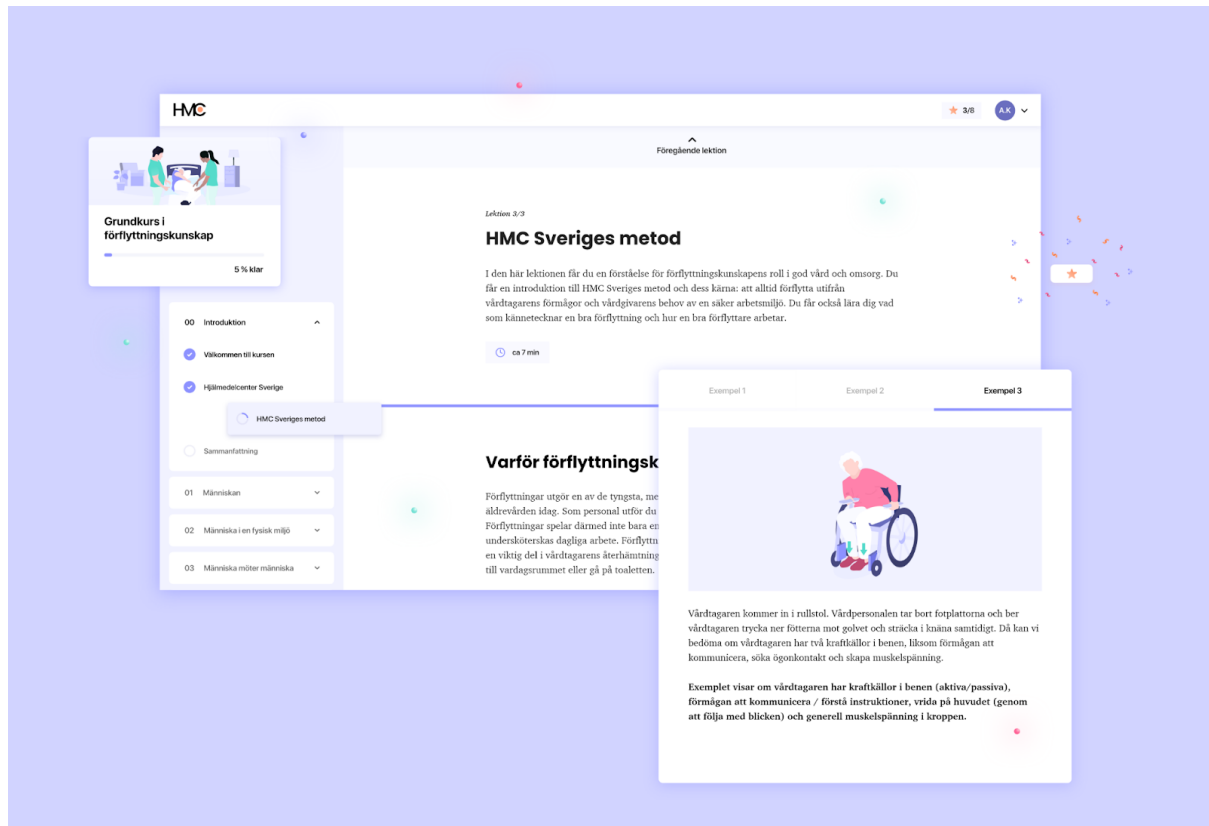




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# E-learning in transfer skills

A study of the possibilities and concerns of translating a traditional education within a health context into an e-learning course

Master's thesis in Interaction Design & Technologies

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MASTER'S THESIS 2021

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Gothenburg, Sweden 2021

E-learning in transfer skills

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Gothenburg, Sweden 2021

E-learning in transfer skills

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## Abstract

The purpose of this thesis project was to explore possibilities and challenges of translating a traditional education within transfer skills into an e-learning service. Through an iterative design process a proof of concept was created, in terms of a high fidelity prototype of an e-course aimed at assistant nurses. In addition to this, a design component library was produced as a start of a design system that could aid in the design of e-courses within various educational contexts. Finally, a set of design principles with associated guidelines, that can be applied in the design process of e-learning courses for practice oriented education, was summarized based on the insights derived throughout the project. Evaluations with learner representatives and subject matter experts respectively have revealed potential for the proof of concept, which can contribute to the client's goal of contributing to a standardization of knowledge level for base level nursing personnel. However, further work is needed to finalize the prototype, and to conduct a final summative evaluation of the e-course, evaluating its quality and usability.

**Keywords:** *Education, e-learning, online training, assistant nurses, interaction design, instructional design, research through design, human centered design, learning experience design, gamification.*



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Hannah Malmback and Julia Wallén, Gothenburg, May 2021



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# Glossary

## A

Assistant nurse  
Health personnel who do not necessarily hold professional degrees or credentials, but have completed training and provide routine patient care under the direction of registered nurses and physicians.  
(sv. *undersköterska*)

## C

Caregiver  
Person who provides another person with care and or assistance of some kind. This could be a health professional such as a nurse, personal assistant or family member.  
(sv. *vårdgivare*)

Care recipients  
Person who receives care and or assistance of some kind and to some degree from a caregiver.  
(sv. *vårdtagare*)

## H

Home care services  
Non-medical support services, such as food preparation and bathing, given by trained personnel to disabled, sick or convalescent individuals in their home.  
(sv. *hemtjänst*)

## M

“Transfer knowledge”  
An interdisciplinary subject that includes biomechanical basics, load ergonomics and physiological movement patterns as well as work environment and assistive technology (moving aids) knowledge (Parmelund & Reifeldt, 2020).  
(sv. *förflyttningskunskap*)

## N

Nursing home  
Facilities which provide nursing supervision and limited medical care to persons who do not require hospitalization.  
A type of nursing home is a retirement home.

## T

Transfer skills  
Techniques applied when assisting a care recipient in transferring situations.

# 1

## Introduction

Learning to move our body is a central part of human development. As infants, humans actively learn to master the skill of locomotion, and the majority take it for granted throughout most parts of life. However, when becoming elderly, or suffering from illness, humans often need to adjust to physical constraints brought by age and or sickness. There can be many reasons to need help with moving the body, like when changing position or moving from one place to another. When a care recipient needs help to change a position, assistant nurses must be able to instruct, act and assist correctly so that the particular person is helped in an optimal way, based on the conditions that exist in the specific situation. The techniques applied during such assistance are called transfer techniques.

Unfortunately, education within this group of professionals is often insufficient (SCB, 2015) and unregulated, resulting in a high variance in education level (Swahn & Söderlund, 2020). One of the most common injuries for healthcare professionals is Cumulative Trauma Disorders (CTD) (sv. *belastningsskador*) that occur in the physical assistance of care recipients (Pompeii, Lipscomb, Schoenfisch, & Dement, 2009; Waters, Nelson & Proctor, 2007). Providing healthcare professionals with the right equipment, such as lifts, is insufficient, if not done in combination with education in transfer techniques and how to manage these tools (Wählin, Stigmar & Nilsing Strid, 2019). Thus, in order to promote a safer working environment and prevent work related injuries education must be provided.

The development of e-learning has brought opportunities to traditional education, in terms of effectiveness and accessibility. The introduction of e-learning for nurses has been applied with successful results, in comparison to traditional lecture-based education, in other health areas (Keefe & Wharrad, 2012). By offering a remote education solution the possibilities of participation increase, as attendance is not constrained by place, and potentially time depending on the type of educational setting (synchronous/asynchronous).

This project aimed to explore the possibilities and challenges of developing an e-learning service for educating assistant nurses in transfer skills. The first goal was to state design principles applied in the design of an e-learning system with a focus on such practical skills. The second goal was to deliver a proof of concept of such a system, in the form of a high fidelity design solution. By doing so, the project aimed to contribute to the research area of remote education within a health context, as well as the client's goals of spreading their method and thereby contribute to a safer, more healthy, and sustainable assistance- and working situation for both care recipients and caregivers.

## 1.1. Purpose and Aim

The purpose of this study was to explore the translation of traditional face-to-face education into an online education within the context of education in transfer skills aimed at assistant nurses.

The study aimed to develop general design principles and guidelines applicable in the context of digitalization of a practical education that should add to the area of research and development of e-learning solutions.

Moreover, the study aimed to develop a proof of concept of such an e-learning service. This was done by developing a high-fidelity prototype that conveyed how the e-course can be structured and visually designed. All activities and design elements that arose due to the development of the high-fidelity prototype were compiled in a component library, to create a reusable solution that allows the client to develop additional courses.

## 1.2. Research Questions

The thesis aimed to answer the following research question:

*What should be considered in the translation of a traditional education of practice oriented topic into a digital learning environment?*

Which could be divided into the following sub questions:

- (i) How can we assure that e-learning education can be applied to the learner's current work situation?*
- (ii) How can we translate practical elements of an education while assuring high quality learning online?*
- (iii) How can we assure that the learning outcome is applicable in the learners' working situation?*

## 1.3. Demarcations

Data collection for this project was restricted to health care professionals in Sweden, due to the scope of the project, and as it is the client's current main market. In addition, the target group of learners for this project was delimited to assistant nurses working in elderly care, as this group of learners constitutes the largest group of participants for the client's current education.

This project did not aim to result in a design that presents a fully functioning e-learning system, as this was out of scope. Instead, the final design was limited to several key aspects of the system that conveyed an understanding of its purpose and function. The design was focused on the learner's perspective, meaning the researchers did not explore the service from the educator/facilitator's point of view within this project.

This project did not focus on the technical aspect of implementation. Thus, the project did not cover technical specifications in detail and didn't develop anything codewise.

The project did not focus on any business aspects as this was out of the designers' expertise and scope of the project. This is however an important aspect of the service and exploration. Decisions regarding this need to be done before implementation.

## 1.4. Ethics

As the design of services for users is done with the intention of creating a change in knowledge or behavior, the design process needs to be based on ethical decision-making (ACM, 2018). Performing any study with participants calls for consideration of the participant's rights, and should always be done with active prevention of harming anyone participating. Handling of patient data is one important factor, where data security needs to be considered. Personal data should be managed in accordance with GDPR (The European Parliament and the Council of the European Union (EU) 2016/679).

As this project was situated within the context of health care, it was important to acknowledge ethical issues regarding the meeting with and treatment of people, who, in this case, often are limited in terms of not only locomotion but also sight, hearing, etc. The handling of care recipients needs to be done with care and respect, and these values need to be communicated in an effective way through the e-course with no physical instructor at hand, in order to maintain high quality and ethical concern.

In addition, legislation and contextual regulations, such as those of the organization in which a learner works, needed to be considered.

### 1.4.1 Value-Sensitive Design

The Value-Sensitive Design (VSD) approach, a method within the human-computer interaction discipline, can serve as a tool to bridge the gap between design and ethics by incorporating ethical concerns into the design process (Friedman, Kahn & Borning, 2003; Cummings, 2006), and was applied throughout this project in order to ensure ethical considerations. VSD accounts for human values in the design process through an iterative design approach by three major components: *conceptual*, *empirical*, and *technical* (Friedman, Kahn & Borning, 2003). These concepts of analysis are described in table 1.1.

**Table 1.1**

*Main components of Value-Sensitive Design (Cummings, 2006).*

Type of analysis	Description
Conceptual ethics analysis	<p>Stakeholders should be addressed by investigation of positive and negative social impacts of both direct and indirect stakeholders.</p> <p>It examines twelve ethical values that have been identified as central in technology development:</p> <p><i>human welfare, ownership and property, privacy, freedom from bias, universal usability, trust, autonomy, informed consent, accountability, calmness, identity, and environmental sustainability.</i></p> <p>Typically in the design process some of these values will be considered more or less relevant.</p>
Empirical ethics analysis	<p>This phase is concerned with usability, as usability vs ethical values need to be considered and potential trade offs made. To exemplify, easy access to personal information can be desirable from a usability perspective, but not align with the ethical value of privacy.</p> <p>It focuses on quantitative and qualitative data to evaluate the design from both a technical and value assessment approach.</p>
Technical ethics analysis	<p>This phase consists of analysis of the design from a technical perspective, by addressing the same values as identified in Conceptual investigation.</p>

## 1.5. The Design Team

This project was completed by the two authors as a research- and design team. Both participated actively throughout all parts of the process, taking on various roles such as researcher, interviewer, designer, etc, however with some divisions of main responsibilities. Throughout this report the authors will be referred to as "the designers".

# 2

## Background

This chapter introduces the client for the project, as well as the educational topic for this particular case. Following this, a background of the concept of e-learning is presented.

### 2.1. Introducing the Context and Client

“Transfer knowledge’ (sv. *förflyttningskunskap*) is an area concerning for example biomechanics, load ergonomics (sv. *belastningsergonomi*), and physiological movement patterns as well as knowledge in the work environment and self-help devices” (Parmelund & Reifeldt, 2020, p.85). “Transfer skills” are best described as methods that should prevent or reduce work-related injuries in health care professionals connected to patient handling (Wåhlin, Stigmar & Nilsing Strid, 2019). Thus, education in transfer knowledge should provide health care staff with techniques that minimize the stress on their bodies during physical assistance of care recipients, and also inform them on the motivations for these techniques in a broader sense.

The work of assistant nurses, Sweden’s largest professional group with 135,300 employees (SCB, 2020), is characterized as stressful and time-consuming. Physical education and training, such as offered by the client, is therefore often deprioritized. Furthermore, health care professionals, including, assistant nurses, personal assistants, and other caregivers, are a professional group with relatively low educational experience (SCB, 2015). In Sweden today we lack regulation of what education and or competencies someone needs to have in order to use the professional title “assistant nurse” (sv. *undersköterska*) (Ds 2020:15; Kommittédirektiv 2017:103), but this question is currently being addressed on governmental level (Socialdepartementet, 2021). An e-learning system aimed at this group of professionals could help to foster a standardized level of knowledge on a national level.

An assistant nurse supports and performs on average 80-90 movements per working day (Parmelund & Reifeldt, 2020). As this group of professionals has a physically demanding job they risk suffering injuries and discomfort. A stressful working situation in combination with a lack of knowledge risks causing assistant nurses to assist and transfer care recipients wrongly. Awareness for care recipients and correct transfer techniques is not only essential for optimal working ergonomics for caregivers but is also of great importance for the care recipients from a health perspective, as movement is a critical part of the human’s health

(Henriksson & Sundberg, 2008). For some care recipients, this movement can be crucial for maintenance and or rehabilitation of mobility, and should thus be performed based on the circumstances and opportunities given by the context and the individual (SFS 2014:821; SOSFS 2012:3).

The use of physical aids can be critical in health care environments, both for care recipients and caregivers. Tools such as drag sheets, belts, slings, and lifts can help in order to move care recipients safely and comfortably (Parmelund & Reifeldt, 2020). The availability of physical aids in the movement of care recipients reduces the number of manual transfers performed, which in turn can reduce the risk of related injuries (most often musculoskeletal injuries) (Wåhlin et al., 2019).

The client for this project is Hjälpmedelcenter Sverige (HMC), a knowledge center with expertise in how to assist and transfer people in the best way possible, according to several aspects. Their method is patient-centered, meaning that they advocate that focus should always be on what the person being transferred can contribute to the locomotion. Their purpose is to educate caregivers in different contexts in order to foster safe and ergonomic locomotions, with attention to the health of both caregiver and care recipient.

As of today, HMC offers education and training in transfer skills by their own method aimed at different professional groups within healthcare, such as assistant nurses, occupational therapists and physiotherapists, and personal assistants. However, they aim to spread their knowledge more effectively. In order to spread their knowledge of transfer techniques in a more effective and qualitative way, and thereby contribute to more secure and sustainable movements for both caregivers and care recipients, HMC aims to digitalize their traditional education by developing an e-learning education.

Representatives from HMC have been actively involved throughout the project in terms of two subject matter experts (SMEs) to ensure that the required knowledge for the course is included and that the activities and e-learning content formats that the designers define communicate this successively. An additional representative from the client has been involved in the project occasionally, to provide insights regarding the client's long-term goals and intentions.

HMC will from here on be mentioned as "the client". The term "transfer skills" will be used to describe the mastering of transfer techniques throughout this thesis. However it is necessary to highlight that the client's method ("the HMC method") covers several aspects of transfer knowledge:

- (1) *The human*, the care recipient's contribution, and (active) participation in the locomotion for their own independence and health.
- (2) *The environment*, covering environmental constraints and opportunities, such as transfer aids.
- (3) *The meeting*, including communication on different levels with the care recipient) (SMEs, personal communication, November 23, 2020; January 25, 2021; April 7, 2021).

According to the method, there are additional motives for applying mindful techniques in transfer assistance, including, but not exclusively, the prevention of injuries of caregivers.

## 2.2. E-learning - Opportunities and Challenges

E-learning takes place when a teacher and student(s) are separated by physical distance (Gilbert, 1995, in Koohang & Du Plessis, 2004). It is characterized by the use of the Internet, computers, or other technical devices, to deliver instructions to the learner and enable engagement in different activities (Ghirardini, 2011; Koohang & Du Plessis, 2004). One of the main reasons for learners to choose online learning is the flexibility offered (Kit et al., 2020). The setup enables learners to engage with the material in private, according to one's preferences, which in turn can enhance the learning experience (Kite et al., 2010; Ishtaiwa & Abulibdeh, 2012). When used as an "information repository", learners appear to value the flexibility enabled by e-learning connected to viewing material (Henderson, Selwyn & Aston, 2017).

A digital education system further brings opportunities unavailable in traditional in-class learning such as direct feedback, for instance through auto-scored quizzes (Holmes & Prieto-Rodriguez, 2018), which provide the student with near-time feedback on his/her knowledge status, where this usually happens only after some time in a traditional test-setting.

Nevertheless, a transition to online-based learning is not without its challenges. Studies have identified a tendency for a perception of face-to-face education as superior to online based learning (Lowenthal et al., 2015; Heirdsfield et al., 2011) due to learners' perception of learning less in online courses in comparison to traditional face-to-face learning (Bergstrand & Savage, 2013; Jaggars, 2014). However, this tendency seems to be mainly due to the educators' learning capabilities and preferences, as learners in this study primarily based this perception on the lecturer's teaching style and structure of education (Bergstrand & Savage, 2013). Therefore, online learning does not necessarily result in a less qualitative education, indeed, learners seem to perform equally well in online learning contexts compared to

face-to-face education (Cavanaugh & Jacquemin, 2015; Chen, Lambert & Guidry, 2010; Driscoll, Jicha, Hunt, Tichavsky & Thompson, 2012).

To accommodate for successful learning, the online course needs to be pedagogically designed, in a way that meets the learners' preferences and supports them sufficiently in their learning process, as well as allows for interaction (Kite et al., 2020; Driscoll et al., 2012; Wu, Tennyson & Hsia, 2010; Barbera, Clara & Linder-Vanberschot, 2013). The course design and delivery of content has been identified as amongst the most crucial factors related to student satisfaction and perceived learning rate (Barbera, Clara & Linder-Vanberschot, 2013).

# 3

## Theory

The following chapter presents theories, principles and frameworks that created the theoretical foundation for the project. Firstly, the human centered design framework is presented, followed by the perspectives of instructional design, learning experience design and research through design respectively. Next, related work within the context of e-learning is presented, followed by gamification in e-learning and gamification techniques. Lastly, a summary of standards within the area of interface design is presented.

### 3.1. Human centered design

Human-centered design (HCD) is all about understanding the people you design for. IDEO (2021) defines HCD as a creative approach to problem-solving that starts with people and ends with innovative solutions that are tailor-made to suit their needs. The approach involves understanding the people you are trying to reach, and design from their perspective. Furthermore, it is not a step-by-step systematic process, but a creative, iterative process with an outcome that is initially unforeseen. This involves getting to know and understand the learners you design for and figure out what drives and motivations they have. This is why involving end-users in the process and getting in touch with them through qualitative and quantitative methods, such as interviews or observations, is an important step in order to create a successful learning experience (Johnson, 2016). This human-centered approach enables designers to offer an experience that people can relate to and appreciate.

Accordingly, the key concerns of HCD are to actively apply a user-centered perspective to the design process, by involving users throughout the process and by stating clear requirements connected to environments, users, and their tasks, and to address the whole user experience (ISO, 2019). Moreover, it is critical to creating designs in an iterative process, where design solutions are evaluated and iterated on in order to reach the most suitable solution through user-centered evaluation methods and to include different experts in the collaborative design process, as multi-disciplinary perspectives promote a more thorough solution (Ibid.).

According to the International Organization for Standardization (ISO, 2019), there are five essential HCD processes that should be undertaken in order to incorporate usability requirements into the software development process (see figure 1). These are (Ibid.):

1. *Plan the human-centered design process*
2. *Understand and specify the context of use*
3. *Specify the user requirements*
4. *Produce designs and prototypes*
5. *Evaluate design against requirements*

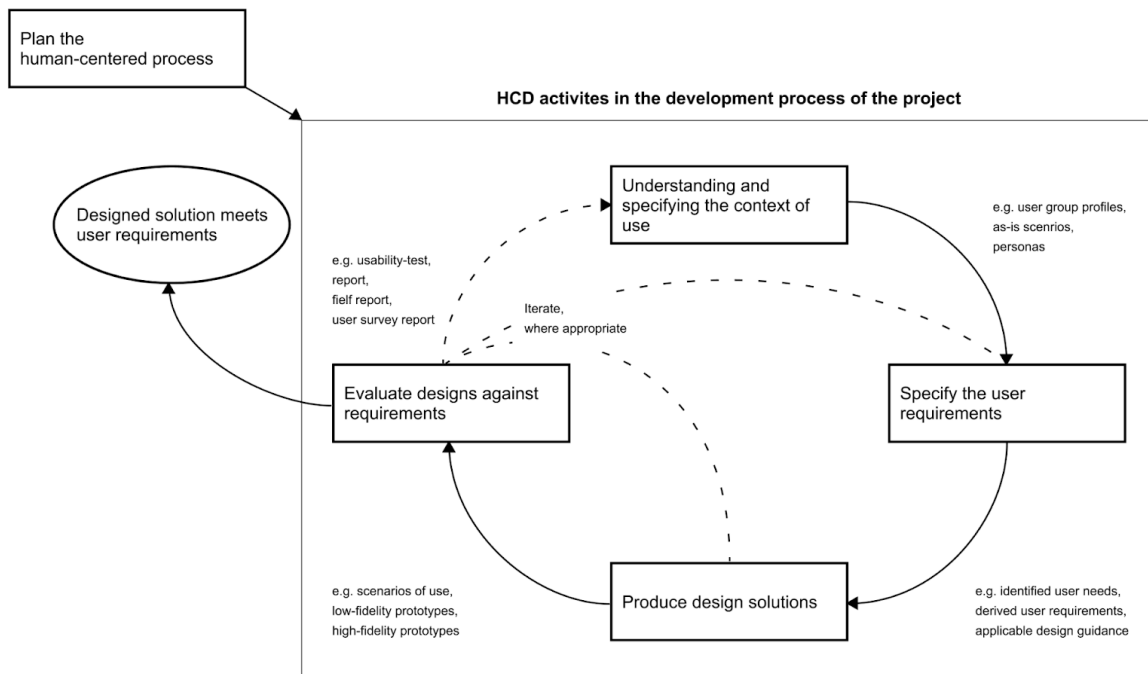
The first phase of HCD is focused on project planning and includes for instance identifying relevant methods and collecting resources, putting together the right team and identifying roles and skills within the team, and stating a plan for the design and development process, among other activities (ISO, 2019). The first phase of planning is done at the start of a project, and is, in exception to the other phases, not as actively revisited throughout the iterative design process.

The second phase is concerned with the context in which the solution should be implemented. Constraints and requirements of the context should be mapped out, as well as the needs, characteristics, and goals of different user groups (ISO, 2019).

The third phase is focused on state requirements based on the context of use analysis (ISO, 2019). These requirements should cover users and usability, as well as context and organization.

Designing is an activity for the fourth phase, where tasks, system interaction, and interfaces should be created for the overall user experience (ISO, 2019). Concretizing solutions in order to evaluate them is an important step in the HCD process.

The fifth phase, evaluation, is the most critical phase of the HCD process as it can confirm how far user and organizational objectives have been met as well as provide further information for refining the design (Maguire, 2001b). Sufficiently comprehensive testing should be carried out in order to give meaningful insights that guide the project and re-design forward (ISO, 2019). Evaluation could be made by either users or experts, however, user-based methods are more likely to reveal genuine problems, while expert-based methods can highlight shortcomings that may not be revealed by a limited number of users (Maguire, 2001b).



**Figure 3.1.** Recreation the HCD process (ISO, 2019).

## 3.2. Instructional Design

Instructional design (ID) is the process by which learning products and experiences are designed, developed, and delivered. Principles of human learning, specifically the conditions under which learning occurs, provides a foundation for the practice (Gagné, Briggs & Wager, 1992) and the theory can be used to define the activities that will guide e-learning development projects (Ghirardini, 2011).

There are different kinds of knowledge and different techniques for learning them. *Declarative knowledge*, such as “Stockholm is the capital of Sweden” is easily conveyed through text or audio, while *procedural knowledge*, that is how to do something, is difficult to teach and understand through such methods (Norman, 2013). Instead, in order to acquire procedural knowledge, it needs to be demonstrated and learned through practice (Ibid).

Gagné, Briggs, and Wager (1992) argue for an individual perspective framing the ID approach, meaning it should be aimed at the individual’s learning, and encourage a learner-centered education. They further emphasize the central impact of the individual’s previous knowledge and skills on the learning process. Gagné and colleagues describe the process of designing instructional systems as consisting of several steps, which should be performed in an iterative fashion when needed. These steps are listed in table 3.1 (Gagné, Briggs & Wager, 1992):

**Table 3.1**

*Steps of the Instructional Design (ID) process (Gagné, Briggs & Wager, 1992).*

#	Step	Description
1	Instructional goals	<p>Instructional goals should be identified on both a higher level, as well as in terms of more specific systematic goals that should be attained through instruction.</p> <p>The designer must ask “What goals will represent a desirable state of affairs?” (Gagné, et al., 1992, p.21)</p> <p>This should be followed by a needs analysis, identifying what needs to be done to reach these goals, depending on the current state of affairs.</p>
2	Instructional analysis	<p>Instructional analysis should be conducted to determine the skills involved in reaching a goal. This can be done through a task analysis for instance.</p>
3	Entry Behaviors and Characteristics	<p>Entry behaviors and characteristics should be identified, to determine which of the required enabling skills the learners bring to the learning task.</p> <p>For an instructional design to be successful the designer must acquire an understanding for the target user. This could for example include identification of learners’ abilities and traits.</p> <p>Step 2 and 3 can be done in parallel.</p>
4	Performance objectives	<p>Next one should define performance objectives to translate the needs and goals into performance objectives that are sufficiently specific and detailed to show progress toward the goals.</p> <p>“The functions of performance objectives are to (1) provide a means for determining whether the instruction relates to the accomplishment of goals, (2) provide a means for focusing the lesson planning upon appropriate conditions of learning, (3) guide the development of measures of learner performance, and (4) assist learners in their study efforts” (p. 26).</p>
5	Criterion-referenced test items	<p>Criterion-referenced test items should be developed to ensure that the individual possesses the necessary prerequisites for learning new skills, as test items allow the teacher to pinpoint the needs of individual students to concentrate on the skills that are lacking and to avoid unnecessary instruction.</p> <p>It is also important to check the results of student learning during the progress of a lesson.</p>

6	Instructional strategy	<p>An instructional strategy should be developed, where knowledge of learning and design theory should be combined with the designer's experience of learners and objectives.</p> <p>For example, in a learner-centered approach, a module is typically presented to the learner, presenting a learning objective, an activity guide, the material to be viewed/read, practice exercises, and a self-check test for the learner.</p>
7	Instructional materials	<p>An important part of the design effort is development and selection of instructional materials, that is media conveying information/instruction.</p> <p>The active development, and or acquisition, of these materials is an essential part of the design process.</p>
8	Design and Formative evaluation	<p>Next one should commit to designing, and perform formative evaluation to receive data for revising and improving the instructional materials to make it suitable for the largest number of learners.</p>
9	Design and Summative evaluation	<p>Finally, summative evaluation should be conducted to examine the effectiveness of the system as a whole.</p>

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### 3.2.1. Merrill's Instructional Design Principles

Individuals have different preferences for their learning, for example, whether they prefer reading or listening. Learners' individuality creates challenges for e-learning environments as learners' various needs, preferences and traits need to be considered (Al-Chalabi and Hussein, 2020; Normadhi, et al. 2019). White and Ploeger (2004) argue that a properly designed online class should be learner-centric, which is in line with ID theory. A *learner-centered approach* puts focus on the learner's needs, skills, and interests (Norman & Spohrer, 1996), thus, content should be relevant and specific to learners' needs, roles, and responsibilities in professional life (Ghirardini, 2011).

The importance of learning material being grounded in relevant context has been appraised for a long time, by the introduction of situated learning (Brown, Collins & Duguid, 1989). The learning activities the learner should engage in and the context in which the knowledge is conveyed needs to be authentic, by reflecting the way and or situation in which the knowledge will be applied (Herrington, Oliver, Herrington & Sparrow, 2001). Scenario-based, or case-based, learning is an excellent method of training your users utilizing real-world case studies by working through them throughout their course. This provides your learners a situated experience in the course that is similar to challenges they will face on the job, and forces users to analyze their decisions in an environment that provides feedback that helps them get to the next step in the learning environment (Canonico, n.d.). Interactions involving explanations, and challenges to student thinking, are the essentials to scenario-based learning (Lundeberg, 2008, p. 1 in National Research Council, 2011).

Students can engage in explanatory interactions together or individually in a multimedia environment, and application of concepts to real life, examination of a situation from multiple perspectives, or reflection on how to approach a problem are examples of activities that can challenge the students' reasoning (Ibid). Online learners are further able to absorb the information more effectively when they see examples and are shown the task they will be able to do, or the problem they will be able to solve as a result of the course (Pappas, 2017).

