CHALMERS
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Shaping Behaviour Through Training

A Tool for Developing and Evaluating the Use of Behaviour Change Techniques in Industrial Operator Training

Master's thesis in Learning and Leadership

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Cover: A metaphorical representation of desirable behaviours within manufacturing industries, illustrating individuals and their behavioural interactions operating as an interconnected system.

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Abstract

Training operators within the manufacturing industry is an essential means of competence development and organisational improvement. In many training contexts, a key objective is to achieve behavioural change among participants, which makes it important to ensure that training initiatives succeed in this regard. For training investments to be justified, it is necessary to be able to evaluate whether trainings employ appropriate learning techniques that are supported by theory, and if they are intentionally designed to facilitate behavioural change. On this basis, the aim of this thesis has been to develop a practical and applicable tool for developing and evaluating trainings with the purpose of effectively shaping or reinforcing behaviours.

Through a literature review and interviews with experts within the industry, five behaviours were identified as relevant for operators to exhibit: *following standards, acting on deviations, following time frames, adapting to the environment*, and *acting with humility*. Furthermore, through a literature review and observations of three trainings, the findings indicate that effective reinforcement or shaping of behaviours within trainings requires the fulfilment of five conditions: *psychological capability, physical opportunity, social opportunity, reflective motivation*, and *automatic motivation*. It was also found that seven intervention functions and 21 unique behaviour change techniques were considered particularly relevant and effective within the context of manufacturing training, taking the target group, learning perspectives, and practical conditions into account.

With this in consideration, a tool was developed combining the identified conditions, intervention functions, and behaviour change techniques, together with a grading system evaluating the extent to which trainings address these aspects. The findings suggest that trainings aiming to shape or reinforce behaviours related to safety, efficiency, and quality may strengthen their capacity to support sustained behavioural reinforcement by achieving a high grading within the tool. To ensure accurate interpretation and application, the tool is accompanied by explanatory sheets, providing the terminology definitions and necessary information explained in this report. Collectively, these contributions offer a structured foundation for designing and evaluating trainings with greater behavioural impact.

Keywords: Behaviour, Behavioural Change, Evaluation Tool, Learning Techniques, Manufacturing Industries, Operator Training.

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Alice Lindqvist, Fanny Riggers, Gothenburg, May 2026

Declaration of Use of AI

This report was written with support from different AI tools, specifically ChatGPT and Chalmers AI. ChatGPT was primarily used as a language support tool to assist with English formulation, including refinement of wording, grammar, and ensuring clarity of meaning in selected sentences. In addition, ChatGPT was used to generate LaTeX code and support the formatting of the report, for example in the creation of tables and the programming of figures. Chalmers AI was used in the initial stage of transcribing interviews, prior to subsequent human review and refinement. However, all writing and analytical work were conducted by the authors, Alice Lindqvist and Fanny Riggers, before any AI tools were applied.

List of Acronyms

Below is the list of acronyms that have been frequently used throughout this thesis:

BCG	Battery Centre Gothenburg
BCT	Behaviour Change Technique
BCW	Behaviour Change Wheel
COM-B	Capability, Opportunity, Motivation - Behaviour
APEASE	Affordability, Practicality, Effectiveness/cost-effectiveness, Acceptability, Safety/side-effects, Equity
PEAS	Practicality, Effectiveness/cost-effectiveness, Acceptability, Safety/side-effects

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1
Introduction

Understanding employee behaviour has been a subject of interest for manufacturing companies for many years. As early as the late 1930s and early 1940s, the study of human behaviour and attitudes in organisations was established in the US [1]. This field of research, known as organisational psychology, highlighted the psychological needs for belonging, appreciation, and influence within workplaces. Today, research in the field focuses on how behaviour affects the organisation, investigating aspects such as values, motivation, and organisational results.

The information gathered through research is applied primarily through leadership and organisational development programs to support organisations and improve their workplaces [1]. One method of implementation is through education for employees. In 2020, 92% of manufacturing organisations offered their staff some form of education, 76% of which consisted of external or internal educational courses [2]. The areas of competence development that manufacturing companies identified as most vital, were profession-specific technical and practical expertise. In addition, subjects such as teamwork and cooperation were also among the highest-prioritised areas.

When investing time and resources into training employees, companies are interested in ensuring that these investments deliver a return. Since employee behaviour has been linked to organisational outcomes such as increased efficiency, collaboration, and workplace culture, educational initiatives are often used as a strategic tool for influencing and reinforcing desired behaviours. To ensure this, it is essential to have trainings that address behaviour through an effective and accurate approach. Currently, evaluation tools exist to measure the efficacy of a training and whether behaviour has changed. There are also design tools available for how to shape unspecific behaviours.

However, the effectiveness of trainings is typically measured through participants' self-assessments of whether they perceive that they have changed their behaviour, which may not constitute a sufficiently reliable measure of actual behavioural change. Meanwhile, existing design tools are often relatively general in nature in order to remain applicable to a broad target group. While this broad applicability broadens their utility, it also limits their level of adaptivity for practical application and for addressing the needs of specific target groups within individual organisations. Therefore, this study aims to develop a tool focused on practical application within training contexts in the manufacturing sector.

1.1 Background

This project is based on a request from Gothenburg Technical College (GTC) to evaluate their training at Battery Centre Gothenburg (BCG). The term *training* refers to shorter competence development initiatives conducted over one or several days. The centre is commissioned by Göteborgs Stad and Västra Götalandsregionen to be operated by GTC, with the aim of meeting the growing demand for competence in industrial technology, electromobility, and sustainability in Sweden [3]. BCG is designed to serve various target groups, one of which includes operators in the manufacturing industry.

A primary goal of the training, specifically for operators, is to foster desired behaviours suitable for their workplaces. In collaboration with the companies commissioning the training for their employees, GTC has determined that these behaviours should focus on safety, efficiency, and quality, as the participants are, or will be, working at manufacturing sites upon completion of the training [4].

BCG has now been operational since the beginning of 2025, and GTC wishes to evaluate the centre's success in teaching desired behaviours and addressing those that are inconsistent with industry requirements. More specifically, they seek to identify current strengths and determine which changes are necessary to enhance the centre's ability to effectively cultivate desired behaviours that the manufacturing companies requests.

1.2 Aim

The aim of this study is to create a tool for the development and evaluation of trainings intended to shape and reinforce operator behaviours in manufacturing industries. The tool seeks to identify the conditions within trainings that facilitate behavioural change, as well as the interventions required to achieve such outcomes. By doing so, it aims to support organisations in clarifying their current practices and identifying opportunities for improvement. The tool is specifically intended to be applicable within industrial training contexts, with particular emphasis on safety, efficiency, and quality.

1.3 Research questions

To achieve the aim of this project, the study is guided by the following set of research questions:

- What behaviours are required for operators working within the manufacturing industry?
- Which conditions must be fulfilled to facilitate the shaping of new behaviours or the reinforcement of existing behaviours?

- Which educational design strategies and interventions support behavioural change or reinforcement in trainings within manufacturing industries?
- What opportunities are available within trainings for implementing changes to content and structure?
- How can behavioural conditions, design strategies, and interventions, be structured into an applicable tool for developing and evaluating trainings in manufacturing contexts?

1.4 Delimitations

The project excludes participants other than operators, since the desired behaviours are considered specific to operator roles and may differ across occupations. Consequently, participants undergoing training for purposes such as inspiration or other learning outcomes unrelated to operator behaviour will not be considered.

The study does not examine participants' behaviours before or after the trainings. Instead, it focuses on what occurs during the training and how the trainings create conditions that enable participants to establish and maintain the desired behaviours after completing the training. Established behavioural psychology suggests that sustaining a new or changed behaviour typically requires at least six months of repeated recall and performance of the behaviour [5], which exceeds the project's time frame. Additionally, the absence of baseline data regarding prior behaviours makes it impossible to scientifically validate behavioural change. By focusing on the trainings themselves, the project remains feasible while ensuring that the findings are grounded in observations conducted at BCG, Volvo Cars, and Volvo AB.

2
Theory

This chapter presents the theoretical framework central to the thesis. First, a deeper understanding of the selected target group, namely operators within manufacturing industries. The chapter then introduces the concept of behaviour, including the factors that influence it and the time required for behavioural change. This is followed by a presentation of the Behaviour Change Wheel, a model that is central to this thesis, together with a step-by-step guide describing its intended application. Finally, relevant learning perspectives related to learning in general and adult learning are presented.

2.1 Manufacturing industries and operators

A manufacturing industry is defined as "an industry that produces goods rather than services, or these industries considered as a group" [6]. It comprises organisations that transform materials, substances, or components into new products through physical or chemical processes [7]. These products may either be used in subsequent production stages or sold directly to customers. The sector is generally characterised by the extensive use of machinery and industrial processes, and includes activities such as resource purification, electronic component production, and product assembly.

Within this context, manufacturing operators play a central role in ensuring the effective execution of production activities. A manufacturing operator is generally responsible for ensuring that production processes run safely, efficiently, and in accordance with established quality standards [8]. Work tasks typically involve operating and monitoring machinery, managing production flow, and performing hands-on assembly. In addition, operators may be responsible for basic maintenance and troubleshooting, conducting quality control through defect identification, as well as handling packaging and material preparation. However, the specific responsibilities vary depending on the role within the production process.

2.2 Behaviour

The definition of behaviour, what is considered desirable behaviour, and what affects someone's behaviour differ across literature and cultures. In this report, multiple dictionaries have been compared. What is universal across all reviewed definitions is that behaviour is considered to be a person's actions in response to a stimulus

[9, 10, 11]. This definition is further elaborated in some dictionaries. For example, behaviour may be conscious or subconscious, and stimuli can be both internal and external [10]. Examples of external stimuli include light, noise, and situations in one's surroundings, while internal stimuli include factors such as hunger, pain, or fatigue. Behaviour is also described as either overt or covert [10]. Covert actions involve voluntary muscles that is not visible to an observer, for example clenching the teeth, or holding one's breath, in contrast to overt actions, which are visible, such as speaking, walking, or gesturing.

Given the complexity of behaviour and the factors influencing it, establishing or changing a behaviour takes time, and the duration varies depending on several factors. These include the person's awareness of the need for change, their motivation, and their readiness to act. According to the *Stages of Change Theory* [12], a framework for understanding human behaviour with a stepwise approach, behavioural change is a gradual process that occurs through a series of stages rather than as a single event. The framework consists of five stages. The first four describe how an individual progresses from not recognising a problem to actively changing their behaviour. The final stage of the theory, *maintenance*, involves sustaining the new behaviour over time to ensure that the change is maintained. This stage can last from six months up to five years, highlighting that behavioural change is a long-term process that requires continuous effort and commitment.

Since behavioural change is a gradual and long-term process, several theories and models attempt to explain the factors that influence the establishment of behaviours. Although they vary in scope and complexity, considerable overlap exists. One commonly identified factor is the external environment, including the physical surroundings and the specific context in which the behaviour occurs [13, 14]. This environmental context also encompasses social influences, such as normative pressure [13, 15]. In addition, internal motivation is frequently highlighted as a critical determinant, implying that the individual must perceive the behaviour as aligned with their personal beliefs, view the benefits of the action as outweighing the alternatives, or consider it an integral part of their goals [13, 14, 16]. Finally, knowledge and skills are recognised as essential prerequisites, meaning that the individual must possess the capability required to perform the behaviour [13, 16].

In addition to the previously mentioned models, Michie et al. [17] offer a more integrated and concise framework for understanding behavioural change. Drawing inspiration from the 1991 US consensus meeting of behavioural theorists, as well as principles of US criminal law used to establish guilt, the framework identifies three conditions that interact to generate a behaviour. These conditions are *capability, motivation,* and *opportunity*. Figure 2.1 illustrates both the interactions between these conditions and how they collectively generate behaviour. This is referred to as the *COM-B system*.

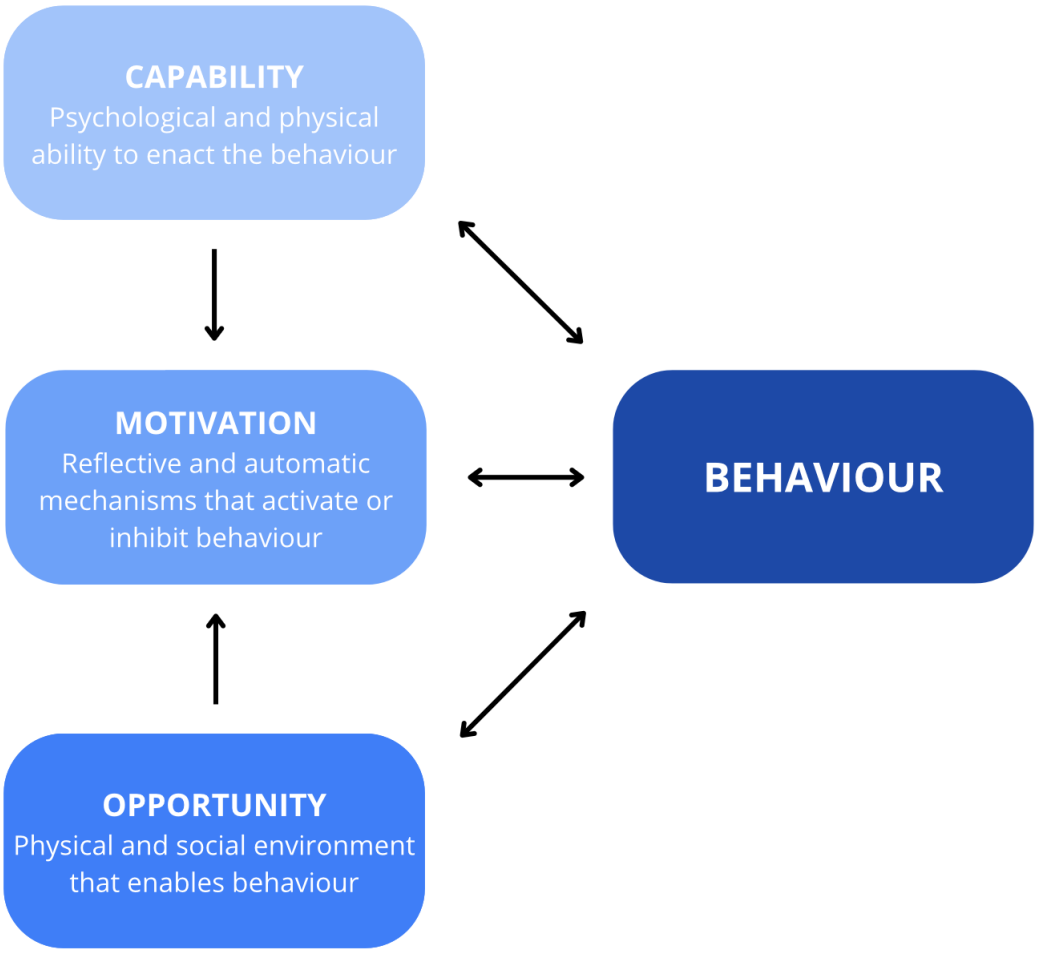

Figure 2.1: Visualisation of the COM-B system.

The first component, capability, consists of two subcategories: psychological and physical capability to engage in a particular activity. Physical capability refers to possessing the physical skills and strength required to perform the behaviour, whereas psychological capability refers to the mental capacity needed to engage in the necessary thought processes. The second component, motivation, is defined as the brain processes that energise and direct behaviour. This includes goals and conscious decision-making, alongside habitual processes, emotional responses, and analytical evaluations. Motivation is further divided into automatic and reflective motivation. Automatic motivation refers to emotions and impulses that arise from associative learning or innate dispositions, whereas reflective motivation involves reflective processes such as evaluations and plans. Finally, the third component, opportunity, refers to all external factors that enable or prompt a behaviour. It is divided into social and physical opportunity. Social opportunity refers to the cultural and social environment that shapes how individuals think and behave, while physical opportunity concerns the surrounding physical environment.

