted the influence of various worker capabilities on work performance, presenting challenges for manufacturing companies. Workers' differences, in terms of age, gender, skills and anthropometry measures, can affect performance of the output in terms of costs, throughput, time, human health and safety (Katiraee et al., 2021). In many production systems the assembly section is the most important component, involving a high manual demand, resulting in significant challenges for companies mainly characterized by high physical workload (Katiraee et al., 2023).

Research by Peltokorpi et al. (2023), focussing on manual assembly learning, disabilities, and instructions, and research conducted by Prasetya (2019), both underscore the importance of carefully considering the form of an instruction for each operator, given varying adaptation

capabilities and cognitive assistance system requirements. This highlights the need to tailor work instructions to the preferences of the different employees, representing a gap in current research. Conversely, various solutions have been explored to mitigate the impact of worker differences on performance. For instance, Katiraee et al. (2023) investigated the impact of assembly line balancing in combination with workers' experience and perceived physical effort, resulting in improved trade-offs between rebalancing of tasks and line cycle time. Developing a framework for instructions tailored to experienced employees could complement such solutions for manufacturing companies.

Another difficult variation between operators within manufacturing settings can be the language barriers. Understanding instructions is very important for sufficient task completion and can for this reason be difficult for foreign operators. (Csaki et al., 2023) investigated the possibility to efficiently adapt language models to new languages. This study managed to adapt languages via large language model into less common languages such as Hungarian and Thai (Rooksby et al., 2016). This sort of technology could also be effective when adapting work instructions to certain groups of employees.

2.3. INFLUENCE OF INCREASED PRODUCT COMPLEXITY ON WORK INSTRUCTIONS

Another aspect influencing the form and content of work instruction is the increased complexity of products within manufacturing companies (Li et al., 2018), combined with the higher degree of small batches. As also stated by Trattner et al. (2017), that the twenty-first century manufacturing companies have been challenged with the struggle to satisfy the increasing demand for product variety and complexity, while maintaining efficient operations. Concepts as LEAN, setup time reduction and flexible manufacturing systems have all been discussed (Trattner et al., 2017), however this increase in product complexity could also have an influence on the use of work instructions within manufacturing companies. Due to the increased complexity and variety, it can be useful to adapt the work instructions based on workers experience. For new employees the work can be found harder due to the increased product complexity. These new employees for example rely highly on specific and detailed instructions to understand all different tasks and products that must be made. For experienced employees, the increased complexity could also influence their preferences, for example by emphasizing the main differences or core components. This way they can keep these changes in mind but still rely on the experience they already accumulated during the years.

Adding to the existing research, this study will focus on experienced employees in relation to the work instructions. As mentioned before, earlier research has been performed regarding the different work instructions possible and the influence of these on performance. But no research has focused on a specific employee group such as the experienced employees. While in practice the thought is that experienced people do not use instructions and new employees are dependent on them. Also, it is relevant to investigate what the use of instructions is for people performing the same tasks years and years. For this reason, this study will focus on experienced employees and investigate their needs and wishes and their perceived relevance towards instructions, and finally craft a framework for designing suitable instructions for these employees. This results in the following summarizing conceptual framework:

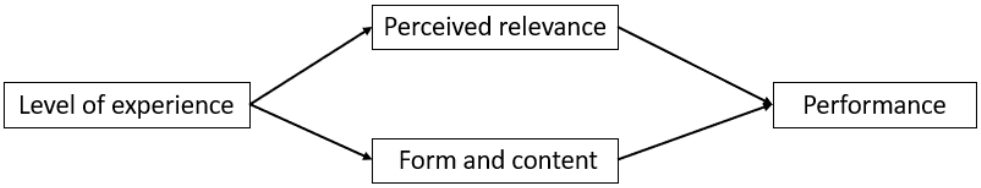

Figure 1: Conceptual framework

This framework shows the relations between several variables influencing each other. During this research, the gap in the literature regarding the influence of the level of experience of employees on the form and content of work instructions will be investigated. The variable "level of experience" influencing the form and content of instructions will be investigated at multiple companies, providing new academic insights. Also, the perceived relevance operators have towards instructions is taken into consideration, for this could highly influence their use of instructions. In the end, the form and content of an instruction influence the actual performance of processes and tasks performed by manufacturing employees.

3. METHODOLOGY

This section describes the used methodology of this study. First, the method Design Science Research (DSR) is explained and motivated, making clear why this is a suitable approach for this study. Additionally, the data collection and way of analysing this data is described.

3.1. DESIGN SCIENCE RESEARCH

To perform this study and create a framework, DSR is conducted. DSR is a suitable method to use when developing a framework during research. DSR has its roots in engineering and the artificial sciences and is a problem-solving paradigm (vom Brocke et al., 2020). Its goal is extending human and organizational capability boundaries through creating new and innovative artifacts by models, methods, constructs, and instantiations (vom Brocke et al., 2020). DSR is ready to take its rightful place within the natural science research in the Information Systems (IS) field, as stated by Hevner (2007). Design science research is a suitable approach for answering the research question, because via design science research a framework can be developed which is not available yet, resulting in the goal of this research. As also stated by vom Brocke et al. (2020), the goal of DSR is creating new and innovative artifacts by models, methods, constructs, and instantiations. DSR is performed in the research following the engineering of Wieringa (2014). This engineering cycle consists of three elements: the problem investigation, treatment design, and finally the treatment validation (Wieringa, 2014).

3.1. DATA COLLECTION

To collect data, a multiple case study is conducted at various companies participating in a RAAK project, jointly conducted by the University of Groningen and HAN Nijmegen. This multiple case study aims to gather relevant information from the participating companies including existing instructions, number of experienced employees, deviations from instructions, and demands of management teams of these companies.

Exploratory interviews are conducted to comprehensively cover all relevant topics related to developing a framework for designing work instructions within the practical setting. These interviews have taken place at six manufacturing companies in the region of Arnhem. Additionally, the diversity between these companies provides a comprehensive overview of the factors that need to be considered when designing a framework for instructions.

To define the current problem and create an overview of the status regarding work instructions, a total of 25 interviews are conducted, over the six different companies. These interviews are carried out on various levels within the companies, namely the team leaders, the creators of the work instructions, and finally the operator. An overview of all interviewees is provided in Table 3-1.

Table 3-1: Overview of interviewees

Company 1	*Interviewee*	*Reference*	*Age*	*Experience*
	Team leader	*TL1*	*X*	*X*
	Creator	*C1*	*X*	*X*
	Operator 1	*O1*	*58*	*40*
	Operator 2	*O2*	*57*	*20*
	Operator 3	*O3*	*58*	*16*
	Operator 4	*O4*	*64*	*48*
Company 2	*Operator 1*	*O1*	*56*	*16*
	Operator 2	*O2*	*49*	*12*
Company 3	*Team leader*	*TL1*	*X*	*X*
	Operator 1	*O1*	*22*	*1*
	Operator 2	*O2*	*32*	*16*
Company 4	*Team leader*	*TL1*	*X*	*X*
	Creator	*C1*	*X*	*X*
	Work supervisor	*WP1*	*63*	*43*
Company 5	*Team leader*	*TL1*	*X*	*X*
	Creator	*C1*	*X*	*X*
	Operator 1	*O1*	*53*	*36*
	Operator 2	*O2*	*62*	*42*
	Operator 3	*O3*	*52*	*10*
	Operator 4	*O4*	*58*	*41*
Company 6	*Team leader*	*TL1*	*X*	*X*
	Work planner	*WP1*	*X*	*X*
	Operator 1	*O1*	*63*	*43*
	Operator 2	*O2*	*43*	*25*
	Operator 3	*O3*	*21*	*2*
	Operator 4	*O4*	*46*	*25*

3.2. THE ENGINEERING CYCLE FOR DSR

In this section the engineering cycle as mentioned by Wieringa (2014) is explained and linked to the research this study aims to perform. This cycle is divided into three different phases, as also shown in Figure 2, first the problem investigation phase is explained. Secondly, the treatment design phase will be explained and linked to the actual activities this research will perform. Finally, the treatment validation phase will be discussed.

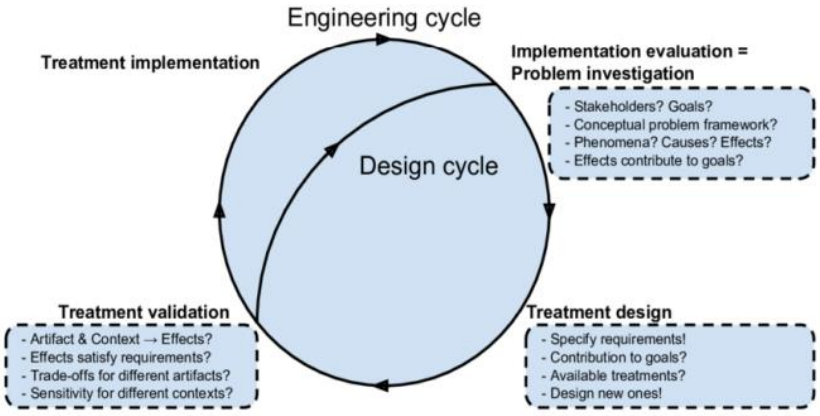

Figure 2: Engineering cycle

3.2.1 PROBLEM INVESTIGATION PHASE

The problem investigation phase serves as a starting point for design science research. This phase interfaces with the so-called relevance cycle as proposed by Hevner (2007). During this phase the specific problem that needs to be addressed will be found, as well as the criteria that the final solution should conform to (Hevner, 2007). Various aspects are addressed during this phase, such as goals, causes and effects of the problem and essential problems from practice (Wieringa, 2014).