Merrill (2002) has, through the study of various instructional design theories and models, identified five core principles for designing effective and efficient instruction, all of which are design-oriented rather than learning-oriented, centered on task-based learning. These principles concern: *connected to the real world*, *the learner's prior knowledge level*, *demonstration*, *application of knowledge in practice*, and *integration of new knowledge into the learner's world*.

Merrill's first principle introduces three main parts connected to problem-centered learning, that build on the idea that there must be a clear connection between the activities the learner should engage in and the real world. These parts are: *show task* and *task level*, which involve showing real-world examples, and *problem progression*, that suggest that the level of advancement should successively increase as learners progress.

In e-learning, this problem progression may involve branching scenarios or online group collaboration projects that are problem-centered, such as conducting a case study (Pappas, 2017). Al-Chalabi and Hussein (2020) have investigated the question of how the personalized parameter for adaptive learning can be implemented in the current e-learning environment and have identified some parameters that are of importance to consider, before the learning process' beginning, to promote stimulating conditions. One of these is including the *level of the learner's knowledge*. In line with this, Merrill's second principle stresses the importance of establishing the learner's initial prerequisites to provide sufficient knowledge foundation if needed. Thus, there are a variety of ways to involve this principle in the course design, such as adding real-world examples, simulations, and stories that meld the old knowledge with the new (Pappas, 2017).

Merrill (2002) argues that learners are more likely to understand how to apply their learning when information is demonstrated and presented with examples. Moreover, many theorists agree that if demonstrations are inconsistent with the intended outcomes, learning will be ineffective (Pappas, 2017). Merrill's third principle involves three parts: *demonstration consistency*, *learner guidance*, and lastly *relevant media*, which explain the importance of consistency between activities and learning goals, appropriate guidance from educators, and the use of media that facilitate learning.

Merrill further suggests that online learners have to apply the information and skills they have learned to get the full benefit of the e-learning course in his fourth principle. Three phases are described for application of knowledge in terms of practice consistency, diminishing coaching, and varied problems, that summarize that activities should align with learning outcomes, decreasing level of support as the learner progresses, and a variation of

problems for the learner to engage with. A single problem is insufficient for learning a new skill (Pappas, 2017), therefore it is important to alternate the challenges presented to the learner.

The fifth and final principle of integration pertains to meaning and context, as the learners must have a chance to integrate their newfound skills or knowledge into their daily lives (Merrill, 2002). The key term here is *transfer*, which is making use of new knowledge in different contexts or settings, making connections with existing knowledge, and putting it to work (Pappas, 2017). Merrill emphasizes the importance of encouraging sharing of knowledge between the learner and his/her world, as well as reflection on the experience, and lastly creation with the acquired knowledge. A summary of Merrill's principles is presented in table 3.2.

**Table 3.2**

*Merrill's five instructional design principles (Merrill, 2002).*

#	Principles	Description
1	Learning is promoted when learners are engaged in solving real-world problems	<p><i>1. Show task</i> This involves showing real-world examples.</p> <p><i>2. Task Level</i> Learning is promoted when learners are engaged at the problem or task level, not just the operation or action level. It is thus important to show real world tasks.</p> <p><i>3. Problem Progression</i> Learning is promoted when learners solve a progression of problems that are explicitly compared to one another. In order to master a complex problem, learners should begin with a less complex problem and successively be introduced to more complex problems. Through a progression of increasingly complex problems, learners' skills gradually improve until they are able to solve complex problems.</p>
2	Learning is promoted when existing knowledge (and skills) is activated as a foundation for new knowledge	It is important to lay a sufficient foundation for learners when building new knowledge, as well as defining the starting point. There are two possible starting points: (1) either students have relevant experience and then the first phase of learning is to be sure that this knowledge is activated and ready for use. However, (2) if students have not had sufficient experience, the first phase of learning should be to provide experience they can use as a foundation.
3	Learning is promoted when new knowledge is demonstrated to the learner	<p><i>1. Demonstration Consistency</i> Demonstrations should be consistent with the goals for learning.</p>

## *2. Learner Guidance*

Learning is promoted when learners receive appropriate guidance, including being directed to relevant information, seeing multiple representations of the task, and multiple demonstrations compared. It is thus important to show alternative points of view.

## *3. Relevant Media*

It is important to ensure that the media supports effective learning. Some forms of media may compete for learner attention while others complement and strengthen learning.

- 4      Learnings is promoted when new knowledge is applied by the learner

### *1. Practice consistency*

Practice activities should align with learning outcomes. This could include phrases like “recall or recognize...” or “predict a consequence of doing this right (or wrong)...”.

### *2. Diminishing coaching*

Learning is promoted when learners are guided in their problem solving by appropriate feedback and coaching. Build learner confidence by initially providing guidance, and then gradually reduce support, allowing the learner to take complete tasks more independently.

### *3. Varied problems*

Learners should be able to apply their learning to different contexts. Practice activities should be presented in multiple forms using a variety of question types in order to maximise the learner’s likelihood of mastering the skill.

- 5      Learning is promoted when new knowledge is integrated into the learner’s world

### *1. Watch me*

Learners are motivated when they recognise their own progress, so learners should be able to demonstrate and share their learning. This can occur when demonstrating or sharing their knowledge and skills to others, reflecting on their learning and understanding of their own lives.

### *2. Reflection*

Creating personal adaptations of the new knowledge and skill is one of the final stages of effective instruction. Reflection on the experience of learning is one way to achieve this, as is being asked to put their new knowledge or skill to work in their own personal context.

### *3. Creation*

The very last phase is about encouraging learners to transfer their learning to their own lives. Learning is promoted when learners can create, invent and explore new and personal ways to use their new knowledge and skill.

### 3.2.3. Instructional Methods and Bloom's Taxonomy

According to Ghirardini (2011), there are three main topics for different kinds of instructional methods. Each method can be delivered in different formats, using different types of media and communication tools. Most courses combine two or more e-learning methods, using different types of e-learning formats. These topics of method are listed in table 3.3.

The type of content is one aspect that decides what instructional method to use. Six main types of learning content are *facts*, *procedures*, *concepts*, *principles*, *interpersonal skills*, and *attitudes* (Morrison, Ross & Kemp, 2001 in Ghirardini, 2011; Anderson et al., 2001).

The distinction of cognitive domains is another valuable aspect when choosing how to present learning content to learners (Lasley II, 2016). Bloom's taxonomy explains the process of learning by dividing it into six types of cognitive performance. Those are: (1) *remember*, the learner is able to recognize or memorize information, (2) *understand*, the learner is able to reformulate a concept, (3) *apply*, the learner is able to use the information in a new way, (4) *analyze*, the learner is able to decompose and define relationships among components, (5) *evaluate*, the learner is able to justify a decision according to a criterion or standard, and create, the learner is able to realize a new product or approach (Anderson et al., 2001; Lasley II, 2016).

**Table 3.3**

*Learning instructional methods* (Ghirardini, 2011).

#	Topic	Methods
1	Expositive methods	<p>Expositive methods emphasize absorption of new information and require learners to listen and read or observe. This means that the learner is only absorbing the material and not interacting with it or making it their own. These methods are often used to communicate conceptual and factual knowledge.</p> <p><i>Example of methods</i></p> <p>Reading, videos, infographics, presentations, webcasting, webinars, case studies, worked examples and demonstrations.</p>
2	Application methods	<p>Application methods involve the learners in practical activities to perform procedural and principle-based tasks. When using these methods, it could be helpful to have a tutor or instructor to provide guidance and facilitate reflection for learners.</p> <p><i>Example of methods</i></p>

Demonstration (practice method), job aids, case- or scenario-based exercises, role play, simulations and serious games, guided research, and project work.

3	Collaborative methods	<p>Collaborative methods are based on dialogue and discussion among facilitators and learners. They add a social dimension to the learning experience by applying the principles of social constructivism and collaborative learning. They allow learners to benefit from having discussions and getting personal feedback.</p> <p><i>Example of methods</i></p> <p>Online guided discussion, collaborative work, and peer tutoring.</p>
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### 3.2.4. Assessment Media

Performance assessment is needed, as argued by Gagné et al. (1992), in order to understand what knowledge and prerequisites the learner possesses, and moreover to examine the learner's learning progress. By creating criterion-referenced test items, such as question-based quizzes, tests, and exams, as suggested by Gagné et al. (1992), the educator can pinpoint individual weaknesses and evaluate progress. It is crucial that assessment is aligned with learning objectives, meaning that it measures the expected outcomes set in the design stage. A learning objective is a description of the competencies and or performance capabilities the learner should acquire through completing a course (Ghirardini, 2011). Thus it combines two main elements: (1) the expected level of performance (through an action verb, such as "describe" or "explain"), and (2) the learning content (the type of knowledge or skills that must be learned). Therefore, questions or assignments should be designed to verify the achievement of a specific objective or the mastery of a given skill and can be done through several methods. Some typical tests are listed in table 3.4.

**Table 3.4**

Recreation of *Types of test for online training* (Ghirardini, 2011, p.116).

Type of test	Description
Prerequisite tests	used to verify if learners have the minimum required knowledge to participate in a certain learning course
Pre-assessment tests (or entry tests)	used to assess a learner's knowledge and skills before beginning a course, in order to personalize learning activities

Diagnostic tests	used to assess the achievement of a unit's learning objectives after the completion of a specific learning unit
Post-assessment test	used to assess the achievement of the course's learning objectives after the completion of the entire course
Certification tests	used to verify specific skills and knowledge inside the organization and are not necessarily related to a learning course.

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What type of assessment tests should be used and questions asked highly depend on the structure of the e-learning, that is whether it is structured as self-paced learning versus facilitated or collaborative learning. In self-paced learning, that is when the learner determines the pace of the course, assessment tests typically involve closed-ended questions, such as through multiple responses, fill-in-the-blank assignments, and ordering of elements (Ghirardini, 2011). In other words, questions with a more specific answer. During facilitated/collaborative learning, however, closed-ended questions are typically combined with exercises that are evaluated by the facilitator (Ibid.).

### 3.3. Learning Experience Design

While ID focuses on conveying informational content in an optimal contextual way, Learning Experience Design (LXD) applies design thinking principles to create an engaging learning experience customized to the learner's preferences and behaviors (Kilgore, 2016).

LXD is a combination of two domains: learning and design (LXD, 2021). It is the process of creating a learning experience that enables the learner to achieve the desired learning outcome in a human-centered and goal-oriented way. The design principle takes on a holistic perspective by understanding the needs and goals of learners, but also of the organization, the course, and other relevant parties (Johnson, 2016). This means that it focuses on both contents as well as the learner and her experience (Ibid.). In LXD solutions are developed from the individual learner's perspective, to create engaging experiences resulting in acquired/increased skill and or knowledge (Jenewein, 2020). The fact that the design serves a purpose to learn is what differentiates LXD from other design disciplines (Floor, 2016).

Both design and learning are broad and diverse domains which in turn consist of many different elements and expertise. According to the Learning Experience Design Organisation (2021), this interdisciplinary field can be divided into four blocks, incorporating elements from these different disciplines and merging them to reach a holistic view of the experience.

The first block, *Human-centered design* (HCD), includes disciplines about the human experience. The HCD approach is described in more detail above in [3. Theory](#). Further elements related to this field are for example interaction design, user experience design, and

game design. You should distinguish and act upon differences between groups of learners and even individual learners (Floor, 2016; Learning Experience Design Organisation, 2021).

The second block connects to *Goal-oriented design* and concerns design disciplines that are focused on creating products that serve a clear purpose (Floor, 2016). Choosing and formulating the right goals is an important part of designing a learning experience (Learning Experience Design Organisation, 2021). Thus you should formulate the desired learning outcome to guide your design. Elements related to this field are for example game design, industrial design, and graphic design.

The third block involves more scientific disciplines about theories of human learning. It is essential to comprehend how human cognition works and how people learn from experience (Floor, 2016; Learning Experience Design Organisation, 2021). Designers typically use psychological expertise to understand the people they design for. Elements related to this field are for example cognitive psychology, neurology, philosophy, and experiential learning.

The fourth and last block is connected to educational professionals, putting the theory of learning into practice (Floor, 2016). Having both a theoretical and practical understanding of learning is essential as it helps to design goal-oriented learning experiences that work in real-life situations (Learning Experience Design Organisation, 2021). Elements related to this field are for example teaching, educational expertise, training, and instructional design.

An LXD process should be iterative, in the sense that it should cover the typical design phases of research, experimentation, ideation, conceptualization, prototyping, iteration, and testing (Floor, 2016). It can be described as a fivefold process, concerned with (1) *strategy*, (2) *requirements*, (3) *structure*, (4) *interaction*, and (5) *sensory* (Plaut, 2014). These are described in table 3.5.

**Table 3.5**

*Phases of the Learning Experience Design (LXD) process (Plaut, 2014).*

#	Topic	Methods
1	Strategy	The process should start by stating objectives by identifying the needs and goals of the learners as well as their organization, such as which additional skills and knowledge they need to be able to change a behavior and what they hope to accomplish by doing this.
2	Requirements	Next, requirements should be stated by identifying what topics, methods, activities, and logistics are required to create a successful learning experience. Assessment criteria should also be stated.

3	Structure	Next, decisions should be taken on how the topics, activities, logistics, and assessments should be structured.
4	Interaction	After the structure is defined, focus should be on the instructional design, in terms of what the learners actually will be doing, hearing, and seeing during the learning experience. During this step, tracking of learners' progress and the question of feedback should also be addressed.
5	Sensory	The final step is concerned with how the materials should implicitly communicate information to the learners about the experience they are about to have.

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### 3.4. Research Through Design

By research through design (RtD) approach, designers aim to embody their insights derived from the design process, most typically, by presenting an artifact or a system design (Gaver, 2012). This enables people to interact with the design, making it possible to observe, understand and talk about it in a more concrete way (Stappers & Giaccardi, n.d.).

Research through design consists of performing design activities that contribute to acquiring knowledge about something in a formative way (Stappers & Giaccardi, n.d.; Zimmerman & Forlizzi, 2014). The knowledge generated through research through design can vary, but for example connect to the prototype itself, the people using it, or the interactions between the prototype and people, to name a few. Zimmerman and Forlizzi (2014) describe three approaches that can be adopted in the RtD process, of which the first is the *Lab practice*, an approach that combines experimental psychology methods with design action, and is suitable for creating novel and appealing interactions and solutions, with a focus on the aesthetics. The second approach is *Field*, which is rooted in participatory design and user-centered practices, and thus embraces both scientific methods from sociology and anthropology in combination with design practices, to explore problem spaces and develop solutions. *The showroom* is the third practice, in which methods derived from art, fashion, and design are adapted to explore designs of critical nature that may provoke and force reconsideration in beholders.

Throughout the design process, Zimmerman and Forlizzi (2014) suggest five specific steps to follow: *select*, *design*, *evaluate*, *reflect and disseminate*, and lastly *repeat*, which are further described below.

The first step, *selection*, involves choosing a research problem or a design opportunity to investigate. Decisions on for example a context and target population to focus on, a societal issue or insight, and or a theoretical framework to apply, should be taken. This step further concerns preparations in terms of selecting a RtD practice to follow, or deciding on a mixture

of approaches, as well as identifying skills within the research team and addressing stakeholders (Ibid.).

The step concerned with *design* is about exploring to understand what the state of the world is and how one can offer to the field in terms of, for example, a new perspective or problem framing (Ibid.). A literature review should be conducted to understand the state of the art and the questions and concerns of other designers working in this space, and fieldwork can be performed, alternatively through a design workshop, to yield interesting ideas. With the initial framing, one can explore solutions by creating new product or service ideas and then select and iteratively evolve and refine this idea.

When an artifact has been produced, it should be *evaluated* based on the concerns of the specific RtD practice selected and on concerns specific to the research question. Following this, the team should *reflect* on what insights the project has brought and then work to disseminate the research (Ibid.). Lastly, Zimmerman and Forlizzi suggest that the RtD process should favorably be iterative, to keep exploring and evolving the ideas and solutions thus steps should be *repeated* when necessary.

## 3.5. E-learning Best Practices and Related Work

This subchapter introduces the concept of microlearning, an analysis method for understanding the target user as an initial step in the process of developing an e-education originated by Dilloughery and Schneeberger (2021), and lastly the E-Learning Usability Properties Framework composed by Koohang and du Plessis (2004) is presented.

### 3.5.1. Microlearning

There has been a big shift towards developing shorter topics and microlearning in recent years, mostly due to people learning on mobile devices, often on the fly, but also because e-learning competes against all kinds of quick answer solutions available on search engines, such as Google, and social networks (Greany, 2019). Greany (2019) argues that, rather than sitting through hours-long courses and forgetting most of the content in a few weeks, there is a big benefit in breaking down learning content into smaller chunks, as users can do something with that learning in-between, and build up their competence and confidence incrementally. She further suggests that e-learning best practice is when it is designed for shorter sittings, but with pointers to tasks or actions in-between. One way to accomplish this is through microlearning.

Microlearning is an instructional method for learning that could take many forms. It can be delivered through different combinations of content presentation, such as infographics, interactive resources, simulations, games and quizzes, animations, and videos (CommLab India, 2019), with different intentions, such as to stimulate reflection, task performance, social interaction, and coaching, to name a few (Thalheimer, 2017 in Kapp & Defelice,

2019). Microlearning should be short (Torgerson, 2016 in Kapp & Defelice, 2019; Tipton, 2017, 2018 in Kapp & Defelice, 2019), simple, and engaging (Tipton, 2017, 2018 in Kapp & Defelice, 2019), fit naturally into the daily workflow, be based in theories on human learning, and adapt continuously to ingrain the knowledge employees need to be successful (Dillon, 2018 in Kapp & Defelice, 2019).

A crucial aspect of what makes e-learning advantageous is its potential to respect its audience's use of their own time. E-learning effectiveness is further measured on whether it makes a difference to a person's behavior or performance habits. To create an effective e-learning design, modern learner trends should be considered, as well as the needs and habits of its end users (Greany, 2019). Efficiency is often an outcome of minimizing cognitive load for users. The human mind has limited capacity, which is why it is highly important to design to minimize extraneous cognitive load, to avoid activities that interfere with the learning (Paas, Renkl & Sweller, 2003). The importance of mindful prioritizing of content is critical to maximizing the usability of an interface, and extraneous cognitive load, that is cognitive capacity devoted for elements/actions that do not add to the user's goals/motives, should be minimized by the exclusion of elements that do not help the user to understand the content (Whitenton, 2013; Paas et al., 2003). Consideration of cognitive load is an important part of the design of multimedia environments (Mayer & Moreno, 2003) and should be actively considered in the ID approach (Paas et al., 2003).

### 3.5.2. E-learning Essential Methods

According to Dilloughery and Schneeberger (2021), the key to a successful e-learning project is to start with a good understanding of the end goal and the individual tasks that go into creating an online course, as well as developing multidimensional project requirements. This step can be broken down into several parts, including analysis of *user*; *needs*; *technique*; and *resources* (see table 3.6).

**Table 3.6**

*Dilloughery and Schneeberger's (2021) analysis methods.*

Type of analysis	Description
User analysis	Involves research about the audience for the e-learning product and important characteristics such as what they already know, as well as their context. Researching the people who will actually learn from the experience is a vital part of the design process.
Needs analysis	Includes defining what learners must understand after taking the course and how they will be able to better perform the task in the field. The aim is to change and improve learners'

knowledge and capabilities, and a needs analysis defines how the e-learning course will support that.

Technical analysis	Dilloughery and Schneeberger (2021) stress the importance of doing research about technical aspects, such as what tools and platforms are available and best suited for the project, but also about learners' technical habits and experiences.
Resource analysis	Other important aspects are factors such as time and budget. For example, if there is pre-existing content to take advantage of when educational material is already available but needs to be translated into a digital learning course.

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### 3.5.3. E-Learning Usability Properties Framework

The E-learning Usability Properties Framework is grounded in the e-learning ID process that takes content, user, and system into account (Koohang & du Plessis, 2004). The framework identifies two major concerns for usability properties needed to be addressed to result in usability attributes (for a list of usability attributes see table 3.7). These two are whether a design *works well* and *looks great* (Koohang & du Plessis, 2004). Within these paradigms, Koohang and du Plessis (2004) distinguish five categories of usability properties connected to functionality and the look of an e-learning system: *presentation*, *navigation*, *communicative enablement*, *technical functionality*, and *learner support*.

The first concern of the looks of the design they explain is addressed through a *presentation*. Aesthetics is at heart in this category, and consistency, visual impression, copywriting, and choice of colors are mentioned as key concerns.

The remaining categories of properties, Koohang and du Plessis (2004) explain, are concerned with the “work well”-paradigm. For each category, key objective usability attributes are listed.

*Navigation* is mainly connected to the effective usage of the system. This means that to support learner control and prevent incorrect operations the navigational structure of the system needs to be clear. Objective usability attributes linked to navigation are *effectiveness*, *efficiency*, *understandability*, *flexibility*, *learnability*, *memorability*.

*Communicative enablement* is concerned with the interaction between learner and content, as well as between relevant participants in the e-learning environment, commonly other peers of educators, to maximize users' experience. What type of communicative means that is suitable is highly dependent on the nature of the interaction, for instance, whether it is synchronous in time or not. The objective usability attributes linked to communication are *effectiveness*, *efficiency*, *flexibility*, *memorability*, and *operability*.

*Technical functionality* is linked to the transparency of the system. To enhance a friction-free interaction it should at all times be visible to the user what is happening and why. The system should furthermore be robust, to minimize the risk of malfunctioning during usage. The objective usability attributes connected are *effectiveness*, *efficiency*, *flexibility*, *memorability*, and *operability*.

Users need support in terms of feedback from the system to experience a flow in their usage. *Learner Support* is concerned with user behavior triggered feedback during activities, but also tolerance of incorrect user operations and available information, such as a glossary. The objective usability attributes linked to learner support are *effectiveness*, *efficiency*, *understandability*, *flexibility*, and *learnability*.

In addition to the objective attributes, the subjective usability attribute of *satisfaction* applies to each category respectively.

**Table 3.7**

Recreation of *Usability attributes in e-learning context* (Koohang & du Plessis, 2004, p.41)

Attribute	E-learning Context
Effectiveness	The e-learning instructional system is effective when the e-learner completely accomplishes a given task with accuracy and precision
Efficiency	The e-learner becomes efficient in using the e-learning system when he or she has gained adequate skills and ability to perform a given task, which can lead to improved productivity.
Flexibility	The e-learning system is fully adaptable to variation and changes in tasks. The e-learning system allows the e-learner to become accustomed to changes that are given in various tasks.
Learnability	The e-learner learns the system in a short amount of time and can easily start accomplishing tasks.
Memorability	When returning to the system, the e-learner remembers how to use the system without reiterating the learning cycle.
Operability	The e-learner is able to and has rights to operate and control the e-learning system with ease.
Understandability	The e-learner easily understands the aptness of the e-learning system in accomplishing a given task.
Attitude & Satisfaction	Attitude & Satisfaction attributes refer to the degree of the e-learner's approval, pleasure, happiness, fulfillment,

contentment, agreement, liking, comfort, appreciation, and enjoyment of/with the e-learning system. All the properties contribute to meet the requirements of this attribute.

Attractiveness	The ability of the e-learning system to attract and draw a-learner's attention. It also addresses the aesthetic satisfaction that the system provides the user.
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### 3.5.4. Social Aspect

A central part in terms of online learning is the possibilities of interaction, between learners' as well as between learner-teachers. Thus, communication tools become a central concern for learning online. In an e-learning environment this communication between learners and educators can be either synchronous and asynchronous, or involve both (Ghirardini, 2011). Asynchronous tools, such as discussion forums or e-mail, can be preferred in situations when the topic to be discussed requires more reflection and the learner works on it for a longer period, while synchronous tools, such as instant chat and video-/audio conference, promote instant discussions and provide a more social engagement (Ibid.). For interaction, such as a discussion board, to promote student satisfaction and enhanced learning experience the structure of the discussion topics must be clear and easy to navigate (McFarland and Hamilton, 2005). Delay and low frequency of answers in interaction are some key issues that risk hinder learners' in their learning process (Kite et al., 2020; McFarland and Hamilton, 2005; Ishtaiwa & Abulibdeh, 2012). Thus, active interaction, not only in an educational sense but also in social, is crucial to promote an appreciated and engaging learning context (Chen et al., 2010; McFarland & Hamilton, 2005).

Students report enjoying interacting with peer learners, enabling them to share ideas and questions in discussion forms or similar communicative channels, and say that this contributes to an enhanced learning experience (Heirdsfield et al., 2011). Interaction with peers is considered critical for learners to reflect and understand the education material (Kite et al., 2020).

Communicative channels that are asynchronous in the sense that they usually are question-answered based and characterized by time delays in between interactions, such as discussion boards, risk however to be limiting and not very engaging (Holmes and Prieto-Rodriguez, 2018; Ishtaiwa & Abulibdeh, 2012). For such interaction settings to be valuable lecturers as well as learners need to contribute actively and consistently (Ishtaiwa & Abulibdeh, 2012) and the social aspect needs to be well developed (Chen et al., 2010).

Collaborative learning and dialogic communication are important factors for fostering a social environment, why the system must provide tools and features enabling learners to interact among themselves, as well as with the educator (Wu et al., 2010). A positive learning climate is central in making learning easy and fun (Ibid.), why the system, as well as facilitator, should encourage learning.

## 3.6. Gamification in a Learning Context

Gamification involves techniques that designers use to insert gameplay elements in non-gaming settings, intending to enhance user engagement (Interaction Design Foundation, 2020). Additional goals of including gamification in learning can be to attract the attention of learners, increase their interest in solving educational tasks, and their understanding of how to apply the received knowledge in practice.

### 3.6.1. Gamification in Learning and the Challenge for Designers

Research has shown potential for implementing game mechanic elements in e-learning contexts (Buckley & Doyle, 2016; Poondej & Lerdpornkulrat, 2019), for example, connected to enhancement of learners' engagement, improvement of particular skills, and optimization of learning.

According to Kapp (2012), game design has broad utility for learning and development and for motivating at-work behaviors, among other things. Furthermore, Kapp argues that e-learning favorably should use games, instead of presenting text and multiple-choice questions with little feedback, to increase engagement. The potential to fail a test can cause stress and fear in learners, negatively affecting learning (Anadea, 2018). Abandoning standard learning methods for gamification methods involves embracing new efficient strategies for avoiding and correcting mistakes, allowing the learner to learn by trial and error. As game elements give experiences meaning, they provide a set of boundaries within a "safe" environment to explore, think and try things out, promoting motivation to succeed and relieving the stress of failure (Kapp, 2012).

Anadea (2018) argues that gamification elements in e-learning can enhance motivation significantly, for example by motivating learners to learn, to visit the site more often, and to complete training, and can be used for many educational purposes. For example, splitting the entire educational course into smaller blocks with goals and using progress as a visual representation of continuous growth is beneficial, as each performed block of exercises can give users a sense of victory (Anadea, 2018). Introducing rewards can thus play on our internal reward system by stimulating our dopamine release (Anadea, 2018).

Social interaction, such as tasks of competition or collaboration, can also be of value, as when learners act together to achieve goals, the sharing of ideas, debate, critical thinking, and strategic thought processes are encouraged (Mulkeen, 2018).

Nevertheless, Interaction Design Foundation (2020) brings up some challenges with implementing gamification in design, such as finding the right balance between the fun factor and the tone of the subject. Designers must tailor the gameplay and the rewards precisely to the users to ensure that gamification serves a clear purpose. Simultaneously, user needs must be fulfilled without forcing them to take certain actions. Users' actions must be voluntary and designers should not push or manipulate them to adopt desired behaviors but instead insert

nudges and prompts which they can find on their own and thereby feel in control of their own experience (Interaction Design Foundation, 2020).

To get gamification right it is vital to know both the users and exactly how they should fulfill the goal or purpose of the course. Motivations will vary according to the task, objective, and learner, and the gamification mechanics must suit the users. Individual differences in users make them interested in and motivated by different things. Some users may be motivated by competition, while others are more collaboratively driven. Therefore it is crucial to balance the gamification elements in learning (Olah, 2020). Some are rather motivated by meaning or purpose. A clear presentation of the reasons for the work, that is, what is to be done and why can motivate those users' learning (Ibid.). To derive the most use out of introducing gamification elements into a learning context, the elements should be of relevance for the cause and context, and not be chosen with the sole purpose of adding game design elements (Prasad, 2020).

User research is necessary to pinpoint who the users are and to understand how they see their world. For example, it is important to define if their work environment suits a challenge-oriented experience with points, awards, and competition. A successful project covers both aspects, to increase engagement through pleasurable activity and satisfy the bigger picture, the original purpose for the design.

### 3.6.2. Techniques for Gamification

Implementing gamification into practice could be done in different ways. Some examples of common game elements are *challenges* (Hamari, Koivisto & Sarsa, 2014), *rewards*, *rapid feedback cycles*, and *competition* (Buckley & Doyle, 2016; Apostolopoulos, 2019).

Letting users test and apply their knowledge is one way to sustain interest and motivation. Introducing *challenges*, such as mini-quizzes, can spur the feeling of achievement (Olah, 2020). Introducing rewards during the experience can add to this further. A *reward* is typically the result of achieving a goal or overcoming an obstacle. It must not necessarily relate directly to the overall goal but can notice the player, or learner, on the progression of competence (Buckley & Doyle, 2016). Thus, progress tracking is often enabled and guided by reward systems. There are many different types of awards. There are for example *experience points* that are gained by performing different actions within for instance an educational course, such as completing a lesson or a quiz or engaging in exploratory content. *Badges* are tokens of some type that are collected similar to experience points: through the achievement and completion of different tasks (Olah, 2020). They could however also symbolize failure or punishment if negatively loaded, as in a grading scale (Lee & Hammer, 2011). As the user is progressing in a game or a course, by collecting points or reaching milestones in the experience, he/she can advance through *levels*, which is another kind of reward. A final example is *easter eggs*: by hiding unpredictable rewards in tasks or paths curiosity and motivation can be increased (Olah, 2020). As it is unpredictable, it will excite the user more, compared to predictable rewards, however, Olah (2020) stresses the

importance to consider what information to hide in such exploratory content, as it should not be mandatory if it is optional for the user to explore it.