To illustrate the COM-B system, recycling can be used as an example of a be-

haviour. Physical capability refers to, in this example, an individual's ability to transport themselves and their waste to a recycling facility, whereas psychological capability involves being able to identify the material composition of products and to sort them correctly. Reflective motivation involves valuing recycling and believing that it contributes positively to environmental protection. In contrast, automatic motivation refers to the formation of recycling habits and the development of positive feelings of accomplishment or negative feelings of guilt associated with recycling or failing to recycle. Physical opportunity includes environmental conditions such as the availability, proximity, and accessibility of recycling facilities. Social opportunity on the other hand refers to observing friends and family prioritise recycling and perceiving it as a socially expected behaviour.

If one or more of the conditions are not fulfilled, they may act as barriers to performing the behaviour. Which conditions that act as barriers vary across different target groups. For example, for individuals living in rural areas with limited access to recycling facilities, physical opportunity most likely will be the primary barrier. Among older adults or individuals with physical impairments, limited physical capability may hinder or prevent the behaviour. Furthermore, in cases where individuals place little value on environmental issues, insufficient reflective motivation may result in the behaviour not being performed.

2.3 Behaviour Change Wheel (BCW)

The Behaviour Change Wheel (BCW), illustrated in Figure 2.2, is a framework intended to guide how specific behaviours can be changed within particular target groups using a systematic and evidence-based approach [18]. These target groups can range from individuals and smaller groups to entire populations. It first provides an understanding of the conditions required for behavioural change, and subsequently outlines an approach to the design, delivery, and implementation of interventions. The BCW was developed following a systematic literature review of 19 existing frameworks, which were found to lack a comprehensive and integrated perspective on behavioural change. In response, the BCW was created to provide a unified framework spanning from the identification of behaviour to the selection of appropriate delivery methods.

The BCW is structured into three dimensions, illustrated as layers of a wheel (see Figure 2.2). At the core lies the COM-B system, described in Section 2.2. As mentioned, COM-B includes capability, opportunity, and motivation, each representing essential conditions for a behaviour to occur. The second layer consists of intervention functions, for example education or training, that can be employed to address deficiencies in the COM-B components. Definitions of each intervention function are provided in Table 2.1. The outer layer comprises policy categories that can be used to support and deliver the intervention functions. In total, the BCW includes nine intervention functions and seven policy categories.

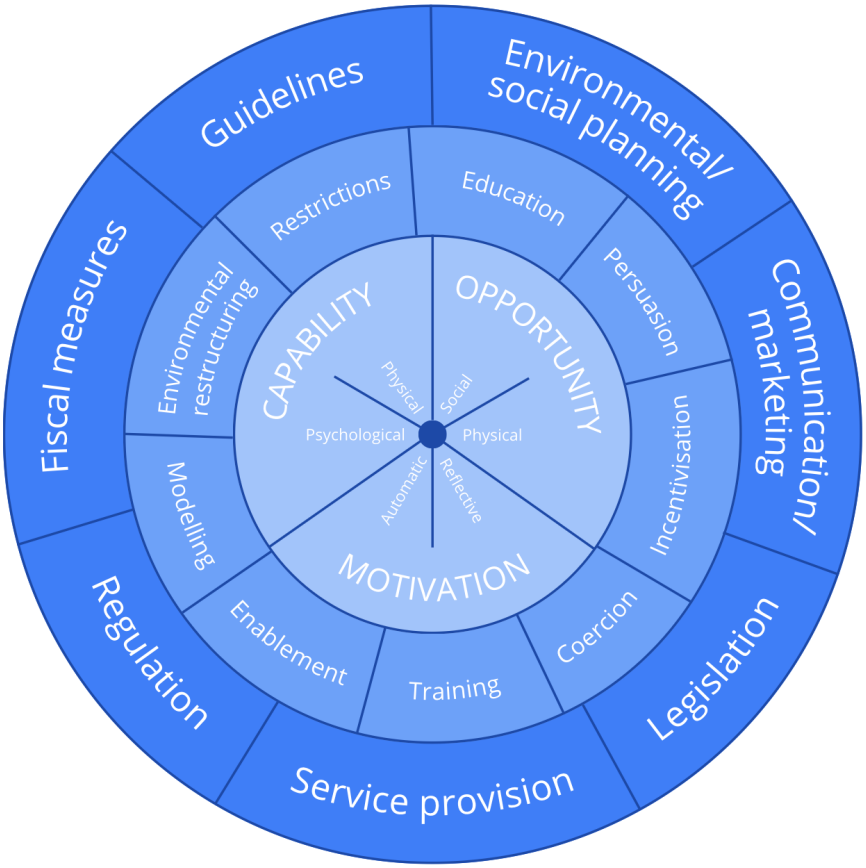

Figure 2.2: The Behaviour Change Wheel.

Table 2.1: Intervention functions and their definitions extracted from [18].

Intervention functions	**Definition**
Education	Increasing knowledge or understanding
Persuasion	Using communication to induce positive or negative feelings or stimulate action
Incentivisation	Creating an expectation of reward
Training	Imparting skills
Environmental restructuring	Changing the physical or social context
Modelling	Provide an example for people to aspire or imitate
Enablement	Increasing means/reducing barriers to increase capability (beyond education and training) or opportunity (beyond environmental restructuring)
Coercion	Creating an expectation of punishment or cost
Restriction	Using rules to increase* the opportunity to engage in the target behaviour (or to increase the target behaviour by reducing the opportunity to engage in competing behaviours)
** [18] uses the term "reduced", which is assumed to be a wording error.*	

The BCW model describes the three layers as interconnected and proposes that certain intervention functions are more effective for targeting particular subcomponents of COM-B. Similarly, certain policy categories are regarded as more suitable for supporting specific intervention functions. The relationships between the subcomponents of COM-B and intervention functions are presented in Table 2.2. Although the links between policy categories and intervention functions are not included in this report, they are described in [18].

Table 2.2: Connections between subcomponents of COM-B and intervention functions.

	Edu.	Pers.	Incent.	Coerc.	Train.	Restr.	Env. res.	Model.	Enable.
C-Ph					✓				✓
C-Ps	✓				✓				✓
O-Ph					✓	✓	✓		✓
O-So						✓	✓	✓	✓
M-Au		✓	✓	✓	✓		✓	✓	✓
M-Re	✓	✓	✓	✓					

The interventions described within the BCW are presented at a general level. To complement this, the framework is accompanied by a taxonomy of 93 Behaviour Change Techniques (BCTs), offering more specific guidance on how to facilitate behavioural change. A complete list of all BCTs can be found in Appendix A. The BCTs are further organised into clusters, grouping techniques with similar characteristics or purposes in order to provide a more comprehensive overview of the techniques. These clusters are presented in Table 2.3.

Table 2.3: Clusters of Behaviour Change Techniques.

BCT clusters	
1. Goals and planning	9. Comparison of outcomes
2. Feedback and monitoring	10. Reward and threat
3. Social support	11. Regulation
4. Shaping knowledge	12. Antecedents
5. Natural consequences	13. Identity
6. Comparison of behaviour	14. Scheduled consequences
7. Associations	15. Self-belief
8. Repetition and substitution	16. Covert learning

To provide a conceptual overview of the framework, Figure 2.3 illustrates how the layers are interconnected. From left to right, the arrows show the relationships

between the different parts of the framework to visualise the overall process flow. According to the model, behaviour consists of three components required to enable the performance of a behaviour, each of which is further divided into two subcomponents. These components are subsequently linked to different intervention functions, through which specific techniques can be applied to influence behavioural change. Lastly, the policy categories and modes of delivery are included, the former as an extension of the development of intervention functions and the latter from the development of BCTs. The policy categories determine the broader strategic context, while the modes of delivery specify the ways in which the interventions are delivered.

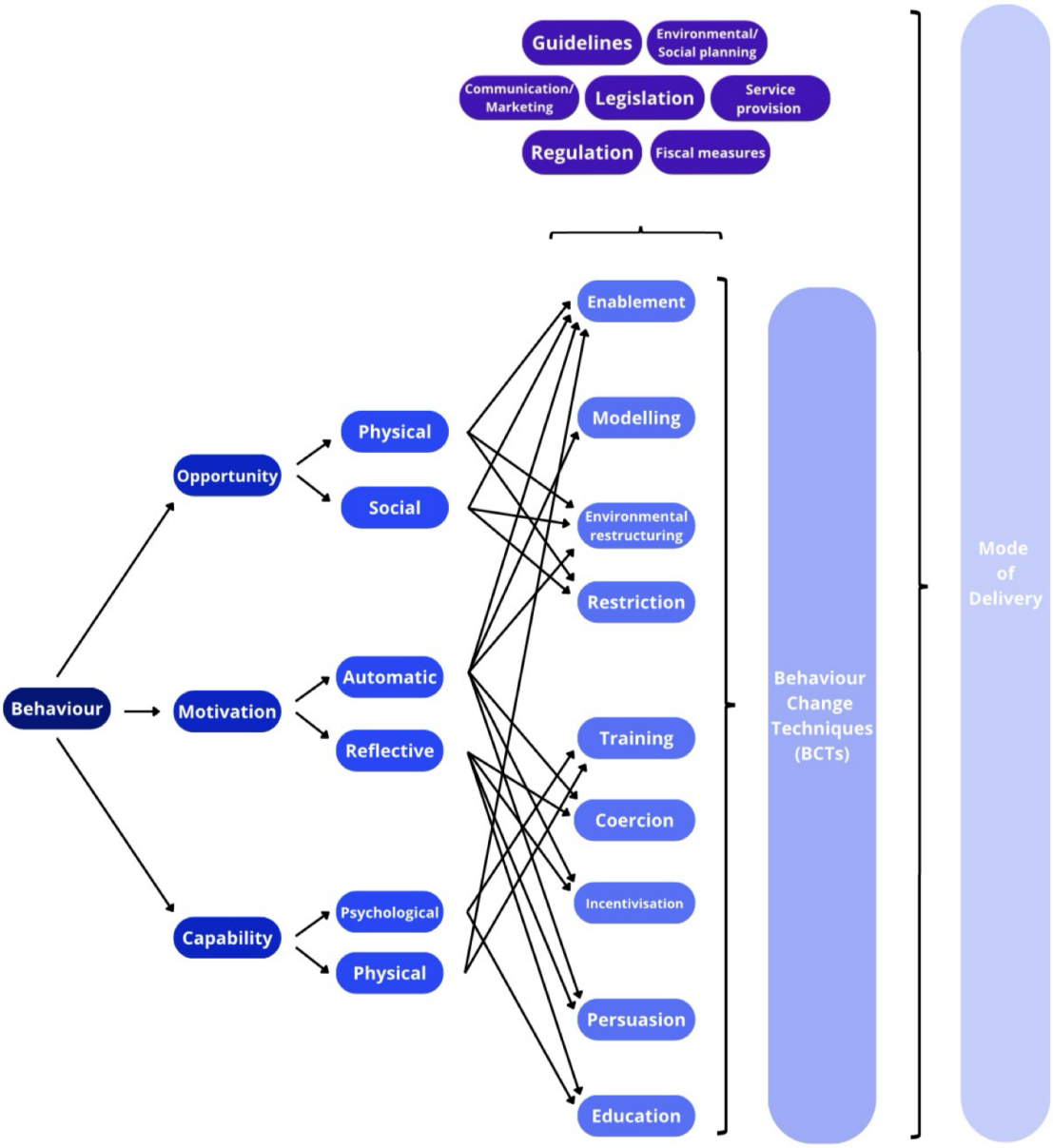

Figure 2.3: Conceptual overview of the BCW framework.

2.4 BCW step-by-step guide

Michie et al. has developed a step-by-step guide to guide individuals who want to implement the BCW and design behaviour change interventions [18]. In total, the guide consists of eight steps divided into three stages. All stages and steps are illustrated in Figure 2.4. Each step presents a structured approach intended to gradually guide the implementer towards the goal of changing a behaviour. Note that the illustration is presented as linear but may involve iterations between steps.

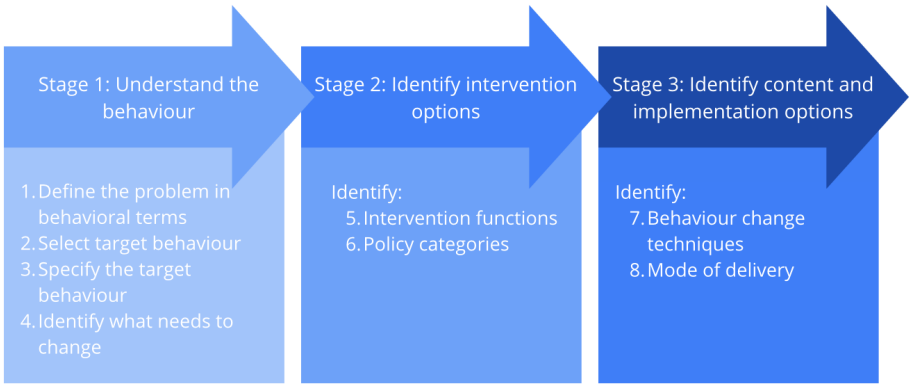

Figure 2.4: Michie step-by-step guide to design behaviour change interventions.

In Stage 1, the implementer is expected to understand the behaviour by defining it, analysing the target group, identifying the core behaviours, and determining what needs to change. In Step 1, *Define the problem in behavioural terms*, it is, as the name suggests, recommended to clarify which behaviours are causing the problem one intends to solve. This step also includes identifying the target group. Step 2, *Select target behaviours*, refers to identifying the core behaviours. To do this, it is suggested to compile a comprehensive list of all behaviours that may influence, occur within the context of, or otherwise be relevant to the problem. This list should then be narrowed down to the target behaviours. To support this selection, the following criteria are proposed to guide decision-making:

- The likely impact if the behaviour were to be changed
- How easy it is to change the behaviour
- The centrality of the behaviour within a system of behaviours and its potential for spillover effects
- Ease of measurement for evaluation

The identified target behaviours are then specified in Step 3, *Specify the target behaviour*. This involves elaborating on each behaviour to improve understanding. To support this, a set of questions is used for each behaviour:

- Who needs to perform the behaviour?
- What does the person need to do differently to achieve the desired change?
- When will they do it?

- Where will they do it?
- How often will they do it?
- With whom will they do it?

The final step in Stage 1, Step 4, is to *Identify what needs to change*. This refers to determining what must change in the individual or the environment to achieve the desired behavioural change. For this step, it is recommended to consult individuals relevant to the context, for example by creating a questionnaire or conducting focus group interviews. The questions can be guided by the COM-B components, where the implementer specifies what needs to change for each component and ask respondents whether a change is needed, already achieved, or not relevant. This process helps clarify which COM-B components are relevant to consider.

In Stage 2, the step-by-step guide outlines how to identify intervention options. The focus in this stage is to identify interventions that are likely to be effective for implementation within the specific context and behaviours established in Stage 1. Step 5, and thus the first step in Stage 2, is *Identify intervention functions*. In this step, the implementer is expected to select appropriate intervention functions for each COM-B component identified in Stage 1 by using the established links between COM-B components and intervention functions presented in Table 2.2. To determine which intervention functions are suitable for a specific context, it is recommended to apply the APEASE criteria. APEASE stands for Affordability, Practicality, Effectiveness/cost-effectiveness, Acceptability, Safety/side-effects, and Equity, and represents categories to consider when selecting appropriate functions (see Table 2.4).