In this phase, the problem of unsuitable instructions for experienced employees is elucidated and explored. To do so, interviews are conducted with experienced and unexperienced employees, team leaders and creators of work instructions, to gather insights into their use of instructions, including their advantages and disadvantages, as well as any additional information that may be provided. These interviews are necessary to perform this research for several reason. Firstly, interviews can capture the contextual setting, such as how instructions are used and specific adaptations that experienced employees develop over time. Second, the interviews allow operators to provide personalized feedback on existing instructions, making it possible to identify certain areas of improvement that might not occur from information available of existing literature. Third, the interviews help comparing the findings from literature with current practices and challenges, making the framework useable for practice. Additionally, the manufacturing context is very dynamic, with continue changes, improvements, and challenges. Interviews provide the real time state of art, making the research more reliable. Finally, current literature does not show research performed towards the use, relevance and wishes of instructions for specific employee groups. These interviews provide this context specific information and these insights to literature.

By synthesizing these findings, the specific problem found in literature, namely employees who either do not use work instructions or do not find them valuable, will be merged with observations and interviews from real-life situations. Defining the problem through combining the collected data, the insights from operators, and existing literature ensures the connection between the research gap and the practical challenges encountered in real life.

Data analysis

During the investigation phase interviews are conducted to gather data which can be used to develop a framework for work instructions tailored to experienced employees. This data is analysed in the following manner. The interviews conducted are transcribed to facilitate a comprehensive analysis of the collected data. After this, the interviews are structured, making sure all interviews have the same lay-out and sequence of questions. Next, the texts are read carefully, analysed, and annotated using codes. During this process the grounded theory is used to analyse part of the process during coding.

The first stage involves open coding, where textual data is broken down into distinct segments. Followed by axial coding, wherein categories are developed based on the concepts identified in the first phase. Finally, selective coding is conducted, focussing on the main category that links the others and providing a framework by synthesizing all findings (Corbin & Strauss, 1990). The interviews conducted are semi-structured, meaning that the answers given already cover certain areas or topics, making it easier to code and structure the data collected. The used interview protocol can be found in Appendix A.

3.2.2 TREATMENT DESIGN

During the treatment design phase, the actual model or artifact is developed to address the problem identified in the previous phase (Wieringa, 2014). As mentioned by Wieringa, a design is a decision about what to do (2014), which then will be documented in a specification. An artifact, which will be created during the phase, is something that is created by people for practical purposes (Wieringa, 2014).

During this phase, the actual framework is generated. This framework is generated using the data gathered from the interviews. The goal is to develop a framework that meets the specific needs and preferences of experienced employees within the general manufacturing context.

Data analysis

During this section the results of the interviews are used to develop a framework for generating work instructions. The exact elements of the framework are not defined yet because these also strongly depend on the answers given in the interview. The creation and definition of elements will take place in the treatment design section.

3.2.3 TREATMENT VALIDATION

The treatment validation phase ensures that the proposed treatment aligns with the stakeholders' goals when implemented (Wieringa, 2014). Validating the artifact precedes its implementation to ensure alignment with stakeholder requirements and allow for adjustments if the requirements identified in the first phase are not fully met. The process of validating the designed treatment is integral to achieving a successful DSR outcome, culminating in a framework ready for implementation.

Data analysis

For the validation of this artefact the different elements as described by Carvalho (2012) are used. These make sure that the validation process of the artefact is done properly. Besides, the artefact is validated at a company already involved in the project. This is done to make sure the artefact is as complete as possible, and different segments of the manufacturing industry have criticized the created artefact.

Artefacts designed during a design science research result in certain knowledge, named knowledge-for-a-purpose Carvalho (2012), which is contrasted to knowledge-for-understanding. Results from any research, including design science research, should be evaluated. Carvalho (2012) describes several elements used to validate a designed artifact.

ARTEFACT SUCCESS

The first element of validity is artefact success, meaning that new artefacts should be successful. Carvalho (2012) divides success into different measurements, from which the two below are chosen for validation:

- Usefulness: contains the degree to which an artifact contributes to the achievement of a result. This is applicable to tools and looks wider than tools, namely by considering that the artifact, by themselves, might be insufficient to reach the goal, but may have to co-operate with other artifacts.

- Efficacy: the degree to which the artifact reaches its expected goal. This measure can be applied to machines and automata, which can be highly independent from other artifacts.

Artefact success can be seen as a concept close to practical utility of the artefact Carvalho (2012).

GENERALIZATION

The second validity element is generalization, meaning that the applicability of a designed framework should not be restricted to specific situations, besides its constraints in terms of time, space, and circumstances Carvalho (2012).

NOVELTY

The third validity element considers novelty. Meaning that research should produce new knowledge. Within the case of design science research new knowledge is reached if there is a new artefact that corresponds to a new class of artefacts, or significantly improves already existing artefacts. Important is that novelty differs from innovation, whereby innovation is the result of changing work practices, which can be achieved through the application of knowledge-for-a-purpose Carvalho (2012).

EXPLANATION CAPABILITY

The fourth and last element to consider is the explanation of the success of the designed objects. Only providing a successful object is not enough, for it should also be explained why it is successful, efficacious, or more efficient than previous designs Carvalho (2012).

Applying these four elements ensure the validity of the research and the provided solution.

4. PROBLEM INVESTIGATION PHASE

This section implements the problem investigation phase. During this phase, interviews are conducted at various companies, and observations are carried out to collect all relevant information necessary for reaching the goal of this research.

4.1. CURRENT COMPANY ANALYSIS

This section describes the current state of instructions per company. First focusing on the form followed by the content and finally the relevance of the instructions in the opinion of the operators. Providing an overview of instruction usage patterns and perceived importance according to experienced and less experienced employees. This results in an overview of the current state of the instructions, and perhaps differences between experienced and unexperienced employees.

Company 1

For company 1, a total of six employees are interviewed. Four operators, one team leader and the creator of the work instructions.

Level of experience

As shown in Table 4-1, all operators are highly experienced in their work, with a minimum amount of 16 years of experience. Therefore, it can be stated that all operators can be considered experienced.

Table 4-1: Age and experience company 1

Company 1	*Interviewee*	*Reference*	*Age*	*Experience*
	Team leader	*T1*	*x*	*x*
	Creator	*C1*	*x*	*x*
	Operator 1	*O1*	*58*	*40*
	Operator 2	*O2*	*57*	*20*
	Operator 3	*O3*	*58*	*16*
	Operator 4	*O4*	*64*	*48*

Current form

At company 1, both paper and digital instruction are utilized. Operator 1 and 2 use paper instructions, while operator 3 and 4 use digital instructions (O1,O2,O3,O4). Additionally, operator 4 combines both forms of instructions, also mentioning that digital instructions are easier in use (O4).

Current content

Currently, the instructions at company 1 primarily consist of pictures, combined with a small amount of text (C1). Check marks are also used a lot, as are highlights to alert the operators in special cases or during quality checks (C1). Tooling is integrated through the entire instruction and are considered a helpful reminder when to use specific tools (O1, O2, O4). Additionally, all tools are pre-calibrated, minimizing the risk of mistakes (C1, O1).

Relevance of instructions

Three operators indicated that the instructions serve as a useful reminder during their operations (O1, O2, O4). Instructions are deemed crucial when product changes occur (O3). Further, instructions are noted as a tool to do your work (O1, O2). Conversely, the team leader and creator of the WI stated that the instructions are primarily important for new employees (C1, TL1). However, this perspective contrasts with the operators' statement, which highlights the importance of instructions for accommodating changes and serving as useful reminders (O1, O2, O4).

Company 2

For company 2, two operators are interviewed. Company 2 is a social employment provision company, meaning a high variance of mental and physical capabilities between the operators within the company.

Level of experience

As shown in Table 4-2, both operators are experienced operators with a minimum of 12 years of working experience.

Table 4-2: Age and experience company 2

Company 2	*Interviewee*	*Reference*	*Age*	*Experience*
	Operator 1	*O1*	*56*	*16*
	Operator 2	*O2*	*49*	*12*

Current form

Company 2 exclusively uses only paper-based instructions (O1, O2). None of the departments or other employees have the option for digital instructions. Additionally, technical drawings are available when necessary (O1).

Current content

The instructions consist of pictures and text, and all follow a universal layout (O1, O2). Also, the instructions are based on the products. Within the instructions no tooling is described and no check moments are integrated (O1).