As rewards are introduced the concept of potential failure naturally follows. To sustain a positive experience and not kill users' motivation, feedback cycles must be rapid and stakes must be kept low (Lee & Hammer, 2011). This means that as the user explores the content and tries different actions, such as answering a question, he/she must receive *immediate feedback* and should not be punished for this trial and error mode. Feedback on the user's progress should further be provided through clear progress indications, such as a progress bar, to acknowledge the user on the system status and his/her progression (Poondej & Lerdpornkulrat, 2019). This is a technique for motivating learners (Anadea, 2018) and transparency in the user's learning progress promotes emotions of accomplishment and satisfaction. Therefore it is necessary not to solely produce the content, such as for an educational course, but to think over its motivational structure.

### 3.7. Interface Design Guidelines and Principles

There is a wide range of design guidelines and principles that can guide the design, in terms of both visual appearance and functional components, of a user experience, building on principles of learnability, efficiency, intuitiveness, and consistency, to name some (Babich, 2020).

Design guidelines fall into several topics such as style, layout, graphical elements, text, accessibility, design patterns, etc. This chapter focuses on some main principles, heuristics, and approaches and is selected to fit this project.

#### 3.7.1. Web Design & Usability Guidelines

Several usability-related issues, methods, and procedures require careful consideration when designing and developing websites (Shneiderman, 2006). These can include the context within which users will be using the service; the experience levels of the users; the types of tasks users will perform on-site; the types of computer and connection speeds used when visiting the site; evaluation of prototypes; and the results of usability tests (Shneiderman, 2006, p.5). Shneiderman's (2006) usability principles and guidelines will be considered throughout the design in this project. For an extensive list of principles, see Shneiderman (2006).

Furthermore, The Web Content Accessibility Guidelines (WCAG) (2018) describe standardized frameworks for content on the web to ensure accessibility and inclusion.

### 3.7.2 Nielsen and Molich's Ten User Interface Design Guidelines

Jakob Nielsen and Rolf Molich established a list of ten user interface design guidelines in the 1990s. They are usually referred to as “heuristics” because they are broad rules of thumb and not specific usability guidelines, and cover several aspects of design such as the importance of consistency; user control and freedom; error prevention; and aesthetics of the design (Nielsen, 2020). Following these user interface heuristics allows us to design with usability, utility and desirability in mind (Wong, 2020), which is why they will be considered as a complement to Shneiderman's (2006) guidelines. For an extensive list of these design heuristics see Nielsen (2020).

### 3.7.3. Color Theory

The process of color selection plays a significant role in design, and is typically a more complex process than solely based on a UI designer's taste and preference (Tubik Studio, 2017).

Designers need to consider the psychological factors involved in color to create a design that expresses the desired mood and feeling. Therefore, the term color psychology has arisen in the design world where designers study the influence of colors on human mood and behavior (Arhipova, 2017). Psychologists have documented that color can have an effect on subconscious judgment and in addition even increase memory, as applying color on visual scenes can help viewers process and store images more efficiently, compared to colorless (Morton, 2019). Accurately chosen colors can moreover advance the usability of the product (Arhipova, 2017).

To convey the right tone, message, and call to action, designers need to understand what colors mean and what reactions they evoke. It is important to learn and understand the target audience, not least because color preferences and meanings depend on many factors including age, gender, and culture (Arhipova, 2017). In this project, the interpretations of colors are from a Western cultural perspective.

### 3.7.4. Cognitive Workload

Interacting with anything demands cognitive effort. In the design of interactive systems and products, it is crucial to address the level of cognitive effort demanded by the system, that is measuring the cognitive workload when using a prototype (Maguire, 2001b).

There are numerous ways to assess this, for example through the use of questionnaires, which are useful in environments when system users are under stress (Maguire, 2001b), such as potentially the case with healthcare personnel. The Subjective Mental Effort Questionnaire (SMEQ) is a questionnaire with one scale where users are asked to report the amount of effort they feel they have invested in a given task (Ibid.). The Task Load Index (TLX) on the other hand has six scales, differentiating between the following aspects: mental, physical, temporal,

performance, effort, and frustration, to measure the person's perception of what a task has demanded from them (Ibid.).

# 4

## Methodology

This chapter lists a number of examples of design methods commonly used in the different phases of the design process, structured according to the HCD phases: *understanding and specifying the context of use*, *specifying user requirements*, *producing design solutions* and *evaluating the design* (ISO, 2019). The methods are listed alphabetically.

Note that a design method does not necessarily belong in one HCD phase exclusively, but can potentially be applied in different ways at various stages of the process and in various phases for different purposes. However, in order to avoid redundancy each method is only mentioned once.

The specific methods applied in this project are specified in the following chapters.

### 4.1. Understanding and Specifying the Context of Use

According to Maguire (2001a), a product that is developed will be used in a certain context and be used by a user group with certain characteristics that need to be identified. The following methods could be used to get a good understanding of the context of use.

#### 4.1.1. Competitor Analysis

Evaluating existing, similar services can provide valuable information about how existing solutions meet user needs. The goal of conducting a competitor analysis is thus to explore already existing solutions and investigate their strengths and their weaknesses, in order to understand direct as well as indirect competitors and how to do better than them (Dalrymple, 2018; Douglas, n.d.). It is a crucial step to the foundation of the solution as it provides strategic insights into the features, functions, flows, and feelings evoked by the design solutions of the competitors. Focus should be on understanding exactly what they are doing right (or wrong) to create an effortless user experience and a product that users appreciate and enjoy.

### 4.1.2. Context of Use Analysis

This method is used to identify detailed information about the users and context of use, through methods such as interviews with stakeholders, questionnaires aimed at end users or secondary literature research. A context of use analysis should cover research about *user group*, *task*, *technical environment*, *physical environment* and *organizational environment* (Maguire, 2001a; Maguire, 2001b), which is described in more detail in table 4.1.

**Table 4.1**

*Factors to consider in a context of use analysis* (Maguire, 2001a; Maguire, 2001b).

Factor	Description
User group	<p>Systems skills and experience, task knowledge, training, qualifications, language skills, age and gender, physical and cognitive capabilities, attitudes and motivations.</p> <p>User group analysis is a crucial step as the design and delivery of e-learning will be influenced by key characteristics of the learners. If necessary, the characteristics of different types of users should be defined, such as individual differences in terms of levels of experience of physical capability.</p>
Tasks	<p>Task list, goal, output, steps, frequency, importance, duration, dependencies.</p> <p>The goals of the users and the overall goals of the system shall be identified. The characteristics of tasks that can influence usability and accessibility shall be described, e.g the way in which users typically carry out tasks, the frequency and duration of performance.</p>
Technical environment	<p>Hardware, software, network, reference materials, other equipment.</p> <p>The technical environment should be considered, including the hardware, software, and materials.</p>
Physical environment	<p>Auditory environment, thermal environment, visual environment, space and furniture, user posture, health hazards, protective clothing and equipment.</p> <p>In addition, the relevant characteristics of the physical shall be described. The physical attributes include issues such as thermal conditions, lightning, spatial layout and furniture.</p>

Organizational environment	<p>Work practices, assistance, interruptions, management and communications structure, computer use policy, organizational aims, industrial relations, job characteristics.</p> <p>Work practices and routines regarding educating personnel is key. This involves defining the amount of time available for e-learning and the learning context. This information influences the amount of content to be provided and the need for chunking the content into small units. It is also important to define the location where learners will participate in e-learning and from where they can access the internet.</p>
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### 4.1.3. Identify Users and Stakeholders

This method involves identifying all the users and stakeholders who may be impacted by the system. This will help to ensure that the cares and needs of all those involved are taken into account (Cone, 2018), and, if required, tested with and by them. The aim is to identify them early in the process and engage them effectively and regularly throughout the project to not miss any critical information (MacDonald, 2016).

### 4.1.4. Interview

User interviews is a UX research method during which a researcher asks users questions about a topic of interest to obtain qualitative data, with the goal of learning about that topic (Pernice, 2018). The level of structure of interviews and control of the interviewer can be balanced according to how much one already knows and what one wishes or needs to know about a certain topic of interest (Preece, Rogers, & Sharp, 2015). While structured interviews can be somewhat similar to questionnaires, with mainly directed, closed questions, unstructured and semi-structured interviews respectively allow for more freedom, as the first is more similar to a conversation on a certain topic, and the latter is structured by a script of questions but allow for immersion and elaboration as needed (Ibid.).

### 4.1.5. Observation

By performing observations the researcher can obtain a first hand look into a context in terms of valuable data acquired through different levels of participation (Preece, Sharp, & Rogers, 2015). Observations can be performed in different phases of the project process, yielding either quantitative or qualitative data needed for the particular phase. In early stages for example, observations can be done to reach an understanding for a problem space and context, goals and tasks, and user behaviours (Ibid.).

#### 4.1.6. Questionnaire

A questionnaire is defined as a research method for collecting data from users to gain information and insights on various topics of interest (Shaded, 2019). Questionnaire is a powerful tool to quickly and easily collect a large set of information on a wide range of topics, especially demographic data and opinions (Preece, Rogers, & Sharp, 2015).

#### 4.1.7. Secondary Research

Secondary research, or desk research, is a research method that involves using already existing data to gain insights about users and their current work situation, as well as the topic of discussion (Ideo, n.d.b). This is done to acquire a comprehensive understanding for the challenge and topic, as well as users, before heading into the field.

#### 4.1.7. Workshop

Kaplan (2019) describes UX workshops as “intensive collaborative sessions used to solve problems and enable progress on a particular challenge throughout the design timeline”. It is usually arranged with people who represent different roles or teams involved in a particular project, such as key stakeholders, subject matter experts (SMEs), and the design team to name a few, in order to align on purpose and goals with the project and get clear on the change they want to achieve, in the near-term and long-term perspective. Kaplan (2019) describes this type of workshop as a “*discovery workshop*”, and argues that exploration of and alignment on impact goals will ensure that the team and the stakeholders share a vision of success. Kaplan further lists some additional kinds of workshops, for example: *empathy workshops*, for reaching an understanding for and priority of user needs, and *design workshops*, for rapid generation of ideas and diverse discussions.

### 4.2. Specifying User Requirements

A central part of the *Human-centered Design Process* is to gain an understanding of users and know their needs (Maguire, 2001a). The following sections present methods to utilize the findings discovered in the previous phase, summarize the problem domain, user requirements, and ideas.

#### 4.2.1. Affinity Diagram

Affinity diagram is an effective technique for organizing a lot of information. It allows designers to organize ideas or findings by grouping them and placing related concepts together (Maguire, 2001b). This can be a valuable method following a brainstorming session where many ideas and solutions have emerged (Ibid.), but it can also be used to organize research findings in earlier stages in the design process.

### 4.2.2. Define Course Sequence

This method should help answer the question of how the learning objectives should be sequenced when structuring a course, and could be done by sketching out a diagram that shows the hierarchy among the objectives where some objectives are at a higher level than the others (Ghirardini, 2011). The outcome of sequencing is a course structure where each element corresponds to a specific learning objective and contributes to the achievement of the overall course goal.

There are several methods that can be used to organize and sequence the content. Ghirardini (2011) lists a number of examples, among these the job-context principle, that suggest that in a job-oriented course the content can be organized to follow the order of the actions in the real job environment.

### 4.2.3. Define Learning Objectives

When designing for an educational context, it is important to formulate a set of learning objectives required to achieve the general, high-level course objective, in order to gain an understanding for what the learner is expected to learn by participating in each learning unit, and in the course as a whole (Ghirardini, 2011). Thus, such learning objectives should be specified for the course as a whole, as well as for each single activity, by looking at the tasks and content elements identified in a task and topic analysis in order to translate the overall course goal into more specific learning objectives (Ibid.). Learning objectives help distinguish between the “good-to-know” and “must-know” content, and determine the emphasis every piece of information needs in the training. Furthermore, Ghirardinin (2011) explains how learning objectives define the expected outcome of each learning unit, concretizing what knowledge and or skill the learner should gain after each unit.

### 4.2.4. MoSCoW Method

The MoSCoW method is one approach to define requirements and scope of a project (Interaction Design Foundation, 2016). Requirements, or other content, is prioritized based on four rankings: *Must have*, *Should have*, *Could have* and *Would have, but won't* (Ibid.). The level of importance is decreasing along the scale from *Must* to *Would*, where *Must have* requirements are needed for the project to succeed, *Should have*s are advantageous but not required, *Could have*s are favorable or interesting but should be less prioritized compared to *Should have*s, and *Would like* are not critical or not appropriate at this stage, but could be interesting in the future (Ibid.).

#### 4.2.5. Personas

Personas are a means of representing users' needs and represent the most important user groups, as well as what differentiate them apart (Friis Dam & Siang, 2021). These personalities create a concrete visualization of the different kinds of users within the target user group and should be based on the insights derived from preceding user research methods. Creating personas should foster empathizing with different kinds of users, by promoting understanding of users' needs, experiences, behaviours, and goals, as well as helping step out of a designers perspective into a user perspective (Ibid.). Potential design solutions can then be evaluated against the needs of a particular persona and guide the ideation process.

#### 4.2.6. Requirements Specification

Specifying requirements concerned with functionality, usability and organization, among other potentially relevant perspectives, is usually a key activity in the design process (ISO, 2019). According to ISO (2019) this should be done in HCD projects, in order to organize explicit statements of user requirements in relation to the context of use and the business objectives.

Requirements can favorably be organized into different levels, ranging from high level to more detailed, connecting to: *business*, *user*, and *system* (Mehta, 2019). It is crucial to acknowledge requirements on all levels, in order to reach a successful product (Ibid.). Data gathering for this document can be done through different methods, such as interviews with users and stakeholders, questionnaires, and other types of research, and should be iterated on throughout the design iterations (Ibid.).

#### 4.2.7. Scenarios of Use

Scenarios of use are stories that display how different users might interact with a product or service to achieve a goal (Usability Book, 2020). The scenarios help clarify the user requirements, as the designer understands the context of use further and what barriers or conditions might hinder the use of the product by providing a context of the persona on a detailed level, their goals, when and where they might complete tasks, and their motivations (Interaction Design Foundation, n.d.b). Furthermore, scenarios give detailed realistic examples of how users should carry out the task in a specific context with the future system.

#### 4.2.8. Task and Topic Analysis

Task analysis is the process of learning about users and understanding in detail how they perform their tasks and achieve their intended goals. There are several types of task analysis but among the most common techniques are *cognitive task analysis* and *hierarchical task analysis* (HTA) (Komninos, 2020b).

By decomposing high-level tasks into more detailed components and sequences one creates a detailed record over the specific sequence of steps needed to reach the intended goals (Komninos, 2020b). The method also includes identifying the knowledge and skills needed to support those actions and decisions. This will help to define content for job-oriented learning courses that aim to develop or reinforce job-related skills (Malamed, n.d.).

In the development of an educational service, such as an e-learning system, the task analysis can be completed by conducting a topic analysis, which is carried out in order to identify and classify the course content (Ghirardini, 2011). A topic analysis is favorable especially when developing an education designed to provide information or educational objectives (Ibid.) Visual instruments, such as mind maps, concepts maps and process diagrams can help clarify connections among content elements.

#### 4.2.9. Training Needs Analysis

The training needs analysis allows the identification of general, high-level course goals (Ghirardini, 2011). The method provides data about the difference between the current state and the desired future. This step is about sorting through all of the course content and separates the “nice to know” information from the “need to know” and the task-based content.

#### 4.2.10. User Story Mapping

Creating user stories is a method for visually mapping out the tasks or steps a user needs to perform from beginning to end during the interaction with an interface. Story mapping is done through organizing sketches of the interactions a user needs to go through to reach their goals when using a (digital) product, and should act as a foundation for discussions within the team (Kaley, 2021). Thus, while scenarios of use focus on the context in which a system or products will be used, story maps focus on the actual interaction.

A story map should cover three levels of hierarchically structured actions: *activities*, *steps* and *details* (Kaley, 2021). Activities represent the main, high-level tasks, steps are what the user must do in order to complete the activity, and details are, as its term suggests, even more concretized information on how this should be done (Ibid.). This method can favorably be used in many phases of the design process to spur discussions and to make sure the team has reached a collective perception of the interaction (YOW! Conferences, 2017).

### 4.3. Producing Design Solutions

This section presents methods for translating ideas into designs and prototypes.

### 4.3.1. Brainstorming

Brainstorming is an ideation method design teams use to generate ideas to solve clearly defined design problems in controlled conditions and a free-thinking environment (Interaction design foundation, 2011).

### 4.3.2. High Fidelity Prototypes

Creation of high fidelity prototypes are suitable in the design process when prototypes of lower fidelity have generated feedback, bringing the process forward towards a final solution (Pernice, 2016). It is an appropriate method to communicate the ideas and suggestions to people outside of the team, as it should present the vision in a graspable way. The high fidelity prototype should answer questions in more detail, for example regarding the navigational structure, the components and their action and the complete user flow (Pierzchała, 2018).

As any other step in the process, this should be an iterative process, allowing different design ideas to be tested, successively leading to a more polished design.

### 4.3.3. “How Might We”-Questions

“How might we”-questions can be used during the process of ideation in order to generate creative ideas related to a specific problem space (IDEO, n.d.a; Rosala, 2021). Statements and themes identified during the discovery phase should be rephrased as questions starting with “How might we...”. The questions should be broad enough to support many different answers to work as a starting point for further ideation methods, such as brainstorming (IDEO, n.d.a).

### 4.3.4. Low Fidelity Prototypes

Sketching is an essential part of the design process. The design phase should start with creating simple sketches, preferably on paper, which will in a next step be translated into low fidelity digital wireframes, which in turn is iterated to mid fidelity and finally high fidelity (Babich, 2018). Between each iteration, the sketches or prototypes should be tested with users to get feedback before iterating into the next step and fidelity.

The main idea of sketching is to come up with the best solution to a problem. Sketching before wireframing begins allows for trying out a multitude of ideas and iterating them before settling on one (Babich, 2018). Furthermore, it supports the fail-fast approach and is a quick and cheap way to generate many ideas.

A common misconception is that sketches and low fidelity prototypes are the same things, but each have different roles in the design process and thus should be used at different stages (Rojas, 2020). Sketching usually comes before prototyping and has the goal of

communicating design ideas in a tangible format. Later it is possible to build low fidelity prototypes based on the sketches.

### 4.3.5. Mid Fidelity Prototypes

A wireframe is a layout of a product that demonstrates what interface elements will exist on key pages, it is a critical part of the interaction design process as it provides a blueprint of the page structure, layout, information and functions (Experience UX, n.d.). After iterating on the early pen and paper sketches made in the previous step, wireframes could be created to visualize the whole skeleton for the digital application. These wireframes could preferably be made in a digital tool. Mid fidelity wireframes should contain grid, scale, and pixel, hence they are more accurate than low fidelity wireframes, but should be gray-scale as it promotes focus on structure and content, avoiding lengthy discussions about colors and details that should come later in the process (Ibid.).

### 4.3.6. Mind Map

Mind map is a powerful visual-mapping strategy for organizing, communicating, and retaining knowledge as it helps lay out complex ideas, processes, and recognize patterns and relationships (Gibbons, 2019). They can represent words, ideas, tasks, or other items linked to and arranged around a central key word or idea. Mind maps are the most simplistic, and thus straightforward type of cognitive maps, according to Gibbons (2019), as they have a clear hierarchy and format, and are relatively quick to create and consume.

### 4.3.7. Moodboard

Setting the mood is a very important step for any design project. It helps everyone involved get on the same page for the visual aspect of the project (Ascanio, 2019). In UX Design and product design, a moodboard is seen as inspirational and directional for the upcoming methods, in the form of a collage of images, fonts, interactions, features, icons, and UI elements to communicate the artistic direction of a project, but also value words. As everything in user experience design, the moodboard should be focused on meeting user needs and problem-solving (Ibid.). Furthermore, consideration must be given to the customer's brand image and values around the service.

### 4.3.8. Parallel Design

Parallel design is the process of producing several optional design ideas, enabling testing of variations of solutions. The aim is for designers to produce designs independently, followed by examination of these collaboratively to promote a wide exploration of the design space (Leavitt et al., 2006).

### 4.3.9. Storyboard

A storyboard communicates a story through images displayed in a sequence of panels that chronologically maps the story's main events (Krause, 2018). The term storyboard is taken from movie production where it indicates a visual representation of the various scenes of a film (Ghirardini, 2011, p.62). While UX storyboards are often likened to movie storyboards, they are very different. While movie storyboards are used to communicate content and feel of each scene, the purpose of UX storyboards is to consider and communicate a sequence of states and demonstrate how users might interact with the future product or service (Cameron, 2020). In e-learning, the storyboard often describes screens about what will happen in the final course. Storyboards also help visualize the users' actions and the environment in which they take place which might be affecting how or why the user does something. What matters is the actions and emotions involved (Ibid).

The storyboards are thus not a final product, but a method to specify which elements will appear in each screen of the e-lesson, and thus should not focus on visual aspects but should identify the structure and connections of content.

### 4.3.10. User Flows

A user flow diagram is a simple chart outlining the steps that a user has to take with a product or service in order to meet a goal (Kominos, 2020a). The user flow diagram considers only what happens with the product and ignores all external factors by describing the path by which visitors will navigate through the website. This can help rapid evaluation of the efficiency of the process needed to achieve a user's goal, as well as identification of what steps users must go through to complete the tasks (Ibid.). Blocks and diagrams are handy ways to visualize every part of the future e-learning website.

## 4.4. Evaluating the Design

Design should be evaluated throughout development, initially using low fidelity prototypes, followed by more high fidelity ones, in order to uncover problems, discover opportunities and learn about users (Moran, 2019).

### 4.4.1. A/B Testing

A/B testing enables comparison of different solutions, receiving feedback on preferences of solution. Different alternative solutions are typically measured against each other based on their individual, that is version A and version B are tested in a between-subjects-study (Nielsen, 2005). Meaning that each participant, that is the user, interacts only with one of the designs.

A/B testing is an effective way of receiving quantitative data on design solutions, however, it does not typically provide insights into qualitative reasons behind preferences (Nielsen, 2005; Kaufmann, Cappé & Garivier, 2015).

#### 4.4.2. Assisted Evaluation

Compared to participatory evaluation, assisted evaluation is to some degree a more formal method for testing design solutions (Maguire, 2001b). Here, user representatives are to complete different tasks with little to no instruction from the test leader (Ibid). This means that the user is given a task to perform, and should think out loud while trying to complete it. The evaluator can prompt with questions along the way, but should otherwise focus on observing and documenting the experience of the user.

#### 4.4.3. Controlled User Testing

Controlled user tests are the most formal methods for evaluation of designs, and commonly performed as summative evaluation of a design. Letting user representatives perform a series of tasks, either in a controlled laboratory environment or in the field, is the most revealing method of usability evaluation (Maguire, 2001b). This method allows for quantitative data collection in a setting as similar to the one in which the system will actually be used as possible, revealing data on time to complete a task, points of apparent user difficulty, number of times assistance is required, and approach to using the system (Maguire, 2001b, p.617) to name some. In other words, the aim is thus to gather information about the users' performance with the system and their comments as they operate it. Users should be given realistic tasks to complete with no instructions on how to do so from the test leader, while data is documented by observers.

The controlled user test can for example be used to evaluate whether usability requirements have been achieved, for example via the following measures: the degree of success with which users achieve their task goals shows *effectiveness*, the time it takes to complete tasks shows *efficacy*, and user comfort and acceptability shows *satisfaction* (Maguire, 2001b).

#### 4.4.4. Expert Evaluation

Expert, or heuristic, evaluation is as its name implies: evaluation performed by an expert of a certain topic, such as usability. Letting an expert evaluate the design is an effective way to identify issues related to established design principles and guidelines (Maguire, 2001b). Potential problems can thereby be fixed without the typically more costly involvement of users. However, a considerable disadvantage of letting one or few experts evaluate the design is the influence of biases (Ibid.), that potentially result in identification of issues that are not necessarily relevant, or the failure to identify potentially meaningful shortcomings of the design.

#### 4.4.5. Formative and summative evaluation

There are two main reasons for usability evaluation and two different types of testing: *formative testing*, to improve the product as part of the development process, and *summative testing*, to find out whether people can use the product successfully (Maguire, 2001b). Thus, formative testing is conducted throughout the design process, and is typically, but not strictly, less prepared and structured, compared to summative testing that is normally used as a last step in the design process as evaluation of a high fidelity prototype (Ibid.).

#### 4.4.6. Participatory Evaluation

Participative evaluation is an informal method for formative evaluation, that is, it is a cost effective and quick way to receive feedback on design solutions (Maguire, 2001b). The method provides a means to identify user problems and misunderstandings about the system, and typically involves users employing a prototype as they work through task scenarios. The user can be questioned on aspects such as their impressions of different designs, what design elements communicate to them, what result they anticipate to follow different actions, and potential suggestions for changes (Ibid.). Participants can be encouraged to explain what they are doing by talking, so-called “think out loud”-method, and prompted by questions when needed (Ibid.). The information should be captured by an observer, and preferably also recorded.

#### Evaluation Walkthrough

One type of participatory evaluation is *evaluation walkthrough*, which is a process of going step-by-step through a system design and getting reactions from user representatives (Maguire, 2001b). It is useful when detailed feedback is required at a detailed level (Nielsen, 1993 in Maguire, 2001b), however, this method could also be applied during development, with early design and prototypes, to allow researchers to collect early feedback that could be used to improve and refine the design. The biggest benefit of walkthroughs is that it is cost-effective and fast to carry out when compared to many other forms of usability testing.

#### 4.4.7. Qualitative and quantitative evaluation

There is a differentiation between qualitative and quantitative testing, where qualitative testing is effective for *discovering issues* in the user experience, and yield data such as descriptions and user quotes, while quantitative testing is more concerned with *describing* the experience, using metrics such as time on task (Moran, 2019).

One way to capture subjective perceptions of and attitudes towards a design is by collecting statistical data through a satisfaction questionnaire (Maguire, 2001b). This method aims at grasping impressions formed by users, based on their experiences with the prototype. Users are, after using a prototype, given a standardized questionnaire to fill in. To clarify, this method is favorably part of the final test session with the final design, after users have been

given the chance to interact with it (Nielsen, 2012). The questionnaire should provide information on *perceived efficiency*, *affect (likability)*, *control*, *learnability*, and *helpfulness* (Maguire, 2001b).

The Subjective Mental Effort Questionnaire (SMEQ) is a questionnaire with one scale where users are asked to report the amount of effort they feel they have invested in a given task (Ibid.). The Task Load Index (TLX) on the other hand has six scales, differentiating between the following aspects: *mental*, *physical*, *temporal*, *performance*, *effort*, and *frustration*, to measure the person's perception of what a task has demanded from them (Maguire, 2001b).

Several other examples of standardized alternatives can be applied in evaluation, such as Software Usability Measurement Inventory (SUMI), Website Analysis and Measurement Inventory (WAMMI), System Usability Scale (SUS), Self-Assessment Questionnaire (SAQ) (Maguire, 2001b).

# 5

## Planning

This chapter describes the planned structure and approach of the project.

The project took place as a master thesis project corresponding to 20 weeks of work. The time was roughly divided into different phases, where the first three weeks were assigned to the planning and start-up of the project. The following 14 weeks were dedicated to project work, while the last three weeks aimed to focus on finalizing documentation, as well as preparing and giving the final presentation. Documentation was done continuously throughout the project and summarized in an extensive report.

The aim was to work iteratively through complete design cycles. A combination of design approaches framed the design process: an HCD approach was applied to promote methods for designing a usable system, while the ID perspective and LXD approaches respectively, were applied to address the learning aspects in the process, and the RtD Field-approach to frame the project further, as it corresponds well to the HCD perspective. Analyzes suggested from e-learning best practices, such as technical analysis, were also applied when needed.

The process was intended to be iterative as this entails receiving feedback from end-users following their use of early design solutions. In this way, the project aimed to apply RtD, where the resulting design solutions embodied insights from the process.

### 5.1. Pre-study

The initial phase of the project aimed to focus on the first phase of the HCD process of *planning*, which is described as the first step in the RtD process of *selecting* and framing the research problem. A literature review of relevant theories was planned to be done to create a theoretical foundation for the project, while secondary research on e-learning best practice and design methods were conducted to identify appropriate methods and resources. Materials from the client's existing course were collected and reviewed for an initial understanding of the course content. The derived insights framed the scope of the project and laid the foundation for the following work.

Key stakeholders in terms of representatives from the client were planned to be brought together with the design team to align on impact goals and set a framework for the design challenge, as suggested by the first step of the ID process of *identifying instructional goals*.

Phase/Step of theory		Methods
HCD	1. Planning	– Literature review
ID	1. Identify instructional goals	– Secondary research
RtD	1. Select	– Discovery workshop with the client

## 5.2. Design Process

The first phase of the design process planned to focus on *understanding the end-users and specifying the context* in which the system will be used, as suggested by HCD. The LXD perspective specifies the importance of creating a *strategy* by concretizing goals and needs of users but also of the organization at this initial stage, in order to create a suitable strategy to bridge the gap between the learners' current state and the goal state. The relevant ID steps at this point are to *identify instructional goals* further and to conduct an *instructional analysis*.

Phase/Step of theory		Methods
HCD	2. Understand and specify the context of use	– Identify users and stakeholders
ID	1. Identify instructional goals 2. Instructional analysis	– Context of use analysis – Task and topic analysis – Empathy workshop with customer
LXD	1. Strategy	– Questionnaire – Interviews (users + SME)
RtD	2. Design	– Training needs analysis + MoSCow method

In the next phase, the main focus was to be on the HCD process's third phase: *specifying user requirements*. Identification of *entry behaviors and characteristics of users*, as suggested by ID, and thereafter *performance objectives* were also defined. At this stage, LXD stresses the importance of identifying *requirements* in terms of the topics, methods, activities, etc that should be included, as well as stating a clear *structure* for these elements. At this stage, the fourth step of LXD approach *interaction*, which is concerned with how to deliver the course content, that is which instructional methods to use, was also considered.