Step 6, *Identify the policy categories*, follows the same procedure as Step 5. The difference is that the links in this step are between intervention functions and policy categories, and that the APEASE criteria are used to identify suitable policy categories rather than intervention functions.

Finally, in Stage 3, guidance on implementation options is provided, with a focus on practical feasibility. Step 7, *Identify behaviour change techniques*, involves determining which BCTs can deliver the identified intervention functions. To support selection among the 93 available BCTs, tables have been developed that link BCTs to suitable intervention functions, where BCTs are organised by frequency of use for each function. To further narrow down the options, it is again recommended to apply the APEASE criteria and to prioritise more frequently used BCTs over less frequently used ones.

The final step, Step 8, *Identify mode of delivery*, refers to determining appropriate implementation options given the target group and context. The implementer is expected to identify relevant modes of delivery independently, although examples such as face-to-face communication and media are provided. Once again, the APEASE criteria are suggested as a useful tool.

Table 2.4: APEASE criteria for evaluating interventions. The criterion descriptions are quoted from [18].

Criterion	Description
Affordability	Interventions often have an implicit or explicit budget. It does not matter how effective, or even cost-effective it may be if it cannot be afforded. An intervention is affordable if within an acceptable budget it can be delivered to, or accessed by, all those for whom it would be relevant or of benefit.
Practicability	An intervention is practicable to the extent that it can be delivered as designed through means intended to the target population. For example, an intervention may be effective when delivered by highly selected and trained staff and extensive resources but in routine clinical practice this may not be achievable.
Effectiveness/ Cost-effectiveness	Effectiveness refers to the effect size of the intervention in relation to the desired objectives in a real-world context. It is distinct from efficacy which refers to the effect size of the intervention when delivered under optimal conditions in comparative evaluations. Cost-effectiveness refers to the ratio of effect (in a way that has to be defined, and taking accounting of differences in timescale between intervention delivery and intervention effect) to cost. If two interventions are equally effective then clearly the more cost-effective should be chosen. If one is more effective but less cost-effective than another, other issues such as affordability, come to the forefront of the decision making process.
Acceptability	Acceptability refers to the extent to which an intervention is judged to be appropriate by relevant stakeholders (public, professional and political). Acceptability may differ for different stakeholders. For example, the general public may favour an intervention that restricts marketing of alcohol or tobacco but politicians considering legislation on this may take a different view. Interventions that appear to limit agency on the part of the target group are often only considered acceptable for more serious problems.
Safety/ side-effects	An intervention may be effective and practicable, but have unwanted side-effects or unintended consequences. These need to be considered when deciding whether or not to proceed.
Equity	An important consideration is the extent to which an intervention may reduce or increase the disparities in standard of living, wellbeing or health between different sectors of society.

2.5 Learning perspectives

According to [19], a learning theory refers to a theoretical framework that "seeks to explain how individuals acquire, process, retain, and recall knowledge during the learning process". The learning theories presented in this section focus on how effective learning opportunities can be structured and supported in general. These theories serve as conceptual tools for analysing and interpreting the processes underlying human learning.

Nine Events of Instruction
Gagné's instructional theory proposes a structured sequence of nine instructional events, organised into three levels of the learning process, to facilitate effective learning [20]. These events correspond to cognitive processes involved in learning. Table 2.5 presents the events grouped by level.

Table 2.5: The nine instructional events grouped into three levels.

Level 1	1. Gaining attention
	2. Informing learners of objectives
	3. Stimulating recall of prior knowledge
Level 2	4. Presenting content
	5. Providing guidance
	6. Eliciting performance
Level 3	7. Giving feedback
	8. Assessing performance
	9. Enhancing retention and transfer

The first level concerns preparation for learning, where attention is activated, goals are made explicit, and prior knowledge is stimulated. The second level focuses on knowledge acquisition and scaffolding. Here, new content is presented in a structured way while learners receive guidance that helps them interpret and organise information effectively. The third level relates to practice, evaluation, and consolidation. Learners are required to demonstrate their understanding through performance tasks, receive feedback to correct and refine their knowledge, and are assessed to determine learning outcomes. The process of retention and transfer ensures that knowledge is not only memorised but can be applied flexibly in new contexts.

Gagné's model integrates behaviourist and cognitive perspectives, emphasising that instruction must be carefully sequenced to support internal learning processes, moving from initial engagement to deep understanding and long-term transfer.

Psychomotor Taxonomy
Dave's psychomotor taxonomy extends educational objectives into the domain of physical skills development [21]. Building on Bloom's taxonomy, Dave outlines five hierarchical levels: *imitation, manipulation, precision, articulation,* and *naturalisation.* These levels describe the progression from basic replication of observed actions

to the automatic and efficient execution of complex motor skills. The psychomotor taxonomy emphasises practice, coordination, and gradual refinement, making it particularly relevant in fields such as vocational training, physical education, and technical skills development. The framework underscores that psychomotor learning involves both cognitive understanding and physical execution, requiring structured opportunities for repetition and feedback.

Lesson Checklist
Pritchard's lesson checklist offers a practical framework for effective lesson planning and delivery [22]. Rather than a formal theory, it serves as a reflective tool for educators to ensure that key components of teaching are addressed. The checklist consist of the following six parameters:

- Clear learning objectives
- Appropriate teaching methods
- Student engagement
- Differentiation
- Assessment strategies
- Opportunities for feedback

Pritchard emphasises the importance of aligning teaching activities with learning outcomes and adapting instruction to meet diverse learner needs. His approach reflects a synthesis of multiple learning theories, encouraging teachers to be flexible and responsive rather than strictly adhering to a single theoretical model.

Social Learning Theory
Bandura's social learning theory emphasises learning through observation, imitation, and modelling [23]. Bandura argued that individuals do not learn solely through direct experience but also by observing other peoples' behaviours and the consequences of those behaviours. Central to the theory are the processes of attention, retention, reproduction, and motivation. Bandura also introduced the concept of self-efficacy, referring to an individual's belief in their ability to succeed in specific tasks, which significantly influences learning and performance. His work bridges behaviourist and cognitive perspectives, highlighting the role of social context and internal mental processes in learning.

Self-Determination Theory
Self-Determination Theory (SDT), developed by Deci and Ryan, is a macro-theory of human motivation that emphasises the role of intrinsic motivation and psychological needs in learning [24]. In their work, they argue that optimal learning occurs when three basic psychological needs are satisfied: autonomy (a sense of volition and choice), competence (a sense of effectiveness and mastery), and relatedness (a sense of connection with others). SDT distinguishes between intrinsic motivation, where activities are performed for their inherent satisfaction, and extrinsic motivation, which varies in degree of internalisation. The theory highlights that learning environments supporting autonomy, providing meaningful feedback, and fostering social belonging enhance motivation, engagement, and well-being. In educational practice, SDT underscores the importance of learner-centred approaches that empower students and promote internal motivation rather than reliance on external rewards or pressures.

V.A.R.K Model
Fleming's V.A.R.K model categorises learners' preferences for receiving and processing information into four modes: Visual (V), Aural (A), Read/Write (R), and Kinaesthetic (K) [25]. The modes are using different senses in interpreting information. The visual learner absorbs information most effectively through sight, particularly via images, diagrams, and tables. Similarly, the read/write learner also relies on visual input, but primarily in the context of reading and writing text. The aural learner, on the other hand, learns best through hearing, for example by listening to explanations or engaging in discussions. Lastly, the kinaesthetic learner uses multiple senses and learns most effectively through hands-on experience, by testing and applying theoretical knowledge in practice. The model suggests that individuals may favour one or more of these sensory channels when learning new material.

2.6 Andragogy

There are several theories about how learning is best designed for children versus adults, and these differences have important implications for education and training. The subject of adult learning, andragogy [26], is associated with Malcolm Knowles, who played a key role in establishing the theory. It is based on the idea that adults are more strongly driven by intrinsic motivation than by external incentives. Unlike children, who often respond to structure, guidance, and rewards, adults tend to engage more deeply when they perceive learning as relevant and purposeful. They are typically motivated by opportunities that align with their personal interests, career goals, or desire for self-improvement. As a result, traditional motivators such as grades, praise, or external rewards often play a secondary role compared to the internal satisfaction of gaining useful knowledge or skills.

Another key aspect of the theory is that adults are generally more task- or problem-oriented in their approach to learning [26]. Rather than pursuing knowledge for its own sake or to meet abstract curriculum goals, they prefer learning experiences that can be directly applied to real-life situations, especially those related to their professional or personal responsibilities. This means that adults tend to benefit more from practical, hands-on learning environments where they can actively engage with realistic scenarios. Approaches such as problem-based learning, case studies, and collaborative group work are therefore particularly effective, as they allow learners to draw on their prior experiences and immediately test new ideas. In contrast, more traditional, didactic, and imposed forms of instruction, where learners passively receive information, are often perceived as less engaging and less relevant by adult learners.

3

Methodology

This chapter presents the methodology of the study. Firstly, a literature review was conducted, followed by a description of how the step-by-step guide of the BCW was applied in the study. Secondly, observations were conducted and interviews were held with trainers and designers of the trainings. Thereafter, analysis of all collected data was made. Finally, a tool for developing and evaluating trainings was created, validated and modified with consideration to its applicability and usefulness.

The project predominantly adopts a qualitative approach. Qualitative methods refer to the in-depth study of a limited number of observations, with a focus on interpretation, meaning, and deeper understanding [27]. In contrast, quantitative methods involve a larger number of observations, where statistical and mathematical comparisons between groups form the basis for drawing conclusions. In other words, the key distinction lies in depth versus breadth of analysis. Given that the study aims to explore a more specialised and narrow research area in depth, a qualitative approach was considered most appropriate.

3.1 Literature review

The project began with a literature review to establish a theoretical perspective on behaviour, including which conditions must be fulfilled to shape new or change existing behaviours, methods for behavioural change, and desired behaviours within manufacturing industries. The review also aimed to identify learning perspectives applicable to operators. It was divided into two parts: literature previously covered during the researchers' master's programme and literature not previously addressed.

The previously covered literature primarily consisted of learning perspectives and was gathered through course literature and lecture notes. Literature unfamiliar to the researchers was identified through a *narrative literature review*. This approach was chosen since it provides an overview of the literature within a specific field while offering a holistic assessment and critical interpretation of selected works, rather than systematically reviewing all available literature [28]. In practice, this means that the review is based on selected key works chosen by the reviewer, who determines which sources are considered relevant for inclusion. Based on this review approach, the literature review methodology illustrated in Figure 3.1 was developed.

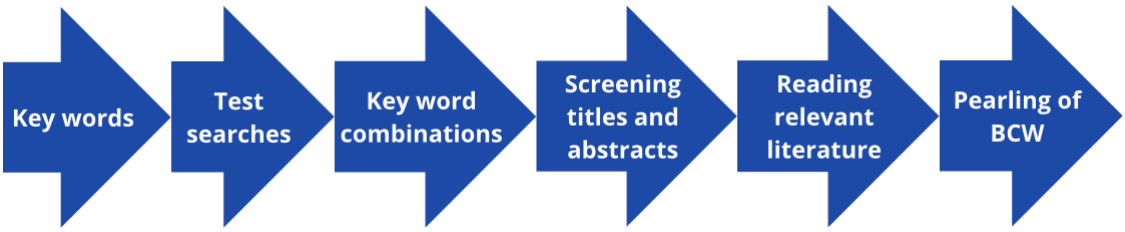

Figure 3.1: Methodology of the literature review.

An initial set of keywords, intended to guide the literature search, emerged through brainstorming using a mind map. The mind map included 10–20 words for each of four themes: behaviour, factors and conditions, interventions, and previous work. These keywords were refined through test searches conducted using the search engine *Google Scholar*, which was used for all searches in this study. During the test searches, different keyword combinations were explored using the Boolean operators OR, AND, and NOT in order to identify appropriate sources of information. This process resulted in a final set of keywords that were primarily used throughout the search process: *behaviour/behavior, change, model, shape, intervention, design, conditions, manufacturing* and *industry*. These keywords were then combined with Boolean operators to search for articles and reports related to behaviour and behavioural change.

The articles were filtered based on accessibility, language, and relevance. This meant that articles were limited to those accessible through the institutional access provided by Chalmers Library, and only articles written in English were included. The search process was continued until a point of saturation was considered to have been reached, where additional searches no longer yielded new relevant information or perspectives.

During this stage, the BCW framework [18] was identified as particularly relevant. It was therefore decided to further explore this framework and its theoretical foundations, for which a *pearling* approach was employed. The pearling method includes both reference tracking, involving scanning the reference list and assessing whether additional sources should be pursued, and citation tracking, involving the identification of articles that have cited the original work [29]. Reference tracking primarily contributed additional contextual background literature, while citation tracking was mainly used to identify other applications of the framework.

Information about all relevant articles was saved in a document together with the relevant information extracted from each article. The collected material were then examined in order to determine its relevance and suitability for inclusion in this report. This process was iterative, involving continuous refinement and selection as concepts and definitions became increasingly clarified.

3.2 Application of the BCW

After the literature review had been conducted, the necessary information was available to proceed to the next stage of developing the tool. This was carried out using the step-by-step guide described in Section 2.4. It is important to note, however, that the aim of this study was to develop a tool for the context of training design. This differs from the original purpose of the BCW, which was developed to address and solve existing behavioural problems within individuals or populations. As a result, several steps deviated from the guide. There are also steps within the framework that leave the implementer responsible for determining an appropriate approach. All deviations from the step-by-step guide, as well as the self-determined approaches, are therefore described in this section. Through multiple steps, experts in both training and production from Volvo Cars and Volvo AB were consulted and are referred to only as *experts* to retain anonymity. In total, five experts were consulted, with a distribution of two in training, one in production, and two with experience spanning both areas.

Stage 1: Understand the Behaviour
In Stage 1, the selected approach differed from the guide in that the study did not aim to identify behaviours causing a problem that needed to be changed. Instead, the aim was to identify which behaviours trainings seek to develop. The study can therefore be viewed as taking a preventive rather than corrective approach. Consequently, instead of defining the problem in behavioural terms in Step 1, the process focused on defining the behaviours to train. This was achieved through a literature review of desirable behaviours and consultation with two experts. One was consulted via email correspondence and one via a digital meeting. Note that the search was not limited exclusively to explicit behaviours. Instead, broader concepts such as attributes, competencies, and behavioural factors were also included, as searches yielded limited results when restricted to explicitly defined behaviours.

For Step 2, concerning the creation of a list of behaviours that may influence the target behaviours, the behaviours collected from the literature review and expert consultations were used. It should be noted that these behaviours were all related to operators' actions and interactions with colleagues, rather than behaviours from a broader structural perspective, such as managerial behaviours or societal structures. Such aspects were considered outside the scope of trainings and therefore outside the scope of this study. To narrow down the list, a Miro board was used to connect similar behaviours and identify core themes.

The four criteria described in Step 2 in Section 2.4 were used to support the decision-making process for each of the selected behaviours. However, two of the criteria were disregarded. *Likelihood to change* was excluded, as all identified behaviours were assumed to either have a positive impact or represent desirable behaviours to master, given that they were highlighted as important by experts as well as in previous studies on desirable workplace behaviours. *Ease of measurement* was also excluded, as fully developed behavioural change typically requires a longer period of time than

trainings can provide (see Section 2.2). Such behavioural outcomes would therefore need to be evaluated later, during work within the factory environment, which falls outside the scope of trainings and, consequently, this study.