Relevance of instructions

The operators consider the instructions useful and necessary to produce the products (O1, O2). Mainly because a lot of details are provided to perform the production of the products. Because of the many details, the instructions are relevant to prevent mistakes (O1).

Company 3

From company 3 a total of three employees are interviewed: one team leader and two operators.

Level of experience

As shown in Table 4-3, the two operators differ highly in level of experience. Operator 1 is only 22 years old and has one year of working experience, while operator 2 already has 16 years of working experience. This contrast allows for an interesting comparison between experienced and unexperienced employees.

Table 4-3: Age and experience company 3

Company 3	*Interviewee*	*Reference*	*Age*	*Experience*
	Team leader	*T1*	*x*	*x*
	Operator 1	*O1*	*22*	*1*
	Operator 2	*O2*	*32*	*16*

Current form

Currently, company 3 uses digital instructions. However, operator 2 noted that the instructions vary between departments, resulting in an inconsistent lay out / content across the company (O2). Sometimes it even occurs that the layout of instructions also differs per team leader, making it difficult to get used to all different formats of instructions (O2).

Current content

Tooling is provided in the instructions and is pre- calibrated, minimizing the risk of errors, specifically for tools requiring specific torque settings (O2). Highlights are used to alert operators to crucial information, and additional information is available, if necessary (O1, O2). Currently, the products are tested for quality after finishing. However, the experienced operator suggested that supervisors should check during production, to prevent mistakes and save time by avoiding reproduction (O2).

Relevance of instructions

Both experienced and inexperienced find instructions relevant as reminders during production (O1, O2). Moreover, they play a crucial role in error prevention, as mentioned by the experienced personnel (O2). The new employee stated that instructions are useful when producing new products (O1).

Company 4

For company 4, interviews were conducted with a total of three employees: a team leader, maker of work instructions and a work planner. Notably, no operators were included, making it more challenging to implement this data. Company 4 is also a social employment provision, resulting in high variance of capabilities among the operators. However, the team leader and creator of work instructions mentioned several statements and ideas about work instructions, which are included in this research.

Tabel 4-4: Age and experience company 4

Company 4	*Interviewee*	*Reference*	*Age*	*Experience*
	Team leader & Department leader	*T1&DL*	*x*	*x*
	Creator	*C1*	*x*	*x*
	Work planner	*WP1*	*x*	*x*

Current form

The form of instructions at company 4 is mainly verbal instructions. The work planner assigns tasks to his employees at the beginning of each day, based on his own knowledge and explaining tasks personally. Consequently, there is no use of work instruction (WP1). At other departments instructions are used, provided by iPads and paper bases instructions (C1). Despite these options, verbal instructions remain prevalent (TL1), resulting in the actual work instructions not being used much in reality.

Current content

The company uses a standardized lay out for its instructions, adhering to a work instruction-info-procedure, created internally (C1). This ensures a consistent lay out for all instructions. Highlights are used in the form of simple pictures and simple colours to enrich the instructions, typically presented in a word file (C1). Another important feature is the use of personalized stickers employees affix to product upon completion. This enables traceability in case of customer complaints, allowing identification of the responsible employee or production location (C1).

Relevance of instructions

The importance and relevance of the instructions for the employees of this company is not specifically mentioned during the interviews. However, as stated by the work planner, most instructions are provided verbal, because everyone is used to this way of working (WP1). Resulting in operators not finding the instructions relevant anymore.

Company 5

Six employees are interviewed for this company, distributed into four operators, one team leader and one maker of the work instructions.

Level of experience

As shown in Table 4-5 all operators interviewed are quite experienced. All operators are above the age of 52 and have at least a total of ten years of work experience, making this a very experienced group of employees.

Tabel 4-5: Age and experience company 5

Company 5	*Interviewee*	*Reference*	*Age*	*Experience*
	Team leader	*T1*	*x*	*x*
	Creator	*C1*	*x*	*x*
	Operator 1	*O1*	*53*	*36*
	Operator 2	*O2*	*62*	*42*
	Operator 3	*O3*	*52*	*10*
	Operator 4	*O4*	*58*	*41*

Current form

The company uses digital instructions as well as paper-based instructions (O1, O2, O3, O4). The instructions within the company are undergoing a transition from paper based towards digital instructions. So currently both forms of instructions are available to use at the company (O2).

Current content

The instructions incorporate a combination of pictures and text and are product-based (O1, O2, O3, O4). The instruction describes tooling throughout, a strategy deemed effective (O1, O2, O4). Additionally, check marks are implemented, meaning operators must confirm completion of tasks before proceeding, proving beneficial for error prevention and aiding performance on so called “off-days” (O2, O4). However, when these checks become too extensive, they start to irritate the operators (O2).

Relevance of instructions

Most operators perceive the instructions important, even with their extensive experience. Primarily, instructions serve as valuable reminder for operators who may forget certain procedures or encounter an off day (O2, O4). Additionally, instructions provide updates when products change, alerting operators by pop up notifications (O1, O3). All operators stated to use the instructions, when necessary, for instance when forgetting something, hesitating about a

task, or during check moments (O1, O2, O3, O4). Interesting is the difference in opinion between team leader and operator, where the team leader states that the instructions are mostly important for new employees (TL1, C1). While the operators state that the instruction must fulfil both wishes of new and experienced employees, namely be simple and quick to use for experienced, and clear enough for new employees (O4).

Company

A total of six employees are interviewed for this company. Distributed into a team leader, creator of work instructions and four operators. Company 6 is a social employment provision, resulting in a high variety of mental and physical capabilities between the operators working in this company.

Level of experience

As shown in Table 4-6 three of the four operators have a minimum of 25 years of experience. Operator 3 only has two years of experience, making this person the less experienced employee interviewed.

Table 4-6: Age and experience company 6

Company 6	*Interviewee*	*Reference*	*Age*	*Experience*
	Team leader	*T1*	*x*	*x*
	Creator	*C1*	*x*	*x*
	Operator 1	*O1*	*63*	*43*
	Operator 2	*O2*	*43*	*25*
	Operator 3	*O3*	*21*	*2*
	Operator 4	*O4*	*46*	*25*

Current form

Currently the instructions are paper based within the company (C1). Additionally, the company has experimented with video instructions due to the workforce's challenges with reading and remembering instructions independently (TL). The operators differ highly in capabilities, mentally and physically, making it difficult to create useful instructions (TL1). Currently, the supervisor explains every task to the operators, so the instructions are not used that much now (TL).

Current content

Most instructions are explained verbally on the work floor, due to the high variety of capabilities between the employees. The instructions that are available consist of pictures and text (C1). Also, some tests were done with video instructions, which was received well. However, when

audio was turned on, it became too extensive for some employees (TL). The operators reported never to use the instructions because everything is explained verbally (O1, O2, O3, O4).

Relevance of instructions

The team leader of the company emphasizes the importance of conveying the consequences of incorrect production or failure to instructions (TL). Currently, operators do not "feel" the consequences of these mistakes and thus do not feel a certain responsibility to perform everything the right way (TL). Addressing this mismatch of relevance from the operator's perspective is a very important topic (TL). In terms of relevance of using instructions, there is none in the opinion of the operators, because everything will be explained to them.

4.2. SUB CONCLUSION

From the findings described above, no considerable difference is found between experienced and unexperienced employees, regarding the instructions both groups use, or the relevance the operators perceive towards instructions. However, also the preferences are investigated for both groups and illustrated in chapter 5, where difference in preferences for form, content and relevance can arise.

5. TREATMENT DESIGN

In this section the treatment design is described following the findings of chapter 4 and the preferences stated by the operators in the interviews. In the end, these findings are combined with the relevance investigated among the operators, resulting in a framework for work instructions. First an analysis per company is performed, followed by a cross analysis combining all findings regarding preferences.

5.1. EMPLOYEES' PREFERENCES PER COMPANY

Company 1

Form preferences

Both users of digital and paper-based instruction expressed a preference for digital instruction, citing a significant ease of use (O1, O3, O4). Notably, no operator indicated a preference for paper-based instructions. Those currently using paper also state digital instructions are superior, as digital formats prevent instructions from being lost, damaged, or soiled (O1, O4). Furthermore, digital instructions enhance efficiency, eliminating the need to browse through several papers (O4). However, operator 2 mentioned that the paper instruction is more convenient to bring to your workplace if needed (O2). Overall, the operators strongly prefer digital formats.

Content preferences

In terms of content, operators strongly prefer the inclusion of pictures in the work instructions, as they are clearer and less complex than text (O1, O3, O4). The creator of instructions also prefers the use of pictures in the instructions (C1). A combination of pictures with minimal text is preferred (O1, O2, O3, O4), with the accompanying text only providing supplementary information that the pictures cannot convey (O2). Excessive or repetitive reading frustrates operators and wastes time.

Notably, operator 3 suggested a legenda within the instruction (O3). Currently, unknown terms or objects must be asked by the work supervisor, which could be avoided by adding a legenda at the beginning of the instructions (O3).

Company 2

Form preferences

The operators interviewed did not specifically mention a preference towards a form of instructions. They mentioned to be satisfied with the current paper-based instructions (O1, O2).