Phase/Step of theory		Methods
HCD	3. Specify the user requirements	– Competitor analysis
ID	3. Identify entry behaviors and characteristics 4. Define performance objectives	– Personas – Scenarios of use – Define learning objectives
LXD	2. Requirements 3. Structure 4. Interaction	– Define course structure – Requirements specification
RtD	2. Design	

Following this, the focus was on the fourth HCD phase of *producing designs and prototypes* and ideation, thus the creation of different solutions was done. ID theory suggests *defining criterion-referenced test items* and *instructional strategy*, as well as *selecting instructional materials*, as key concerns which should be addressed. Furthermore, at this stage, the LXD aspects of *interaction* and *sensory* were further investigated, that is how the interaction should work and what the learner will be seeing, hearing, etc, what kind of and how feedback should be communicated to the learner, and how these materials should implicitly communicate information to the learners about the experience they are about to have.

Phase/Step of theory		Methods
HCD	4. Produce designs and prototype	– Mind map
ID	5. Define criterion-referenced test items	– Brainstorming
	6. Define instructional strategy	– User flows
	7. Selection of instructional materials	– Affinity diagram
LXD	4. Interaction	– Storyboarding
	5. Sensory	– Parallel design
RtD	2. Design	– Low-fi sketches
		– Mid-fi prototypes (wireframes)
		– Hi-fi prototype
		– Review of design guidelines
		– Participatory observation

Evaluation of design solutions is part of the HCD process, ID approach and RtD respectively, and should be done next, in order to validate design decisions and ensure usability and quality.

Phase/Step of theory		Methods
HCD	5. Evaluate design against requirements	– Evaluation walkthrough
ID	8. Design and Formative evaluation	– Participatory evaluation
	9. Design and Summative evaluation	– Controlled user testing
RtD	3. Evaluate	– Satisfaction questionnaire
	4. Reflect and disseminate	– Assessing cognitive workload

Iterations planned to be performed when needed, meaning that methods were reused and phases revisited where appropriate.

# 6

## Process

The following chapter presents the process adopted throughout the project, sectioned according to the iterations performed. The process started with a pre-study, which was followed by four complete design iterations.

As mentioned previously, the basis for the process was provided by the five HCD phases (see figure 1), the five concerns of the LXD approach (see table 3.5), and the nine steps of ID (see table 3.1). For each iteration, the methods that were applied are presented along with a description of the work in each method. This is followed by the result from the particular phase as well as a reflection.

### 6.1. Pre-study

The first step was to frame the design challenge and plan the design process.

#### 6.1.1. Process

The pre-study was conducted to establish an overview of the design challenge and frame the design problem space, as suggested by RtD (Zimmerman & Forlizzi, 2014). This included structuring a schedule for the weeks assigned to the master thesis project, presented above in 5. Planning.

#### Discovery Workshop with the Client

A discovery workshop was conducted with the client to align on purpose with and goals for the project, as well as determine the change they want to achieve with the future system in a near and long term perspective. The workshop was also a chance for the SMEs to share some information about the intended target users since the group is familiar to them as they recurrently meet representatives through various physical educational courses.

#### *Participants*

The two designers and the two SMEs from the client participated in the workshop.

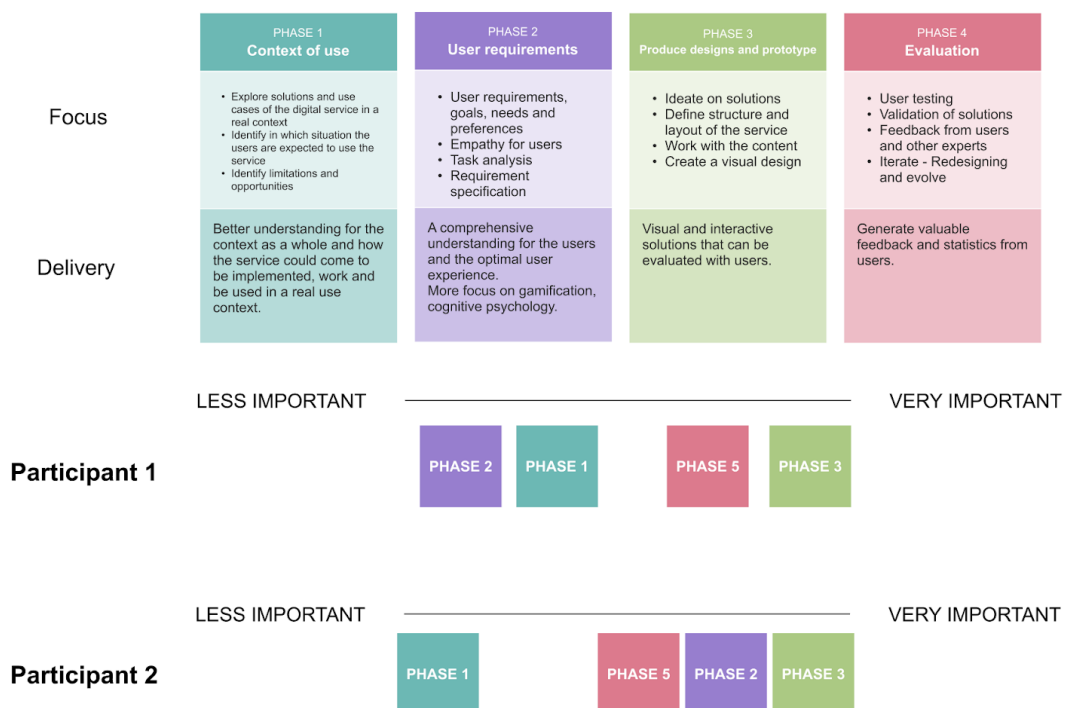
## Preparation

A workshop guide was made to list essential points that would be addressed in the workshop and time estimation for each section was made. This document was used as a supporting script during the workshop to guide the sessions, to ensure that all points for discussion were covered.

Discussion topics and exercises were planned. A slideshow was prepared in Google Slides ([www.google.com](http://www.google.com)) presenting main points and exercises to the participants. Activities were prepared in the online visual communication tool *Miro* ([www.miro.com](http://www.miro.com)). Post-it notes were prepared together with priority matrices and personas templates (see figure 6.1). A document with instructions for preparations was sent to the SMEs via e-mail in advance, including the aim of the workshop and instructions on how to create a Miro account.

The last step of preparation included a pilot test of the workshop, in which all points and exercises were run through by one researcher while the other acted as a participant.

### Exercise 2: Expectations and Priority



**Figure 6.1.** Example exercise material in Miro.

## Execution

The workshop was conducted online via a video conference software ([Zoom.us](http://Zoom.us)), and took in total circa half a day, including breaks, divided into three sessions. Digital communicative and collaborative tools were used to build a collaborative environment.

One of the designers acted as moderator, leading the workshop while the other was responsible for note-taking. The designers switched roles halfway through the day.

First, the participants were welcomed and the agenda was presented. The designers shared their screen where the slideshow was displayed. The participants either watched the slideshow and listened to the moderator, or, when assigned to do so, participated in exercises in Miro. The aim was that the participants should be the active ones in exercises, while the moderator led the discussions along the way.

The moderator presented the topic of discussion, and participants were sometimes encouraged to actively discuss together while they wrote down ideas on virtual post-it notes, and at other times instructed to first perform the exercise silently by themselves, before sharing thoughts with each other and the moderator. During the first activity in Miro, the moderator explained functions and navigation in the program when needed.

The first topic of discussion was concerned with identifying the reasons for the meeting, the reasons for the development of the intended service, and the motives for doing it at this time.

The following topics of discussion concerning *expectations of and priorities for the project*, as seen from the client's perspective, and *the change the client wanted to make through the project and the service*.

Next followed an exercise concerned with the intended users, which involved creating first drafts of personas together in Miro. Individual differences among users, connected to, for example, level of education, characteristics, and experience, were pinpointed, as well as their motives for using the service. To foster clear communication, statements on what the users should *know*, *feel* and *do* after their interaction with the service, as well as some potential obstacles they may have were listed and discussed (see figure 6.2).

Moreover, questions regarding the service, such as the client's expectation on different use cases, its connection to the client's other services, and visual expectations on the interfaces, were discussed.

After each discussion and exercise, the notetaker summarized and presented the most important points that emerged during the conversation. In this way, the designers were able to validate the insights immediately, allowing for elaboration and correction when needed.

Notes were summarized and sent out to the SMEs via e-mail, to promote possible correction or elaboration.

## Literature Review and Secondary Research

A literature review and secondary research were conducted on relevant theories and topics, such as human learning theories, design methodologies, e-learning best practices and methodologies, and gamification.

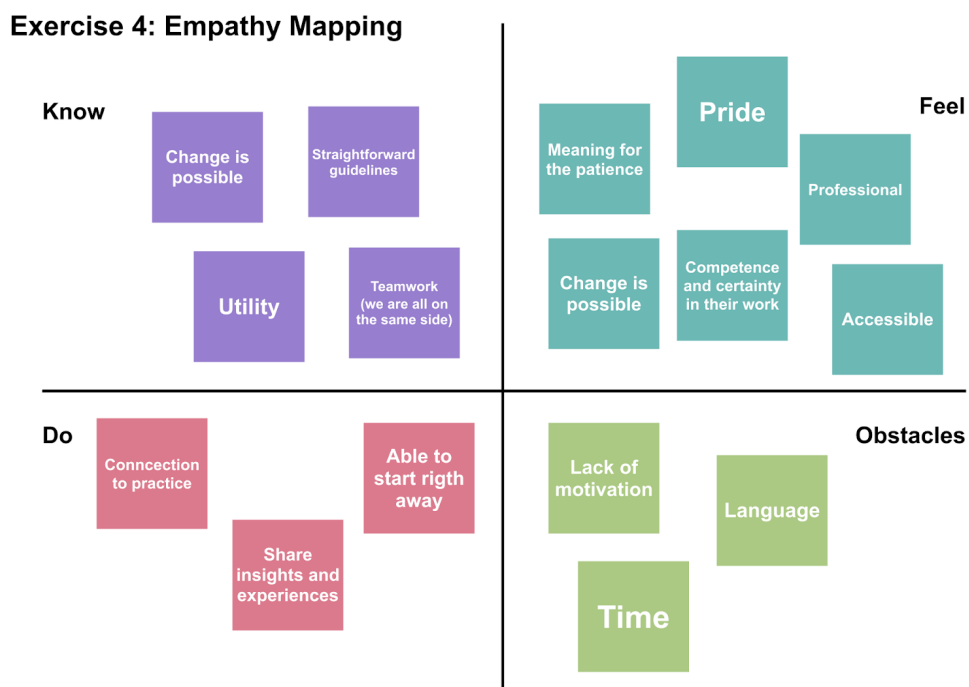
## 6.1.2. Results and Reflections from Pre-study

The following subchapter presents the key results and reflections from the pre-study.

### Aim and Scope

The discovery workshop was the first official project-related meeting between the research team and the client, and thus an important step of the project. This contributed to an understanding of the project's purpose, aim, and intended main focus of the design process as seen from the client's perspective, as well as an overview of the client's intentions with, motives for, and expectations on the project.

The insights summarized in this phase included a definition of the design opportunity of translating a traditional face-to-face education within transfer knowledge to an e-learning course. The main aim was set on that the project should contribute to the client's goal of spreading their method in an efficient and qualitative way. The key goals were set on exploring a solution that builds on pedagogy, offers an education that is grounded in the learner's practical work, and provides the learner with tools and techniques that can be applied in their working situation. The learners should primarily receive a theoretical ground and an introduction to practical exercises and training, which should provide learners with a useful foundation for further education and training in transfer skills.



**Figure 6.2.** Example data from the discovery workshop with the client.

The discussions and documentation framed the design challenge at a first stage, and guided the designers in their following work, for instance in terms of what topics and literature to investigate in the literature review.

## Theoretical Framework

The review resulted in a comprehensive summary of selected theories that created a foundation for a holistic perspective on the human learning process, and a design approach for proceeding with the design challenge. These theories are presented in [3. Theory](#).

## 6.2. Iteration 1

During the first iteration, the main focus was set on conducting an extensive context of use analysis, that should result in an understanding for the users and the context, through an exploration of users' characteristics and tasks, as well as organizational, technical, and physical conditions and constraints, as suggested by Maguire (2001a; 2001b).

### 6.2.1. Process

The following subchapter presents the process from the first iteration including what methods were used and describing the procedure to conduct them. Methods in the first iteration include *Identify Users and Stakeholders*, *Moodboard*, *Competitor Analysis*, *Questionnaire*, *Interviews*, *Task Analysis*, *Topic analysis*, *Training Needs Analysis*, and *Evaluation Workshop* are presented.

#### Identify Users and Stakeholders

Identification of users and stakeholders, both direct and indirect, was done in order to understand the various needs and concerns related to the project, and to identify entry behaviors and characteristics of the target user, as suggested in the ID approach (Gagné, Briggs & Wager, 1992). Information provided through the client during the workshop in the pre-study phase in combination with documentation from one of the designer's previous project in collaboration with the client (Wallén, 2019) acted as the main foundation for this analysis.

#### Moodboard

As a first step in the iterative design process, a mood board was created to frame the direction of the project in terms of values, attitudes, and design. Value words and inspirational pictures were collected to set the mood for the client's brand and vision. This helped to concretize a shared focus of what values and attitudes the service should communicate, and created a first creative idea of the visual goal state for the design.

## Competitor Analysis

A competitor analysis was performed online mainly by reading about and trying out similar products or services from other companies. Indirect competitors that not necessarily provide a similar product or service but potentially use similar techniques or solutions were explored, such as other online-based education services. Direct competitors were seen as companies offering educational solutions within the topic of transfer skills or related topics online. The participatory evaluations were performed of similar services provided by a couple of direct competitors through purchase and use. Weaknesses and strengths, as well as price range, for each competitor, were summarized in a table to create an overview of the existing solutions.

## User Studies: Questionnaires

To reach representatives of the target users and to get insights into the context of use, two different questionnaires were created. One of which was aimed at “base-level personnel”, such as assistant nurses, and one at decision-makers, such as unit managers, to gather information on attitudes towards education, previous skills, and experiences of online training, among other questions.

### *Participants*

Target participants for the first questionnaire were personnel within healthcare who assist care recipients, who represent the target user group and are potential users of the service. The target participants for the other questionnaire were decision-makers who would not themselves be users of the e-course, but who could have decision-making power on whether to purchase and provide personnel with education.

### *Preparations*

Both questionnaires were constructed of object-specific questions (for questionnaire questions see [appendix A](#)). The majority of questions were close-ended, sometimes followed by open-ended questions, allowing the participant to motivate or elaborate on their answer (Dalrymple, 2017).

Participants were informed of their rights to anonymity and participation, and that the data would not be shared with anyone outside the project, and would be deleted when the project is finished. The initial part of the questionnaire covered demographic data, such as gender and age, followed by questions concerning *technical habits; workplace routines and principles for educating personnel; routines for how they learn transfer techniques today; general interest and needs regarding transfer techniques in particular; similar use of services; and their attitudes towards online education services.*

The questionnaires were pilot tested within the team only to identify practical mistakes, such as interruptions in the flow of questions, spelling errors, etc. The questionnaire for base-level

personnel was further tested with one assistant nurse that gave feedback on the questions asked. No changes were made to the questionnaire before distribution.

### *Distribution*

The questionnaires were distributed through e-mail to unit managers at different organisations within Sweden, both to get in contact with unit managers and to ask them to distribute the other questionnaire to their personnel. The questionnaire for personnel was also distributed in a Facebook group for assistant nurses in Sweden.

### User Studies: Interviews

To add to the quantitative data interviews were performed with the two different groups: base level personnel and decision makers.

### *Participants*

Participants were recruited through the questionnaire, where they were asked to submit their e-mail if interested in participating in an interview. Thus, participants were representatives from the user group of base-level personnel and unit managers from the group of decision-makers.

### *Preparations*

The interviews were semi-structured, as suggested by Preece, Rogers, and Sharp (2015), guided by some questions but allowing for elaboration (for interview questions see [appendix B](#)). A manuscript was used as an introduction to ensure consistency between sessions and that all critical information was covered.

### *Execution*

The interviews were performed online, via video conferencing software (Teams or Zoom, depending on the participant's preference). Both designers participated in each interview, however, one acted as interview leader and the other was in charge of notetaking. The sessions were recorded (video and audio), if the participant gave his/her oral consent, otherwise no recording would be done, and solely written notes would be kept during the session. This was asked before the recording started. The recording was motivated by preventing misunderstandings.

Participants were orally informed upon interview start about their rights to anonymity and participation, and that the recording would not be shared with anyone outside the project, and that it would be deleted when the project is finished.

The questions for base-level personnel covered some of the topics introduced in the questionnaire in more depth: *routines and opportunities for education, general interest and needs regarding transfer techniques, in particular, attitude towards education, and online*

*education services in particular, and preferences for educational setup*, while the interview with decision managers covered technical, physical and organizational conditions that may affect the service's use.

## Instructional Analysis - Task and Topic Analyzes

Instructional analysis, as suggested by the ID perspective, was conducted through a hierarchical task analysis (HTA) to identify the skills involved in reaching the goal (increased knowledge in transfer skills) by visualizing how learners learn the client's method today, as well as how they apply the knowledge in their current work situation. Course material provided by the SMEs and information on the client's website formed the main basis for the analysis.

The instructional analysis was used as a foundation to identify the tasks that the e-learning service must support, as well as what learners' goals are and what they need to do to achieve those goals.

To complete the task analysis, a topic analysis was conducted, to identify course content and classify content elements. The content was visually structured in a mind map to clarify connections between different elements.

## Training Needs Analysis

A training needs analysis was done to identify the gap between the current knowledge and or work of the target group and the desired state. In other words, identification of what needs to be done to reach the set goals (Gagné, Briggs & Wager, 1992). Insights were derived from the competitor analysis, questionnaires, and user interviews.

Training needs analysis of the client's current methodology for training and educating learners in transfer skills were also conducted, as well as an analysis of what is expected from the learners in terms of achievements and knowledge acquisition, to gain a shared understanding of the course content that needs to be implemented in the intended online course.

This data was summarized in a table covering the need, whom it mainly concerned, and the source of the insight (interview, research, etc).

## Evaluation with SMEs: Empathy Workshop

In order to reach a comprehensive understanding of the course content and to reach a priority of user needs, an empathy workshop was conducted with the client.

### *Participants*

Two representatives of the client in terms of SMEs participated in the workshop, together with the two designers.

### *Preparations*

A workshop guide was made to list essential points that should be addressed in the workshop, such as the main purpose and key questions. This document was used as a supporting script during the workshop to guide the sessions, to ensure that all points for discussion were covered. The data from the topic analysis was not prepared any further.

### *Execution*

The workshop took place online, in a video conference software (Zoom), and took in total circa 90 minutes. A digital communicative software (Miro) was used to present the content data to all participants.

The work division was set up so that one of the designers was the moderator, leading the workshop, and the other was responsible for note-taking.

Firstly, participants were welcomed and the agenda was presented. The designers shared their screen to show all participants the mind map, which was walked through by the moderator. Semi-structured questions guided the discussion, and SMEs were encouraged to interfere or question content as it was presented.

To prioritize the content the MoSCoW method was applied. The moderator explained the method to the participants, who then were in charge of prioritizing the content. This was needed to clarify what should be seen as critical content and what could be seen as secondary according to the SMEs.

The workshop ended with some final structured questions regarding general concerns of the project, not necessarily connected to the content covered in the topic analysis.

## 6.2.2. Results and Reflections from Iteration 1

The following subchapter presents the key results and reflections from the first iteration in terms of an overview of stakeholders, data from conducted user studies, a presentation of the identified target user group, and lastly the outcome of the SME workshop.

### *Stakeholders*

The identified direct stakeholders are summarized in table 6.1. Stakeholders' cares and unmet, or undermet, needs were listed for users, customers and beneficiaries, as suggested by Cone (2018) (see table 6.2).

**Table 6.1.***Summary of stakeholders.*

<b>Stakeholder group</b>	<b>Stakeholders</b>
Users	<ul style="list-style-type: none"><li>– assistant nurses and other caregivers in elderly and hospital care</li><li>– relatives who assist family members</li></ul>
Customers	<ul style="list-style-type: none"><li>– private nursing homes</li><li>– private home care services</li><li>– municipalities (public nursing homes and the like)</li><li>– hospitals</li><li>– private individuals</li></ul>
Beneficiaries	<ul style="list-style-type: none"><li>– care recipients</li><li>– caregivers (such as assistant nurses)</li><li>– unit managers and administrative personnel</li><li>– occupational therapists and physiotherapists</li><li>– relatives</li><li>– the client</li></ul>
Key influencers	<ul style="list-style-type: none"><li>– family and relatives of care recipients</li><li>– caregivers</li></ul>
Key decision-makers	<ul style="list-style-type: none"><li>– municipalities</li><li>– private nursing homes</li><li>– private home care services</li><li>– individuals (relatives who assist family members)</li></ul>

**Table 6.2.***Summary of stakeholders' cares and needs.*

Stakeholder group	Cares	Needs
Users	<ul style="list-style-type: none"> <li>– learn transfer knowledge</li> <li>– for the care recipients</li> <li>– own health</li> </ul>	<ul style="list-style-type: none"> <li>– basic/sufficient education/knowledge to provide good quality care</li> <li>– time for education</li> <li>– more engaging ways to learn/motivation to learn</li> <li>– reflection on how they work when assisting care recipients (in terms of transfer)</li> </ul>
Customers	<ul style="list-style-type: none"> <li>– provide good quality care for care recipients</li> <li>– provide safe and healthy environment for personnel</li> <li>– minimize accidents</li> </ul>	<ul style="list-style-type: none"> <li>– efficient and affordable alternatives to traditional education</li> <li>– more accessible education within transfer skills</li> </ul>
Beneficiaries	<ul style="list-style-type: none"> <li>– a rehabilitative approach in the daily care</li> <li>– a safe, healthy and professional care</li> </ul>	<ul style="list-style-type: none"> <li>– safe and secure care from all personnel</li> </ul>

## Data Analysis from User Studies

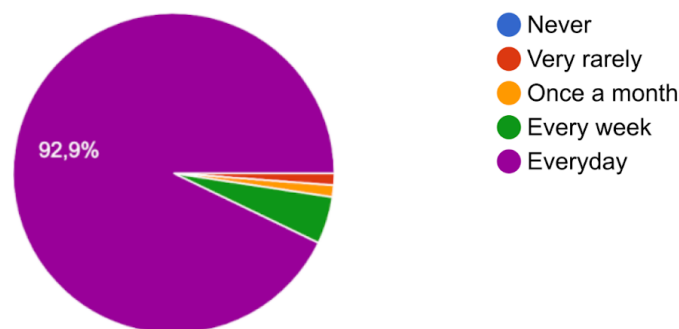
### *Base Level Personnel*

84 participants (age range estimated 20-65 years (age intervals: 16-29; 30-49;  $\geq 50$ )) completed the questionnaire for assistant nurses. The majority (84%) of these participants reported they have been working within healthcare for longer than five years, while 13% have been working one to five years. 77% have a health education on high school level, 11% have a higher level of health education, while the remaining 35% have either a high school or advanced education in other fields. 47% of the participants work in a nursing home, such as a retirement home (sv. *äldreboende*), 37% in home care services, and the remaining 18% in a different context (for instance personal assistance or in a hospital). 94% were hired in the public sector and the remaining 6% in the private sector.

The results from the questionnaire showed that the target user group has a sufficient level of technical skills for participating in an e-course (conclusion based on daily to frequent use of technology such as smartphones and computers, either in work situations or outside of work for 98% of participants, see figure 6.3). For the question “*How often do you use technology such as a computer, tablet or smartphone?*” the answer distribution was: “Never” 0% (blue), “Very rarely” 1,2% (red), “Once a month” 1,2% (orange), “Every week” 4,8% (green), “Everyday” 92,9% (purple).

How often do you use technology such as a computer, tablet or smartphone?

84 answers

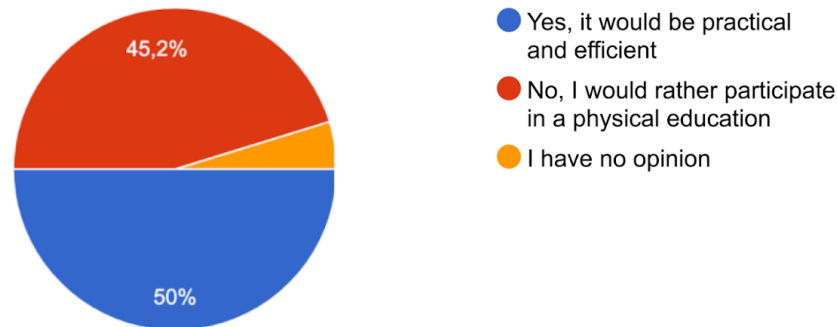


**Figure 6.3.** Answer distribution for the question “How often do you use technology such as a computer, tablet or smartphone?”

The vast majority (80%) were familiar with online education and had participated in at least one educational course online, but attitudes towards it were divided (50% positive, see figure 6.4). Participation in an online course was described as positive due to flexibility, standardization of education, the potential of individual adjustments (such as progress at one's own pace) (see figure 6.5), and cost-effectiveness. For the question “Would you like to participate in a transfer skills education online?” the answer distribution was: “Yes, it would be practical and efficient” 50% (blue), “No, I would rather participate in a physical education” 45,2% (red), “I have no opinion” 4,8% (orange). For the question “Imagine that you will be enrolled in an e-course for transfer skills, how would you prefer the structure of the course to be like?” the answer distribution was: “One concentrated occasion” 28,9% (blue), “A module-based education performed at one pace (e.g. 3 distinct modules/parts with different content)” 71,1% (red).

Would you like to participate in a transfer skills education online?

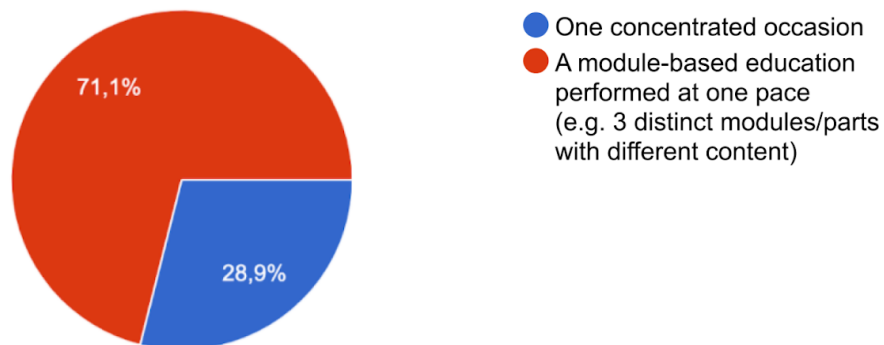
84 answers



**Figure 6.4.** Answer distribution for the question “Would you like to participate in a transfer skills education online?”

Imagine that you will be enrolled in an e-course for transfer skills, how would you prefer the structure of the course to be like?

83 answers

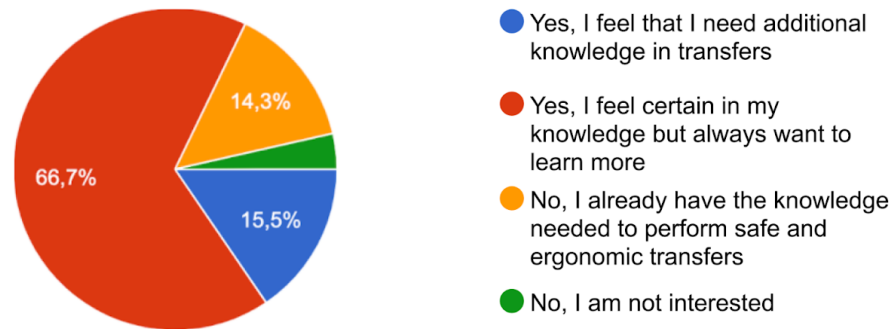


**Figure 6.5.** Answer distribution for the question “Imagine that you will be enrolled in an e-course for transfer skills, how would you prefer the structure of the course to be like?”

The majority of assistant nurses (82%) stated to have an interest and or perceived need in education transfer skills, either due to insufficient knowledge or a continuous need for further education and or repetition (see figure 6.6). The negative aspects of e-education in transfer skills were described to be the lack of possibility to practice the knowledge in a real work setting, with direct support and feedback from educators. For the question “Do you feel a personal need for education in transfer skills?” the answer distribution was: “Yes, I feel that I need additional knowledge in transfers” 15,5% (blue), “Yes, I feel certain in my knowledge but always want to learn more” 66,7% (red), “No, I already have the knowledge needed to perform safe and ergonomic transfers” 14,3% (orange), “No, I am not interested” 3,6% (green).

### Do you feel a personal need for education in transfer skills?

84 answers



**Figure 6.6.** Answer distribution for the question “Do you feel a personal need for education in transfer skills?”

Five assistant nurses were interviewed (age range 22-62 (M= 46 years), one of which was hired in the private sector, and four in the public sector. Two worked in a nursing home, and three worked in both a nursing home and home care services alternately. One has been working occasionally but yearly in healthcare for 5 years, 2 have been working continuously for >10 years, and two have been working continuously for >20 years. They had varying experience and educational levels of transfer skills.

The results from the interviews with assistant nurses showed that there often is an insufficient level of knowledge and lack of preparation, especially in terms of new and occasional recurring staff, such as temporary staff during summertime.