The final methodological choice regarding Stage 1 was made in Step 4, *Identify What Needs to Change*. In accordance with the recommendations of the step-by-step guide, relevant individuals connected to the context were consulted. It was decided to consult two experts using a questionnaire in order to determine which components should be included in the tool. For each of the selected behaviours and each COM-B component, one to three statements were formulated to address what needs to occur for the target behaviour to take place. The experts responded to each statement with either YES or NO when asked whether there was a need for training related to the statement. Full tables containing all statements for each behaviour can be found in Appendix C.

Stage 2: Identify Intervention Options

Stage 2 also included deviations from the original step-by-step guide. Firstly, in Step 5, *Identify Intervention Functions*, it was decided not to include all criteria within APEASE when evaluating appropriate intervention functions for the tool. The criteria that were excluded were the first and last criterion, affordability and equity. These were excluded because discussions with experts indicated that these aspects were not perceived as barriers in decisions related to training development. However, it should be noted that this reflected their perspectives specifically. Consequently, only practicability, effectiveness/cost-effectiveness, acceptability and side-effects/safety were considered, and these are hereafter referred to as the PEAS criteria in this report instead.

The PEAS criteria for each intervention function were evaluated using four possible ratings: high, moderate, low, or dependent on the specific behaviour. Intervention functions that received any negative rating were considered inappropriate and were therefore excluded. In contrast, intervention functions that received only moderate or positive ratings were considered appropriate for inclusion.

Step 6 in Stage 2, *Identify Policy Categories*, was excluded entirely. Policy categories are defined in the BCW framework as "decisions made by authorities that support the delivery of intervention functions" [18]. In this study, the trainings themselves were considered the relevant authority, and their intervention function was predefined as communication. Other authorities outside the trainings were considered beyond the scope of the study and were therefore not included.

Stage 3: Identify Content and Implementation Options

The final stage, Stage 3, begins with Step 7, *Identify Behaviour Change Techniques*. As recommended by the step-by-step guide, the list of 93 unique BCTs was used as a starting point. Reducing the list was an iterative process, and several different approaches were used to systematically screen the BCTs. Throughout the process, extensive reasoning regarding whether to include or exclude specific BCTs were con-

ducted. After each iteration, the remaining BCTs were documented in tables. The screening was conducted separately for each intervention function, meaning that all 93 BCTs were screened for each function. Each iteration therefore yielded two outcomes: the number of BCTs remaining in total (including duplicates) and the number of unique BCTs remaining. In total, three aspects were used for the screening process. Two of these, the lists of most and less frequently used BCTs for each intervention function and the APEASE criteria, were recommended by the guide. In addition, a third aspect was added, namely merging the outcomes from Steps 5 and 7 in order to better correlate the BCTs with the respective intervention functions and, in turn, the respective COM-B components.

The first aspect involved screening based on the lists of *most frequently used* and *less frequently used* BCTs for each intervention function. These lists included approximately 10–20 BCTs each. To guide the elimination process, a set of parameters was established specifically for this study. These were learning theories, the contextual setting, and characteristics of the target group. This process resulted in 157 BCTs, of which 40 were unique BCTs.

Second, the PEAS criteria were applied to the remaining BCTs. The elimination process was again guided by the parameters described in the previous paragraph. However, unlike previous applications of the PEAS criteria, this step adopted a more overarching approach, using the criteria primarily to guide discussions rather than documenting assessments for each criterion individually. This step further reduced the number to 107 BCTs, of which 36 were unique.

Third, merging the outputs from Steps 5 and 7, thereby creating an overview of the relationships between the COM-B components, intervention functions, and BCTs, enabled further screening. Through this process, it became apparent that some BCTs did not align appropriately with the COM-B components and could therefore be excluded. Following this step, an additional iterative review process was conducted, involving multiple rounds of reconsideration and revision of the selected BCTs based on the three screening aspects. After this process, 50 BCTs remained, although the number of unique BCTs remained 36.

The final step of the guide, Step 8 (Mode of Delivery), was predefined as face-to-face as only trainings were observed. Consequently, further considerations regarding specific delivery methods were not required.

3.3 Observations

Since there was limited accessible written documentation describing how the trainings addressed behaviour and behavioural change, the study collected empirical data through observations and interviews. The study employed a sequential design in which the observations preceded the interviews, enabling the researchers to observe the actions and interactions of participants and trainers without being influenced

by the interviewees' perceptions or reflections.

In total, three trainings were observed and information about them are found in Table 3.1. Each training was observed once, and the observations were conducted in the following order: *ESS introduction*, *BCG*, *Simulated Work Environment*, and finally *The incident at station 900*. Note that ESS introduction and The incident at station 900 are two parts of the same training.

Table 3.1: Information about the observed trainings.

Company	**Name of the training**	**Training content**	**Duration**
GTC	BCG	Electrical safety, industrial technology, electromobility, and sustainability	44 h (5 days)
Volvo AB	ESS introduction (part 1) and The incident at station 900 (part 2)	Electrical basics and safety as well as responsibility of the electrical roles and a case work-investigation of an accident	19 h (3 days)
Volvo Cars	Simulated Work Environment (SWE)	How to apply lean principles in a moving-line production	8 h (1 day)

All observations were conducted as non-participant, minimising the risk of influencing the learning environment or participants' experiences. The researchers took separate notes and later compared and discussed their observations. The notes were written in a table developed by the researchers containing all chosen BCTs and intervention functions in connection to each BCT cluster (see Appendix B). Notes and reflections were documented continuously throughout the observations, without separating the observations according to specific target behaviours. The discussions following the observations contained which BCTs had been identified and whether both researchers had seen them, what could have been done differently in certain situations, and how the design of the training could be improved.

The participants and trainers observed were informed about the study in advance and provided written informed consent in accordance with standard research practice [30]. Participants and trainers were informed about the general purpose of the observations, but the specific parameters being assessed were not disclosed in order to minimise the risk of altered behaviour resulting from observer awareness.

3.4 Interviews

Following the observation phase, interviews were conducted to gain a deeper understanding of the operational realities within the organisations studied. While the observations provided insights into how the training sessions were conducted, the interviews were necessary to identify opportunities for applying the tool in practice. In total, four interviews were conducted with five participants, with both researchers present at each session. The interviewees consisted of trainers (responsible for delivering the content) and instructional designers (responsible for developing the trainings), whereas two were designers and three were both trainers and designers.

The interviews lasted between 30 and 50 minutes. Two interviews were conducted face-to-face, while the remaining two were conducted online. All interviews were audio-recorded and transcribed using *Chalmers AI*, after which the transcripts were revised using *intelligent verbatim transcription (with slang)*. This method preserved the meaning and natural flow of the participants' responses while removing unnecessary filler words and repetitions, thereby improving readability without compromising analytical relevance [31]. The transcriptions were divided equally between the researchers, although both reviewed the finalised transcripts to ensure that the participants' statements were represented in the same ways as they appeared during the interviews.

The interviews were semi-structured, characterised by a set of predefined areas while allowing for flexibility and follow-up questions [27]. The areas consisted of start-up questions, then the three phases of training: before, during and after. For the predefined questions asked, see Appendix D. Subsequently, relevant information was extracted from the transcriptions, analysed and coded into five themes: *decision-making and flexibility*, *behavioural considerations in training design*, *target group adaptation*, *constraints*, and *perceived behavioural outcomes of the training*.

Participation in the interviews was voluntary, and all interviewees provided written informed consent prior to participation, following the same procedure as for the individuals involved in the observations [30].

3.5 Creating the tool

The last part of this project was to fulfil the aim of the study: to create a tool for developing and evaluating the use of BCTs in trainings. The creation was carried out in three phases. First, a draft version of the tool was created. Second, it was validated through additional observations. Lastly, the tool was modified and refined into its final version.

Creation
In the first phase, a draft for the tool was made. The design was based on the same outline as the sheet that had been created during the previous observations (see Appendix B). The draft consisted of four columns: COM-B components, intervention functions, BCTs, and a final blank column intended for the inclusion of a grading system.

A grading system was considered necessary to include in the tool in order to evaluate and assess the trainings. The grading system was illustrated using circles representing different levels of satisfactory use of the techniques. However, the number of grading levels could not be determined until further data collection had been conducted.

In addition to a grading system, it was decided that each BCT should be assigned a weighting according to its perceived importance. This was done to create clearer distinctions regarding the significance of including each BCT within the training. However, similarly to the grading system, further observations needed to be conducted in order to determine the weighting levels and assign an appropriate weighting to each BCT.

Another factor taken into consideration was to simplify the tool without jeopardising the inclusion of important information, in order to facilitate ease of application. With this as a starting point, a suitable solution was considered to be designing the tool to fit within a single A4 page. However, in the first draft, the number of BCTs was too extensive for this to be achieved, and possible solutions therefore had to be explored during the subsequent validation phase.

Validation
To validate the tool and to be able to make grading- and weighting-choices, an additional observation was made at the BCG training. During the observation, the draft of the tool was used for each of the desired behaviours that were decided in Stage 1 of the step-by-step guide (see Section 3.2), to test its ability to evaluate a training.

The training followed the same procedure as the first observation at BCG, resulting in 44 hours observed over 5 days with trainers and participants that all gave their consent to being observed. The researchers took notes on separate sheets of the tool-draft.

Modification
After the second observation at BCG, further choices and modifications were made to the tool-draft. It was decided that the grading system should consist of a four-stage scale ranging from *not observable* to *observable and a prominent part of the training*. A scale with more grading levels was avoided since smaller differences between the grading steps could make the distinctions too diffuse and potentially reduce the reliability of the results.

To decide on a weighting system, pie-charts were created to help visualise how the weighting amplified the influence of the most critical BCTs and reduced the relative contribution of those considered less essential. This resulted in dividing the BCTs into three levels: $\times 1$, $\times 2$, and $\times 3$, where the weighting multiplies with the graded BCT. BCTs weighted as $\times 1$ indicates limited impact on the training. In contrast, $\times 3$-weighted BCTs represent key components whose absence is considered to significantly weaken the training. The $\times 2$ category represents BCTs with a moderate contribution to improving the trainings.

To fit the evaluation table onto one A4 page, some of the BCTs were merged into broader and less niche techniques, resulting in 30 BCTs in total of which 21 were unique ones. Since this condensed the tool, accompanying explanatory sheets containing definitions and terminology were developed to support the user in navigating the tool. Thus, the final version of the tool was completed.

4

Results

This chapter presents the findings of this thesis. The chapter is structured into four sections, in which the results are presented in the same sequence as they were generated throughout the study. Figure 4.1 provides an overview of the sections and the data collection methods upon which the respective results are based. Initially, relevant findings from Steps 1–3 described in Section 3.2 are presented. These include attributes identified through the literature review and consultations with experts, which ultimately resulted in the five target behaviours.

Thereafter, in the following section, the results from Steps 4, 5, and 7 are presented. The findings played an important role in the design choices of the tool, specifically regarding which COM-B components, intervention functions, and BCTs to include. These choices were based on expert consultations, the PEAS criteria, and conducted observations.

The subsequent section presents the final version of the tool, which was developed based on the previous findings, together with the validation process and the analysis of weighting and score distribution illustrated through pie charts. Finally, the interviewees' perspectives regarding the ease or difficulty of applying the guideline within trainings are presented.

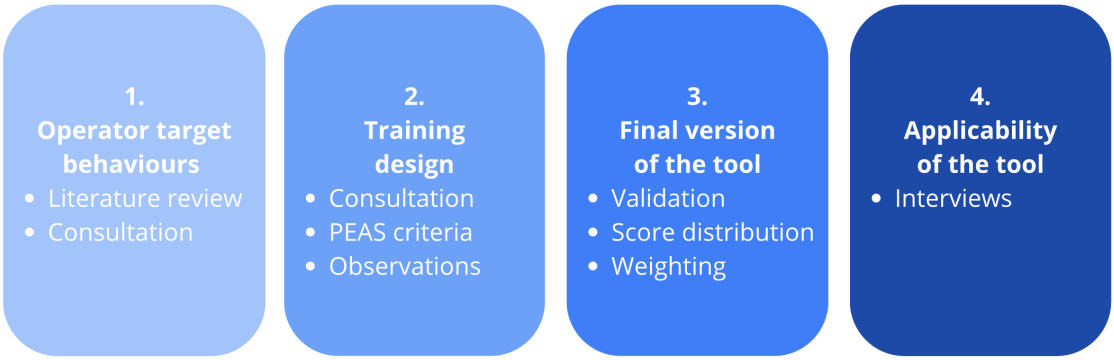

Figure 4.1: Structure of the results chapter.

4.1 Operator target behaviours

Identification of target behaviours within the manufacturing industry was conducted through a combination of literature review and expert consultation. As limited results were found regarding specifically behaviours, broader concepts such as attributes, competences, and behavioural factors were also included. The parameters identified as relevant to the context, listed in Table 4.1, were derived from [32, 33, 34, 35].

Table 4.1: Attributes considered desirable for employees working in industrial contexts to exhibit according to the literature.

Accountable	Efficient	Positive attitude
Adaptable	Follows directions	Preparation
Alert	Helpful	Prioritisation
Attention to detail	Honesty	Punctuality
Benevolence	Humility	Report unsafe acts/
Careful	Initiative	conditions
Communication	Listening	Respect
Compliance	Observation	Responsible
Considerate	Open to ideas	Self-awareness
Cooperation	Orderly	Sufficient rest
Deference	Owns up to mistakes	Timely delivery
Dependable	Patience	Willingness to learn

The consulted experts, when asked to identify behaviours they consider important in a factory setting, listed the following in Table 4.2. Note that not all of these are strictly behaviours. However, they are included to provide a broader perspective on what is considered desirable in operators according to the experts.

Table 4.2: Parameters considered desirable for operators in industrial contexts to exhibit according to consulted experts.

Expert 1	**Expert 2**
• Work safely • Ensure quality in production • Meet time schedules • Good communication • Good collaboration	• Show respect • Follow standards • Look out for each other • Speak up and assume good intentions • Safety • Understand the reasons behind established work methods

The target behaviours synthesised through the comparison of findings from the literature review and expert consultations are presented in Table 4.3. In total, five

behaviours were defined as the desired behaviours for operators to exhibit, providing a representative perspective, whereby the previously identified parameters can be understood as falling within or being encompassed by at least one of these five.

Table 4.3: Selected target behaviours based on the literature review, expert consultations, and interviews.

Behaviour	Description
Following standards	Adhering to manuals and instructions, as well as established policies and rules in daily work.
Acting on deviations	Addressing issues related to items or tasks, other people, and oneself, for example by keeping things organised and managing personal factors such as fatigue.
Following the time frame	Following the established time frame by arriving on time, maintaining an appropriate work pace, and planning work proactively.
Adapting to the environment	Adjusting to new standards, collaborating effectively with colleagues, and responding to external factors such as errors or variations in production volume or pace.
Acting with humility	Asking for help when needed, admitting mistakes, and maintaining a respectful attitude towards others.

4.2 Tool design

The design of the tool was guided by the selection of which components of the COM-B system, intervention functions, and BCTs to include. This process aimed to determine the most appropriate elements for the given context and target group, thereby defining the scope and content of the tool.

The questionnaire that was administered to experts in the application of the step-by-step guide in Step 4, aimed at identifying which COM-B components manufacturing operators need to be trained in. The responses indicated that physical capability does not need to be addressed within the trainings, as operators are assumed to already possess the necessary prerequisites. For the remaining COM-B components, responses varied between "need to consider" and "need to consider, but not in this training," depending on the specific behaviour and training context. However, each component received at least one "need to consider" rating across the behaviours, and was therefore included.

The results of the PEAS criteria (practicability, effectiveness/cost-effectiveness, acceptability and safety/side-effects) applied in Step 5, which were used to determine

which intervention functions from the BCW are suitable for the training context, target group, and selected behaviours, are presented in Table 4.4. Each criterion was rated as high, moderate, or low. In cases where the ratings depended on specific target behaviours, this is noted.