Content preferences

In terms of content, the operators interviewed stated a preference for a combination of pictures and text (O1, O2). However, checks marks, highlights or the integration of tooling was not necessary, for operators will learn these things by experience (O1).

Company 3

Form preferences

At company 3 a preference for digital instructions emerged, for two different reasons. Firstly, digital instructions are easier to use and secondly, paper instructions are less sustainable (O1). Operator 1, who is less experienced, also stated a preference towards digital form of instructions.

Content preferences

Regarding content, operator 2 mentioned that both pictures and text are necessary during production (O2). Both operators, experienced and less experienced, prefer minimal text combined with pictures (O1, O2). The team leader prefers pictures, believing that operators will use the pictures-based instructions more often (TL1).

Notably, operator 2, the more experienced operator, mentioned that he prefers multiple check moments during production by his supervisor (O2). This approach ensures tasks are performed correctly from the start, reducing the need of post-production repairs (O2).

Company 4

Form preferences

The operators prefer digital instructions, citing their ease of navigation and functionalities such as zooming in for enhanced usability (TL1&DL). The work planner reported that instructions are often not used as verbal instructions are favoured (WP1).

Content preferences

Operators prefer simple instructions with minimal text and for example some symbols (WP1). The work planner also mentioned he did not see the advantages of adding text to instructions and finds the instructions with only pictures easier to understand (WP1). Despite these

preferences, the work planner currently favours verbal instructions due to the high variety in operators (WP1).

Company 5

Form preferences

Operators at company 5 prefer digital instructions, citing ease of use, time efficiency and clarity compared to the paper based (O1, O2, O3, O4). Even operators previously using paper-based instruction now express a preference for digital ones (O2).

Content preferences

In terms of content, the operators mainly prefer minimal text in the instructions (O1, O2, O4). This preference stems from a desire to avoid extensive reading redundant information such as much repetition, which could be replaced by pictures or shorter summarizing texts (O2). All operators express a strong preference for the inclusion of pictures, mentioning that a picture often convey sufficient information (O1, O2, O3, O4). Additionally, check marks through the instructions are considered valuable to prevent mistakes and ensure tasks completion (O2, O4). However, these must not be too extensive, such as verifying if the operator gathered the necessary material (O2).

Company 6

Form preference

At company 6, operators prefer verbal instructions (O1, O2, O3, O4). Due to the high variety of capabilities within the company most instructions are provided verbally. Operators are satisfied with verbal instructions and can easily ask questions to their supervisors (O1, O2, O3, O4). However, the team leader prefers a digital form of instructions because these are easily adaptable and are also suitable for the companies' goals considering implementation of different levels of instructions within one format (TL). This approach also supports the company's goal of educating the employers and make them able to work independently.

Content preference

While most instructions are explained verbally, the company aims to integrate different levels of detail in one instruction. This allows operators to select an appropriate level of their needs, enhancing independence and flexibility, particularly for complex or infrequent tasks (TL). Implementing three different levels in the same instruction increases personalization and supports independent work among a wider range of employees (TL).

5.2. CROSS COMPANY PREFERENCES

In this section the cross-company preferences are analysed by dividing the companies into in two groups: company 1, 3, 5, the regular companies, and company 2, 4, 6, the social employment provisions. The analysis revealed significant differences between regular and social employments provision companies, necessitating separate analyses. First the social employment companies are treated, followed by the regular companies. Preferences cross companies will be investigated, focusing on differences between experienced and less experienced employees, and lined to the perceived relevance of instructions.

5.2.1 SOCIAL EMPLOYMENT PROVISION ANALYSIS

This section combines results from company 2, 4 and 6 to draw conclusions regarding the form, content, and relevance of instructions for social employment provisions.

Form preferences

The predominant preference at these companies is verbal instructions, largely due to the high variety of capabilities between operators working at these companies. However, some departments using non-verbal instructions prefer digital ones. Digital formats are preferred for their adaptability and educational advantages, which helps more employees to work independently. While some operators mention to be satisfied with the current paper-based instructions, they have never been working with digital formats, suggesting a potential area for practical testing. Other expressed a preference for digital instructions.

Content preferences

Operators cross company prefer simplicity in instruction content, meaning minimal text, clear pictures, and some symbols. Team leaders prefer implementation of different detail levels in the instructions, to cater different operators' capabilities. Despite these preferences, verbal instructions are still preferred by the operators, because these can be tailored individual needs and provide more immediate clarity than written instructions. Operators using instructions did not really mention a strong preference towards highlights or check marks. However, these could foster a more independently working environment, by alerting operators to prevent mistakes.

Perceived relevance

Instructions are deemed less relevant in these companies due to the heavy reliance on verbal communication of instructions. The high variability makes it challenging to find a fitting format for instructions, causing this verbal way of instructing, which operators highly appreciate.

However, these companies might benefit from adopting a dual approach, using both verbal and written instructions to accommodate different needs. A stated by a team leader, the primary goal of social provision companies is to develop and educate employees through performing tasks, differing from regular companies, that focus on efficiency and quality. Therefore, using both instructions could be advantageous. Moreover, there are also operators wishing to work with a work instruction independently, indicating the need for suitable formats to support this preference.

5.3. SOCIAL EMPLOYMENT PROVISION INSTRUCTION FRAMEWORK

To provide a suitable instruction for the operators working with the work instructions, the following topics should be aimed at:

Form:

- Digital

A digital form should be implemented. For ease in use, updateability, and allowance of implementing different levels of detail.

Content:

- Visual content

Combine pictures with minimal amount of text to ensure clarity and make the instructions more understandable.

- Quality assurance

Use check marks and highlights to ensure task completion and minimize errors and mistakes. Also, these provide a certain certainty for the operators when finishing tasks.

- Tool integration

Integrate tooling information in the different steps in the instructions to remind operators of the necessary tools and reduce errors.

- Different levels of detail

Implementing different levels of detail, so all employees can choose their own fitting amount of detail for producing the products. This way more operators can work independently. This will stimulate the operators to develop and educate their selves, which in the end is a high dominant goal to reach for these social provision companies.

Social employment provision companies should combine verbal and 'normal' instructions. Some employees will always rely on verbal instructions and may not adapt to written ones, while others prefer written instructions, perhaps with the condition that multiple levels of detail are available. Implementing both types reduces the burden on supervisors as more operators use written instructions. Decreasing the need for verbal instructions. This dual approach also supports employee development, a key goal for these companies.

5.2.2 REGULAR COMPANY ANALYSIS

This section compares the findings of company 1,3 and 5, drawing conclusions about the form, content, and relevance of instructions for regular manufacturing companies.

Form preferences

A strong preference towards digital instructions is evident from the findings. Two operators mentioned to appreciate the possibility of paper-based instructions as a backup. No considerable differences were found between the experienced and less experienced employees regarding the form of instructions; both groups preferred digital instructions.

Content preferences

Across companies, there is a unanimous preference for instructions with pictures and minimal text, as stated by all 10 operators. So, both experienced and less experienced shared these preferences. Check marks and highlights are appreciated for quality assurance and mistake prevention; however, these should not be overly detailed or "childish". These checks should focus on tasks performed rather than basic steps like picking up materials and should be integrated during production to avoid post-production corrections.

Cross companies, tooling guidance through the instructions is also seen as useful by most operators. Especially for new operators who need to familiarize with tasks. Experienced employees find tooling reminders useful in specific cases or special products. Pre-calibration of these tooling is valued as it prevents mistakes and reduces operator responsibility.

Finally, all companies use product-based instructions, which is considered useful for allowing operators to flexibly work on different products at various workstations.

Perceived relevance

Both experienced and less experienced consider instructions important. The operators state the instructions as useful reminders, mainly in case of product changes. Instructions are particularly relevant for less experienced operators when dealing with new products, as they must familiarize themselves with these products. The biggest difference in perceived relevance is the

experienced using instructions mainly as reminder and new employees are more dependent on them. However, experienced employees stated not to prefer a different form of instructions between experienced and less experienced.

Overall, no considerable differences were found between experienced and unexperienced employees regarding form, content, and relevance of instructions. For this reason, the framework generated in the next paragraph is a framework created for general work instructions, applicable for both groups of employees. However, the usage of instructions between experienced and unexperienced differ, where experienced do use them as reminders and unexperienced as a tool to get familiar with the tasks and products and to ensure task completion. Despite this difference, the instructions generated with this framework are applicable for both groups.

5.4. REGULAR COMPANIES INSTRUCTIONS FRAMEWORK

Form:

- Digital

The instructions should be presented in a digital format, via laptops, screens, or tablets, to enhance ease of use and updateability.

Content:

- Visual content

Utilize pictures as primary method of providing information, supported by brief and clear text where necessary.

- Quality assurance

Integrate check marks and highlights within the instructions to prevent mistakes and ensure tasks are performed correctly.

- Tool integration

Include information about tools needed at specific steps. Ensure the pre-calibration of tools to minimize errors during production.