*“Regular staff expect new employees to have some prior knowledge and skills” - Participant 2*

Some participants explained that in terms of how to assist care recipients in their daily movements, there is an expectation for employees to be well prepared and confident in every situation. However, participants point to the fact that care recipients are individuals, with differences and personal constraints, abilities, and wishes. The need for a standardized education was brought up by a few participants, who mentioned the fact that the knowledge you acquire and the techniques you learn are brought to you through colleagues. By watching and being instructed by colleagues, new staff “inherit” routines. However, as one participant pointed out, this brings the risk of needing to learn and relearn varying routines from several different experienced colleagues. Several of the interviewed assistant nurses emphasized the need for recurrent education and repetition of knowledge, to have a meaningful effect on work in practice, and further to prevent falling back into old habits, in terms of movement assistance.

*“You are expected to possess knowledge and techniques needed for all situations, but the job is done in many different situations and in different ways. You meet all kinds of different people with individual needs.” - Participant 1*

*“It is important to have some ground knowledge on how to best assist the care recipient with concern for their health and experience, but also for your own.” - Participant 3*

### *Unit Managers*

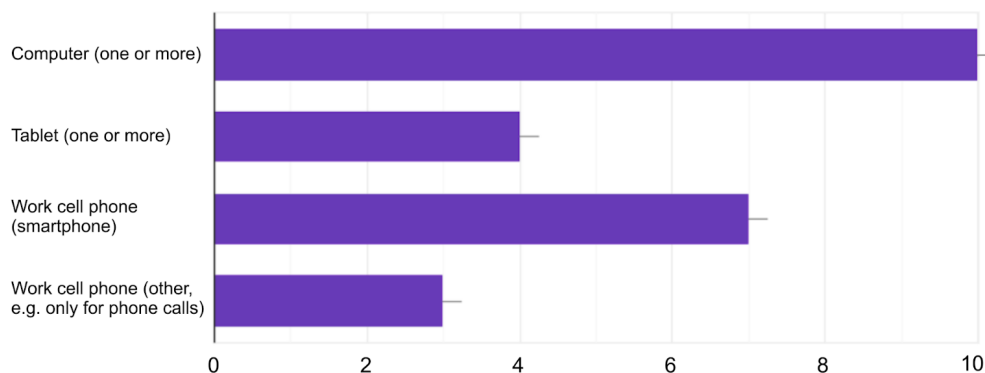
Ten participants (age range circa 30-65 years) completed the questionnaire for decision-makers. All of them have been working within healthcare for longer than 5 years. 67% of the participants work in a nursing home, 22% in home care services, and the remaining 11% in a different context. 44% were hired in the public sector, and 56% in private.

Questions for the unit managers concerned technical, physical, and organizational conditions that may affect its use, as suggested by Dilloughery and Schneeberger (2011). Topics covered were for example what kind of technical equipment is available at the organization, what the routines look like for education in general, the possibilities for participating in an e-course (at home or work), and who decides if and which education should be provided to the personnel.

A hundred percent of decision-makers reported an existing general need for education in transfer skills at their workplace. For the question “What kind of technology is used at the workplace?”, the answer distribution was: “Computer (one or more)” 10/10, “Tablet (one or more)” 4/10, “Work cell phone (smartphone)” 7/10, “Work cell phone (other, e.g. only for phone calls)” 3/10 (see figure 6.7).

What kind of technology is used at the workplace?

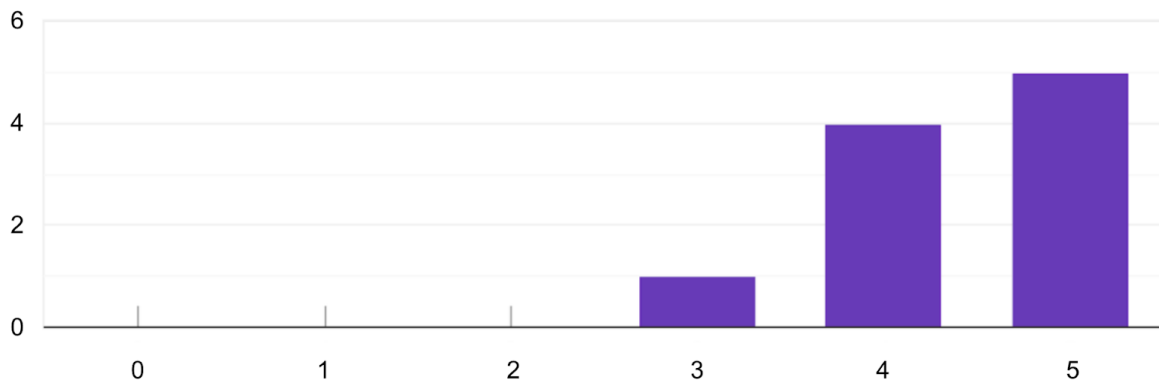
10 answers



**Figure 6.7.** Answer distribution for the question “What kind of technology is used at the workplace?”

What is your perception of the general need for education in transfer skills at your workplace?

10 answers



**Figure 6.8.** Answer distribution for the question “What is your perception of the general need for education in transfer skills at your workplace?” (0 = no need; 5 = great need).

One unit manager (age 61 years) was interviewed. The participant was hired in the private sector within a nursing home, and had been working within healthcare for >20 years, but never in home care services.

The unit manager confirmed the existence of variances in requirements and routines between different organizations, and sectors. She presented an internal educational plan to offer personalized education, aimed at personnel at different levels, to offer everyone within the organization the opportunity of starting with a basic understanding and training in the most basic techniques, and successively advance in their skills. She further described routines for educating a group from the personnel further, to become “transfer instructors”, that should be responsible for educating other personnel in transfer techniques.

*“It is a bit like an educational journey for each staff: You start at a base, learning to manage a few resources, and successively learn to master situations that require total help and various different aids” -*

Unit manager

The unit manager reported on a current tendency for a resource shortage and a large inflow of new personnel, partly due to the current pandemic of covid-19, resulting in less structured onboarding and an ad hoc method for educating personnel where it is most needed.

The constant need for education is evident, according to the unit manager who described an apparent tendency for falling back into old working habits, although they do not support the techniques advocated by the organization and education. She stressed the importance of continuous education in shorter intervals, to foster a change and desired results. In line with the opinions of the interviewed assistant nurses, the unit manager expressed a perception of practical training as necessary to acquire sufficient transfer techniques. In addition to this, she

underlined the importance of stating a clear connection between the educational content and the work context.

*“What we have come to realize is that new personnel need the opportunity to act and test themselves. However, the theoretical parts can most likely be covered digitally, as a complement to practical exercises”* - Unit manager

*“There is a possible risk of the information falling flat, if you do not get a chance to reflect on it and understand it in the context you work in”* - Unit manager

Moreover, she stressed the desire for an accessible and clear way for unit managers to keep track of their personnel, as there as of today did not exist a standardized way of documenting and analyzing this, in the experience of the unit manager.

## Target User Group

The results from the field studies align with the assumption made by the SMEs in the discovery workshop on who the main target group could be for this particular case: base-level personnel, such as newly employed assistant nurses, with insufficient knowledge in transfer skills with a need for accessible education. Therefore, the target group was set on assistant nurses working in a nursing home or come care.

Individual differences within the target user group were identified to include, but are not limited to, *variance in experience and knowledge in transfer skills, variance in interest and attitudes towards education, variance in technical literacy and skills, differences in the native language, variance in preferences for the setup of education (at home or the workplace; in group or individually; module based or time-based)*. The users, that is the participants, of the e-course were called "learners" throughout this project, and thus are mentioned as so throughout this report from here on.

## *Organizational and Physical Environment*

The user studies revealed a difference in possibilities for the user scenario depending on the workplace. Two main organizational contexts were identified: nursing homes and home care services, where personnel visit the care recipients in their own homes. These settings affect the conditions for education, as the workplace varies tremendously. Assisting care recipients in a nursing home typically provides more possibilities, in terms of space and available aids, while the environment is more often constrained when assistance is provided within the care recipient's own home. The additional main differences between the workplaces are whether they belong to the public or private sector, affecting policies, confidentiality, financing and budget, routines, decision authority, among other factors.

The work setting further risks constraining the educational setup, as assistant nurses' daily work typically demands all time and focus to be put on their main task: assisting care recipients, as reported by the interviewees. Thus, little time can be assumed to be naturally left for education, but this needs to be scheduled.

### *Technical Environment*

Technical analysis revealed that while there seems to be opportunities for personnel working in a nursing home to participate in an e-course at the workplace, personnel in home care services do not have the same opportunities due to lack of technical equipment. The policies for technology use and confidentiality also vary, mainly between the private and public sector, but also between workplaces within the same sector, hindering some personnel from participating in an e-education outside of the workplace, for example at home.

At this stage of the process, the decision on what platform to provide the service through has not been made, however the qualitative user studies showed a preference for computers due to the display size. Whether the service should be accessed through the web, through the client's system, or other alternative needs further investigation.

### *Goals and Needs*

As suggested by ID and LXD, the goals and needs of learners and organizations were set based on the user studies.

The main takeaways from the user studies were that the flexibility of online education, making it more accessible, and the possibility of repetition of knowledge, in combination with the potential for standardization of base knowledge level in transfer skills were the main advantages. Moreover, learners wished to be able to complete the course at their own pace and structure their work as individually suitable. However, there was a tendency for preference of a traditional face to face education in terms of the practical elements of education, as several learners within the base level personnel group (32 of 84) announced a need for practical training in transfer techniques to master the correct techniques and to foster empathy for the care recipients.

The user studies and the training needs analysis revealed a need for caregivers to learn about transfer skills and techniques in their work context, meaning there needs to be a clear connection between educational context and work settings.

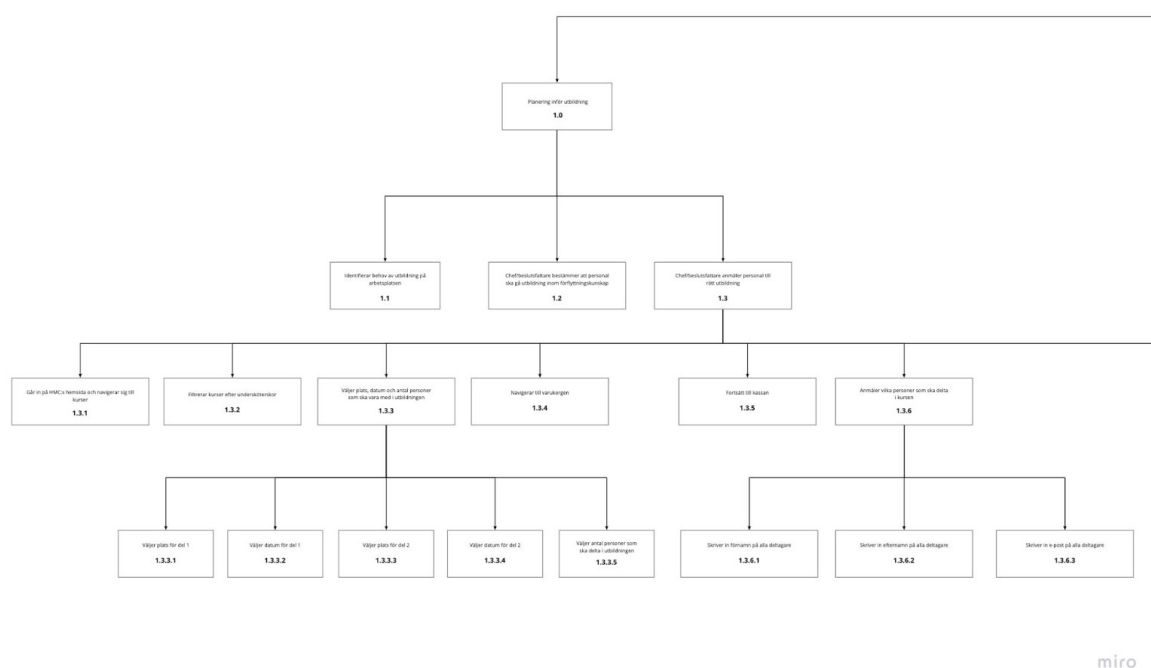
The goals for the client were stated *as to provide learners with a theoretical understanding of transfer skills and a first introduction to the client's method, to motivate learners to apply the knowledge in their work, and to increase the quality of the caregivers work setting as well as the care recipient's experience.*

The goals for the organizations at which the target learners work were stated as: *to increase the personnel's knowledge in transfer skills through education, and by doing so, to increase quality in caregiving for care recipients and foster safe work conditions for caregivers.*

Lastly, the goals for the learners were stated as: reach a standardized basic level of knowledge, reach an increased level of knowledge in transfer skills in new and or inexperienced personnel, and apply the knowledge in their work.

## Tasks

The tasks needed to perform in order to reach the overall instructional goal for learners (to reach an increased knowledge in transfer skills) were identified on an overarching level. Those were: *a decision-maker identifies or is acknowledged on a need for education, the decision-maker purchases the course, the learner accesses the course, the learner participates in the course, the learner completes a post-assessment-test, the learner receives a diploma, and ultimately the learner applies the knowledge in practice.* An extract of the HTA is displayed in figure 6.9.



**Figure 6.9.** An extract of data from the HTA in Miro.

## Course Content

The activities performed within this iteration, such as task, topic, and training analyzes respectively, resulted in an overview over the course content which led to a more solid comprehension for the existing content, and a first idea of the intended educational content within the e-learning.

## Feedback from SMEs: Empathy Workshop

The empathy workshop contributed to some changes made to the topic analysis, and an extensive document of notes connected to the content, as well as the priority of content. This outline of content and priority of which content should be included in the e-learning course created a solid foundation for the designers following work.

### 6.2.3. Design Guidelines v.1

Based on the stakeholders' needs and the insights derived from research in the pre-study, user studies and competitor analysis, a first draft of design guidelines were listed. Each guideline is presented using the following format:

#### G#. Guideline

*Description or motivation of guideline. (Source of insights for guideline)*

### System Interaction

- G1. The system should provide an easy way to access the course (concerning log in etc)  
*The experience should be as focused on the learning tasks as possible, therefore interaction with the system needs to be hasslefree from the start. (Theory)*
- G2. The system should provide autosave to ensure stable input and easy access  
*The learner should not need to be confused or stressed about the risk of his/her progress being lost if leaving the course. Therefore it is essential that the system autosaves and re-enters the course where the learner last left off. (Theory; User studies)*
- G3. The system should provide clear feedback on system status  
*The learner should not feel confused regarding or frustrated by the system during usage, by providing the learner with clear feedback on the state of the system this can be minimized. (Theory)*
- G4. The system should provide clear feedback on the learners performance  
*Clear progress feedback throughout the course is needed in order to motivate the learner and to provide the learner with transparency of progress. (Theory)*
- G5. The system should allow for easy navigation between different elements within the course  
*The learner must be able to navigate within the course hasslefree. It should be clear how the learner can move from one state to another, revisiting content if needed. This also includes providing the learner with understandable feedback on what elements are accessible and not at certain stages, and why. For example, descending modules can be locked until the learner has completed certain tasks. (Theory; Competitor analysis)*
- G6. The system should foster a steep learning curve for navigating the course  
*Learners must quickly learn the course structure and how to navigate it in order to not spend unnecessary time and effort outside the main learning activities of the course. (Theory)*
- G7. The system should support memorability  
*When learners return to the course after a period of not using it, they should rapidly reestablish proficiency. (Theory)*

G8. The system should be designed to minimize errors

*The possibilities of errors should be minimized to promote a frictionless interaction. (Theory)*

G9. The system should be able to communicate with other softwares

*Communication with other software systems used within an organization can be a valuable add on for the system, enabling for example easy accessibility for managers or the like to monitor educated personnel's progress and performance. (User studies)*

G10. The system should follow WCAG standards of level AA

*The system should meet requirements for accessibility to promote an inclusive design. This is a potential requirement from stakeholders within the public sector that are potential buyers of the service. (Theory; Stakeholder: SMEs; User studies)*

G11. The system should be responsive to various screen sizes

*To promote a usable experience it is crucial that the site is accessible on mobile, tablet and web with good UX and performance. (Theory, User studies)*

G12. The system should remember the learner's state in between sessions

*The system must have a memory for the learner's progress, and allow the learner to resume their work at the activity they left. (Theory; Competitor analysis; User studies)*

G13. The system should support darkmode and lightmode

*Learners should have the flexibility to use the system both day and night, to be in full control over their time spent, and to ensure an appreciated user experience independent of time of the day. This is especially needed as the target group typically work both during day and night time. (User studies)*

G14. The system should be designed to minimize cognitive load

*To promote focus on the main tasks, the design should be developed with caution as to not create cognitive load. (Theory)*

## Course Structure and Content

G15. The system should allow learners to carry out the training in their own pace

*Learners need to be in control over when to participate in the course, and not be restricted by a certain point in time. With that said, a final deadline for completing the course is suitable, however the learners should be given the flexibility to complete the course whenever before the deadline. (User studies)*

G16. The course should allow for a personalized experience

*Enable personalized customization of content, based on what the learner is interested in, or what the learner's work environment looks like, for instance, what physical aids are available and or used. (Theory; User studies)*

G17. The course should provide a fun and engaging way of learning

*To promote an engaging user experience, that supports learning, and that stands out from competitors the course should provide interactive exercises during course progress. (Competitor analysis)*

G18. The course should include variations in learning activities

*Offering a range of learning activities creates a variance that can foster a more engaging learning experience. (Stakeholder: SMEs; User studies)*

G19. The course should provide clear statements explaining the purpose and goals of and content within the course

*It should be clear to learners what they can expect to learn through the course, and what skills they should have acquired after completion. (Stakeholder: SMEs; User studies)*

G20. The course should provide a clear reflection of the client's method

*The course should be directly grounded in the client's method, that forms the basis for the educational content (Stakeholder: SMEs)*

G21. The course should have a clear connection to context, so as to make the knowledge applicable in the working situation

*The content within the course needs to be clearly derived from the working context in which the knowledge and skills acquired should be applied. (Theory; Stakeholder: SMEs; User studies)*

G22. The course should provide a clear overview over the content

*Learners should be prepared for the next steps, and receive an overview over course structure and content, so as to be able to plan the activities ahead . (Theory; Competitor analysis)*

G23. The degree of difficulty should be adapted to the learners level of knowledge

*The learning content should be on the appropriate level of difficulty for the individual learner in order to foster learning. This means that learners who are in need of additional support should be provided with this, but also that more experienced learners should be stimulated by sufficiently challenging materials (Theory, Stakeholder: SMEs; User studies)*

G24. The course should support social interaction

*The social aspect can be seen as critical in some aspects, and it is appreciated to provide learners with some opportunities for discussions in groups. (Theory; User studies)*

G25. The system should support repetition of knowledge

*Critical content should be repeated to promote learning. One way of achieving this is through the incorporation of exercises. (Theory; Competitor analysis)*

G26. The course should be available in various languages

*To reach a diverse group of learners with various language skills, the system should support language differences to some extent. (Stakeholder: SMEs)*

G27. Visual content should be of high quality

*High quality of visual content, such as pictures and other graphics, is important to foster an engaging and friction free usage, and to send a professional presentation to learners and customers. (Competitor analysis)*

G28. The course should assess the learners performance

*To ensure that the learner has reached the learning objectives it is critical to include some type of assessment test. (Stakeholder: SMEs; User studies)*

G29. The course should support auto-correction of tasks and tests

*It is a requirement from the stakeholder in terms of the client that the system should be automatic in the sense that the client should not need to actively assess the tests within the course. (Stakeholder: SMEs)*

## 6.3. Iteration 2

The following iteration had the main focus of compiling all information and insights brought from the previous pre-study and iteration, by digging deeper into the target learners and context, as well as structuring the educational content.

### 6.3.1. Process

The following subchapter presents the process and methods used in the second iteration including *Personas*, *Scenarios of uses*, *Defining Course Sequence*, *State Learning Objectives*, *Identify type of Learning Content*, *Requirement Specification*, and *Evaluations with SME and Learners*.

#### Personas and Scenarios of Use

The individual differences initially identified during user studies in iteration 1 were brought into this iteration and concretized during the creation of personas and scenarios of use. The first drafts of personas were created in the discovery workshop with the SMEs. Those were further iterated based on secondary research, and data from questionnaires and interviews. The personas covered demographical data, interests and values, prior knowledge level connected to the work as an assistant nurse, and transfer skills, in particular, technical habits, current work situation, description of a typical working day, future goals, and a few quotes. To make the personas more “real”, illustrations were made to represent their characteristics.

Scenarios of use were then created based on the personas to provide examples of future use cases of the e-learning website and how the service could work in a real environment. To make the personas “come to life” scenarios are created that feature them in the role of a learner. The persona was placed in a specific context with a problem they want to, or have to, solve. The scenarios reflected different kinds of learners and their motivation and goals for attending the training, as well as where and when it takes place. Important factors about the context of use were highlighted in the scenarios, such as whether the learners would complete the course in private or in a group with possibilities for discussions, whether they would perform it at the workplace or home, or if the learner worked in home care services or a nursing home.

The scenarios of use method aimed to understand learners’ motivations, needs, barriers, and more in the context of how they would use the future system.

#### Define Course Sequence, Identify type of Learning Content and State Learning Objectives

The course content outlined in the previous iteration during the task and topic analysis was re-visited and more thoroughly translated for the e-learning course.

The course content was classified according to type, for example, *facts*, *procedures*, and *concepts* (Morrison, Ross & Kemp, 2001 in Ghirardini, 2011), and mapped to the cognitive performances described in Bloom's taxonomy (Anderson et al., 2001; Lasley II, 2016). Based on this content, *learning objectives*, that is what the learner should know or be able to do after the lesson or course, together with *learning steps*, that is increments of what needs to be done or achieved to reach the objective, were stated. The learning objectives were formulated to cover the expected level of (cognitive) performance and the learning content (i.e. the type of knowledge or skills that must be learned).

Furthermore, the content was sequenced according to the structure of the content in the available course material and modified as the designers deemed fit concerning the job-context principle (Ghirardini, 2011), to reflect the work context in which the learners should apply the knowledge. The entire course structure was mapped out in a course plan, together with learning objectives (for unit/module and lesson respectively), learning steps, and description of the content for the particular learning step, as suggested by Ghirardini (2011). For an overview of the structure of the course plan, see figure 6.10.

<b>Learning objectives for course</b> <ul style="list-style-type: none"> <li>• <i>Learning objective<sub>1</sub></i></li> <li>• <i>Learning objective<sub>2</sub></i></li> <li>• <i>etc</i></li> </ul>	
Module #. (Name of module)	
<b>Learning objectives for module</b> <ul style="list-style-type: none"> <li>○ <i>Learning objective<sub>1</sub></i></li> <li>○ <i>Learning objective<sub>2</sub></i></li> <li>○ <i>etc</i></li> </ul>	
Lesson #. (Name of lesson)	
<b>Learning steps</b>	<b>Content</b>
<i>Description of what needs to be done or achieved in order to reach the objective</i>	<i>Description of what content to include.</i>

**Figure 6.10.** Overview of the structure of the course plan.

## Requirement Specification

A specification of requirements was created to summarize all the essential findings, through the rephrasing of needs into requirements to know what the e-learning course is required to

deliver, before going into the design phase. A table including requirement, a comment describing the requirement, who is the main beneficiary, and the sources of insight was listed.

Requirements were divided into different topics: *user requirements*, covering the tasks that the system will support and the functions that will be provided to support them, *usability requirements*, measurable requirements for the usage of the system such as performance goals that include success rates and the time it takes learners to find specific information or preference goals that address their satisfaction and acceptance, and *organizational requirements*, that is requirements are those that come out of a system being placed into a social context rather than those that derive from the functions or tasks. *Hardware and software requirements*, covering which functions the system is to provide, justified based on the learner's needs and their (different) ways of performing the task, will be covered only briefly as this is not the main focus of the project. Requirements for the visual design were also divided.

## Evaluation with SME: Validation of Course Plan

Two interviews were individually performed with each of the two SMEs to validate the course plan.

### *Participants*

Two SMEs participated in the evaluation, in two separate sessions led by one individual designer at a time.

### *Preparations*

The defined course content and sequence, as well as learning steps and objectives, were summarized in a table for evaluation with the SMEs. The SMEs were sent the summary in advance to be able to review and reflect on it, before it was further discussed in an interview.

### *Execution*

Stakeholder interviews with SMEs were conducted repeatedly throughout the project, to answer questions as they arose in the process. The interviews at this stage were unstructured to semi-structured, as suggested by Preece, Rogers, and Sharp (2015), as some areas of discussion were completely unfamiliar to the designers and thus needed to be performed as open discussions, while others needed some prepared questions structure. However, the session was to a great extent conducted as an open discussion between the designer and SME, where both sides had the opportunity to ask questions and share ideas.

One of the interviews was performed online, via video conferencing software (Zoom), while the other was conducted via telephone. The designer kept notes during the discussion.

## Evaluation with learners: Personas and Scenarios of Use

Evaluation of the created personas and authored scenarios of use were evaluated with a representative from the target user group to validate their accuracy.

### *Participants*

One assistant nurse participated in the evaluation. She was recruited via e-mail, as she had participated in an interview during the previous iteration.

### *Preparations*

A short script was prepared in terms of the key points of discussion.

### *Execution*

The session was performed online, via video conferencing software (Zoom). One designer acted as moderator, while the other kept written notes.

The participant was welcomed, and briefly updated on the project's progress since the last iteration. The moderator then presented the personas, as well the scenarios of use to the participant by visually displaying them and reading them out loud. The participant was encouraged to address any arising concerns or questions on the personas and scenarios of use during the presentation. The moderator finalized the session by asking a few more direct questions regarding the content in the scenario of use.

## 6.3.2. Results and Reflections from Iteration 2

The following subchapter presents the key results and reflections from the second iteration in terms of a more detailed overview of the target user group and use cases, the initial defined structure of a course plan, the outcome of the SME evaluation, and a specification of requirements.

### Different Kinds of Learners and Use Cases

Three different personas were created to reflect different types of learners and requirements. One example of a persona is shown in figure 6.11. For the two additional personas created see appendix C.

The personas, in combination with scenarios of use, were used to communicate ideas and understandings of learners, in terms of behaviors, needs, constraints, etc. The personas were used extensively during the design process to ensure that the final design supported a diverse group of learners and their goals.



## Erik

### Hard facts

Erik is 37 years old and lives in a house with his wife, two children and dog in Halmstad, Sweden. Erik and his family live about 30 minutes outside the city as they all love nature and having it calm and quiet. However, Erik's both children however love to hang out with friends, so it's always a full house.

Erik has worked as an assistant nurse for 10 years now. He started working in a nursing home within the municipality, but now works at a privately owned home care service. He thinks that his current job has better working conditions and fits him better as it's more independent.

Erik studied nursing and care in high school, but he also has a specialist education in dementia and geriatric psychiatry. Erik got tired of working in elderly care for a while and retrained as a sports teacher for a few years. However, he got tired of that as well and returned to elderly care, with more experience of how the body works and the importance of moving our bodies, even for elderly people!

### Interest and Values

Erik is 37 years old and lives in a house with his wife, two children and dog in Halmstad, Sweden. Erik and his family live about 30 minutes outside the city as they all love nature and having it calm and quiet. However, Erik's both children however love to hang out with friends, so it's always a full house.

Erik has worked as an assistant nurse for 10 years now. He started working in a nursing home within the municipality, but now works at a privately owned home care service. He thinks that his current job has better working conditions and fits him better as it's more independent.

Erik studied nursing and care in high school, but he also has a specialist education in dementia and geriatric psychiatry. Erik got tired of working in elderly care for a while and retrained as a sports teacher for a few years. However, he got tired of that as well and returned to elderly care, with more experience of how the body works and the importance of moving our bodies, even for elderly people!

### Prior Knowledge

Erik has a big interest in sport and training, he takes good care of his body and is very well aware of the importance of an active lifestyle in order to live a healthy and long life. He enjoys outdoor activities the most, such as hiking or fishing.

Erik also finds it really interesting to read about psychology and how the human mind works. Everything with humans and the human body takes his attention. He often watches documentaries about humans behaviors and lifestyles, as well as about the human revolution. Getting old and weak scares him a little, but he also knows that it belongs to life.

Ever since Erik was a little kid, he has had the ability to feel empathy for other people that are struggling somehow. He has always felt a special need to help people who are needs extra support in their everyday life. Especially those people whose brains do not function as normal, such as dementia.

Erik likes to be close to people but it's important for him to be for himself sometimes, why the home care service works better for him than working in a nursing home.

### Technical Habits

Erik owns a smartphone and computer but does not use it to a greater extent. He has never found a greater interest in technical stuff, nature and humans attracts him more. Typically turn to his kids for help when needed, as his own interest in technology is very low.

However, he uses his smartphone almost daily for Social Media such as FB, and plays some games occasionally. He uses the computer mainly for emails and paying bills, approx. every other week. He also just bought a smartwatch to keep track of his heart rate and other interesting statistics about his body during the day. Such technology finds him more interesting to learn.

Erik also uses a smartphone daily in his work, as it's used to unlock/check in at residents houses, and is used for delegation of medicine/signing, which he thinks works smoothly and well.

### Work Situation

At Erik's job, they are quite far ahead with digitalisation compared to other workplaces. His boss has started an intern project that involves digitizing and streamlining the assistant nurses' work as much as possible. Erik is a bit skeptical about this as he thinks his way of working works well today, even if it is a bit stressful at times. He argues that it takes longer to learn a lot of new technology and new ways of working.

Erik's supervisor is very concerned that all staff should feel competent and secure in their role as assistant nurses, not least when performing heavy lifts. All staff are therefore offered to attend training in movement knowledge often, too often if you ask Erik. The problem is also that these educations are often located in Gothenburg, at a company named HMC Sweden, as they are the best on the market, which is time consuming and makes Erik's job even more stressful.

Since Erik works in the home care service, he is usually on the go, or at care recipients' homes. However, his job has an office where he usually starts and ends the working day. It also happens that he stops there for coffee and food. It's not a big office, it's mostly admin staff and managers who works there, but on the other hand there are some computers, coffee machine, and a cozy corner for everybody to use.