The overall assessment of the appropriateness of each intervention function is presented in the rightmost column and is based on the evaluation of each criterion. The reasoning for these assessments is provided in the column labelled "Comments." Notably, the only intervention functions deemed inappropriate were coercion and restriction (see definitions in Table 2.1). Coercion was excluded primarily because it is considered unsuitable for adult learners and may contribute to a negative organisational culture. Restriction was deemed inappropriate, as it is not well suited to the context of trainings. In total, seven intervention functions were deemed appropriate for inclusion in the tool. These were *education*, *persuasion*, *incentivisation*, *training*, *environmental restructuring*, *modelling*, and *enablement*.

The seven intervention functions, matched with appropriate BCTs based on theory, are presented in the first two columns of Table 4.5. The intervention functions observed for each BCT during the observation phase across the three trainings are presented in the third column. The results indicate that the majority of the intervention functions identified in theory were also present in practice. As shown, there is also a high degree of alignment between the intervention functions associated with BCTs in the theoretical framework and those identified during observations. Several BCTs, particularly those related to enablement and training, appear consistently across both theory and practice.

However, some discrepancies were identified. Certain BCTs that are theoretically associated with multiple intervention functions were observed in a more limited manner in practice. This is particularly evident for techniques such as feedback and self-monitoring, where their application was linked to fewer intervention functions than suggested by the theoretical framework.

Table 4.4: Evaluation of suitable intervention functions for the trainings using the PEAS criteria (practicability, effectiveness/cost-effectiveness, acceptability and safety/side-effects).

Intervention function	**PEAS evaluation**	**Comments**	**Appropriate**
Education	P: High E: Moderate A: High S: Low	P: Setting exists (practical) E: Effectiveness unclear, lacking theory A: Standard procedure S: -	Yes
Persuasion	P: High E: Depends on TB (target behaviour) A: Moderate S: Moderate	P: Trainers have arguments E: Limited if arguments already known A: Depends on participants' personality S: Participants may feel forced	Yes
Incentivisation	P: Depends on TB E: Moderate A: Moderate S: Moderate	P: If behaviour is required in work tasks, effect may be limited E: Short-term effective A: Human nature S: Expectation of greater rewards over time	Yes
Coercion	P: High E: Low–Moderate A: Low S: High	P: Easy to implement E: Short-term only A: Not acceptable for adults S: Risk of negative culture	No
Training	P: High E: High A: High S: Moderate	P: Easy to apply, adjustable methods E: Preferable for target group A: Well accepted S: Risk without sufficient knowledge	Yes
Restriction	P: High E: Moderate A: Moderate S: Moderate	Policy-level constraints (guidelines, regulation, legislation) outside project control	No
Environmental restructuring	P: Moderate E: Moderate A: Moderate S: Moderate	P: Small changes easy, but location harder to adjust E: Depends on implementation A/S: Mixed acceptance, may improve over time	Yes
Modelling	P: High E: High A: High S: Low	P: Trainers with training E: Supported by role-modelling theory A: Natural imitation behaviour S: Training needed to increase effect	Yes
Enablement	P: High E: High A: High S: Low	P: Easy to apply, adjustable E: Small changes can have big impact A: Generally accepted S: -	Yes

Table 4.5: Intervention functions identified in theory compared with observations connected to the BCTs.

BCT	**Intervention functions from theory**	**Observed intervention functions**
Goal setting	Enablement	Enablement
Problem solving	Enablement	Enablement
Action planning	Enablement	Enablement
Review goals	Enablement	Enablement
Discrepancy between current behaviour and goal	Enablement	Enablement
Feedback	Persuasion Enablement Training Incentivisation	Education Training
Self-monitoring	Persuasion Training Enablement	Training
Social support	Enablement	Enablement
Instruction on how to perform the behaviour	Training	Training
Behavioural experiments	Training	Training Education
Information and salience of consequences	Education Persuasion	Education
Demonstration of the behaviour	Training Modelling	Modelling
Prompts/cues	Environmental restructuring	Environmental restructuring
Practice and habit formation	Training	Training
Graded tasks	Training	Training
Credible source	Persuasion	Persuasion
Social reward	Incentivisation	Incentivisation
Conserving mental resources	Enablement	Enablement
Structuring/restructuring the physical environment	Environmental restructuring	Environmental restructuring
Structuring/restructuring the social environment	Environmental restructuring	Environmental restructuring
Framing/reframing/ persuasion about capability	Persuasion Enablement	Persuasion

Figure 4.2 further illustrates the distribution of identified BCTs across the observed trainings. The BCTs considered during the observations are listed in Table 4.5. The variation between trainings suggests differences in how behavioural change is addressed, both in terms of the number and type of techniques applied. While some trainings incorporate a broad range of BCTs, others rely on a more limited set. Detailed information regarding the specific BCTs and intervention functions observed in each training is provided in Appendix E.

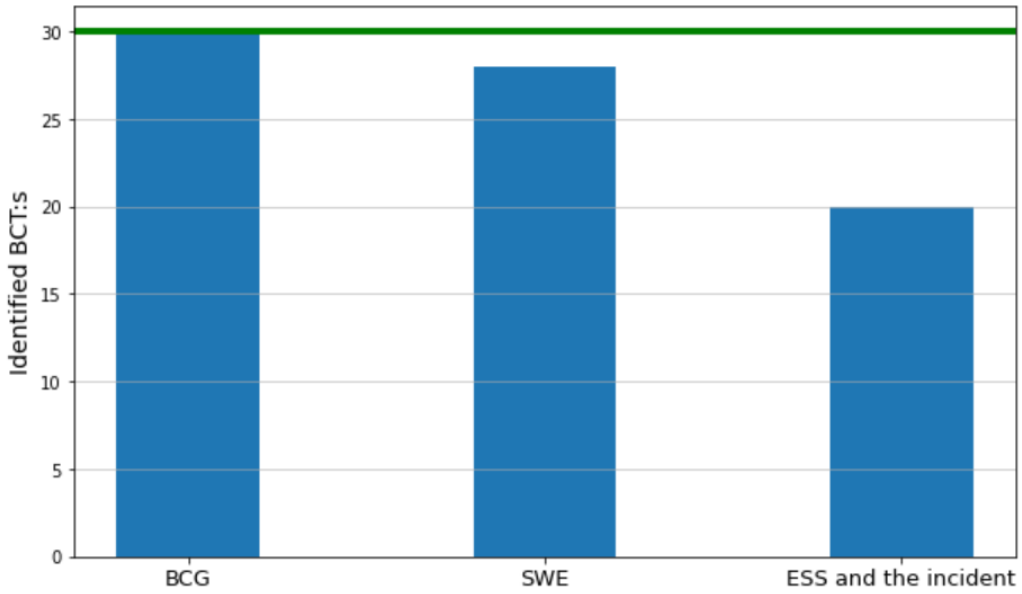

Figure 4.2: Identified BCTs across each training. The green line indicates maximum number of observable BCT:s.

4.3 Final version of the tool

The final version of the tool is presented in its complete form in Table 4.6. The first page consists of the tool itself, intended for use during the development or evaluation of a training. The tool is designed to be applied separately to each target behaviour, allowing individual behaviours to be assessed or addressed one at a time. The subsequent three pages provide terminology explanations to facilitate its application and interpretation, outlining key concepts and clarifying the content included in the tool. The definitions are directly cited from [18].

The tool is organised to provide an overview of how different COM-B components can be addressed through specific interventions and BCTs. Each element is also assigned a weighting, reflecting its relative importance. The weighting is combined through a scoring system giving the training a resulting score, with a total maximum of 213 points.

Table 4.6: Final version of the tool.

Evaluation Tool			
COM-B	**Intervention**	**BCT**	**Evaluation**
Psychological capability	Education	Feedback	◯ ◯ ◯ x3
	Training	Feedback	◯ ◯ ◯ x3
		Self-monitoring	◯ ◯ ◯ x3
		Instruction on how to perform the behaviour	◯ ◯ ◯ x3
		Behavioural experiments	◯ ◯ ◯ x1
		Practice and habit formation	◯ ◯ ◯ x3
		Graded tasks	◯ ◯ ◯ x2
	Enablement	Conserving mental resources	◯ ◯ ◯ x2
Physical opportunity	Environmental restructuring	Structuring/restructuring the physical environment	◯ ◯ ◯ x3
Social opportunity	Environmental restructuring	Structuring/restructuring the physical environment	◯ ◯ ◯ x3
		Structuring/restructuring the social environment	◯ ◯ ◯ x3
	Modelling	Demonstration of the behaviour	◯ ◯ ◯ x3
Reflective motivation	Persuasion	Credible source	◯ ◯ ◯ x3
		Framing/reframing/persuasion about capability	◯ ◯ ◯ x1
	Education	Information and salience of consequences	◯ ◯ ◯ x3
		Feedback	◯ ◯ ◯ x3
		Behavioural experiments	◯ ◯ ◯ x1
Automatic motivation	Incentivisation	Social reward	◯ ◯ ◯ x1
	Modelling	Demonstration of the behaviour	◯ ◯ ◯ x3
	Enablement	Conserving mental resources	◯ ◯ ◯ x2
		Goal setting	◯ ◯ ◯ x3
		Problem solving	◯ ◯ ◯ x2
		Action planning	◯ ◯ ◯ x2
		Review goals	◯ ◯ ◯ x3
		Discrepancy between current behaviour and goal	◯ ◯ ◯ x2
		Social support	◯ ◯ ◯ x1
	Environmental restructuring	Prompts/cues	◯ ◯ ◯ x1
	Training	Self-monitoring	◯ ◯ ◯ x3
		Practice and habit formation	◯ ◯ ◯ x3
		Graded tasks	◯ ◯ ◯ x2
			Result: /213 p

Terminology explained

COM-B component	Definition
Psychological capability	Knowledge or psychological skills, strength or stamina to engage in the necessary mental processes
Physical opportunity	Opportunity afforded by environment involving time, resources, locations, cues, physical 'affordance'.
Social opportunity	Opportunity afforded by interpersonal influences, social cues and cultural norms that influence the way that we think about things, e.g. the words and concept that make up our language
Reflective motivation	Reflective processes involving plans (self-conscious intentions) and evaluations (beliefs about what is good and bad)
Automatic motivation	Automatic processes involving emotional reactions, desires (wants and needs), impulses, inhibitions, drive states and reflex responses

Intervention function	Definition
Education	Increasing knowledge or understanding
Persuasion	Using communication to induce positive or negative feelings or stimulate action
Incentivisation	Creating an expectation of reward
Training	Imparting skills
Environmental restructuring	Change the physical or social context
Modelling	Provide an example for people to aspire or imitate
Enablement	Increasing means/reducing barriers to increase capability (beyond education and training) or opportunity (beyond environmental restructuring)

Terminology explained

BCT	Definition
Feedback	Monitor and provide informative or evaluative feedback on performance of the behaviour or the outcome (of performance of the behaviour)
Self-monitoring	Establish a method for the person to monitor and record their behaviour(s) or outcomes of behaviour(s) as part of a behaviour change strategy
Instruction on how to perform the behaviour	Advise or agree on how to perform the behaviour
Behavioural experiments	Advise on how to identify and test hypotheses about the behaviour, its causes and consequences, by collecting and interpreting data
Practice and habit formation	Prompt practice of the behaviour in a context repeatedly so that the context elicits the behaviour
Graded tasks	Set easy-to-perform tasks, making them increasingly difficult, but achievable, until behaviour is performed
Conserving mental resources	Advise on ways of minimising demands on mental resources to facilitate behaviour change
Structuring/ restructuring the physical environment	Structure/change the physical environment in order to facilitate performance of the wanted behaviour or create barriers to the unwanted behaviour
Structuring/ restructuring the social environment	Structure/change the social environment in order to facilitate performance of the wanted behaviour or create barriers to the unwanted behaviour
Demonstration of the behaviour	Provide an observable sample of performance of the behaviour, directly in person or indirectly e.g. via film, pictures, for the person to aspire to or imitate
Credible source	Present verbal or visual communication from a credible source in favour of the behaviour
Framing/reframing/ persuasion about capability	Suggest the deliberate adoption of a perspective or new perspective on behaviour in order to change cognitions or emotions about performing the behaviour. It can also include telling the person that they can successfully perform the wanted behaviour, arguing against self doubts and asserting that they can and will succeed

Terminology explained

BCT	Definition
Information and salience of consequences	Provide information (e.g. written, verbal, visual) about consequences of performing the behaviour (e.g. health, social, environmental, emotional), including methods that emphasise these consequences to make them more memorable.
Social reward	Arrange verbal or non-verbal reward if and only if there has been effort and/or progress in performing he behaviour
Goal setting	Set or agree a goal defined in terms of the behaviour to be achieved/the outcome of the wanted behaviour
Problem solving	Analyse, or prompt the person to analyse, factors influencing the behaviour and generate or select strategies that include overcoming barriers and/or increasing facilitators
Action planning	Prompt detailed planning of performance of the behaviour (must include at least one of context, frequency, duration, and intensity). Context may be environmental (physical or social) or internal (physical, emotional or cognitive).
Review goals	Review behavioural or outcome goals jointly with the person and consider modifying goals or behavioural change strategy in light of achievement
Discrepancy between current behaviour and goal	Draw attention to discrepancies between a person's current behaviour and the person's previously set goals or action plans
Social support	Provide social support or non-contingent praise or reward for performance of the behaviour. Includes encouragement and counselling, but only when it is directed at the behaviour
Prompts/cues	Introduce or define environmental or social stimulus with the purpose of prompting the cueing the behaviour. The prompt or cue would normally occur at the time or place of the behaviour

The scoring system consists of a four-stage grading scale, in which the evaluator is expected to assign the score that best reflects the training. The scores should be assigned as follows:

3: Observable and a prominent part of the training
2: Observable and moderately prominent in the training
1: Observable but not a prominent part of the training
0: Not observable

The weighting is categorised as ×1, ×2, or ×3, where ×1 indicates limited impact on the training, ×2 indicates a moderate contribution to improving the training, and ×3 indicates a substantial impact, such that the absence of the component disadvantages the training.

To illustrate the impact the weighting has on the grading of BCTs, a comparison of the score distribution for each weighting category was conducted (see Figures 4.3 and 4.4). In these figures, green represents all BCTs categorised as ×3, yellow represents ×2, and red represents ×1. As shown in the charts, the ×3 weighting is affected most noticeably, with the weighting increasing its share from 57% to 72%. The ×1 category is also notably affected, showing a difference of 15 percentage points. The ×2 category is affected to a lesser extent, with a difference of 3 percentage points.

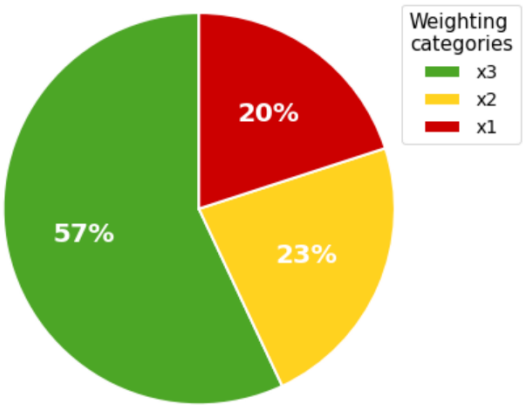

Figure 4.3: Percentage score distribution *without* weighting.