- Consistent structure

Using a consistent structure provides clarity for the operators and a consistent way of “reading” the documents.

By following this framework, companies can generate effective work instructions that cater the needs and preference of operators. Ultimately enhancing productivity and maintaining high quality of manufacturing processes.

6. TREATMENT VALIDATION

In this section, the validation of the created artefact is conducted. A company already involved in this research provided feedback to use for the validation. Below, the re-described aspects are treated with feedback provided from the company, in combination with the validation aspects as described by Carvalho (2012), artefact success, generalization, novelty and explanation capability.

6.1. ARTEFACT SUCCESS

Completeness

According to the company, the content of the framework was complete and there were no missing aspects. Also, no suggestions for the removal of aspects were mentioned. However, it is suggested to emphasize that the structure of work instructions should always be the same, which could be mentioned more clearly in the framework. Resulting in a standard way of formatting the instructions and providing clarity for the users. This suggestion is added to the developed framework.

Usefulness

The framework is considered useful for companies creating work instructions. The company indicates that the method of creating instructions following this framework is beneficial and likely results in useful and complete work instructions. The framework is applicable to several software options, such as Word, PowerPoint and VKS, making it widely applicable.

Efficacy

The efficacy of the artefact could not be fully validated as the framework has not been implemented due to time constraints. However, the company suggested that the artefact is useful, complete, and applicable across various software options, indicating that the efficacy of the framework would likely be sufficient. This assumption should be investigated further.

6.2. GENERALIZATION

The framework's applicability should not be restricted to specific situations, as mentioned by Carvalho (2012), apart its constraints in terms of time, space, and circumstances. The developed framework fulfils this requirement, because of its usability in various manufacturing settings and applicable for instructions for all products or sub-assemblies. However, implementation of the framework is dependent on the availability of sufficient digital resources at the company

but given the general trend towards digital instructions within manufacturing companies this should not pose a significant problem.

6.3. NOVELTY

This study introduces new knowledge developing a complete and useful artefact for generating work instructions tailored to experienced employees, which is also applicable for new employees. The study revealed that there is no desire and need for different instructions between these two work employee groups; the artefact is applicable for both groups regardless their experience, however these groups differ in usage of the work instructions.

6.4. EXPLANATION CAPABILITY

Providing a successful artefact is insufficient without explaining why it is successful or efficacious (Carvalho, 2012).
Firstly, the framework is successful because it addresses the specific needs of experienced and unexperienced employees, tailored to the real-world scenarios. Secondly, it provides a holistic approach and does not leave significant gaps in the design. Additionally, it is practically applicable and user-friendly, because the framework is simple, and it does not require extensive trainings for use. At last, the framework is evidence based, because it is the result of a combination between literature and practical research and validation.

By addressing these aspects and considering the feedback provided by the company, the framework is validated as a successful, generalizable, novel, and explained artefact for creating effective work instructions in manufacturing settings.

7. CONCLUSION

In this section the conclusion is given. Firstly, a conclusive answer is provided, responding to the research goal. This is followed by a description of the limitations. Finally, some recommendations for future research are presented.

The goal of this study is to create a framework for designing work instructions tailored to experienced employees. This objective was based on the assumption that experienced employees neither utilize nor value the current instructions. However, this study revealed that experienced employees do find instructions valuable. It can be concluded that experienced employees still use work instructions and value them, mainly as essential reminders. Also, no need for different instructions for experienced employees compared to unexperienced is found, for their preferences are highly aligned. Following these findings, it can be concluded that a framework specially tailored for experienced employees is not necessary. However, most of the work instructions were not fully aligned with the current preferences of experienced and unexperienced employees. For this reason, these findings finally resulted in a general framework for instructions, applicable for both group of employees.

To design a framework for creating work instructions, research is conducted regarding form and content. The framework emphasizes the necessity of digital instructions combined with visual content such as pictures and text. Additionally, the inclusion of check marks and highlights is recommended to ensure task completion and prevent errors. The integration of pre-calibrated tooling should be provided through the instructions to cater the preferences of the operators. Besides the fact that there is no need for different instructions for both groups of employees, their use of instructions differ. Experienced employees use them as reminders and for quality assurance, while inexperienced use the instructions mainly to get familiar with the products and assure task completion.

In addition, the study revealed significant differences between social employment provision companies (SEPs) and regular manufacturing companies regarding preferences and use of work instructions. SEPs exhibit a higher variability in mental and physical capabilities of their employees, resulting in a predominant reliance on verbal instructions in addition to written instructions. This contrasts with regular companies, where a strong preference for digital instructions is found.

Although employees of both types of companies recognize the importance of instructions, the method of delivery and the content of the instructions differ considerably. Regular companies implement more structure and standardized instructions, where SEPs could benefit more from a more flexible and adaptive approach by combining two sorts of instructions. For both companies, it was not necessary to develop different forms of instructions between experienced and unexperienced employees, resulting in a general framework for each type of company that applied to both groups of employees.

8. DISCUSSION

This section compares the findings of this study to the literature found, which contradictions are found and what this research adds to the literature.

Several studies conducted research about the role of instructions within manufacturing companies, considering their form, content, usage, and transition. As mentioned by Villani et al. (2019), stating the shift of the role of the employee from traditional machine operating towards a more supervisory and process monitoring role. Which aligns with the findings of this research, for example the shift from paper-based instructions towards digital instructions, allowing companies to keep instructions up to date easily and make the use of instructions more efficient for employees. The preference both experienced and unexperienced have towards the use of digital instructions aligns with the statements Letmathe & Röbler (2022) made, advocating for a radical shift towards digital instructions in manufacturing settings due to the quick product changes, smaller lot sizes and required adaptability of the operators. Adding to this research, it now found that besides this necessity to change to digital instructions due to the changing environment in manufacturing setting, employees themselves also favour the use of digital instructions compared to the paper-based instructions, for their ease in use, efficiency, and clarity.

Another finding of existing literature regards the need for a flexible approach to work instructions as discussed by Prasetya (2019), stating this necessity because of the varying cognitive skills and information processing capabilities among employees, which can result in different performance output as stated by Katiraee et al. (2023). However, this contrasts to the findings of this research. It is found that the differences in preference for form, content, and relevance between experienced and inexperienced employees does not considerably exist. Meaning there is no need for different instructions between experienced and unexperienced employees. Instead, their preferences and needs are highly aligned, which resulted in a general framework, adapted to the current wishes of the operators in the present manufacturing settings. Experienced and unexperienced employees do differ in usage of instructions, where experienced use them more as reminder and unexperienced as tool to get familiar with their task and to ensure task completion.

For the SEPs involved in this study, the statements made by Prasetya (2019) do align with the practice. These SEPs should consider a flexible approach towards the form of instructions. Contrasting to the differences between inexperienced and experienced employees at regular companies, the cognitive and processing capabilities of the operators working at the SEPs are significant high, making it indeed necessary to implement a flexible approach of generating and providing work instructions for these employees. Resulting in a framework for instructions next to the wanted verbal instructions companies already provide. These findings also align with the statements made by Peltokorpi et al., focussing on assembly learning and disabilities (2023), underscoring the importance of considering form of an instruction for each operator, given their varying capabilities.

8.1. LIMITATIONS

This research yielded several insights but is subject to certain limitations outlined in this section. Firstly, the study was conducted at six companies, divided between social employment provisions and regular companies. This division reduced the sample size of experienced employees of regular companies as well as the SEPs. Potentially affecting the generalizability of the findings. The smaller sample size made it more challenging to draw general conclusions. Secondly, the number of interviewees varied per company, which could influence the consistency of the findings. Additionally, the number of experienced employees interviewed were significantly higher than the number of unexperienced employees interviewed, which also may affect the results. Even though these findings should be interpreted with a bit caution, they do provide a useful framework for other manufacturing companies.

Additionally, due to time constraints, the framework has not been extensively tested in real-life scenarios. Only a start of validation has been made at one company that was already involved in this research, providing preliminary insights in the usefulness and successfulness of the created artefact. However, this should be conducted more extensively to ensure the validity and practical use of the created framework.

Finally, the study heavily relied on interviews, which are subjective and may introduce biases. However, the findings are sorted, structured, and analysed following a systematic method to minimize this risk.

8.2. FUTURE RESEARCH AND RECOMMENDATIONS

Further research should focus on validating the proposed framework at objective companies, not involved in this research. Due to time constraints this was not possible within the current research. However, such research could improve the effectiveness and completeness of the framework, resulting in a more robustly validated framework. Future research could also focus on the actual implementation of the framework for work instructions. Investigating its long-term impact on employee performance, satisfaction and the framework's usefulness when applied to several products. This will provide deeper insights in the effectiveness of the proposed framework.

A recommendation concerns the research of Rooksby et al. (2016), about an application able to track screen time on multiple devices, such as mobile phones and windows and mac computers. This research towards the preferences for form and content, but also the use of instructions, could be improved with such technological possibilities to validate the statements made by the operators. It is evident from the findings that operators value and use the instructions provided, however, to check this, screen time tracking could be used to check these statements and improve the research. By tracking screen time instruction usage and effectiveness can be measured more objectively.