### A Typical Working Day

- Bikes to the office to start the working day.
- On some days during the week Erik meets up with colleagues for a meeting before travelling to care recipients; other days he just parks his bike, collects whatever material he knows he will need during the day and drives off to the first stop.
- Arriving at a care recipient's house Erik either unlocks the door with his smartkey in his smartphone, or checks in the arrival on the device mounted inside the home after being let in by the resident/family, depending on the routines for the particular individual.
- He greets the resident(s) and typically helps them with showering, shaving, getting dressed, going outside for a walk or performing rehabilitation activities prescribed by rehab.
- The time spent at each stop varies depending on activities for the meeting and the status of the care recipients, however Erik often feels stressed and sometimes needs to leave early due to alarm from other care recipients.
- Erik typically enjoys his day, as most care recipients are very nice and often offer him snacks such as cookies after his visit. However, some are more hostile and do not enjoy "having strangers in their house" as they say.
- After the working day is done, Erik returns to the office for potential documentation, sometimes has a chat with colleagues, parks the car, and bikes home.

### Future Goals

Would like to advance within his career, receiving more responsibility for administrative tasks, such as scheduling or the like. Potentially even become unit manager as he believes to have ideas that can contribute to the working place.

Figure 6.11. Example of one of the personas.

The population of assistant nurses is a complex user group to design for as they have different conditions in form of skills and experience in terms of healthcare work, transfer skills, and technical literacy. Nevertheless, the user evaluation of personas and scenarios of use indicated that the designers had mapped out a genuine and accurate representation of the user group, as the group representative approved those.

The scenarios of use method resulted in a deeper understanding of potential situations in which the assistant nurses would perform the e-course. There are two main contexts in which the assistant nurses could carry out the course: at the workplace or home (during paid working hours). However, user studies with assistant nurses and managers respectively revealed the collective preference or prerequisite that the e-course should be performed during working hours. Therefore, the main focus was set on specifying different conditions in the physical environment at the assistant nurses' workplace.

As revealed during user studies in the previous iteration, it is most likely that the assistant nurses will complete the course on a computer, partly as this is the main available technology, but also as the course requires full focus from the learner and for the learner to see the content clearly. However, from a usability perspective, it is important to design a solution that is responsive for both tablet and mobile.

Several factors can affect the execution of the e-course depending on the work environment. The two overarching alternate working contexts revealed in the user studies include: working in a nursing home or working with home care. These different contexts result in several noteworthy differences. For example, in terms of the physical, technical and organizational conditions, as described in the context of use analysis in iteration 1. The range of activities that the learners can engage in is restrained by these conditions, for instance as available transfer aids are needed for the learners to engage in physical training and staged transfer situations. However, such aids are typically not available for these purposes.

## Course Plan

Analysis of and mapping out all content resulted in the first version of a course plan, covering sequence, learning content, and learning objectives. The structure is modular, that is, the content is divided into modules with corresponding lessons. During the project, the order of certain lessons and modules could be changed depending on new insights. One could say that it is like putting together a puzzle, where all pieces of content in the course depend on each other.

The overall goal with the architecture of the course was to come up with a structure that aligned with the three steps in the HMC method and how the tasks are supposed to take place in reality. Likewise, make sure that all examples demonstrated in the course do not address any theory that has not been covered yet.

## Module 2. Step three of the HMC method: The Human

### **Learning objectives for module**

- *The learner can explain the role of the human, that is the care recipients, in the HMC-method*
- *The learner can motivate the care recipient's right to participate in his/her own transfer*
- *The learner can motivate the importance of identifying and encouraging the unique care recipients abilities*

### Lesson 2.1. The care recipient's participation in transfer situations

Learning steps	Content
<i>The importance of the care recipient's participation in a relocation/transfer situation</i>	<p>Stress the importance of the care recipient's active contribution to the relocation/transfer situation based on abilities, for their own health and for the sake of the caregivers.</p> <p><i>Having the care recipient at the center of our work means that we must at all times take advantage of and, if possible, develop the care recipient's own abilities. By making the care recipient maximally involved in their own relocation, we also create the best conditions we can for those of us who are to support the relocation. With the help of the care recipient's own, active and passive abilities, we reduce the power consumption and the risk of injury in the transfer [...]</i></p>

**Figure 6.12.** Extract from the course plan.

## Feedback from SME: Validation of Course Plan

Based on the feedback from the SMEs, some adjustments were made to each unit within the course plan according to their input. Those changes mainly covered what information should be conveyed and thus what content to include.

## Requirements Specification

Based on the personas and scenarios of use, as well as other insights derived from previous methods in the process, a first draft of the requirements was specified. The specification covers requirements regarding, for example, user needs and the context of use, relevant ergonomics and user interface knowledge, standards, and guidelines, usability, and organizational requirements that directly affect the user (see appendix D). The requirements specification describes the detailed usability requirements to set objectives and help prioritize the following work. The document was continuously updated during the project as new insights emerged.

### 6.3.3. Design Guidelines v.2

New insights and further reflections, such as the requirement specification, contributed to a revision of the design guidelines. Below is a summary of the guidelines from iteration 1, where guidelines added during iteration 2 are presented in bold.

*Note that the numbering for some guidelines have shifted as new guidelines have been added.*

#### System Interaction

- G1. The system should provide an easy way to access the course (concerning log in etc)  
*The experience should be as focused on the learning tasks as possible, therefore interaction with the system needs to be hasslefree from the start. (Theory)*
- G2. The system should provide autosave to ensure stable input and easy access  
*The learner should not need to be confused or stressed about the risk of his/her progress being lost if leaving the course. Therefore it is essential that the system autosaves and re-enters the course where the learner last left off. (Theory; User studies)*
- G3. The system should provide clear feedback on system status  
*The learner should not feel confused regarding or frustrated by the system during usage, by providing the learner with clear feedback on the state of the system this can be minimized. (Theory)*
- G4. The system should provide clear feedback on the learners performance  
*Clear progress feedback throughout the course is needed in order to motivate the learner and to provide the learner with transparency of progress. (Theory)*
- G5. The system should allow for easy navigation between different elements within the course  
*The learner must be able to navigate within the course hasslefree. It should be clear how the learner can move from one state to another, revisiting content if needed. This also includes providing the learner with understandable feedback on what elements are accessible and not at certain stages, and why. For example, descending modules can be locked until the learner has completed certain tasks. (Theory; Competitor analysis)*
- G6. The system should foster a steep learning curve for navigating the course  
*Learners must quickly learn the course structure and how to navigate it in order to not spend unnecessary time and effort outside the main learning activities of the course. (Theory)*
- G7. The system should support memorability  
*When learners return to the course after a period of not using it, they should rapidly reestablish proficiency. (Theory)*
- G8. The system should be designed to minimize errors  
*The possibilities of errors should be minimized to promote a frictionless interaction. (Theory)*
- G9. The system should be able to communicate with other softwares  
*Communication with other software systems used within an organization can be a valuable add on for the system, enabling for example easy accessibility for managers or the like to monitor educated personnel's progress and performance. (User studies)*

G10. The system should follow WCAG standards of level AA

*The system should meet requirements for accessibility to promote an inclusive design. This is a potential requirement from stakeholders within the public sector that are potential buyers of the service. (Theory; Stakeholder: SMEs; User studies)*

G11. The system should be responsive to various screen sizes

*To promote a usable experience it is crucial that the site is accessible on mobile, tablet and web with good UX and performance. (Theory, User studies)*

G12. The system should remember the learner's state in between sessions

*The system must have a memory for the learner's progress, and allow the learner to resume their work at the activity they left. (Theory; Competitor analysis; User studies)*

G13. The system should support darkmode and lightmode

*Learners should have the flexibility to use the system both day and night, to be in full control over their time spent, and to ensure an appreciated user experience independent of time of the day. This is especially needed as the target group typically work both during day and night time. (User studies)*

G14. The system should be designed to minimize cognitive load

*To promote focus on the main tasks, the design should be developed with caution as to not create cognitive load. (Theory)*

G15. The course should be available in various languages

*To reach a diverse group of learners with various language skills, the system should support language differences to some extent. (Stakeholder: SMEs)*

G16. The course should support auto-correction of tasks and tests

*It is a requirement from the stakeholder in terms of the client that the system should be automatic in the sense that the client should not need to actively assess the tests within the course. (Stakeholder: SMEs)*

## Course Structure and Content

G17. The system should allow learners to carry out the training in their own pace

*Learners need to be in control over when to participate in the course, and not be restricted by a certain point in time. With that said, a final deadline for completing the course is suitable, however the learners should be given the flexibility to complete the course whenever before the deadline. (User studies)*

G18. The course should provide a fun and engaging way of learning

*To promote an engaging user experience, that supports learning, and that stands out from competitors the course should provide interactive exercises during course progress. (Competitor analysis)*

G19. The course should provide a clear reflection of the client's method

*The course should be directly grounded in the client's method, that forms the basis for the educational content (Stakeholder: SMEs)*

G20. The course should provide a clear overview over the content

*Learners should be prepared for the next steps, and receive an overview over course structure and content, so as to be able to plan the activities ahead. (Theory; Competitor analysis)*

**G21. The course should support social interaction**

*The social aspect can be seen as critical in some aspects, and it is appreciated to provide learners with some opportunities for discussions in groups. (Theory; User studies)*

**G22. The system should support repetition of knowledge**

*Critical content should be repeated to promote learning. One way of achieving this is through the incorporation of exercises. (Theory; Competitor analysis)*

**G23. Visual content should be of high quality**

*High quality of visual content, such as pictures and other graphics, is important to foster an engaging and friction free usage, and to convey a professional presentation to learners and customers. (Competitor analysis)*

**G24. The course should assess the learners performance**

*To ensure that the learner has reached the learning objectives it is critical to include some type of assessment test. (Stakeholder: SMEs; User studies)*

**G25. The course should include variations in learning activities**

*Offering a range of learning activities creates a variance that can foster a more engaging learning experience. (Stakeholder: SMEs; User studies)*

**G26. The course should provide clear statements explaining the purpose and goals of and content within the course**

*It should be clear to learners what they can expect to learn through the course, and what skills they should have acquired after completion. (Stakeholder: SMEs; User studies)*

**G27. The course should have a clear connection to context, so as to make the knowledge applicable in the working situation**

*The content within the course needs to be clearly derived from the working context in which the knowledge and skills acquired should be applied. (Theory; Stakeholder: SMEs; User studies)*

**G28. The degree of difficulty should be adapted to the learners level of knowledge**

*The learning content should be on the appropriate level of difficulty for the individual learner in order to foster learning. This means that learners who are in need of additional support should be provided with this, but also that more experienced learners should be stimulated by sufficiently challenging materials (Theory, Stakeholder: SMEs; User studies)*

**G29. The course should allow for a personalized experience**

*Enable personalized customization of content, based on what the learner is interested in, or what the learner's work environment looks like, for instance, what physical aids are available and or used. (Theory; User studies)*

## 6.4. Iteration 3

The third iteration focused on translating all insights and ideas into visual solutions, thus the main focus was on HCD's fourth phase *producing designs and prototypes*. These solutions are done both in order to explore and test out different ideas, to communicate them, and to evaluate solutions, within the team and with external stakeholders.

### 6.4.1. Process

The following subchapter presents the process and methods used in the third iteration including *Define Instructional Methods*, *User Flows*, *Brainstorming*, *Affinity Diagram*, *Wireframes*, *Storyboards*, and *Evaluations with SMEs, Learners, and Expert*.

#### Define Instructional Methods

After defining learning objectives, content, and the overall structure in the course, the next step was to translate all content into learning activities, i.e. how the content should be presented to the learners. When preparing an online course, the main challenge will not be structuring the content but ensuring that learners have enough online activities. Research on learning activities appropriate, or potentially appropriate, for an e-learning course was conducted and summarized in a table. The table listed activities in categories in general terms such as text, images, infographics, audio, video, scenarios, interactive elements, etc. These could then be further broken down into subcategories of various kinds. Scenarios could for example be broken down into the subcategories: Real-world examples, Case studies, Branching scenarios, and Simulations. Use cases and best practices were then listed for each subcategory to get an overview of which activity is suitable for when. The table gave a good understanding of the solution space and when specific learning activities are good to use.

As the table compiled common learning activities in online education, the next step was to select the right activity or representation for the project course and each of the learning objectives. Activities were chosen and mapped to the course content, depending on the type of content and what cognitive level the learner should reach, according to Bloom's taxonomy (Anderson, et al. 2001). The table structure is shown in figure 6.13.

<b>Learning objectives for course</b> <ul style="list-style-type: none"> <li>• <i>Learning objective<sub>1</sub></i></li> <li>• <i>Learning objective<sub>2</sub></i></li> <li>• <i>etc</i></li> </ul>		
Module #. (Name of module)		
<b>Learning objectives for module</b> <ul style="list-style-type: none"> <li>○ <i>Learning objective<sub>1</sub></i></li> <li>○ <i>Learning objective<sub>2</sub></i></li> <li>○ <i>etc</i></li> </ul>		
Lesson #. (Name of lesson)		
<b>Learning steps</b>	<b>Content</b>	<b>Learning activities</b>
<i>Description of what needs to be done or achieved in order to reach the objective</i>	<i>Description of what content to include.</i>	<i>Description of what activity the learner should be engaged in.</i>

**Figure 6.13.** Table structure of mapping out activities against learning objectives and content for each lesson.

## User Flows

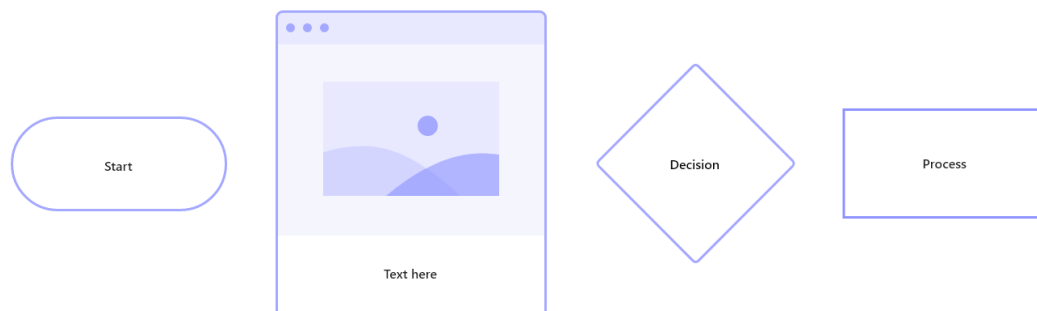
User flows were sketched out based on the activities and tasks the learners are expected to complete in the e-course. These were made to visualize and concretize early design ideas and to get a feeling of the overall flow of the course. The user flows were divided into the following sections:

1. Steps performed before the course
2. Steps performed during the course
3. Steps performed after the course

Due to time constraints, it was decided to focus mostly on the second part, the steps that the learners need to go through during the course. Steps were thus sketched out from the time that the learner starts the course until the final test has been taken.

The user flows were sketched out visually in Adobe XD ([Adobe.com](https://www.adobe.com/)) and structured in modules and lessons to get a good overview of the course sequence. The elements in the user flow were based on various shapes to represent different actions (see figure 6.14). Each step was visualized in small wireframes that explained what learners were expected to see and do in each view. Furthermore, the user flows were highlighted at points where learners are

needed to actively do something such as scrolling down, clicking on an interactive element, etc. This was to get a feel for the participation in the course, the key here was to find a balance between interactivity and absorbing information. Various decisions that the learners are needed to make in the course were also outlined, for instance, if there was certain information that was hidden for exploration in the course. The different elements used in the user flows are shown in figure 6.14.



**Figure 6.14.** Elements used in the user flows.

The aim was to structure the flow as engaging and pedagogical as possible. From a pedagogical perspective, it is important to follow a thread throughout the course and offer interactive activities regularly to create a varied and engaging course, so the learners does not get tired or lose motivation to complete the course. In addition to the visual user flow, a table was created with a very concise written description for each step.

## Brainstorming

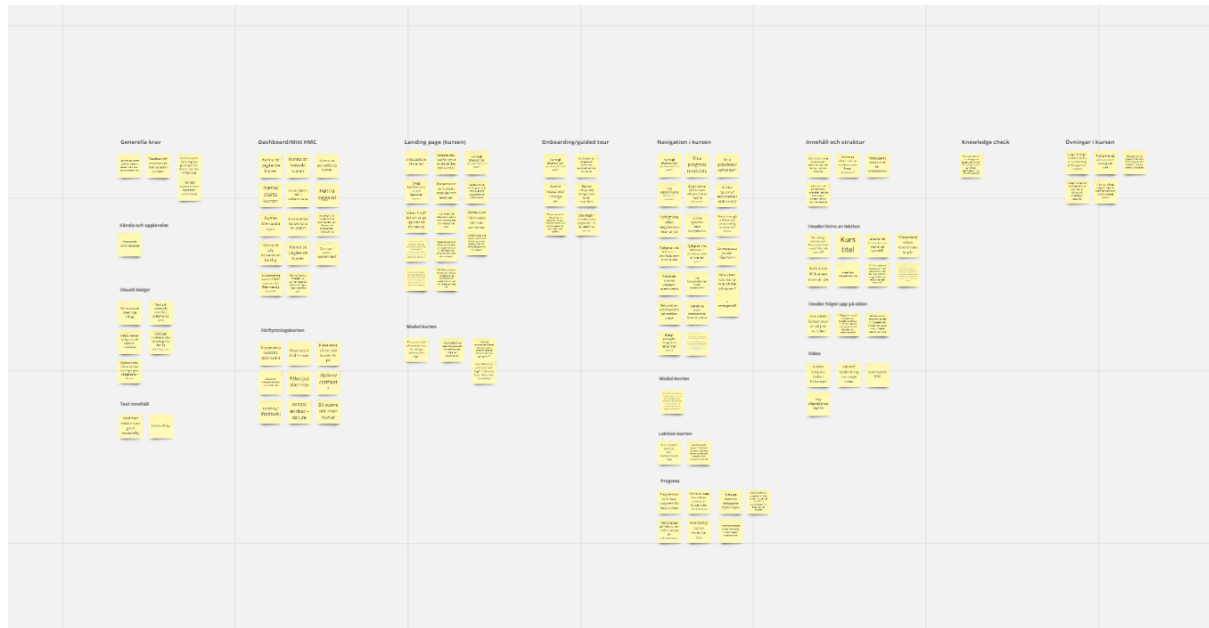
A brainstorming session was conducted internally within the team, to process the information collected so far in the project and to spur creativity and ideation to take design solutions one step further.

Several different ideas, related to the structure, functions and features of the e-learning service, were sketched out by each designer individually, before shared with each other. Some of the most interesting, and realistic, ideas were selected collectively and saved as a guiding line for further ideation. This decision was made based on the designers preferences and with regards to the requirement specification and the set goals for the project.

## Affinity Diagram

An affinity diagram was created to make sense of all the ideas that emerged during ideation sessions, such as the brainstorming, to simplify it and enable identification of themes, to foster an understanding of what is most important and what factors to focus on, which should support the most successful design possible from a learner's perspective. The diagram was

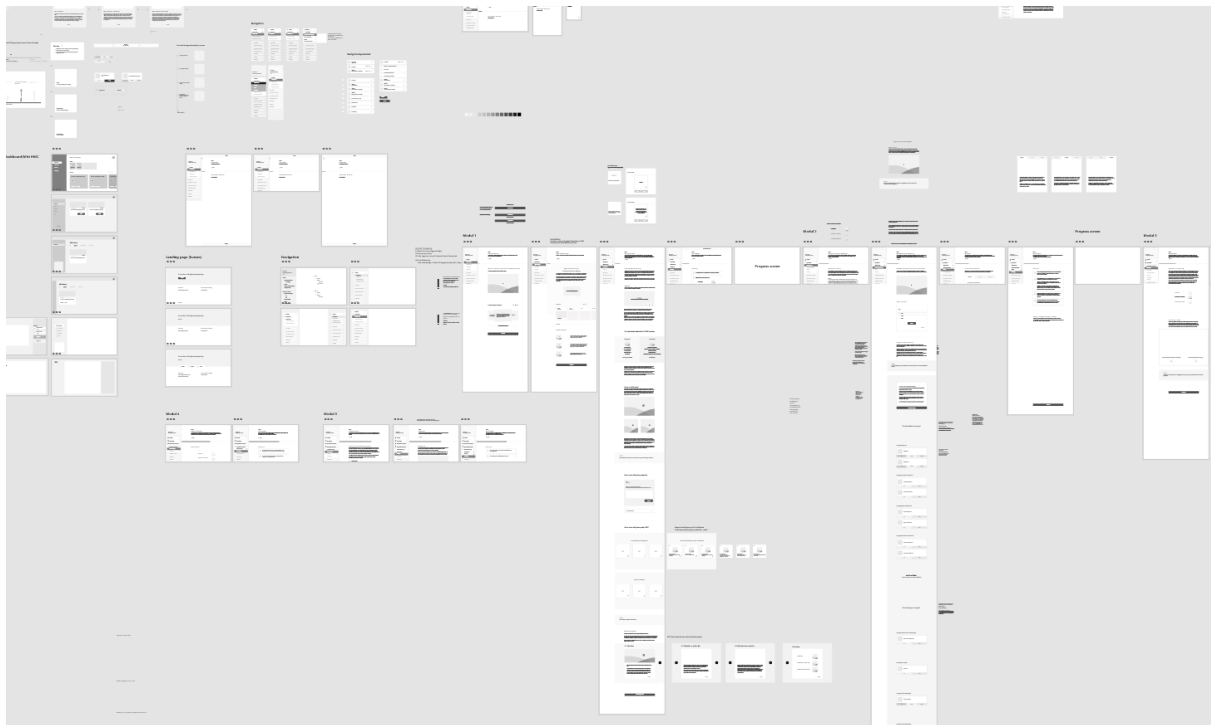
created in an online post-it tool (Miro) to create a visual representation of thematically grouped ideas (see figure 6.15).



**Figure 6.15.** Overview of the Affinity Diagram that was created in Miro.

## Wireframes in Mid Fidelity and Parallel Design

A mid-fidelity prototype was created in Adobe Xd in terms of gray-scaled wireframes representing each screen in the user flow (see figure 6.16). Each element followed a grayscale to avoid focusing on anything besides the content, interaction, and navigation. Creating grayscale wireframes supports creating multiple solutions for the same task, then evaluating and comparing to determine which solution to continue with. Different design solutions of the various components of the e-learning system were created in parallel to widen the possible design solutions, to promote diverse alternatives resulting in an optimal solution. The simplicity of the medium allows for quick changes and multiple designs without having to waste time satisfying the look and feel.



**Figure 6.16.** Wireframes created in Adobe XD.

The first focus was on creating the overall structure and navigation in the course. Already at this stage, it was important to develop a layout that is responsive for both tablet and mobile. Throughout the process, a lot of effort was put into creating a design that could easily be translated into code later.

The next step was to map out content and activities in the form of visual, grayscale elements. Almost every lesson and module were sketched out in this fidelity to get a holistic view of the course.

The main purpose of developing wireframes in mid-fidelity was to test and validate the flow and content with representatives from the target user group and experts.

In connection with developing wireframes, the first draft of a design component library was created as part of a design system for the e-course. The more content that was produced visually, the more design components were created. In addition, all activities and content that were translated into the design were compiled in a table where different attributes and states were listed for each design element. Each block of design element had different alternatives to support customization. Settings were also listed for each of the design elements which describes what the designer should be able to change on each element, for example, padding, background, color. The table was mostly made for future work to build an LMS for the client, letting them design and digitize more courses than the one translating in this project. However, creating the first draft of a component library also made the prototyping phase more effective as many design elements could be reused as the process goes on.

## Movie Storyboards

To present an overview of the content and feel of each scene in the educational videos included in the course, movie storyboards were created. This further fostered a clear communication between designers and the client of what should be included and how it should be presented effectively. This was a good method to use due to the time frame of the project, as it was decided that no type of videos or GIFs would be produced at this stage. However, to get a holistic sense of the content, an understanding of what is addressed in each video is needed, why storyboards were an effective way to communicate this.

For each learning step and associated content that was decided to be presented through video, a movie storyboard was created in terms of a sequence by shot depiction of the video presenting what each frame should include. Each storyboard also contained specific notes regarding each scene, describing the content as well as a manuscript for what information should be conveyed. These were used as a basis for the participatory workshop for further validation which is described below.

## Evaluation with SMEs: Participatory Workshop

Validation of the content and structure of the course was evaluated with SMEs during a wireframe walkthrough and discussion session. The main purpose of the walkthrough was to validate that the pedagogical approach supported the customer's goal of maintaining or even improving the quality of the course. In addition, certain content needed to be clarified by the customer and the storyboards validated.

### *Participants*

The two SMEs and the two designers.

### *Preparations*

Some particular questions were prepared in advance, but the session was otherwise unstructured as questions were addressed from both designers and SMEs throughout the session.

### *Execution*

The session proceeded for circa two hours in total. The design team led the walkthrough by clicking through the mid-fidelity prototype, step by step, observed by the SMEs. One designer managed the interaction with the prototype, while the other was in charge of documenting. Both actively participated in the discussion with the two participating SMEs. All notes were documented, sequentially structured according to the interaction experience.

The next step was to validate the procedures sketched out in the storyboards to identify if any important steps were missing. In addition to the walkthrough, approximately one hour was assigned to the participatory observation of certain elements of the education relating to the

storyboards. Due to national restrictions because of the Covid-19 pandemic, the designers could neither participate nor directly observe the traditional education with other learners. However, the SMEs provided a first-hand demonstration of several elements of the course, mainly connected to transfer with lifts. Both designers observed and participated by acting as care recipients being lifted, and as a caregiver by handling the lift. The main documentation was done by notes, and video was taped using a smartphone during the lifting situations.

This opportunity not only gave the designers a better understanding of the skills and techniques that the learners of the online course should master and understand, but also a better understanding and empathy for the care recipients' exposed role in different transfer situations.

## Evaluation with Learners: Wireframes

A formative evaluation in terms of a cognitive walkthrough of the wireframes was conducted with two representatives from the target group, in two separate sessions.

### *Participants*

Two learner representatives participated in the evaluation, in two separate sessions. One of which was a practitioner assistant nurse, with rather high prior knowledge in transfer skills and a high experience of participating in online-based educational courses. The other participant had no prior knowledge in transfer skills, low experience in online courses, and would begin to work as an assistant nurse in a nursing home in the near future.

### *Preparations*

A manuscript with semi-structured questions regarding various parts of the prototype as well as other related concerns, such as new ideas for evolving the prototype, was prepared beforehand and used as a guide during the session. Questions regarding the prototype covered usability concerns, for instance, connected to layout and navigation, and also functions and content to some extent, while the general questions touched upon motivation and socializing with other learners and teachers.

### *Execution*

One designer and one participant took part in each evaluation session, which was performed online, via video conferencing software (Teams or Zoom depending on the participant's preference).

As only one designer was leading the walkthrough, notes were not kept meanwhile, as this would interfere with the test leader's focus on the task and the interaction with the participant. Therefore, each session was recorded and transcribed directly after the session by the test leader. A manuscript was used as an introduction to ensure consistency between sessions and that all critical information was covered. Each participant was orally informed

about their rights to anonymity and participation before recording, and that the recording would not be shared with anyone outside the project, and that it would be deleted when the project is finished. The individual participant had to give his/her consent before recording was started, otherwise, no recording would be done, and the test leader would keep written notes instead.

All participants gave their consent for recording.

### Evaluation with Expert 1: Usability

A formative evaluation was conducted with the intention that the expert should use rules of thumb to measure the usability of the user interfaces and give relevant feedback regarding his expertise in coding and UX design.

#### *Participants*

The participant was a UX designer/front-end developer, with several years of experience in developing both web-based experiences and mobile applications. In addition, the participant had a good understanding of the user group, the context, and the client's method as he and one of the designers previously did a project within the same area.

#### *Preparations*

Some questions were listed in advance and some issues were prioritized to be looked for and presented to the expert, but the evaluation was overall an open feedback session.

#### *Execution*

The evaluation took place face to face. Wireframes were evaluated for guidance and feedback mainly on technical constraints, layout, navigation, and usability.

As the expert himself could interact with the prototype, the designer leading the evaluation could take notes alongside. The test leader stopped at the listed issues where a discussion about potential solutions was held. The feedback was integrated into the next iteration of the design, taking the prototype one step further in fidelity.

## 6.4.2. Results and Reflections from Iteration 3

The following subchapter presents the key results and reflections from the third iteration in terms of a summary of the outcome design ideation, a list of instructional methods, the first version of the prototype, a presentation of a mid-fidelity version of the prototype and UI component library, and finally the outcome of the various conducted evaluations.

## Ideas and Challenges

During the project, a lot of good ideas arose, not least during the brainstorming session. However, not all were feasible to adapt and some were left for future work. Since the project has a time limit, the ideas were given priority over what was most important to implement at this stage, where defining the course content and instructional methods in mid-fidelity were considered most important. The idea was to get the whole course out in mid-fidelity and then choose which sections should be translated into a higher fidelity with visual expression later on.

A major challenge in translating such a practical education into a digital course is to figure out how to ensure and support the learners to implement the knowledge they gain in the course into their everyday work and put it into practice. Learners often find it difficult to use the knowledge gained and apply it in their work. A lot of time and energy was thus put into thinking out the best way of supporting this. Ideas such as offering digital course material directly on the mobile phone emerged, such as in the form of assessments and demonstrating the steps in HMC's method. These steps are presented in the course, however, to support learners to apply it at work, a tool that is available directly on-site would be useful.

Another idea that emerged was to provide practical challenges to the learners such as doing a transfer with a care recipient with support and instructions from an app that explained how to do it in the best possible way, based on the HMC method. Such an app is under development but has not become reality yet and is therefore not available (for proof of concept see [www.juliawallen.com](http://www.juliawallen.com)). However, the idea of giving challenges can also be applied by prompting learners to think about the challenge or suggestions in their work.