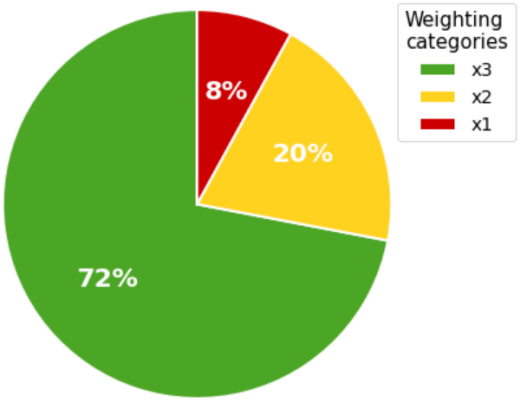

Figure 4.4: Percentage score distribution *with* weighting.

The weighting also reflects the relative importance of each intervention function. Therefore, a comparison has been presented using pie charts in Figures 4.5 and 4.6. The results indicate that, after weighting, the intervention functions training, education, modelling, and environmental restructuring account for a larger proportion, whereas incentivisation, persuasion, and enablement represent a smaller proportion. However, it should be noted that these differences are relatively minor, with percentage point variations ranging from 0.8 to 2.8.

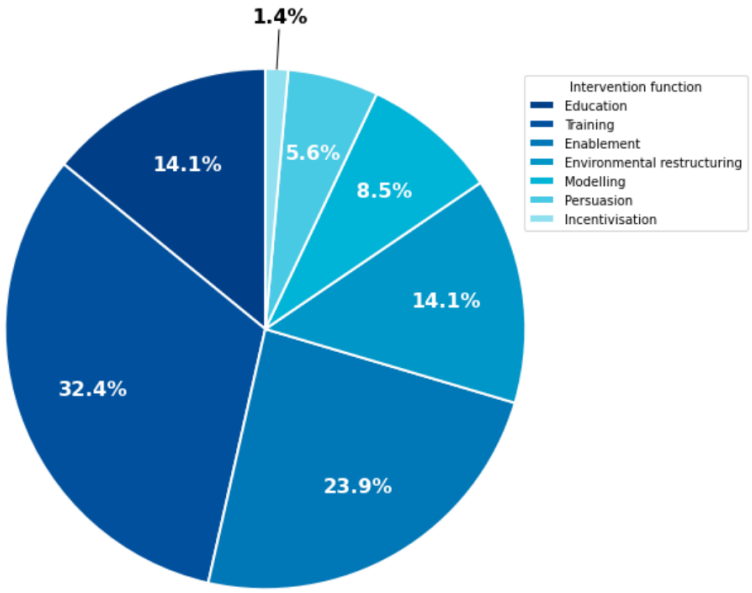

Figure 4.5: Distribution of intervention functions among BCTs *with* weighting.

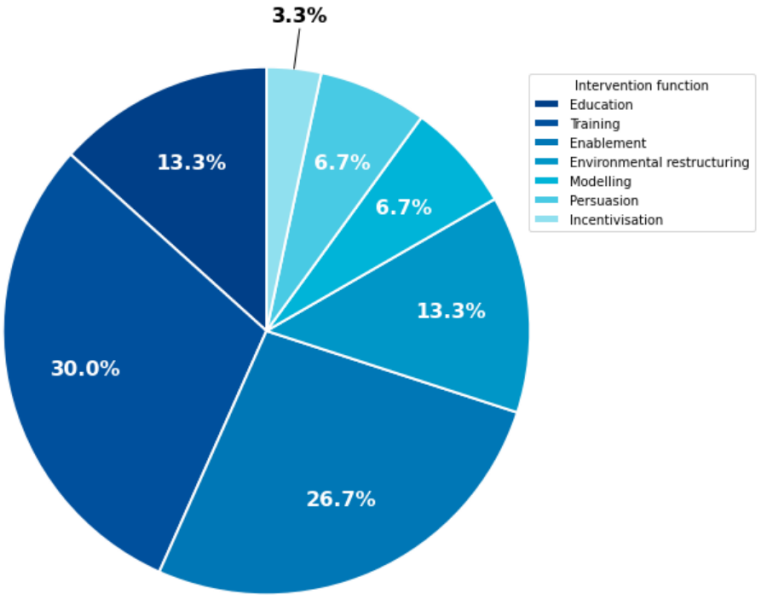

Figure 4.6: Distribution of intervention functions among BCTs *without* weighting.

4.4 Applicability of the tool

The applicability of the tool was examined through interviews with five participants who had relevant connections to the three trainings. The assessment focused on the ability of the training developers and organisers to implement changes based on the tool's results, as well as on practical constraints that may affect implementation. It also considered how the trainings adapt to the intended target group, namely operators, for whom the tool was designed.

The responses were summarised and categorised, with distinctions made between statements mentioned by multiple interviewees and those raised by individual respondents. The citations are coded with "Int" (interviewee), followed by a number between 1 and 5, and "Tr" (training), followed by either A, B, or C. Interviewee 1 and 2 are associated with training A, interviewee 2 with training B and interviewees 4 and 5 with training C. The names of the interviewees and trainings are omitted in order to preserve the anonymity of the participants.

Decision-making and flexibility
The process of developing and making decisions regarding changes in trainings varies across the interviewees trainings. Two main approaches were identified: a decentralised and creative approach, in which training developers are given considerable freedom in how to implement requests from the client, and a more centralised and standardised approach, in which trainings are based on existing concepts and implemented with minimal modifications or decided on more globally.

In two of the trainings, the interviewees described the design process as collaborative and iterative, where developers, trainers, and/or project teams exert significant influence over both content and delivery methods. Decisions are made jointly, and ideas are developed through workshops, testing, and continuous feedback from the client. One interviewee elaborates:

> *When we were in the planning phase, we brainstormed some ideas, wrote them down and presented them to each other, and then agreed on what we thought worked well together and what didn't. After that, each person took ownership and responsibility for their own work. So it was quite open, you could structure things however you wanted. [. . .] Honestly, I'd say everything was decided collectively in the end.* (Int 1, Tr A)

A similar experience was described by another interviewee from a different training:

> *[. . .] I don't think we can say today who came up with the idea that it would be exactly this format. It's more that someone says something and then it evolves from there.* (Int 5, Tr C)

In contrast, another interviewee described a more standardised approach, in which the training is determined at a global level and functions as a largely static concept. An example is that changes are only introduced to the training when new guidelines are issued at the factory level.

Despite this top-down structure, a bottom-up feedback loop exist, enabling trainers to identify local gaps and propose improvements to the curriculum at a global level:

> *So it runs through a few different channels, but we're not the ones deciding anything, it's all done globally, essentially. Then we can provide input based on what we see, and raise it at a global level.* (Int 3, Tr B)

Target group adaptation
All interviewees agree that target group adaption within the trainings is a natural step during the planning phase. However, there are differences in whether target group adaptation is only carried out during the planning phase, or if it is also performed for each new group undergoing training. The chosen approach appears to depend on how similar the target groups attending the trainings are.

For two of the trainings, where the participants are predominantly employees of the companies, target-group adaptation primarily takes place during the planning phase. In one interview, it is stated, for example:

> *We have a clear sense of the target audience, so I wouldn't say that we automatically adapt the concept depending on who we're delivering it for, because it's already designed for the target audience from the beginning.* (Int 4, Tr C)

Another training follows a similar approach, where the training is not adapted for different groups, except for language or possibly the duration of the training:

> *The only thing we adapt is whether it's in Swedish or English. But we also make adjustments if we have upper secondary students coming here, where they might do a shorter training since they don't have as much time [...] but the concept is the same.* (Int 3, Tr B)

For one training with participants coming from external organisations and representing a wide range of target groups, it is described that some information about the participants is provided prior to the training, such as their roles, educational background, and age. Based on the available information, each training session is adapted. One interviewee explains:

> *We have a fully tailored setup based on what the companies have requested for their new employees.* (Int 1, Tr A)

For this training, it is also specifically described how the training is adapted for operators. One interviewee explains both how and why:

> *We have operators who come here and are going to work in production, where in many cases, not all, there's a bit of a baseline that they don't like being in a classroom setting. And they prefer working practically. You can really see that in their attitude, they're more engaged when they get to work hands-on, where they understand things better. Discussions we've had after they've worked hands-on are generally more detailed and have greater depth than when they have discussions after being given theoretical material.* (Int 2, Tr A)

Another interviewee expresses a similar view:

> *When we know we have a type of target group that isn't as used to the classroom setting, we try to keep the classroom session, so to speak, as short as possible and let them learn as much as possible simply by doing.* (Int 1, Tr A)

Constraints

When the interviewees were asked about constraints within their trainings, time emerged as a central aspect mentioned by several. In many cases, time was linked to participants' or trainers' schedules and when they are able to be away from production. It was also connected to the overall duration of the training. This, in turn, affects what can realistically be achieved within the given time frame. Two interviewees describe these perspectives:

> *Say we have 40 minutes, but we would really have wanted an hour and a half. Then there are things we have to cut. [...] That takes away some of the overall understanding of the topics we cover. It can sometimes feel a bit discontinuous. We haven't necessarily heard it from the participants, but we as trainers can notice it [...].* (Int 2, Tr A)

> *Then there's also the fact that it's always difficult to make staff available. For example, those working in production, it's not always easy to pull them away. So one day usually works, but more days become challenging for us.* (Int 3, Tr B)

Another aspect related to time constraints is the need for trainings to be sufficiently long to enable behavioural change. At the same time, it is clarified that behaviours are not only developed during the training itself, but as part of an ongoing learning process that continues in the workplace:

> *The longer period of time they spend here, the more we see a difference in how they behave and how their mindset shifts. Even their overall attitude toward the learning process changes. They start to take everything here seriously, even though they know it's not exactly how things look in the production.* (Int 1, Tr A)

> *I mean, ideally you'd want to have them here for several weeks to really instil behaviours, because if there is a behaviour that we might not want, it doesn't change in a day. It requires continuous reinforcement, reminders and helping them internalise it.* (Int 3, Tr B)

A constraint not explicitly mentioned by the interviewees, but which became apparent when they were asked to describe the behaviours they aim to teach or influence, was a limited understanding of what is considered a behaviour. Table 4.7 presents a comprehensive list of all attributes mentioned, many of which overlapped across

interviews. It should be noted that some of these attributes are not considered behaviours according to the theoretical definition used in this study, for example ownership and patience.

Table 4.7: Identified behaviours and their descriptions based on the interviews.

Attributes	**Description**
Following standards	To follow instructions and established working methods to the letter.
Working safely	To prioritize safety above all else and perform risk assessments.
Communicating	To actively share information and dare to ask questions.
Collaborating	To work effectively in teams and help each other in the process.
Problem-solving	To dare to raise problems, pull the andon, and find root causes.
Continuous improvement	To constantly challenge the process to improve.
Responsibility/ Ownership	To feel personal responsibility for one's work and one's process.
Meticulousness	To perform work with precision and follow instructions binarily to ensure it is correct.
Ask for help	To have the ability and courage to escalate problems or ask for assistance instead of guessing.
Planning	To be able to structure one's work and work efficiently to reach set production goals.
Reflection	To be able to analyze one's own and the group's work at the team boards after shifts to learn from experiences.
Order and tidiness	To maintain a clean and organized work environment for increased safety and well-being.
Technical confidence	To overcome the fear of using and controlling technical systems such as HMI (Human-Machine Interface).
Patience	To understand that quality and learning are more important than finishing quickly.
Inclusion and respect	To act in a way that welcomes diversity and never harasses or excludes colleagues in the team.

Other constraints raised by the interviewees relate to both organisational and contextual factors. Limitations connected to trainers include varying levels of experience and a limited number of available trainers. The nature of the industry, at times characterised by confidentiality, further restricts openness and knowledge sharing. In addition, the use of pre-defined scripts can limit flexibility in delivery, while some

respondents note that a training alone does not always lead to the desired outcomes. Practical constraints are also highlighted, such as the inability to fully test safety-related aspects, limitations related to training facilities and lacking prior knowledge about the target group.

5
Discussion

This chapter discusses the findings and methodological considerations of the study in relation to the research aim and the developed tool. The discussion is divided into four sections. First, the choices made during the development of the tool are reflected upon and motivated. Second, limitations related to the methodology and the obtained results are addressed. Third, the relevance and applicability of the study and the tool are discussed in relation to the intended context. Finally, suggestions for future work and further research are presented.

5.1 Choices in tool design

This section discusses the choices made throughout the study in relation to the development of the tool. First, the exclusion of certain COM-B components, intervention functions, and BCTs are discussed. Next, the choice to include the weighting is motivated. Lastly, included intervention functions are addressed.

Excluded COM-B components, intervention functions, and BCTs
During the process of creating the tool, methodological and design choices regarding the selection of COM-B components, intervention functions, and BCTs were made. Some choices have already been motivated in the Methodology (chapter 3) and Results (chapter 4). This includes the COM-B component *physical capability* and the intervention function *restriction*. Physical capability was excluded as it is assumed that operators already possess the necessary prerequisites, and restriction was deselected as it is a function aimed at a broader scope, outside the context of a training, directed towards policy categories.

On the other hand, some excluded elements need elaborated reasoning for their exclusion. One such exclusion was the deselection of *coercion* as an intervention function, and the BCT clusters *scheduled consequences* and most of the BCTs in *rewards and threats*. The reasoning behind these choices was mainly based on how operators, as adults, are motivated. According to the theory of Andragogy described in Section 2.6, adults are primarily driven by intrinsic motivation and feel engaged when they perceive learning as relevant and purposeful. Threats, coercion, or scheduled consequences were therefore considered inefficient choices, as they aim to force the learner into action rather than persuade or explain the underlying rationale.

Another theory addressing motivation in general, not limited to adults, is SDT (see Section 2.5), which emphasises the importance of intrinsic motivation and advises against reliance on external rewards and pressures. This further strengthens the argument for deselecting the intervention functions and BCTs mentioned above. More specifically, SDT states that optimal learning occurs when learners' need for autonomy is fulfilled. The use of threats, coercion, and scheduled consequences will therefore limit the learner, as control shifts from the individual to external factors, potentially leading to feelings of compulsion rather than volition.

The arguments made regarding coercion, threats, and scheduled consequences, namely that they negatively affect intrinsic motivation and autonomy, particularly for adults who have a greater need for these, can also be applied to explain why most rewards were excluded from the tool. This is because rewards in general also function as external motivators. However, social reward was still included as one of the remaining BCTs. The reasoning behind this choice relates to another of the three core elements in the SDT, relatedness, which concerns the need to feel connected to others. Social reward was seen as an effective way to support this need. Examples of preferred rewards include applause or public praise from other participants or trainers. It is expected that such social rewards will create a sense of recognition, reinforce the value of one's efforts, and foster a feeling of being seen and connected to others.

Implementation of weighting

The weighting was another choice made during the process of designing the final tool. The aim of implementing the weighting was to assign greater value to BCTs that were considered more important for the training, thereby allowing them to have a more significant impact on the overall score distribution. The weighting ($\times 1$, $\times 2$, and $\times 3$) affected the percentage scores to varying degrees. The $\times 3$ category increased by 15 percentage points, while $\times 1$ decreased by 12 percentage points. The $\times 2$ category changed only marginally, decreasing by 3 percentage points. This indicates that the weighting increased the influence of the most important BCTs while reducing the contribution of less essential ones.

The reasoning behind determining the importance of each BCT and subsequently categorising them was primarily based on learning perspectives described in Chapter 2. The BCTs included in the $\times 3$ category are *feedback, self-monitoring, instruction on how to perform a behaviour, practice and habit formation, demonstration of behaviour, information about or salience of consequences, structuring or restructuring the physical and social environment, credible source, goal setting* and *reviewing goals*. The majority of these were considered to play a central role in effective learning from the identified learning perspectives, as they are either explicitly stated or described in similar terms across one or more of the presented theories.