Another recommendation for this study is to explore the potential of language-adaptive models for work instructions. Caski et al. (2023), demonstrated the successful adaptation of large language models to less commonly spoken languages. In the manufacturing setting examined in this research, the workforces comprise a diverse group of employees, also differing in languages, resulting in a challenge in delivering instructions comprehensive to all. However, by leveraging existing language models and their adapting capability, work instructions can be delivered to all employees in their own language. This approach is likely to enhance both efficiency and quality of the end products. Furthermore, it reduces the time required to adapt all instructions manual because creators do not need to translate all instructions anymore.

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APPENDIX A: INTERVIEW PROTOCOL

In this appendix the interview protocol conducted at the six different companies is provided.

1	**Vooraf bekijken van enkele werkinstructies**

Voorafgaand aan het bedrijfsbezoek:

- Werkplekken van de werknemers → Welke werkplek gaan we bekijken
- Werkplek van de engineers/makers van de werk instructies
- Uitgeprint de documenten/werk instructies
- Informatie over wie de trainingen geeft → Extern of intern persoon → Mogelijkheid om ook de externe persoon te spreken?
- Data van de werknemers (om de werk inconsistentie te meten) → Time tracking, efficiency, working progress, quality control checks, performance reviews of the workers

3	**Gesprek met werkleider/teamleider van de werkplekken die geobserveerd worden.**

Work performance inconsistency

1. Zijn er aanzienlijke inconsistenties (volgorde van taken, tijdsduur, kwaliteit) van het werk onder de werknemers, en zo ja, wat denkt u dat de oorzaken daarvan zijn?
2. Denkt u dat uw werkinstructies zorgen voor consistentie in de werkuitvoering'? Waarom wel/niet? (Inconsistentie in snelheid, kwaliteit)

Standardized werk procedures

--> Definitie: Gestandaardiseerd werk (SW) is een nauwkeurig gedocumenteerd en visueel systeem van stappen die in een bepaalde volgorde worden uitgevoerd om zo efficiënt mogelijk te produceren. Het doel is om consistentie te creëren en te behouden voor de eindproducten (Graupp, 2023, definitie van de TWI).

1. Zijn er gestandaardiseerde werkprocedures binnen jouw organisatie? (SOP, TAS)
2. Helpen deze gestandaardiseerde werkprocedures met het begrijpen van de werk instructies?

Ontvangst en opvolging van werkinstructies

1. Hoe ontvangt u de werkinstructies voor de operatoren?
2. Hoe volgt u momenteel de naleving van de werkinstructies door de operatoren?
3. Wat zijn de meest voorkomende obstakels die u tegenkomt bij het handhaven van de instructies op de werkvloer? En hoe lost u dit op?
4. Do workers understand the logical sequence and priorities in working instructions?

Afstemming met training en ontwikkeling

5. Hoe zorgt u ervoor dat de werkinstructies aansluiten bij de trainingen en ontwikkelingen van de operatoren?
6. Hoe gaat u om met situaties waarin de werkinstructies niet aansluiten bij de behoeften en/of het kunnen van de operator?

Aanpassing en evaluatie van werkinstructies

7. Kunnen de werknemers de werk instructies veranderen na dat ze problemen ervaren? Zo ja, hoe worden werkinstructies bijgesteld op basis van feedback van de operatoren en/of wijzigingen?
8. Hoe worden operatoren op de hoogte gesteld van de wijzigingen in de werkinstructies?
9. Hoe wordt de effectiviteit van de werkinstructies in de gaten gehouden en geevalueerd?
    a. Is it possible to improve efficiency by adjusting the form or logical sequence of working instructions?
10. Wat zijn uitdagingen of obstakels die u ervaart bij het beheren van werkinstructies?

Rol van technologie

11. Welke rol speelt technologie bij het opstellen, uitvoeren en beheren van de werkinstructies binnen u organisatie?
12. Welke ondersteuning, techniek of aanvullende informatie heeft u nodig bij het uitvoeren en beheren van de werkinstructies?

5	**Interviews met operators** **(30 min per operator, max. 2 personen interviewen per operator, 6 operators per bedrijf)**

Contextuele vragen

1. Wat is uw leeftijd?
2. Wat is uw hoogst voltooide opleidingsniveau?
3. Hoe lang werk je binnen deze organisatie?
4. Hoeveel jaar werkervaring heb je tot nu toe opgebouwd, inclusief eerdere banen?
5. Heb je naast je opleiding nog andere specifieke trainingen of cursussen gevolgd die gericht waren op het beter uitvoeren van je werk?
6. Heb je ooit moeite gehad met het begrijpen van geschreven werk instructies vanwege je taalvaardigheid?
7. Heb je ooit gemerkt dat begrijpend lezen je hindert bij het correct uitvoeren van taken op basis van geschreven instructies?

Verantwoordelijkheid en presentatie van werk instructies:

1. Wie is er verantwoordelijk voor het maken en verspreiden van de werk instructies binnen uw afdeling?
2. Hoe ontvangt u de werkinstructie, wat vindt u van deze manier?
3. Wat is het eerste wat u doet na het ontvangen van een werkinstructie en waarom?
4. Hoe worden de werk instructies aan u gepresenteerd? (Tekstuele vorm, visueel, als audio-instructies) en met welke technologie (papier, beeldscherm, projectie, …). Wat vindt u van deze manier?
5. How many types of working instructions have you used? Do you have a preference?
6. Verschilt dit nog in bepaalde omstandigheden? Bijvoorbeeld bij nieuwe / bekende producten? Of naar aanleiding van uw ervaring binnen het bedrijf? Dus in het begin andere voorkeuren dan nu?
7. Wat voor verschillen merkt u tussen de verschillende vormen? Wat zijn voordelen / nadelen van deze vormen?

Structuur en elementen van werk instructies:

1. Is er een vaste structuur voor de werk instructies die je ontvangt?
    1.1. Zo ja, wat zijn de gebruikelijke elementen die daarin voorkomen en in welke volgorde staan ze meestal? (Elementen = stapsgewijze instructies, gereedschappen, stuklijsten, kwaliteitschecks)
    1.2. Kun je voorbeelden geven van de typische elementen die je tegenkomt in werk instructies?
2. Hoe zou u deze indeling en inhoud beoordelen? Zijn er delen die als overbodig zouden kunnen worden beschouwd?
3. Worden er voldoende ondersteunende middelen zoals bijvoorbeeld foto's gebruikt om de instructies te verduidelijken?
4. Wat is voor u een prettige verhouding tussen afbeelding en tekst?
5. Bestaan de werkinstructies uit instructiestappen en controlestappen, of zijn dit losse werkinstructies?
6. Wat zijn de verschillen tussen instructiestappen en controlestappen?
7. Welke andere soorten stappen zijn er naast instructiestappen, controlestappen en

eventueel afstelstappen? (afstellen/instellen van waardes op eventuele machine).

8. In hoeverre komen er in de instructies "nieuwe" handelingen / processen voor? Bepaalde acties waarvoor de instructie echt nodig is / waar de instructie de handeling als het ware aanleert?
9. Worden de instructies gekoppeld aan een specifiek product, werkplek of activiteit?
    9.1. Worden ze bijvoorbeeld meegeleverd met het product of zijn er aparte werk instructies voor verschillende werkplekken of activiteiten?
10. Staat in de werk instructies de optimale tijdsduur voor het uitvoeren van taken? (zoals takt time of cyclustijd)
11. Staat in de werk instructies technieken om fouten te identificeren en/of te behandelen?
12. Staat in de werk instructies gebruik van tools of specifieke objecten die nodig zijn voor het uitvoeren van taken? (Denk hierbij aan aspecten zoals kennis van de werkomgeving, hoe tools worden gepositioneerd of gebruikt, en andere objectspecifieke informatie)
13. Hebben de werkinstructies altijd benodigdheden?
14. Onderscheid je verschillende soorten benodigdheden? (Denk aan materiaal en gereedschap).
15. Zie je de benodigde materialen altijd vooraan een werkinstructie staan? Of door de hele werkinstructie heen, bijvoorbeeld bij elke stap?

Level of detail van de werk instructies

1. In hoeverre krijgt de werknemer ruimte voor eigen interpretatie bij het hanteren van de werk instructies? E.g. Moeten de instructies precies worden opgevolgd of worden er ook wel eens trucjes gebruikt door de werknemer om het process sneller te maken?
    1.1. In hoeverre zijn de werk instructies gedetailleerd? Biedt de beperktheid aan details ruimte voor interpretatie?
2. Wat is uw ervaring met bijvoorbeeld kritieke punten van aandacht die in de instructies worden aangegeven? Of het gebruik van average throughput time?
3. Worden er ook quality checks gedaan tussen het produceren door?

4. Zijn er handelingen/ verplichtingen/ inhoud in de instructies die het werk voor u juist belemmeren / moeilijker maken? Zoja, wat? (Voorbeelden)
5. Hoe zou dit makkelijker/ beter gedaan kunnen worden?