Furthermore, ideas about implementing gamification to motivate learners and make the course more engaging emerged. Research has shown potential for implementing game mechanics elements in e-learning contexts (e.g. Buckley & Doyle, 2016; Poondej & Lerdpornkulrat, 2019). Some common game elements are e.g. *the concept of reward*; *rapid feedback cycles*; *competition* (Buckley & Doyle, 2016; Apostolopoulos, 2019); and *challenges* (Hamari, Koivisto & Sarsa, 2014). One idea about letting the learners collect stars by doing voluntary activities in the course arose. Another idea was to hide rewarding points in exploratory content, which makes it more exciting and prompts the learners to explore the content further. Letting learners test their knowledge through diverse knowledge checks in the course was also an idea that needed further investigation.

In connection with having knowledge checks throughout the course, ideas emerged about providing quick and direct feedback regarding all exercises. As rewards are introduced the concept of potential failure naturally follows. In order to sustain a positive experience and not kill learners' motivation, feedback cycles must be rapid and stakes must be kept low (Lee & Hammer, 2011). This means that as the learner explores the content and tries different actions, such as answering a question, he/she must receive immediate feedback and should not be punished for this trial and error mode. Feedback should further be provided through

progress indications, such as a progress bar, to acknowledge the learner on the system status and his/her progression (Poondej & Lerdpornkulrat, 2019).

Ideas about including collaborative learning emerged, such as role-play exercises that can be performed together with colleagues, that encourage the learners to engage in practical tasks where they should act as care recipient and caregiver respectively. However, these ideas were difficult to continue with as all learners will not have access to colleagues during the learning session. This became clear under the context of use analysis and especially when looking at the organizational environment for assistant nurses working in the home care service, who often work alone. In addition, workplaces do not have any good places or moving aids for testing movements on each other. The conclusion could be drawn to not involve any mandatory collaborative learning activities at this stage.

One of the major topics that were brainstormed was the ease of navigating the course. Easy navigation within the system can for example connect to allow the learner to mark sections within the course that they want to go back to. Ideas about letting learners be able to mark parts within the course that they encounter that they do not fully understand, or as they perceive as extra important, or for any other reason would like to revisit at this stage. This offers them efficient navigation, without needing to remember the place for it.

## Instructional Methods

The learning material is important, but how you present it is equally critical. When developing both user flows and wireframes, the visual presentation for the content in the course developed in the form of activities. The goal was to build a structure of the course that felt varied, containing both absorb, do, and connect activities. The different activities ideas are presented in table 6.3. below with a corresponding description of when to, preferably use it.

**Table 6.3.**

*Summary of potential instructional methods.*

Instructional Method	Description
Static Content	
Text	Used to describe non-visual content.
Statements / Highlights	Used to highlight important content in the course which are directly connected to the learning objectives and the final test.
Quotes	Used for presenting previous learners' comments about the course.

List	Used for listing content, both text and images could be included in the list.
Images/illustrations	Used to demonstrate something. Comes in different forms and are used extensively throughout the course.
Video	Used for demonstrating movements and other important tasks that require the learner to actually see the procedure in a whole sequence.
GIF:s	Used for demonstrations of shorter sequences.
Process (scroll down)	Used for demonstrating step-by-step processes.
Do's and don'ts	Used for demonstrating how to do and not to do.
Reflective question	Used for reflection before getting the theoretical answer.
Examples / Scenarios / Demonstrations	Used for putting the example in a real context.
Key takeaways	Used in each summary of each module to highlight the key takeaway from the specific module.
<hr/> <b>Interactive Content</b> <hr/>	
Accordions	Used in situations where it is okay to hide content, where the learner can explore the content freely.  Used for not overwhelming the learner with information and content.
Tabs	Used in situations where it is okay to hide content, where the learner can explore the content freely.  Used to not overwhelming the learner with information and content.  Used for dividing similar content/examples.
Labeled graphic (hotspots)	Used for hiding information on images, click on them to get more information.
Process (clickable - side)	Used for demonstrating step-by-step processes.
Flashcard (flip)	Used for question/answer exercises. Encouraging to find out the answers by clicking on the cards.
True or false	Used for making the learner reflect, forcing he/she to make an active decision before getting the correct answer.

Knowledge check	Used for checking if the learner is keeping up, as well as supporting repetition.
Walkthrough	Used for longer exercises such as demonstration how to perform risk assessments or status assessments.
Links	Used for linking back to previous lessons for repetition
Sorting	Used as one way of checking the knowledge during the course. Used mostly for categorizing content in a fun and engaging way.
Quiz	Multiple choice or multiple responses. Used as one way of checking the knowledge during the course.

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## Overall Flow and First Version of Prototype

So far in the project, the designers have had a holistic view of the design problem, taking into account the whole context. Some steps, such as how the learners get access to the course, were not visually mapped out but were listed to get the overall picture. Below are the steps that are expected to be made but not included in the user flows.

### *Presteps (performed by other than target learner)*

- Step 1. The unit manager or other admin staff register the personnel to the course
- Step 2. The assistant nurse is notified that they should attend the course and receive a link to it via their job mail.

### *Before the course (performed by the target learner)*

- Step 1. The learner click on the link
- Step 2. Creates an account on “My HMC”
- Step 3. Finds the course “Basic Course in Transfer Knowledge”
- Step 4. Clicks on the course
- Step 5. End up on the landing page for the course
- Step 6. Clicks on “start course” → Lesson 1 opens

From here, the steps were sketched out visually. See figure 6.17 for an extract from the user flows.

The user flows resulted in a better understanding of how the course will be structured and what instructional methods to include when. The visual mapping of the learner's interaction throughout the system, in combination with the written documentation of the steps, provided a clear overview of the flow. By mapping out the content visually, it became easier to see patterns and analyze if the structure follows theories regarding how an online course should be structured to optimize learning. For example, if there were too many video activities in a row during a lesson, this could easily be identified by looking at the user flows and adjusted if deemed needed.

As a result of doing the user flows, the designers realized that there were many steps that the learner needs to go through in the course and a lot of content that needs to be translated into higher and higher fidelity. Due to the time constraints, it was not feasible to translate all course content to high-fi. The scope of the project was further narrowed down, to focus on the user experience from the state *starting the course* to *completing the final lesson*. To specify, all the steps preceding the course, such as getting access to the course, as well as the steps of completing the post-assessment test and all other steps succeeding the course, are excluded from the design scope hereon.

Del 1

## User flow 2: Under kursen

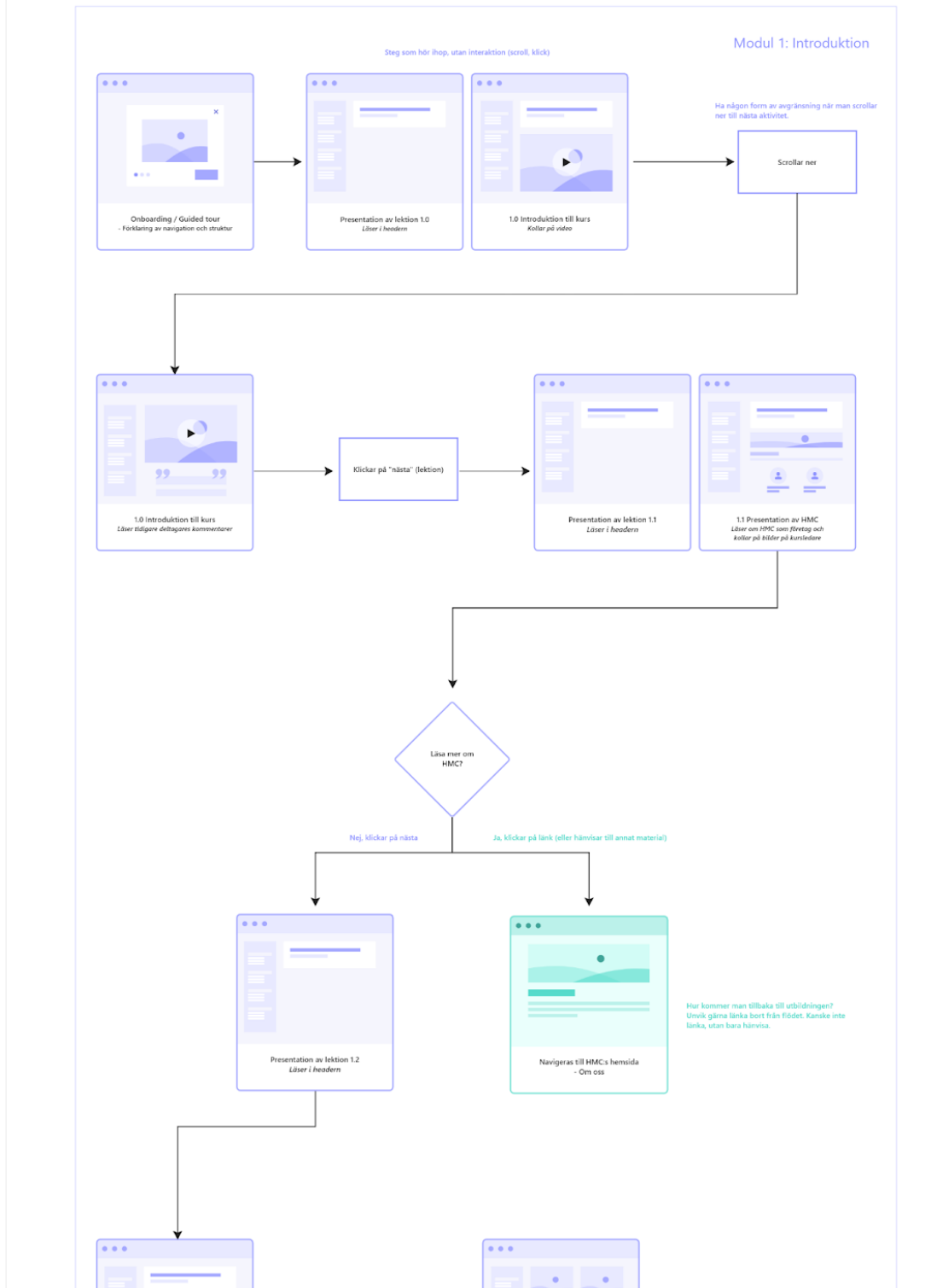


Figure 6.17. Extract from user flows.

## Instructional strategy

Great focus has been laid on creating an instructional strategy, or pedagogical approach, suitable for the learning experience to promote learning and maintain a high quality of the course, during digitalization. By mapping out the learning content, objectives, and instructional methods, a clear view of the pedagogical approach started to form. Grounded in ID theory, LXD theory, and Merrill's principles, the key part of the pedagogy connects to *scenario-based learning*, in which there should be a clear connection between the learning content and the context in which it should be applied, and *learner-centered learning*, where the learner engages in the material on his/her own.

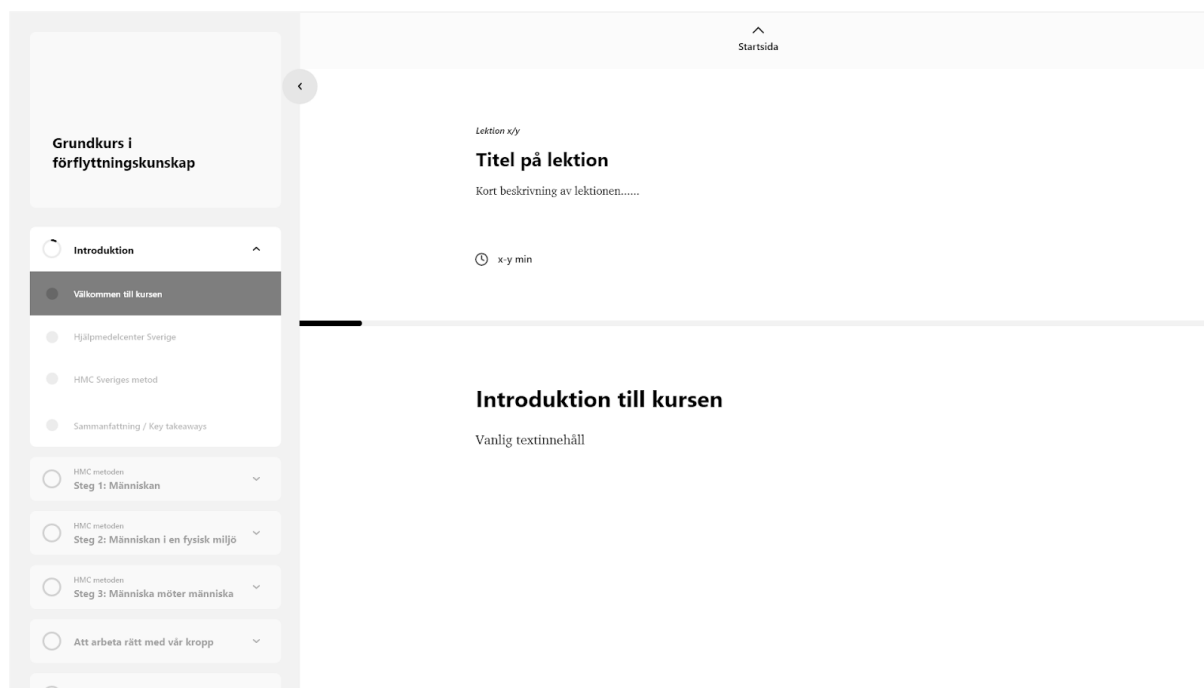
Furthermore, the course offers some flexibility for the learner to influence what content he or she absorbs by offering a “deepening track” in the course. All critical information is presented statically, meaning that the learner himself/herself can not influence whether it is presented or not, while certain other information that is not as critical can be hidden and requires the learner to explore it himself.

To create an engaging, motivating, and fun course, the activities should vary and be structured in order so that the learners do not get tired or lose motivation to complete the course. Furthermore, repetition is a key aspect in learning, the learners are offered to self-assess their knowledge by completing certain activities to ensure that they keep up. Another approach involved is to gradually build on the knowledge in the level of difficulty. More of this is presented in the final prototype, see [7.1. Final Prototype](#).

## Mid Fidelity Prototype and UI Component Library

In connection with the creation of wireframes in mid-fidelity, the first version of the navigation and layout was built in the course (see figure 6.18). The creation of wireframes resulted in a design structure that followed a certain pattern for consistency and memorability in the interface. The learners should clearly understand and recognize when a new lesson started and when a new module started, as well as seeing progress during the course.

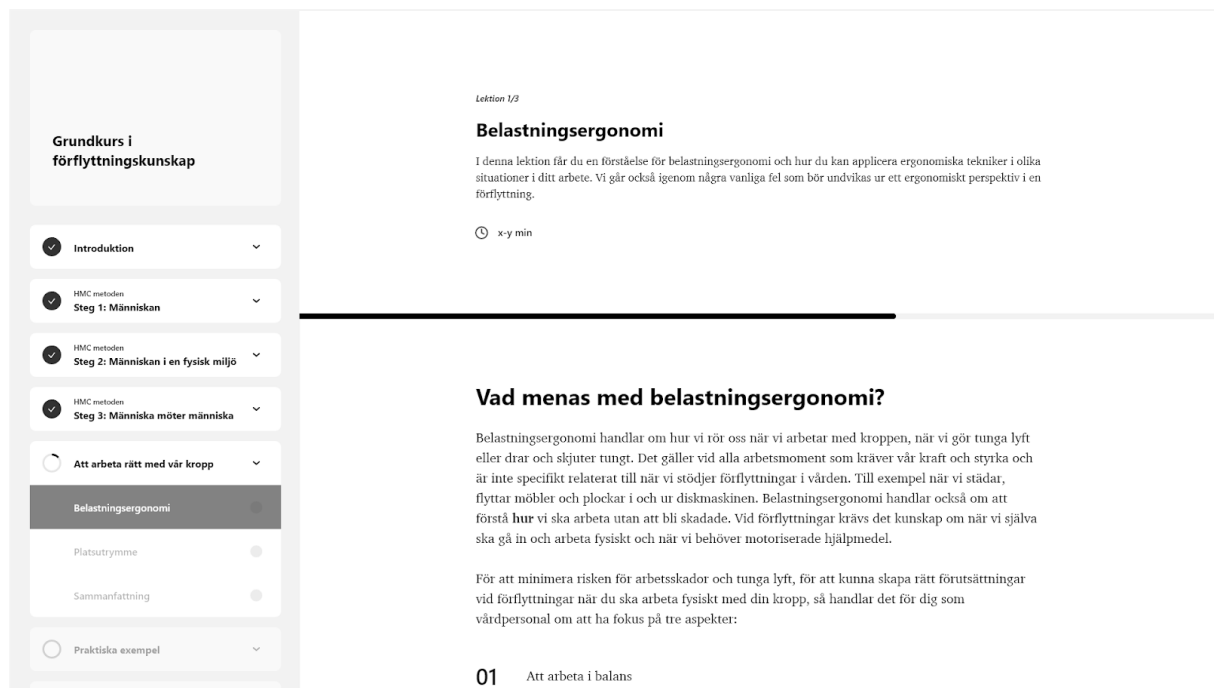
Each module is divided into lessons with a summary to support repetition throughout the course. The summary also makes it extra clear to the learners that they will soon enter the next module. Each lesson contains a header with a title of the lesson, a brief description of what is covered in the specific lesson, and what the learner is expected to learn, along with a time estimate of how long the lesson will take. The course content is further divided into sections with clear dividers to provide a lot of white space, support readability, and minimize cognitive load.



**Figure 6.18.** Wireframes focused on navigation and layout.

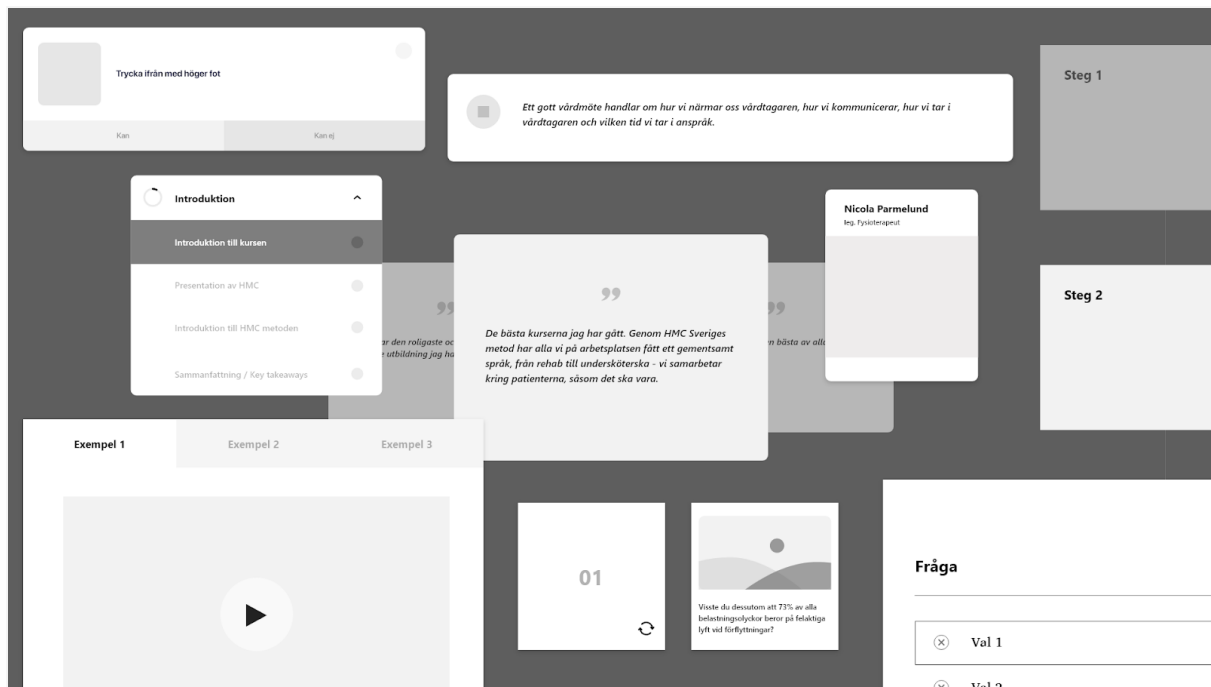
The course is structured in blocks to make it easier to get an overview of the modules and lessons that the learners must go through. Since the client's method follows a clear step-by-step process, and the whole course is structured in such a way that the content from the first lessons is dependent on the others, the decision was made that the learners cannot jump freely between the lessons. Instead, learners must do the course in the chronological order in which it is structured. However, one can always go back to earlier lessons or modules that have been “unlocked”, that is modules that have been started. The learners can navigate through the course in the side menu (see figure 6.19). This design structure was validated with the client and received positive feedback (see section Feedback from evaluation with SMEs below).

Another important result from the creation of the wireframes was the mapping of all content in the course, at this stage added to the tables that had been developed in previous stages. Mapping out all the content in this fidelity was time-consuming, but the more design components that were created, the more could be reused and the prototyping could be streamlined. Visualizing the content made it easier to get feedback from SMEs and a feel for the course as a whole and therefore an important step in developing the optimal design solution.



**Figure 6.19.** Wireframes focused on the navigation menu to the left.

With the goal that the client eventually will be able to build their courses with their own LMS, based on the research and design developed in this project, a UI component library has been created alongside prototyping. These components were then developed into higher fidelity. By thinking in design components rather than specific design solutions for this specific course, the solution will not only cover a single course, but can contribute to the digitalization of several courses. All design components were compiled in a list for future work (see appendix E).



**Figure 6.20.** First draft on the component library.

## Feedback from SMEs: Participatory Workshop

The evaluation conducted with the SMEs resulted in positive feedback together with new ideas and improvements for the final design. Certain content also became more clear after the session. With this project, the designers have understood the importance of involving SMEs in the process, validating the ideas and content often to ensure that the high quality is remaining or even better, improving.

One of the SMEs suggested including specific characters of care recipients during the course, which could then be used for demonstrations and scenarios. Including a fictional person makes the examples more real and hopefully contributes to the connection to context promoting learners' understanding. Furthermore, an essential part of the client's method is the professional and conscious care meeting. Especially connected to this, it could be beneficial to provide a face of the care recipient the learners are supposed to help, to encourage empathizing with the care recipient. The designers took the suggestion further into the next iteration.

A discussion about prioritizing certain content was held during the evaluation. It emerged that some content, such as previous learners' comments about the course and presentation of the people behind the course could be cut if necessary. It also became clear that the client did not want any exercises that required their energy or time. Therefore, the section where previous learners have posted comments was removed. As the client demands to be in full control of the presented content, all types of "free input" activity require the client to review and accept content which was not desirable at this stage.

The prototype received good feedback regarding the choice of activities, the knowledge check elements were highly appreciated. Also, the section when highlighting important content that will be brought up in a final test later received positive feedback.

The decision to select and focus on a few common transfer situations was made collectively between the SMEs and designers. The SMEs listed five transfer examples that should be used as scenarios within the course.

A big challenge was to translate the lesson that presents personal lifts as it covers many practical parts. A big discussion was therefore held with one of the SMEs to come to a conclusion on how to translate the content that exists today digitally, without losing too much quality on learning. The discussion resulted in a new structure of the lesson that better fit the assistant nurses' way of working with lifts. The content and activities should follow the order that follows the assistant nurses' way of working when to move care recipients with lifts in a real context. In addition, the SMEs demonstrated the procedure for the designers. Seeing the sequence in real-time gave a greater understanding of the task and the opportunity to film and take pictures of the sequence to reuse it in the course.

Finally, the implementation of gamification received good feedback. The client thought it was a great idea to let the learners collect something during the course, to make it more fun, engaging, and motivating.

## Feedback from Learners: Wireframes

The tests provided valuable feedback and generated a list of new requirements and ideas.

The implementation of gamification was interesting, although the participant pointed out that it can be very individual. Gamification can motivate learners to learn and trigger them to fulfill the course. However, motivation can also come from the learning itself.

*“Rewards, such as a point system, could be really interesting. But I also think that it is a kind of reward in itself to get direct feedback on the question.” - Participant X*

The designers took this feedback into the next iteration and had the mindset to support as many different types of motivations as possible in the learning experience. Furthermore, the overall structure and navigation in the course felt self-explanatory and was easy to understand according to the participants. Also seeing progress during the course was appreciated.

The participants expressed that video and images are necessary to include in the course to demonstrate things. At this stage, the prototype only had empty states with illustrations that represented videos and pictures, but the participants understood the principle and thought it felt like a good mix of exercises in general. Varying the text content with interactive exercises received very positive reactions. Likewise to highlight the most important content in the course in the forms of highlight.

The participants thought it was good to involve reflection questions in the course, to get a chance to think before getting the answer in the form of theory. However, one participant pointed out that some questions can be difficult to answer if you are a completely new assistant nurse, who has no experience in transfer assistance of care recipients, such as “What do you define a good transfer to be?”. The participant thus comes to the conclusion that it can always be good to think for oneself, even though you may not know the answer. Additional feedback that emerged is presented in table 6.4.

**Table 6.4.**

*Summary of various feedback from evaluations with learner representatives.*

Design element	Quotations from participants
Summary	<ul style="list-style-type: none"> <li>– Summary is clear with key takeaways, practical examples, nothing that is missing here.</li> <li>– Good to present key takeaways as a bulleted list. Then you get a chance to read it several times if you want. Bullet list is clear, simple and easy to understand.</li> </ul>
Knowledge check	<ul style="list-style-type: none"> <li>– If you do not have time to do the whole course at once, then it is great that there are small tests during the course. As much repetition as possible!</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>– Interesting to include so you get a trigger to actually think about the knowledge you have learned in your work. It can be really motivating to think about this the next time you work.</li> </ul>
Instructions	<ul style="list-style-type: none"> <li>– If you compare with giving a longer description of how to carry out a transfer, then it is probably better that you get a little less description / notice about what can be good to think about, in a more general way. Because movements are so specific and individualized. It can be hard to specify how to do it. One day something works, the next day it does not work, there are so many different situations all the time. When I train colleagues, I usually, among other things, encourage them to think about how they get out of bed in the morning. Then you know roughly how we all move. Then they think for themselves and get some idea of what their own movements feel like, and in this way they understand what a natural movement pattern is.</li> </ul>
Activities	<ul style="list-style-type: none"> <li>– Really good to show do's and don'ts! It is super common to fall back into old moving patterns and do wrong.</li> </ul>

	<ul style="list-style-type: none"> <li>– In this module there will be a lot of video, but it's probably good because this with personal lifts is very critical and you probably do not understand it without seeing it in action. Personal lifts are the most risky in transfers as well.</li> </ul>
Interactive elements and hiding content	<ul style="list-style-type: none"> <li>– Interesting ideas! Good that you can explore content if you want, as long as you do not hide essentials.</li> <li>– In general, the more you need to get involved and engage with the content the better. It is good to be as active as possible, instead of just reading.</li> </ul>
Explanations of words	<ul style="list-style-type: none"> <li>– Great to offer definitions in the text. If you are unsure of any word, it is perfect that you can get an explanation quickly and easily, immediately when you see it! Sometimes you can be insecure and need to be reminded.</li> </ul>

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## Feedback from Expert: Usability

The evaluation with the expert in UX//Front-end resulted in quick and direct feedback about structure and navigation. Evaluating the design with someone who talks the same language was very grateful.

The expert liked the idea of involving gamification and collecting points throughout the course. Furthermore, the expert suggested showing the collections of stars in the upper right corner of the interface. In that way, it should always be accessible for the participants and hopefully, trigger motivation even more. The expert also thought it was a good idea to introduce one or more characters in the course, he expressed himself “It is such details that make the design stand out and enhance the user experience.”

The expert gave valuable feedback on the process bar, which according to him seemed a bit unclear whether it accounted for the entire course or only the module. Some adjustments were made to the next iteration.

The prototype got positive feedback about the navigation in the course. The expert was pleasantly surprised that the researchers had come up with a good responsive design that works in both mobile and tablet view, without changing too much in the desktop layout. However, the expert suggested doing a user test focusing on the navigation to assure that it was clear for end-users as well.

During the summary sections, the expert suggested adding an info button that explains the sections further. For example, at key takeaways, it should state that these are extra important for learners to remember into the final test. He argued that it probably will not be clear enough just by reading the title “Key Takeaways”. The expert also suggested that the summary sections should stand out more from the remaining lessons.

### 6.4.3. Design Guidelines v.3

No guidelines were added during iteration 3, however guideline 44 (bold) was rephrased with a slight shift of focus. Below is a summary of the guidelines from iteration 3.