To begin with, *feedback* is highlighted in both Nine Events of Instruction and Lesson Checklist, thereby strengthening its inclusion as one of the most crucial BCTs. Similarly, *goal setting*, *instruction on how to perform a behaviour*, and *reviewing goals* correspond to elements such as informing learners of objectives and identify-

ing assessment strategies presented within these frameworks. The BCTs *practice and habit formation* can, on the other hand, be related to the Psychomotor Taxonomy. Within the taxonomy, learning a new action involves progressing through the stages of imitation, manipulation, precision, and articulation, which closely correspond to repeated practice. Habit formation can, in turn, be related to the final stage, naturalisation, where the behaviour becomes integrated and performed automatically. Finally, Social Learning Theory emphasises that individuals learn not only through personal performance but also through observation and imitation. This supports the inclusion of *demonstration of behaviour* among the most crucial BCTs.

In addition to learning perspectives mentioned above, target group adaptation also played an important role in determining the $\times 3$ categorisation. For instance, both andragogy and SDT emphasise self-improvement and autonomy, which supports the inclusion of *self-monitoring* as a key component. Furthermore, the BCT *credible source* aligns with andragogical principles, as adults need to perceive learning as relevant and purposeful. For this to occur, both the trainer and the training must be experienced as trustworthy and credible.

The last two BCTs included among the most crucial ones, namely *information about or salience of consequences* and *structuring or restructuring the physical and social environment*, were not primarily selected based on learning perspectives or target group adaptation. Instead, information about or salience of consequences was included due to the strong emphasis on safety identified consistently throughout all data collection sources. Structuring or restructuring the physical and social environment, on the other hand, was included based on observations made during the educational sessions, where the environment was found to be fundamental in enabling the effective use of other BCTs. For example, the physical placement of participants within a classroom influenced their ability to observe the trainer and thereby imitate demonstrated behaviours.

The categorisation of the $\times 2$ and $\times 1$ BCTs is, similarly to the $\times 3$ category, largely supported by learning theories and principles of andragogy, which motivated their inclusion in the tool. However, the BCTs in $\times 2$ were not considered fundamental prerequisites for delivering a training. Instead, they can be seen as elements that enhance or improve the quality of the training. The BCTs in $\times 1$ were assessed as potentially more difficult to implement in practice due to constraints such as limited time, physical environment, or the level of openness within the target group. For example, how much interaction and personal engagement can realistically be achieved during the training. Therefore, these were assigned a lower weight in order to provide a more balanced and justified representation of the overall ranking of the training.

In addition to affecting the score distribution of the BCTs, the weighting also influenced the distribution of the intervention functions. As presented in the Results chapter, Figures 4.5 and 4.6 illustrate the distribution of intervention functions before and after weighting. The figures show that the weighting has no effect on

the relative order of the intervention functions, nor does it result in any significant changes in their percentage distributions. The ordering can therefore be discussed without considering weighting as a contributing factor.

Included intervention functions

The relative proportions of the intervention functions within the tool are illustrated in Figures 4.5. The figure show that *training* and *education* account for the largest proportions and therefore have the greatest impact on the final scores when the tool is used for evaluation. This ranking aligns with the intervention functions that, based on the interviews and theoretical foundations, were considered most important to emphasise. Training was highlighted during the interviews as a particularly important component, as operators are generally more engaged when working practically. This is also consistent with the *lesson checklist*, presented in Section 2.5, which emphasises the importance of adapting teaching methods to the characteristics and needs of the target group.

Education, on the other hand, was described by one interviewee as something they aim to limit, as the target group does not favour it. However, this referred specifically to education in the context of classroom-based sessions. In a behavioural change context, education encompasses BCTs in a broader sense. For example, *feedback* included in the tool may constitute education occurring outside the classroom, such as during hands-on exercises. To provide nuance, certain BCTs, such as *information about and salience of consequences*, will likely involve classroom-based elements, as this is often a practical and efficient way of delivering information. This is not necessarily a disadvantage. Although the target group may prefer hands-on training, classroom-based elements can be appropriate in specific contexts where certain types of information need to be conveyed. The trainings are intended to educate, and education as a component is, in most cases, unavoidable, as participants typically enter the trainings without prior knowledge of the desired behaviours. They therefore require context, background, and information in order to understand and apply the knowledge effectively.

While training and education were found to have the greatest influence within the tool, this does not imply that the remaining intervention functions should be excluded. Even though the interviewees' experiences suggest that the target group primarily consists of kinaesthetic learners, variation still exists among participants. It is therefore important to maintain a range of intervention functions within the training to accommodate different ways of processing and applying information, in accordance with the V.A.R.K model (see Section 2.5). Consequently, it was prioritised to include all intervention functions deemed relevant in the tool, rather than focusing on only one or two, for example, solely selecting training.

5.2 Limitations

To begin with, an important methodological consideration concerns the choice of literature review approach. The decision to do a *narrative literature review*, rather than a *systematic literature review* enabled a more flexible and time-efficient process. To strengthen this approach, expert input from industry practitioners was incorporated, which helped substantiate the theoretical perspective and provided valuable empirical grounding to complement the literature. This choice was largely guided by practical considerations related to the project scope. While this approach allowed for a broad and exploratory understanding of the field, it may also entail the possibility that certain relevant studies were not captured due to a less exhaustive search and screening process. In this way, practical insights were used to mitigate potential gaps in the literature. A systematic literature review could have offered a more comprehensive and structured synthesis, however the narrative approach was considered appropriate for achieving the study's objectives within the given constraints, while still ensuring a sufficiently robust foundation for the analysis.

The selection of the theoretical framework, the BCW, introduced both clear advantages and certain limitations. A key advantage of using this established framework is that it provides a well-validated foundation, as it is built upon a synthesis of 19 behaviour change frameworks and has since been widely applied and further refined across diverse empirical contexts. This enabled the study to build upon already established knowledge and thereby progress further within the timeframe of the project. One potential limitation is the decision to rely almost exclusively on this framework, which may be perceived as restricting the exploration of other potentially relevant context-specific approaches. However, this was considered the most appropriate approach for the present study, as the researchers had limited prior experience with behaviour change interventions. Consequently, relying on a framework grounded in extensive expertise within the field was regarded as more suitable, allowing the focus instead to be placed on adapting the framework to the specific context, target group, and educational setting, which aligned more closely with the researchers' area of expertise.

Another aspect to consider when discussing the limitations, is the selection of BCTs observed during the observations. As described in Chapter 3, the excluded techniques were not included in the observation protocol. As a result, these techniques were not identified during the observations and, consequently, no feedback could be provided regarding potentially unsuitable BCTs currently being used that, according to the tool, should be replaced or removed. However, this was an intentional methodological choice, as including all 93 BCTs (see Appendix A) in the observations would have made it considerably more difficult to capture detailed information regarding the techniques considered most beneficial. In addition, the observations indicated that techniques that may be directly unsuitable for the target group and context are generally already recognised by trainers as negatively impactful and are therefore typically not included in the trainings.

Limitations related to the study's scope and sampling should also be considered. This project has targeted trainings for operators within the manufacturing industry in general. However, only trainings conducted within the battery and automotive manufacturing industries were observed, and the interviews and expert consultations were likewise limited to individuals working within these industrial contexts. This was due to both the niche of the BCG training and to the industrial contacts available for the study, which consequently led the project to be naturally directed towards these industrial contexts. With support from the literature however, this study has still been able to draw general conclusions based on the observations made and the types of behaviours desired within the manufacturing industry as a whole, and the target group could therefore be broadened to operators in the manufacturing industry in general.

Finally, another limitation of the selected trainings is that they differ in terms of spaces for training and, to some extent, content. This makes it more difficult to directly conclude that one training teaches behaviour better than another, since variations in physical learning environments and delivery formats introduce additional contextual factors that influence learning outcomes beyond the training content itself and especially what is feasible within the specific facilities used. If observations had instead been conducted in more uniform classroom environments with highly similar content, clearer conclusions regarding more and less effective trainings could have been drawn, since the data collection would have given more data on a homogenous group and trainings and made conclusions easier to draw. However, for this project, achieving a range for the applicability of the tool was prioritised, meaning that variation across settings was intentionally included in order to test the robustness and transferability of the tool across different real-world conditions rather than isolating a single specific environment. In that regard, the study has succeeded.

5.3 Applicability & relevance

This section discusses the applicability and relevance of the developed tool. Applicability refers to whether the tool can be understood and practically used by its intended users, while relevance describes the extent to which the evaluation process is considered useful and feasible within organisational and training contexts.

Applicability
A recurring consideration throughout this study has been how to design the tool in a way that balances applicability, clarity, and an appropriate level of detail. From the outset, the intended users of the tool have been hired consultants, in-house trainers, training developers, and other employees with relevant knowledge of and connection to the training. During discussions and presentations of the tool, it became evident that some concepts may still require additional clarification depending on the user's prior experience and familiarity with behavioural terminology. To support the users, the final version of the tool therefore includes definitions and explanations of terminology intended to facilitate interpretation and practical application.

The identified concerns relate partly to difficulties in understanding the terminology and partly to a limited understanding of the definition of behaviour in general. This became apparent during the interviews, not explicitly stated by the interviewees but identified through their responses. For example, when interviewees were asked to describe which behaviours the training aims to teach (see Table 4.7), some of the attributes mentioned did not align with the theoretical definition of behaviour. Attributes mentioned by the interviewees such as ownership, technical confidence, and patience describe how an individual feels or is expected to feel, rather than observable behaviours. Similarly, terms such as problem solving and continuous improvement refer more to methods, techniques, or overarching goals than to specific behaviours.

Therefore, the tool may be more suitable for use by individuals with expertise in the field, such as consultants specialising in behavioural change or similar areas. However, it is also possible that engaging with this report may provide a sufficient level of in-depth understanding of behaviour and the underlying theoretical model, thereby enabling users to apply the tool effectively.

Relevance

Another aspect that has been considered, assuming that a suitable target group finds the tool applicable, is the relevance of undertaking the process of evaluating a training using the tool. For the tool to be useful, there must be room to implement the missing or under-represented BCTs, provided that the user considers such changes feasible and beneficial within their context. Factors limiting implementation were identified by the interviewees. The parameters that were found to constrain implementation options are primarily related to the company's decision-making structure and limitations within the time.

One example raised during the interviews concerned the trainers' and creators' opportunities to make changes to the training content. One interviewee, for instance, described that only minimal modifications can be made at their level, as decisions are taken at a more globally within the company. Trainings with this type of structure may find the implementation of the tool challenging, as proposing changes to an already established concept at a global level requires both time and resources. This may not be considered worthwhile without a clear indication of improvement, which may be difficult as the tool does not include long-term follow-up of behaviour maintenance after the training. However, as indicated by another interviewee, many trainings operate without such constraints, instead adopting a more decentralised approach with greater flexibility, which allows a quicker implementation. The tool can therefore still be considered relevant for a broader target group.

A further constraint that may challenge the relevance of modifying trainings based on the evaluation results is time. Time was described by several interviewees as a limiting factor, particularly in relation to allocating time for conducting training, as both trainers and operators are needed in the production environment. Implement-

ing changes to create a more behaviour-adapted training may require extending the duration of the training, which may not always be feasible. While such changes may be challenging to implement, they could be justified as a long-term investment in the organisation through improved employee competence. However, many of the proposed implementation options could also replace existing training elements that are less effective in supporting the desired learning outcomes, meaning that additional training time may not necessarily be required.

5.4 Future work

Future work in the area could build on this study by further exploring how training effects are sustained over time and how the developed tool can be applied and validated in practice. One way to extend this work would be to investigate how participants' workplaces continue the process after the training ends, with the aim of supporting the long-term maintenance of behavioural change. Longitudinal studies (observing individuals or groups over extended periods of time) would be particularly valuable in this regard, as they would enable the examination of behavioural persistence, relapse patterns, and the factors that support or hinder sustained adherence to newly acquired practices. A training can only initiate change to a certain extent due to time restriction and continued support in the workplace is essential for consolidating and stabilising new behaviours.

In this context, future research could focus on the final stage of the *Stages of Change Theory*, maintenance (see Section 2.2). This study argues that, following a well-planned and well-executed training, participants are likely to have progressed through the first four stages (pre-contemplation, contemplation, preparation, and action), making the maintenance phase critical in preventing regression to previous behaviours and embedding change into everyday routines. Identifying mechanisms that support this phase, particularly within organisational contexts, would therefore be a key direction for future work.

In addition, future work could further study the actual use and practical implementation and application of the developed tool. One possible approach would be to conduct qualitative interview studies with designers, trainers, and other practitioners who would actively use the tool to develop and evaluate trainings. Such studies could provide insights into how the tool is interpreted and operationalised in real-world contexts as well as help validate the tool even further.

Another relevant direction for future research would be to examine whether trainings that score highly according to the tool also lead to measurable and sustained behavioural change over time. Such studies could contribute to validating the predictive value of the tool by investigating whether trainings with higher scores also prove more effective in practice. Comparing the tool's evaluations with actual training outcomes would provide evidence of whether the identified BCTs and educational components are associated with successful behaviour change. In addition, such re-

search could help identify which aspects of the tool are most strongly related to training effectiveness and whether certain criteria should be weighted differently in future versions of the tool.

Moreover, expanding the empirical scope beyond battery and automotive manufacturing would further validate the tool and thereby enhancing its credibility and reducing barriers to its adoption in other industrial settings. Comparative studies across different manufacturing sectors could reveal industry-specific constraints and opportunities, as well as identify which elements of the tool are universally applicable and which may require a more contextual adaptation. This would contribute to refining the tool and enhancing its robustness as a tool for supporting behavioural change through training in diverse industrial settings.

6
Conclusions

The aim of this thesis has been to develop a tool capable of evaluating trainings with the purpose of effectively shaping or reinforcing desirable behaviours. Parameters such as practicability and applicability were considered important throughout the study in order to ensure that the tool would serve a meaningful purpose in practice.

In order to create a tool, target behaviours for operators working within manufacturing industries, had to be identified. These were found to be: *following standards, acting on deviations, following time frames, adapting to the environment*, and *acting with humility*. These behaviours were derived from three central themes that emerged repeatedly, although expressed in different ways, throughout both the literature review and interviews: safety, efficiency, and quality.

Regarding parameters that can support behavioural change, the literature review and observations conducted at three trainings identified five conditions necessary for change, seven intervention functions, and 21 suitable behaviour change techniques, of which 11 were considered particularly important (see Figure 6.1). These parameters were identified with consideration given to the context of trainings, the target group of operators, and learning perspectives, particularly those related to adult learning.

Conditions that must be fulfilled (COM-B components)
Psychological capability | Physical opportunity | Social opportunity | Reflective motivation | Automatic motivation

Intervention functions
Education | Training | Enablement | Environmental restructuring | Modelling | Persuasion | Incentivisation

Most crucial Behaviour Change Techniques
Feedback | Self-monitoring | Instruction on how to perform the behaviour | Practice and habit formation | Structuring/restructuring the physical environment | Structuring/restructuring the social environment | Demonstration of the behaviour | Credible source | Information and salience of consequences | Goal setting | Review goals

Figure 6.1: Summary of important parameters for behaviour-oriented learning.

Based on these findings, a tool could be developed consisting of conditions, intervention functions, and BCTs considered important for supporting behavioural change within trainings. The tool outlines both what needs to be fulfilled during the training and how this can be achieved in order to support effective behaviour-oriented learning. However, it should not be viewed as a stand-alone solution for changing operators' behaviours, as continued reinforcement in the workplace is considered essential for long-term behavioural change.