Algemene meningen over de instructies en Feedback:

1. Wat is in het algemeen uw mening over de werk instructies die worden gebruikt binnen het bedrijf?
2. Wat zijn voor u aspecten /wensen/ verwachtingen die u graag binnen een instructie ziet?
3. In hoeverre voldoen de huidige instructies aan uw wensen en verwachtingen? Waarom deze verwachtingen?
4. Wat doet u als iets in een werkinstructie niet klopt, onvolledig is, anders of beter kan?
5. Would it be possible for you to provide suggestions for improvement and offer feedback within your company?
6. Worden jullie betrokken in het maakproces van de werkinstructies? Zoja, op welke manier?
7. Hoe ontvangt u wijzigingen of updates in de werkinstructies? En hoe gaat u hiermee om?
8. Welke rol speelt technologie bij het gebruiken van de werkinstructies binnen u organisatie?

Gebruik en afwijking van werkinstructies

1. Hoe gaat u aan de slag met het in elkaar zetten/maken van een product? Gebruikt u hierbij de werkinstructie? Zo ja hoe? Zo nee, wat doet u dan?
2. What is your learning process for working instruction?
3. Wijkt u weleens af van de werkinstructies? Wat zijn situaties of redenen waarom u afwijkt van de werkinstructies?
4. Welke ondersteuning, techniek of aanvullende informatie heeft u nodig bij het gebruiken van de werkinstructies?
5. Wat is volgens u het doel van de werkinstructies?
6. Hebben de instructies volgens u nut tijdens de werkzaamheden? Waarom wel / niet?
7. In welke mate heeft u de instructies nodig voor het begrijpen van de werkzaamheden? Nodig voor de handelingen (taken) of voor proces (volgorde)? Of iets anders?
8. Ken je verschillen in voorkeuren voor hoe instructies worden weergegeven tussen collega's?

Omgaan met externe & interne factoren

1. Hoe gaat u om met tijdsdruk in uw werk?
2. Hoe gaat u om met afleidingen of onderbrekingen tijdens uw werk/het volgen van de werkinstructies?
3. Hoe gaat u om met onduidelijkheden in de werkinstructies?
4. Ervaar je op dit moment moeilijkheden bij bepaalde stappen of handelingen van de werk instructies die duidelijker hadden moeten worden uitgelegd?
    4.1. Zo ja, kun je aangeven wanneer deze moeilijkheden zijn ontstaan, bijvoorbeeld toen je net begon met dit proces, gisteren, of bij de introductie van een nieuw product of nieuwe instellingen?
    4.2. En hoe verschilde dit van je ervaring toen je net begon?
5. Heb je ooit nieuwe of onbekende termen of taalgebruik aangetroffen in werk instructies of in de beschrijving van gereedschap?

5.1. Zo ja, heb je daarbij problemen ervaren bij het begrijpen of uitvoeren van taken? Kun je voorbeelden geven

Standardized werk procedures

 Definitie: Gestandaardiseerd werk (SW) is een nauwkeurig gedocumenteerd en visueel systeem van stappen die in een bepaalde volgorde worden uitgevoerd om zo efficiënt mogelijk te produceren. Het doel is om consistentie te creëren en te behouden voor de eindproducten (Graupp, 2023, definitie van de TWI).

1. Zijn er gestandaardiseerde werkprocedures binnen jouw organisatie? (SOP, TAS)
2. Helpen deze gestandaardiseerde werkprocedures met het begrijpen van de werk instructies?

Afronden taak

1. Hoe rondt u een product of taak af voordat u doorgaat met de volgende?

<u>Training (als ze aanwezig zijn)</u>

 Definitie: Trainingen binnen het kader van assembly werk zijn gericht op het verbeteren van de vaardigheden en kennis van werknemers om hun taken effectief uit te voeren, evenals het leren omgaan met nieuwe machines of apparatuur die relevant zijn voor hun werkzaamheden. Voorbeeld van trainingen

i. **Taakspecifiek-training:** Training gericht op het aanleren van specifieke taken binnen het assemblageproces, zoals het monteren van onderdelen, solderen, of kwaliteitscontroles uitvoeren.
ii. **Machine en apratuur-training**: Training om werknemers te leren hoe ze verschillende machines en apparatuur moeten bedienen en onderhouden die worden gebruikt in het assemblageproces, zoals robots, CNC-machines, of specifieke gereedschappen.
iii. **Veligheids-training:** Training gericht op het veilig uitvoeren van taken binnen het assemblageproces, inclusief het gebruik van persoonlijke beschermingsmiddelen, veilig omgaan met gevaarlijke materialen en het herkennen van veiligheidsrisico's.
iv. **Probleem oplossing-training**: Deze training richt zich op het effectief identificeren, analyseren en oplossen van problemen die zich kunnen voordoen tijdens het assemblageproces. Het leert werknemers vaardigheden zoals het herkennen van afwijkingen, het stellen van de juiste vragen en het implementeren van oplossingen om herhaling van fouten te voorkomen.
v. **Kwaliteits-training:** Training om werknemers te leren hoe ze de kwaliteit van producten kunnen waarborgen tijdens het assemblageproces, inclusief het identificeren van defecten, het uitvoeren van inspecties en het volgen van kwaliteitsrichtlijnen.

Algemene Training Informatie:

1. Worden deze bovenstaande trainingen gegeven binnen uw werkafdeling?
   1.1. Wat voor soort trainingen worden gegeven?
2. Wanneer worden de trainingen gegeven en hoe vaak?

Aanpassing aan Werkplek en Taken:

1. Op welke manier worden de trainingen afgestemd op de taken en verantwoordelijkheden van werknemers op de werkplek?
2. Worden de trainingen gekoppeld aan een specifiek product, werkplek, activiteit of aspect?

1.1. Welke onderwerpen worden behandeld op deze trainingen? Wat voor leerdoelen worden behandeld op deze training?

Detailniveau en Instructies:

1. Hoe gedetailleerd zijn de trainingen vergeleken met de werk instructies?
   1.1. Heeft u het gevoel dat na de trainingen de werk instructies op het gebied van de training minder gedetailleerd zouden kunnen zijn? (Zoals op het gebied van instellen van een tool)
2. Werden er tijdens de trainingen richtlijnen gegeven met betrekking tot de optimale tijdsduur voor het uitvoeren van taken? (zoals takt time of cyclustijd)

Specifieke Trainingstechnieken:

1. Welke specifieke technieken of methoden werden tijdens de training behandeld om fouten te identificeren en/of te behandelen die je anders niet zou hebben geweten als je direct op de werkplek was begonnen aan het product?
2. Werd er tijdens de training aandacht besteed aan het gebruik van tools of specifieke objecten die nodig zijn voor het uitvoeren van taken, en hoe verschilt dit van wat je zou hebben geleerd als je direct op de werkplek was begonnen?
3. Werd tijdens de training aandacht besteed aan het niveau van detail dat nodig is bij het uitvoeren van taken, en hoe verschilt dit van wat je zou hebben geweten als je direct op de werkplek was begonnen?
4. Worden er tijdens de training trucjes of handige tips aangeleerd om stappen sneller onder de knie te krijgen, die anders niet zouden zijn overgebracht als je direct op de werkplek was begonnen?

Evaluatie en Verbetering:

1. Heb je tijdens de training moeilijkheden ervaren bij bepaalde stappen of handelingen die duidelijker hadden moeten worden uitgelegd, en zo ja, hoe verschilt dit van wat je zou hebben ervaren als je direct op de werkplek was begonnen?
2. Heb je tijdens de training nieuwe concepten of procedures geleerd die niet duidelijk waren in de werkinstructies?
3. Zijn er tijdens de training specifieke tips of best practices gedeeld die niet werden genoemd in de werkinstructies?

<u>Work performance inconsistency</u>

1. Zijn er aanzienlijke inconsistenties (volgorde van taken, tijdsduur, kwaliteit) van het werk onder de werknemers, en zo ja, wat denkt u dat de oorzaken daarvan zijn?
2. Denkt u dat uw werkinstructies zorgen voor consistentie in de werkuitvoering'? Waarom wel/niet? (Inconsistentie in snelheid, kwaliteit)
3. Welke specifieke effecten heeft de training gehad op de uitvoering van uw werkzaamheden?
   1.1. Heeft u bijvoorbeeld gemerkt dat uw snelheid of kwaliteit van werken is verbeterd na de training?

6	**Interview met 1 of meer makers van werkinstructies en/of trainingen (voorbeeld?)**

Algemene vragen:

Kan je je zelf kort voorstellen en benoemen wat je achtergrond is en huidige positie?

Contextuele factors vragen:

1. Wat is uw hoogst voltooide opleidingsniveau?
2. Hoe lang werk je binnen deze organisatie?

3. Hoeveel jaar werkervaring heb je tot nu toe opgebouwd, inclusief eerdere banen?
4. Heb je naast je opleiding nog andere specifieke trainingen of cursussen gevolgd die gericht waren op het beter uitvoeren van je werk?

Maken van Werk instructies

Informatie Verzamelen en Ontwikkeling van Werk Instructies:

1. Hoe komt de aanvraag voor het ontwikkelen van een werkinstructie binnen? En vanuit wie komt deze aanvraag? Of besluit de opsteller dat zelf?
2. Wanneer u werk instructies ontwikkelt, baseert u deze dan op persoonlijke ervaring door de handeling zelf uit te voeren, of vertrouwt u voornamelijk op andere bronnen voor het verzamelen van informatie?
    2.1. Hoe verzamelt u informatie om werk instructies te maken? Baseert u zich voornamelijk op persoonlijke ervaring, input van experts, observaties op de werkvloer of andere bronnen?
3. Hoe zorgt u ervoor dat de werkinstructies aansluiten bij de trainingen van de operatoren?
4. Hoe lang ben je meestal bezig met het opstellen van een werkinstructie?
5. Do you have a standard for making work instructions? How would you define these standards?
6. Which working instruction presentations do you usually prefer? Do you think different presentations will have an impact?
7. What do you think good working instruction should look like?
8. Hoe wordt de effectiviteit van de werkinstructies in de gaten gehouden en geëvalueerd? En zou u de instructies dan aanpassen?

Technologie

1. Welke technieken, software of hulpmiddelen zet u in bij het ontwikkelen van werkinstructies? Zijn er richtlijnen voor bijv. taalgebruik, het gebruik van afbeeldingen, zijn er templates beschikbaar waarin de instructies gemaakt kunnen/moeten worden?
2. Welke rol speelt technologie bij het opstellen, uitvoeren en beheren van de werkinstructies binnen uw organisatie?

Aanpassing en Criteria van Werk Instructies:

1. Hoe komen de werkinstructies bij de operators op de werkplek terecht? Wat voor techniek wordt hiervoor ingezet?
2. Hoe communiceert u eventuele wijzigingen of updates binnen de werkinstructies naar de operators?
3. Worden de werk instructies op maat gemaakt voor specifieke functies of afdelingen binnen het bedrijf, of zijn ze universeel en van toepassing op alle werknemers?
4. Will you give workers some power to modify or improve working instructions? Have you considered letting workers make part of the working instruction themselves?
5. After you have completed a working instruction, will you spend time analyzing and improving the working instruction based on the worker's performance? How does the feedback loop look like?

Uitvoering en Flexibiliteit van Werk Instructies:

1. Hoe gaat u om met situaties waarin werknemers afwijken van de werk instructies?
2. Would you add something like a quality check in the working instruction to restrict the worker from doing the next step? Do you think these checks are meaningful?
3. In hoeverre krijgt de werknemer ruimte voor eigen interpretatie bij het hanteren van de werk instructies? Bijvoorbeeld, moeten de instructies worden gevolgd of worden er ook trucjes gebruikt om het proces sneller te maken?
    3.1. In hoeverre zijn de werk instructies gedetailleerd? Biedt de beperktheid aan details ruimte voor interpretatie?

Inhoud van Werk Instructies:

1. Welke criteria hanteert u bij het bepalen van de inhoud en structuur van werk instructies?
2. Op welk gedeelte van het proces richt de werk instructies zich op? (Het volledige proces, Taken, Activiteiten). En waarom wordt hiervoor gekozen?
3. Hoe zorgt u ervoor dat de werkinstructies begrijpelijk zijn voor verschillende niveaus van ervaring en vaardigheden bij de operatoren?
4. Worden de instrumenten voor de handelingen uitgelegd in de werk instructies? Waarom niet of wel? (Denk hierbij aan aspecten zoals kennis van de werkomgeving, hoe tools worden gepositioneerd of gebruikt, en andere objectspecifieke informatie)
5. Welke elementen worden meegenomen in de werk instructies en waarom zijn juist deze belangrijk? (Denk aan tijdsindicatie, volgorde, errors, nieuw taalgebruik)

Complexiteit en Aandacht in Werk Instructies:

1. Tijdens het maken van de werk instructies wordt er gedacht aan de complexiteit van bepaalde stappen/handelingen? Wordt er meer aandacht besteed aan moeilijkere stappen?
2. Hoe incorporeert u de moeilijke stappen in de werk instructies?

<u>Standardized werk procedures</u>

1. Welke rol speelt standaardisatie in het ontwikkelen van werk instructies? Hoe zorgt u ervoor dat de instructies consistent zijn en dezelfde resultaten opleveren, ongeacht wie ze uitvoert?
2. Hoe worden standaardwerkmethoden vastgesteld en gedocumenteerd binnen uw organisatie?
3. Hoe wordt de naleving van gestandaardiseerde werkmethoden gemeten en gecontroleerd op de werkvloer?

<u>Maken van Training (als aanwezig)</u>

Informatie Verzamelen en Analyse:

1. Hoe verzamelt u informatie om trainingen te maken? Baseert u zich voornamelijk op persoonlijke ervaring, input van experts, observaties op de werkvloer of andere bronnen?
2. Hoe zorgt u ervoor dat de trainingen aansluiten bij de werk instructies van de werknemer?

Inhoud en Structuur van Trainingen:

1. Hoe bepaalt u de inhoud en structuur van de trainingen?
2. Op welke manier identificeert u de trainingsbehoeften van werknemers voordat u begint met het ontwikkelen van trainingsmateriaal? Welk aspect van de werk instructies gaat u op focussen?

Trainingsbehoeften:

1. Worden de trainingsbehoeften van werknemers op individueel niveau geïdentificeerd, of worden er algemene behoeften vastgesteld die van toepassing zijn op alle werknemers binnen een bepaalde afdeling?
    1.1. Als er individuele trainingsbehoeften worden geïdentificeerd, op welke manier worden deze bepaald?
    2.1. In hoeverre zijn de werk instructies gedetailleerd? Biedt de beperktheid aan details ruimte voor interpretatie?
2. Hoe gedetailleerd zijn de trainingen die u ontwikkelt voor werknemers die werk instructies zullen gebruiken?

Instrumenten en Elementen in Trainingen:

1. Worden de instrumenten voor de handelingen uitgelegd tijdens de trainingen? Waarom niet of wel? (Denk hierbij aan aspecten zoals kennis van de werkomgeving, hoe tools worden gepositioneerd of gebruikt, en andere objectspecifieke informatie)
2. Welke elementen worden meegenomen in de trainingen en waarom zijn juist deze belangrijk? (Denk aan tijdsindicatie, volgorde, errors, nieuw taalgebruik)
3. Tijdens de trainingen wordt er gedacht aan de complexiteit van bepaalde stappen/handelingen? Wordt er meer aandacht besteed aan moeilijkere stappen?
4. Worden er tijdens de trainingen trucjes (kneepjes van het vak) aangeleerd die werknemers helpen om de taken sneller en efficiënter uit te voeren?

<u>Personaliseerde trainingen/werk instructies</u>

1. In hoeverre wordt personalisatie overwogen bij het ontwikkelen van werk instructies en trainingen binnen uw organisatie?
    1.1. Als er geen gebruik wordt gemaakt van personalisatie waarom niet?
    2.1. En als er wel gebruik wordt gemaakt van personalisatie op welke variabelen wordt de personalisatie dan op gebaseerd? (E.g. Specifieke methoden die worden gebruikt om de werk instructies en trainingen aan te passen aan de individuele behoeften en vaardigheden van werknemers)
2. Welke persoonlijke kenmerken zijn relevant voor het personaliseren van werk instructies (bijvoorbeeld leeftijd, werkervaring, kwalificaties, enzovoort)?
        1.1. En voor trainingen?
3. Wordt personalisatie beschouwd als een prioriteit bij het ontwikkelen van trainingsprogramma's, of wordt het eerder als optioneel beschouwd?
4. Zijn er voorbeelden waarbij het implementeren van gepersonaliseerde werk instructies of trainingen heeft geleid tot verbeterde prestaties of betrokkenheid van werknemers?
5. Hoe wordt de balans gevonden tussen het bieden van gepersonaliseerde instructies en het behouden van consistentie en uniformiteit binnen het bedrijf?
6. Wordt er rekening gehouden met individuele trainingsbehoeften bij het opstellen van persoonlijke ontwikkelingsplannen voor werknemers? Zo ja, op welke manier?
7. Als bedrijven personalisatie willen implementeren, geven ze dan de voorkeur aan op maat gemaakte werkinstructies, individuele trainingen, of een combinatie van beide?

<u>Work performance inconsistency</u>

1. Wordt er ook gekeken naar de effectiviteit van werkinstructies? Zo ja, waar wordt dan naar gekeken?
    1.1. Zijn er prestatie-indicatoren of andere maatregelen die worden gebruikt om de impact van de instructies te evalueren?
2. Zijn er aanzienlijke variaties in de uitvoering van het werk onder de werknemers, en zo ja, wat denkt u dat de oorzaken daarvan zijn?
3. Wat was de impact van werk instructies op de werk uitvoering? (inconsitencie in snelheid, qualiteit etc)
4. Wat was de impact van training op de werk uitvoering? (inconsitencie in snelheid, qualiteit etc)