The intended target group for using the tool consists of consultants, trainers, and training developers. The validation phase and consultations indicated that explained terminology within the tool, together with reading this report, would likely be necessary for effective application. Interviews also showed that factors such as time constraints and limited decision-making freedom may restrict the implementation of recommended changes, highlighting the need for organisational prioritisation in order for the tool to provide practical value.

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A

BCTs in the BCW framework

The following table presents the taxonomy of the 93 Behaviour Change Techniques (BCTs) included in the Behaviour Change Wheel framework. The BCTs and their categorisation are reproduced from [18].

Cluster	**Behaviour Change Technique**
1. Goals and planning	1.1 Goal setting (behaviour) 1.2 Problem solving 1.3 Goal setting (outcome) 1.4 Action planning 1.5 Review behaviour goal(s) 1.6 Discrepancy between current behaviour and goal 1.7 Review outcome goal(s) 1.8 Behavioural contract 1.9 Commitment
2. Feedback and monitoring	2.1 Monitoring of behaviour by others without feedback 2.2 Feedback on behaviour 2.3 Self-monitoring of behaviour 2.4 Self-monitoring of outcome(s) of behaviour 2.5 Monitoring of outcome(s) without feedback 2.6 Biofeedback 2.7 Feedback on outcome(s) of behaviour
3. Social support	3.1 Social support (unspecified) 3.2 Social support (practical) 3.3 Social support (emotional)
4. Shaping knowledge	4.1 Instruction on how to perform behaviour 4.2 Information about antecedents 4.3 Re-attribution 4.4 Behavioural experiments

5. Natural consequences	5.1 Information about health consequences 5.2 Salience of consequences 5.3 Information about social and environmental consequences 5.4 Monitoring of emotional consequences 5.5 Anticipated regret 5.6 Information about emotional consequences
6. Comparison of behaviour	6.1 Demonstration of the behaviour 6.2 Social comparison 6.3 Information about others' approval
7. Associations	7.1 Prompts/cues 7.2 Cue signalling reward 7.3 Reduce prompts/cues 7.4 Remove access to the reward 7.5 Remove aversive stimulus 7.6 Satiation 7.7 Exposure 7.8 Associative learning
8. Repetition and substitution	8.1 Behavioural practice/rehearsal 8.2 Behaviour substitution 8.3 Habit formation 8.4 Habit reversal 8.5 Overcorrection 8.6 Generalisation of target behaviour 8.7 Graded tasks
9. Comparison of outcomes	9.1 Credible source 9.2 Pros and cons 9.3 Comparative imagining of future outcomes
10. Reward and threat	10.1 Material incentive (behaviour) 10.2 Material reward (behaviour) 10.3 Non-specific reward 10.4 Social reward 10.5 Social incentive 10.6 Non-specific incentive 10.7 Self-incentive 10.8 Incentive (outcome) 10.9 Self-reward 10.10 Reward (outcome) 10.11 Future punishment

11. Regulation	11.1 Pharmacological support 11.2 Reduce negative emotions 11.3 Conserving mental resources 11.4 Paradoxical instructions
12. Antecedents	12.1 Restructuring the physical environment 12.2 Restructuring the social environment 12.3 Avoidance/reducing exposure to cues 12.4 Distraction 12.5 Adding objects to the environment 12.6 Body changes
13. Identity	13.1 Identification of self as role model 13.2 Framing/reframing 13.3 Incompatible beliefs 13.4 Valued self-identity 13.5 Identity associated with changed behaviour
14. Scheduled consequences	14.1 Behaviour cost 14.2 Punishment 14.3 Remove reward 14.4 Reward approximation 14.5 Rewarding completion 14.6 Situation-specific reward 14.7 Reward incompatible behaviour 14.8 Reward alternative behaviour 14.9 Reduce reward frequency 14.10 Remove punishment
15. Self-belief	15.1 Verbal persuasion about capability 15.2 Mental rehearsal of successful performance 15.3 Focus on past success 15.4 Self-talk
16. Covert learning	16.1 Imaginary punishment 16.2 Imaginary reward 16.3 Vicarious consequences

B

Observation sheet

The following table presents the observation sheet used during the observations, including all BCTs and intervention functions grouped by BCT cluster, along with a comments field.

BCT cluster	**BCT**	**Intervention function**	**Comments**
1. Goals and planning	Goal setting (behaviour) Goal setting (outcome) Problem solving Action planning Review (behavioural-goals) Review (outcome-goals) Discrepancy (now-goal)	Enablement	
2. Feedback and monitoring	Feedback (behaviour) Feedback (outcome) Self-monitoring (behaviour) Self-monitoring (outcome)	Persuasion Incentivisation Training Enablement	
3. Social support	Unspecified	Enablement	
4. Shaping knowledge	Instruction Behaviour experiments	Training	
5. Natural consequences	Info: health consequences Info: social/environmental consequences Info: emotional consequences Salience of consequences	Education Persuasion	
6. Comparison of behaviour	Demonstration	Training Modelling	
7. Associations	Prompts/cues Reduce prompts/cues Associative learning	Environmental restructuring	

BCT cluster	**BCT**	**Intervention function**	**Comments**
8. Repetition and substitution	Behavioural practice/rehearsal Habit formation Habit reversal Graded tasks	Training	
9. Comparison of outcomes	Credible source	Persuasion	
10. Reward and threat	Social reward Outcome reward	Incentivisation	
11. Regulation	Conserving mental resources	Enablement	
12. Antecedents	Restructuring physical/social environment Adding objects	Environmental restructuring	
13. Identity	Framing/reframing	Persuasion Enablement	
15. Self-belief	Verbal persuasion about capability	Persuasion	
16. Covert learning	Vicarious consequences	Enablement	

C

Questionnaires to identify COM-B components

The following tables present the five questionnaires administered to experts to determine which COM-B components should be included in the tool. One questionnaire was developed for each of the five target behaviours. For each behaviour and COM-B component, one to three statements were formulated based on the question of what needs to occur for the target behaviour to take place.

Target behaviour: Following standards ***Adhering to manuals and instructions, as well as established policies and rules in daily work.***		
COM-B Components	**What needs to happen for the target behaviour to occur?**	**Is there a need to train?**
Physical capability	Have the skill to read	
Psychological capability	Know that there are manuals/rules/policies to follow Know the correct technique to navigate in the manuals Know the subject-specific terminology used in the manuals	
Physical opportunity	Manuals/rules/policies have been created/written Have manuals available	
Social opportunity	See colleagues following the standards	
Reflective motivation	Hold beliefs that following standards will lead to higher SEQ (safety, efficiency, quality) Hold beliefs that they are capable to follow standards (growth instead of fixed mindset)	
Automatic motivation	Creates routines/habits to follow standards	

Target behaviour: Acting on deviations

Addressing issues related to items or tasks, other people, and oneself, for example by keeping things organised and managing personal factors such as fatigue.

COM-B Components	**What needs to happen for the target behaviour to occur?**	**Is there a need to train?**
Physical capability	Have the motor skills to clean/correct things out of order	
Psychological capability	Know what a clean environment implies Know what the quality standards are Know how and when to give feedback/critique to others Know their own limitations (tired, stressed, not feeling well)	
Physical opportunity	SEQ standards have been created/written Have SEQ standards available	
Social opportunity	See colleagues following the SEQ standards See colleagues receive/give feedback/critique in an appropriate manne	
Reflective motivation	Hold beliefs that acting on discrepancies will improve SEQ Hold the belief that acting on others' discrepancies will not jeopardise the relationships between colleagues Hold beliefs that acting on their own discrepancies will not jeopardise their employment	
Automatic motivation	Have routines/habits to act on discrepancies	

Target behaviour: Following the time frame

Following the established time frame by arriving on time, maintaining an appropriate work pace, and planning work proactively.

COM-B Components	**What needs to happen for the target behaviour to occur?**	**Is there a need to train?**
Physical capability	Have the skill to tell time Have the motor skills to keep up the pace	
Psychological capability	Know the correct technique to navigate the schedule Know how to plan their own work from the schedule (do preventative work at the right time, know what to do and in what order)	
Physical opportunity	A schedule has been created Have the schedule available	
Social opportunity	See colleagues following the schedule	
Reflective motivation	Hold beliefs that following the schedule will lead to high efficiency Hold beliefs that following the schedule will not jeopardise the safety and quality Hold beliefs that they are capable to follow the schedule and keep up the production pace (growth instead of fixed mindset)	
Automatic motivation	Create routines/habits for being on time and continually check the schedule (start of the day, between breaks, for meetings)	

Target behaviour: Adapting to the environment

Adjusting to new standards, collaborating effectively with colleagues, and responding to external factors such as errors or variations in production volume or pace.

COM-B Components	**What needs to happen for the target behaviour to occur?**	**Is there a need to train?**
Physical capability	Needed skills already included	
Psychological capability	Know how to implement new standards Know how and when to adjust to colleagues (help them when they're feeling unwell and be able to compromise when disagreements occur)	
Physical opportunity	Be noticed of changes that require adjustments There are alternative work assignments when there are stops/malfunctions in the line Superiors are available for guidance	
Social opportunity	See colleagues adapting to the change	
Reflective motivation	Hold beliefs that adapting to external factors will lead to improved SEQ Hold beliefs that they are capable to adapt to the changes (growth instead of fixed mindset)	
Automatic motivation	Create routines/habits for implementing adaptations to new standards/colleagues	

Target behaviour: Acting with humility

Asking for help when needed, admitting mistakes, and maintaining a respectful attitude towards others.

COM-B Components	**What needs to happen for the target behaviour to occur?**	**Is there a need to train?**
Physical capability	Needed skills already included	
Psychological capability	Know when and how to ask for help Know what it means and have the interpersonal skills to act respectfully Know how to communicate their mistakes	
Physical opportunity	The supervisors are available/open for questions/confessions Have procedures for how to respectfully handle machines/tasks	
Social opportunity	See colleagues confess/own their mistakes See colleagues ask for help when needed See colleagues acts respectfully	
Reflective motivation	Hold beliefs that asking for help will lead to a satisfactory answer or solution Hold beliefs that owning their mistakes will not have jeopardise their employment Hold beliefs that acting respectfully will improve the work environment for them and their colleagues	
Automatic motivation	Establish routines/habits for how to act respectfully towards machines and colleagues	

D

Interview questions

This appendix includes the interview questions used in this study. The areas consisted of introductory questions followed by the three phases of training: before, during and after.

Introductory Questions

- What is your current role?
- How did you end up in that role?
- When did you become part of the training?

Planning of the training

- How are decisions regarding the structure, content, and methods of the training made, and who makes these decisions?
- How much freedom do you have to modify or decide on the content and structure of the training?
- Is it specified which behaviours you are expected to teach?
  - If **yes**:
    - Who specifies this?
    - Which behaviours?
  - If **no**:
    - Have you identified any behaviours that **you** believe should be taught?
- Was the teaching of behaviours discussed during the development of the training? (to the best of your knowledge)
- In what way do you consider behaviour today when planning or further developing the training material?
  - If little or not at all:
    - Would you do anything differently if you were to redesign the training from scratch today with behaviour in mind?
    - If **yes**:
      - What?
      - How?

        * If **no**:
            · Why not?
- Is the training currently adapted to different target groups?
    - If **yes**:
        * In what way for operators?
        * Have you noticed different teaching techniques that are more or less effective for operators?
    - If **no**:
        * Why is that?
- Do you see any practical limitations in the training regarding the teaching of behaviours? (Environment, time, resources)

- Do you see any untapped opportunities in the training regarding the teaching of behaviours?

During the training
- In what way do you consider behaviour during the training itself?

After the training
- Which behaviours do you **think** participants take away from the training?

- Which behaviours do you **want** participants to take away from the training?

    - Is there a gap between the two?

E

BCTs identified in trainings

Information on the specific Behaviour Change Techniques (BCTs) observed in each training is provided below. A check mark indicates that the BCT was observed, whereas a dash indicates that the BCT was not observed.

Battery Centre Gothenburg			
COM-B	**Intervention**	**BCT**	**Evaluation**
Psychological capability	Education	Feedback	✓
	Training	Feedback	✓
		Self-monitoring	✓
		Instruction on how to perform the behaviour	✓
		Behavioural experiments	✓
		Practice and habit formation	✓
		Graded tasks	✓
	Enablement	Conserving mental resources	✓
Physical opportunity	Environmental restructuring	Structuring/restructuring the physical environment	✓
Social opportunity	Environmental restructuring	Structuring/restructuring the physical environment	✓
		Structuring/restructuring the social environment	✓
	Modelling	Demonstration of the behaviour	✓
Reflective motivation	Persuasion	Credible source	✓
		Framing/reframing/persuasion about capability	✓
	Education	Information and salience of consequences	✓
		Feedback	✓
		Behavioural experiments	✓
Automatic motivation	Incentivisation	Social reward	✓
	Modelling	Demonstration of the behaviour	✓
	Enablement	Conserving mental resources	✓
		Goal setting	✓
		Problem solving	✓
		Action planning	✓
		Review goals	✓
		Discrepancy between current behaviour and goal	✓
		Social support	✓
	Environmental restructuring	Prompts/cues	✓
	Training	Self-monitoring	✓
		Practice and habit formation	✓
		Graded tasks	✓

Simulated Work Environment			
COM-B	**Intervention**	**BCT**	**Evaluation**
Psychological capability	Education	Feedback	✓
	Training	Feedback	✓
		Self-monitoring	✓
		Instruction on how to perform the behaviour	✓
		Behavioural experiments	-
		Practice and habit formation	✓
		Graded tasks	-
	Enablement	Conserving mental resources	✓
Physical opportunity	Environmental restructuring	Structuring/restructuring the physical environment	✓
Social opportunity	Environmental restructuring	Structuring/restructuring the physical environment	✓
		Structuring/restructuring the social environment	✓
	Modelling	Demonstration of the behaviour	✓
Reflective motivation	Persuasion	Credible source	✓
		Framing/reframing/persuasion about capability	✓
	Education	Information and salience of consequences	✓
		Feedback	✓
		Behavioural experiments	✓
Automatic motivation	Incentivisation	Social reward	✓
	Modelling	Demonstration of the behaviour	✓
	Enablement	Conserving mental resources	✓
		Goal setting	✓
		Problem solving	✓
		Action planning	✓
		Review goals	✓
		Discrepancy between current behaviour and goal	✓
		Social support	✓
	Environmental restructuring	Prompts/cues	✓
	Training	Self-monitoring	✓
		Practice and habit formation	✓
		Graded tasks	✓

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COM-B	**Intervention**	**BCT**	**Evaluation**
Psychological capability	Education	Feedback	-
	Training	Feedback	-
		Self-monitoring	-
		Instruction on how to perform the behaviour	✓
		Behavioural experiments	-
		Practice and habit formation	✓
		Graded tasks	-
	Enablement	Conserving mental resources	✓
Physical opportunity	Environmental restructuring	Structuring/restructuring the physical environment	✓
Social opportunity	Environmental restructuring	Structuring/restructuring the physical environment	✓
		Structuring/restructuring the social environment	✓
	Modelling	Demonstration of the behaviour	✓
Reflective motivation	Persuasion	Credible source	✓
		Framing/reframing/persuasion about capability	✓
	Education	Information and salience of consequences	✓
		Feedback	-
		Behavioural experiments	-
Automatic motivation	Incentivisation	Social reward	✓
	Modelling	Demonstration of the behaviour	✓
	Enablement	Conserving mental resources	✓
		Goal setting	✓
		Problem solving	✓
		Action planning	✓
		Review goals	✓
		Discrepancy between current behaviour and goal	-
		Social support	✓
	Environmental restructuring	Prompts/cues	✓
	Training	Self-monitoring	-
		Practice and habit formation	✓
		Graded tasks	-

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