#### System Interaction

- G30. The system should provide an easy way to access the course (concerning log in etc)  
*The experience should be as focused on the learning tasks as possible, therefore interaction with the system needs to be hasslefree from the start. (Theory)*
- G31. The system should provide autosave to ensure stable input and easy access  
*The learner should not need to be confused or stressed about the risk of his/her progress being lost if leaving the course. Therefore it is essential that the system autosaves and re-enters the course where the learner last left off. (Theory; User studies)*
- G32. The system should provide clear feedback on system status  
*The learner should not feel confused regarding or frustrated by the system during usage, by providing the learner with clear feedback on the state of the system this can be minimized. (Theory)*
- G33. The system should provide clear feedback on the learners performance  
*Clear progress feedback throughout the course is needed in order to motivate the learner and to provide the learner with transparency of progress. (Theory)*
- G34. The system should allow for easy navigation between different elements within the course  
  
The learner must be able to navigate within the course hasslefree. It should be clear how the learner can move from one state to another, revisiting content if needed. This also includes providing the learner with understandable feedback on what elements are accessible and not at certain stages, and why. For example, descending modules can be locked until the learner has completed certain tasks. (Theory; Competitor analysis)
- G35. The system should foster a steep learning curve for navigating the course  
*Learners must quickly learn the course structure and how to navigate it in order to not spend unnecessary time and effort outside the main learning activities of the course. (Theory)*
- G36. The system should support memorability  
*When learners return to the course after a period of not using it, they should rapidly reestablish proficiency. (Theory)*
- G37. The system should be designed to minimize errors  
*The possibilities of errors should be minimized to promote a frictionless interaction. (Theory)*
- G38. The system should be able to communicate with other softwares  
*Communication with other software systems used within an organization can be a valuable add on for the system, enabling for example easy accessibility for managers or the like to monitor educated personnel's progress and performance. (User studies)*
- G39. The system should follow WCAG standards of level AA  
*The system should meet requirements for accessibility to promote an inclusive design. This is a potential requirement from stakeholders within the public sector that are potential buyers of the service. (Theory; Stakeholder: SMEs; User studies)*

G40. The system should be responsive to various screen sizes

*To promote a usable experience it is crucial that the site is accessible on mobile, tablet and web with good UX and performance. (Theory, User studies)*

G41. The system should remember the learner's state in between sessions

*The system must have a memory for the learner's progress, and allow the learner to resume their work at the activity they left. (Theory; Competitor analysis; User studies)*

G42. The system should support darkmode and lightmode

*Learners should have the flexibility to use the system both day and night, to be in full control over their time spent, and to ensure an appreciated user experience independent of time of the day. This is especially needed as the target group typically work both during day and night time. (User studies)*

G43. The system should be designed to minimize cognitive load

*To promote focus on the main tasks, the design should be developed with caution as to not create cognitive load. (Theory)*

**G44. The course should provide language support**

*To reach a diverse group of learners with various language skills, the system should provide language support to some extent, for instance through availability of easy-Swedish mode and subtitles for videos. (Stakeholder: SMEs)*

G45. The course should support auto-correction of tasks and tests

*It is a requirement from the stakeholder in terms of the client that the system should be automatic in the sense that the client should not need to actively assess the tests within the course. (Stakeholder: SMEs)*

## Course Structure and Content

G46. The system should allow learners to carry out the training in their own pace

*Learners need to be in control over when to participate in the course, and not be restricted by a certain point in time. With that said, a final deadline for completing the course is suitable, however the learners should be given the flexibility to complete the course whenever before the deadline. (User studies)*

G47. The course should provide a fun and engaging way of learning

*To promote an engaging learning experience, that supports learning, and that stands out from competitors the course should provide interactive exercises during course progress. (Competitor analysis)*

G48. The course should provide a clear reflection of the client's method

*The course should be directly grounded in the client's method, that forms the basis for the educational content (Stakeholder: SMEs)*

G49. The course should provide a clear overview over the content

*Learners should be prepared for the next steps, and receive an overview over course structure and content, so as to be able to plan the activities ahead. (Theory; Competitor analysis)*

G50. The course should support social interaction

*The social aspect can be seen as critical in some aspects, and it is appreciated to provide learners with some opportunities for discussions in groups. (Theory; User studies)*

G51. The system should support repetition of knowledge

*Critical content should be repeated to promote learning. One way of achieving this is through the incorporation of exercises. (Theory; Competitor analysis)*

G52. Visual content should be of high quality

*High quality of visual content, such as pictures and other graphics, is important to foster an engaging and friction free usage, and to send a professional presentation to learners and customers. (Competitor analysis)*

G53. The course should assess the learners performance

*To ensure that the learner has reached the learning objectives it is critical to include some type of assessment test. (Stakeholder: SMEs; User studies)*

G54. The course should include variations in learning activities

*Offering a range of learning activities creates a variance that can foster a more engaging learning experience. (Stakeholder: SMEs; User studies)*

G55. The course should provide clear statements explaining the purpose and goals of and content within the course

*It should be clear to learners what they can expect to learn through the course, and what skills they should have acquired after completion. (Stakeholder: SMEs; User studies)*

G56. The course should have a clear connection to context, so as to make the knowledge applicable in the working situation

*The content within the course needs to be clearly derived from the working context in which the knowledge and skills acquired should be applied. (Theory; Stakeholder: SMEs; User studies)*

G57. The degree of difficulty should be adapted to the learners level of knowledge

*The learning content should be on the appropriate level of difficulty for the individual learner in order to foster learning. This means that learners who are in need of additional support should be provided with this, but also that more experienced learners should be stimulated by sufficiently challenging materials (Theory, Stakeholder: SMEs; User studies)*

G58. The course should allow for a personalized experience

*Enable personalized customization of content, based on what the learner is interested in, or what the learner's work environment looks like, for instance, what physical aids are available and or used. (Theory; User studies)*

## 6.5. Iteration 4

The fourth and final iteration was focused on HCD phases four and five: *producing designs and prototypes* and *evaluating design against requirements*, where a more detailed prototype was created. The high fidelity prototype was then evaluated with expert and learner representatives respectively.

### 6.5.1. Process

This section explains the methods used in the fourth and final iteration of the project, where the focus was on developing a high-fidelity prototype. Methods in the fourth iteration include *Moodboard*, *High Fidelity Prototype* and *Evaluations with Expert and Learners*.

#### Moodboard

The previously created moodboard was iterated on with a focus on visual design. As value words and attitudes were already represented, the moodboard was expanded with images, UI elements, fonts, and color palettes to inspire the visual design.

#### High Fidelity Prototype

Before creating the visual design and a more high-fidelity prototype, it is critical to refer to design guidelines for guidance as they contain the most widely agreed practices. There is a substantial body of ergonomics and user interface knowledge, standards, and guidelines which should be used to inform the design of both hardware and software, to reach a successful design (Interaction Design Org. n.d.). Guidelines concerning displays, input devices, dialogue principles, menus, presentation of information, user guidance, and other user interface and accessibility guidelines were reviewed. Other guidelines related to internal user interface style guides, product knowledge and knowledge on users, and other aspects of the context of use, such as user expectations and stereotypes (Nielsen, 2001; (Nielsen, 2020; Shneiderman, 2006) were also explored before the high fidelity prototyping began.

The high fidelity prototype was created, using a computer-based prototyping tool (Adobe XD) when the foundation for the e-learning solution reached a sufficient level of advancement and quality. This provided a more realistic mock-up of the e-learning service and user flows.

At this stage, the visual design was created in terms of colors, fonts, icons, illustrations, and other graphic elements. In connection with the visual design, the overall graphics were created and a more detailed component library was established.

Icons and illustrations were created in the vector graphics program Adobe Illustrator. Illustrator has all the drawing tools you need to turn simple shapes and colors into sophisticated icons and graphics. Furthermore, Illustrator is vector-based, which means that elements can be scaled up and down and remain sharp and appealing. At this stage, it was important that all icons and illustrations should follow the same look and feel to create a consistent interface. The most time-consuming work was to make illustrations for the course. This was done by translating film sequences and images of various kinds provided by the client. The focus was only on producing two-dimensional illustrations, all forms of animations in the form of gifs or videos have been left for future work.

As already mentioned, due to time constraints, only parts of the user flow were designed. Those parts were selected based on their importance for the course and variety, in order to

show as much of the intended final product as possible. The final prototype is presented in more detail in [7.1. Final Prototype](#).

As the last step, the prototype was made clickable, enabling interaction with the prototype. The interactive prototype was used in an evaluation session with an expert, where accomplishing sets of tasks enabled identification of potential issues, mainly connected to technique and usability, but also content to some extent.

## Evaluation with Expert 2: Usability

Formative evaluation of the high fidelity prototype was conducted again to get valuable feedback from someone other than those in the team. This time with a higher fidelity prototype, focusing more on details in the UI.

### *Participants*

This expert evaluation was performed by the same UX designer/front-end developer as in iteration 3 (see 6.4. Iteration 3).

### *Preparations*

The starting point was the high fidelity prototype, added with the visual look and feel, as well as interactive elements. Since this high-fidelity prototype only covered certain lessons in the course, it was extra important to explain the overall picture to the expert before the walkthrough. A short script about what needed to be covered was written down in a document.

The designers went through the high-fidelity prototype themselves and wrote down what to test and how. The designers pinpointed the challenges and critical issues in the interface to be able to address these flag issues with the expert.

### *Execution*

The evaluation took place face to face, where one of the researchers held the evaluation and acted as a test leader. The test leader started the session by briefing the participant on what to cover in the evaluation and the flagged issues. Because the prototype was clickable, the participant could integrate with it himself. The test leader first let the participant click through the flow and think aloud. Meanwhile, the test leader observed facial expressions and wrote down what was said. Allowing the expert to interact with the prototype without guidance encourages findings concerning unknown design issues.

In the second walkthrough, the test leader took over the control and clicked through the prototype, stopped at the flagged issues, and held a discussion with the expert. Those issues that were not covered in the first walkthrough could be brought up and answered here.

## Evaluation with Learners: High Fidelity Prototype

The high-fidelity prototype was evaluated together with user representatives, based on the E-learning Usability Properties Framework (Koohang & du Plessis, 2004).

### *Participants*

Session 1. Two learner representatives with good knowledge in the topic of transfer skills.

Session 2. Two learner representatives with some knowledge in the topic of transfer skills.

The evaluation was divided into two sessions, where the first aimed to evaluate the prototype with two more experienced assistant nurses. In the second session the participants were less experienced assistant nurses. The main reason for this was to consider the participants' different prerequisites regarding prior knowledge in moving and handling of care recipients.

### *Preparations*

The E-learning Usability Properties Framework was used as a guide in the evaluations of the design in terms of its usability, by creating a basis for the questions guiding the walkthroughs. The usability attributes of understandability and operability were the main concerns at this stage, as the users did not have the opportunity to explore the interface more freely. The designers also took the opportunity to ask questions about activities as well as look and feel during the sessions.

Questions that the designers wanted to ask during the walkthroughs were compiled in a table describing the type of topic to be evaluated (such as navigation, structure and content, exercises, concepts, look and feel), the question to be asked, and a brief explanation if necessary. The questions were then mapped out to the corresponding view in the prototype, that is where in the flow the designers wanted to ask the questions. The walkthrough was pilot tested with another UX designer to get feedback and test the overall structure of the evaluation. Some minor changes were made after the pilot test before conducting the real ones.

### *Execution*

All walkthroughs were conducted online over Zoom as this was deemed most suitable, due to the scope of the high fidelity prototype, and as the available participants did only have a shorter period of time available for participating in the evaluations. The execution followed the same procedure for all walkthroughs with the difference that the designers switched roles in between. The procedure is described below.

One designer held the walkthrough and the other observed, both verbal reactions and facial expressions of the participant, and took notes. In addition, the evaluation was recorded in order to analyze the result afterward if needed. This was done only if the participant gave their oral consent for recording. The test leader began with an introduction describing the agenda and how the walkthrough will be performed and empathized that the participant

should think freely and aloud. Before the walkthrough itself, the test leader described a scenario of the pre-steps that are assumed to be taken before starting the e-course, to put the participant in the right context. The test leader then shared her screen and went through the selected screens step by step, keeping an open discussion with the participant, asking some guiding questions with a focus on:

- What do you see on this screen?
- Does this make sense?
- Is there any confusion?
- Do you understand what each element means?
- If I do action X, what do you think will happen?

Afterward, the participant was thanked for participating.

## 6.5.2. Results and Reflections from Iteration 4

This subchapter presents the results from this iteration in terms of a summary of the visual palette of the prototype, a first glance at the high fidelity prototype, and the feedback generated through the performed evaluations.

The final results of the high fidelity prototype and design guidelines are presented in detail in [7. Result](#).

### Look and feel

Working as an assistant nurse is stressful and the fact that they work in a hectic and energy-intensive environment cannot be overlooked. Designing for this type of context and user group reinforces the importance of creating a product that does not trigger stress or negative feelings. This phase is not just about creating a good looking design, it is about creating a feeling in the interface that fits well into the context and supports the learner's mindset. The attributes forming the basis for the development of the look and feel in the interface are listed in table 6.5.

**Table 6.5.**

*Attributes of look and feel of the prototype.*

Category of Attributes	Attributes
Style keywords	<ul style="list-style-type: none"> <li>– White-space</li> <li>– Minimalism</li> <li>– Simplicity</li> <li>– Clean</li> <li>– Modern</li> <li>– Frictionless/smooth</li> </ul>

	<ul style="list-style-type: none"> <li>– Bold</li> <li>– Innovative</li> <li>– Playful</li> </ul>
Tone of voice	<ul style="list-style-type: none"> <li>– Understanding</li> <li>– Polite</li> <li>– Optimistic</li> <li>– Straightforward</li> </ul>
Mood statements	<ul style="list-style-type: none"> <li>– Engagement</li> <li>– Productive</li> <li>– Efficient</li> <li>– Calm</li> <li>– Interesting</li> <li>– Progress</li> <li>– Valuable</li> <li>– Rewarding</li> </ul>
Client branding	<ul style="list-style-type: none"> <li>– Professional</li> <li>– Reliable</li> <li>– Safe</li> <li>– Patient-centred</li> <li>– Nursing-centred</li> <li>– Proactive</li> <li>– Winn-winn!</li> </ul>

---

However, it is important to state that the look and feel of an interface do not only affect what emotions the product makes the learner feel, but also the understandability of the product and affordance of the element. The look and feel of a product is thus at least as important as the functionality.

## Color palette

The selected colours are designed to clearly communicate actions, status, and directions within the interface (see figure 6.21). They serve to make things easier to understand and recall. Colors should guide, not distract. Furthermore, color combinations are created with colour blindness and contrast in mind. In this project, the designers choose contrast over trendiness to support readability.

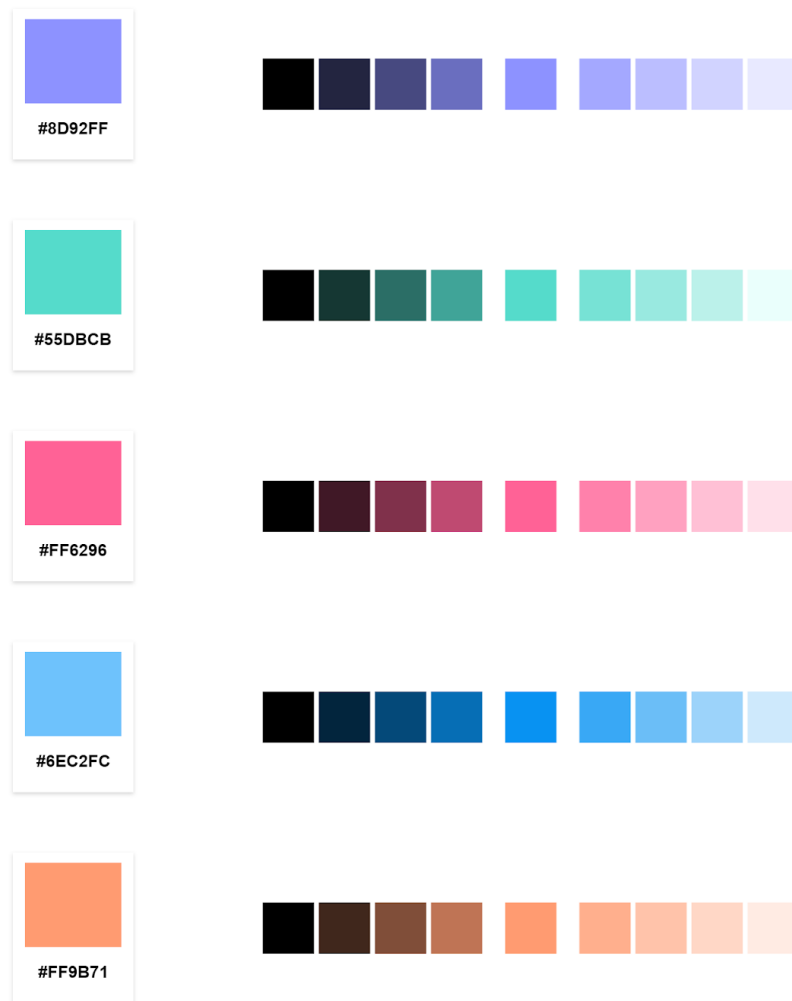
A light theme has been chosen as the default for the e-course, but the idea is that learners easily should be able to switch to dark mode if, for example, they work night shifts as dark colours are more pleasant for the eye. Furthermore, the 60-30-10 rule was applied to the extent possible to bring the balance into the composition. When choosing a color palette, the 60 percent of the palette should be dedicated to one color (primary), another (complementary) color makes up 30 percent of the palette, and a third color (accent) is used for the remaining 10 percent of the design. Such a proportion is thought to be pleasant for human eyes since it allows perceiving all the visual elements gradually (Arhipova, 2016).

White was chosen as the primary color in the interface to communicate purity and clarity. White is commonly used as the background color especially for the resources for which readability is a vital part as for the e-course. A purple analogous color was chosen as the complementary color to make the design comfortable to the eye and indulge the feeling of calmness. A more strong and energetic purple was chosen as the accent color to pop in the interface. White and purple were thus chosen as the master colors in the interface.

However, other colors have also been used to make the interface more vivid. An orange color was chosen to highlight activities where the learner can collect stars. Orange is an energetic and warm color bringing the feelings of excitement. Orange combines red's power and yellow's friendliness, so it has potential to trigger feelings of motivation and enthusiasm, which fits well for triggering learners to complete exercises, to promote creativity and adventure. In addition, the illustrations of the people contain the same shade of orange to make it more pleasant for the eye.

Green is used to communicate good and right in the e-course, as green has more positive energy than most other colors. In contrast, a clear pink color is used to communicate bad and wrong in the e-course, as the pink is closely related and can be associated with red color that is mostly connected to negative reactions.

Blue is also used to some extent in the interface, especially in the illustrations to communicate trust and reliability, as well as give learners calming feelings.



**Figure 6.21.** Color palette used in the e-course.

## Typography

Typography is one of the best sources of communication within a user interface. Applying standards and guidelines regarding typography is crucial in order to foster a clear communication between system and users. One of the most important techniques to achieve clear typography is the visual hierarchy. Text with higher font size and darker colors catches the user's attention the most, therefore, creating a clear structure of which information that is the most important and should be read first, can be achieved by having it as the most prominent element on the screen.

Since the learners will read a lot, it is important to choose fonts that support readability and clarity. Great content is meaningless if not presented well. Hitting the right mark for

typography is thus a key factor in the overall success of an e-course. Three different fonts were chosen for the entire course, which are presented below.

### *Poppins*

Poppins is geometric in style and clean. Thanks to the range of font styles available and the font's open feel, this font is great for both headlines and paragraph copy to improve readability and style.

Poppins was chosen for titles in the e-course to communicate modernism, professional, playfulness, boldness and clarity.

## **Poppins**

**Title 1 – 40 px, bold**

**Title 2 – 28 px, bold**

**Title 3 – 21 px, bold**

### *Charter*

Charter is a transitional serif typeface designed by Matthew Carter in 1987. It was designed as a body text font and remains suitable for printing on both modern high-resolution laser printers and lower resolution printers due to its strong, legible design (Fontdesk, 2020).

Charter was chosen as a body text font to support readability and due to its simplicity, clarity and modernism.

## Charter

Body text - 21 px, regular

### *SF pro display*

The SF pro display font was mainly used for "call to action" text and other small text within the interface. This sans-serif typeface is the system font for iOS, macOS, and tvOS. It provides a consistent, legible, and friendly typographic voice.

This font was chosen for its minimalism, clarity and straightforwardness.

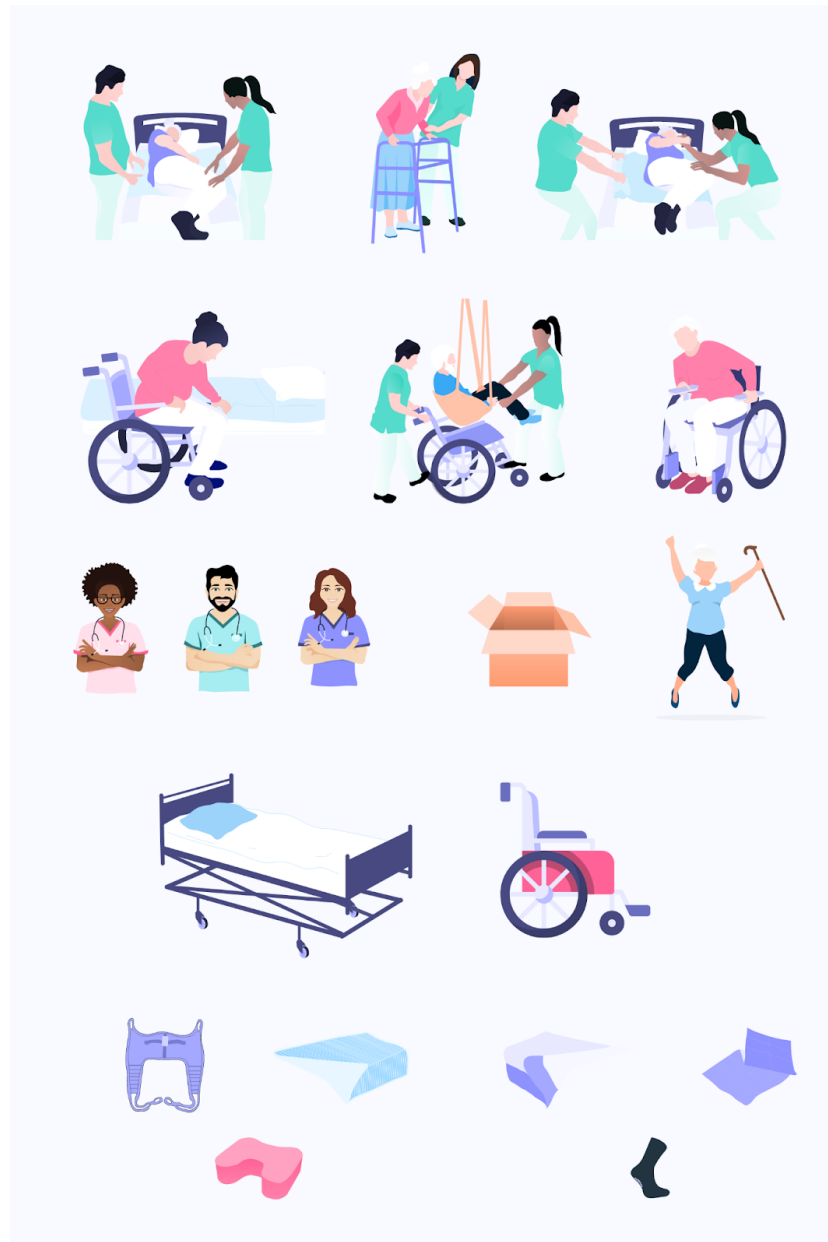
## **SF pro display**

Call to action - 21 px, semibold

Small text - 16 px, bold

## Illustrations and Icons

An important part of developing an e-course is to communicate the content in a clear way, including clear pictures and illustrations. Illustrations were made mostly for demonstrating movements with care recipients and to present different moving aids. All illustrations should follow the same look and feel, based on the style keyword for the entire interface. The illustrations are thus bold, playful and clear (see figure 6.22).

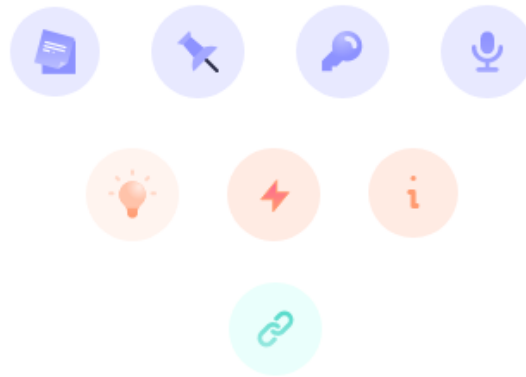


**Figure 6.22.** Extract of some illustrations made for the e-course.

Some icons were also developed to communicate different activities and actions in the e-course, as well as creating a recognition factor in the content. For example, the key in figure 6.23 should demonstrate key takeaways which are presented in the summary for each module. In addition, as previously described, there is a certain color coding in the interface,

where the exercises where learners can collect stars are highlighted with the orange color, files that are available off the course (such as assessments, files etc) with green, and essential "regular" content follows the purple color palette.

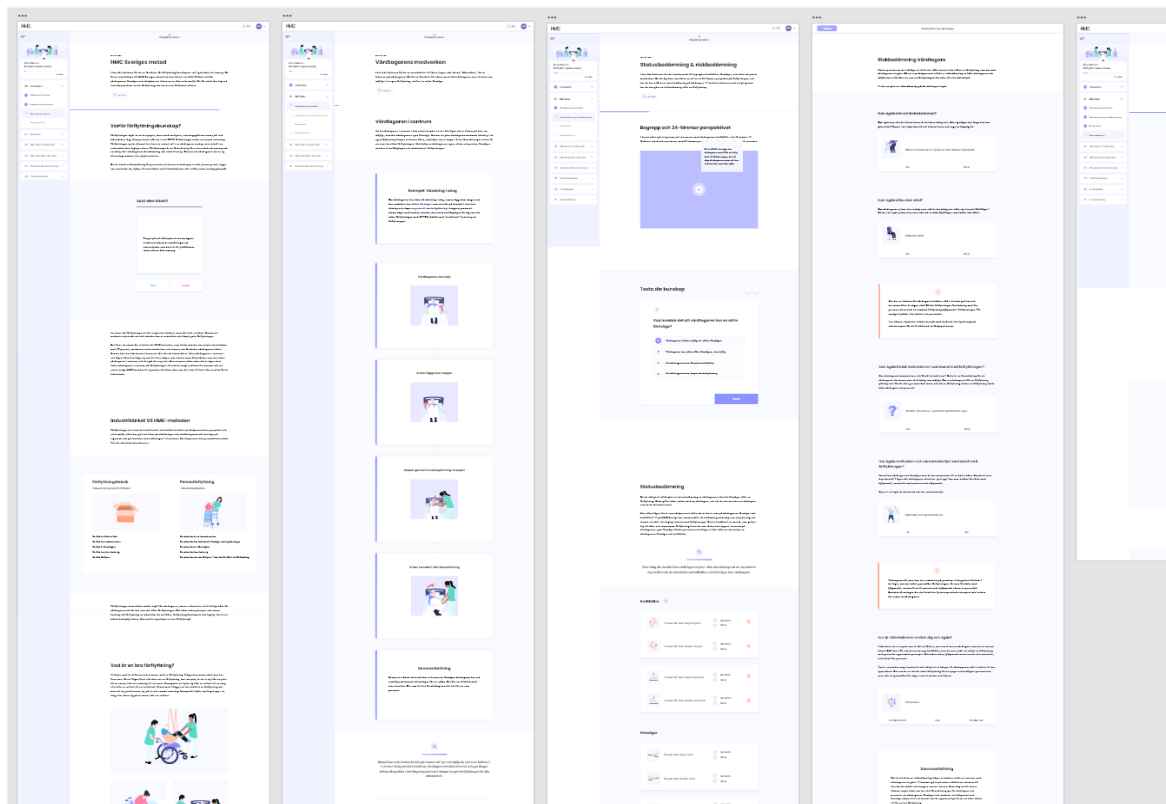
The high fidelity prototype is presented in detail in [7.1. Final Prototype](#).



**Figure 6.23.** Extract of some icons created for the e-course.

### High-fidelity prototype

After several iterations, a highly functional and interactive prototype was developed, which is quite close to the final product with visual feeling and details included. This was used in the usability evaluation to discover the potential issues that may exist in the workflow, interactivity, and so on. After the evaluations, a few changes were made to the final design. Below is a sneak peek of the high-fidelity prototype, which is described in more detail in [7.1. Final Prototype](#).



**Figure 6.24.** Extract on the high-fidelity prototype.

## Feedback from Expert: Usability

Again, the expert evaluation gave valuable feedback regarding potential usability issues. In the first walkthrough performed in iteration 3, where the expert tested the prototype more freely, the expert expressed that the navigation in the course felt spotless. According to him, he knew exactly where he was in the course and argued that the progressbar together with checkboxes helped achieve this. Just by looking at the navigation menu, you can see which lessons have been completed and which are left to explore further.

One of the biggest challenges that arose when creating the high fidelity prototype was to come up with intuitive solutions for different states in the user interface. A common trap for designers is to only focus on creating designs that represent the perfect state of a user interface. It is easy to design when everything is full of beautifully formatted content, but a large percentage of users' experience includes different states. And as interaction designers, we need to focus on these states too. For example, when the learner is to perform an activity where they can collect a star, there are at least two different states.

### 1. Before starting the activity

In this state, the learners must clearly see that there is a star to collect (but have not received it yet), explanation on what to do in the activity, and a call to action - to start the activity.

2. After completing the activity

In this state, the learners should clearly see that they have collected the star, that the activity has been completed, but also the possibility to redo the exercise. The call to action should change to “do again” or similar.

Furthermore, say that the activity has many different steps, then more states are needed and it becomes even more complex. These types of challenges were discussed with the expert and solutions were ideated on, which are presented further in [7. Result](#).

## Feedback from Learners: High Fidelity Prototype

First and foremost, testing took place during the learner's working hours and it was noticed that all of them were stressed during the walkthroughs. However, this is in the same situation and condition that the learners are typically expected to complete the course, at their working place in between shifts, thus the conditions for evaluations mapped to the real world.

Overall, the participants were positively surprised that the course was so well structured, engaging and visually appealing. Two of them even expressed that they would like to test the entire course as soon as possible. Furthermore, they expressed several times that the interface felt clear just by looking at it, both the overall navigation and the activities. However, there were some confusions with the activities that were difficult to understand at first glance. This can be due to many factors, such as:

1. Simply that the interface is not designed clearly and intuitive enough
2. That the learners themselves do not sit in front of the interface and see content good enough. Sharing the screen also degrades the quality of the interface, making it harder to see content.
3. The participant did not receive all the information necessary about the activity due to time aspects. In the real course, learners are supposed to read descriptions about the activity before conducting it. During the evaluation there was no time to do this, instead the participants were asked to give feedback from a holistic perspective of the course, without reading or going into detail.

These aspects together with other conditions that may affect the result from the evaluation was taken into account when analyzing the feedback and is discussed further in [8. Discussion](#).

See appendix F for a summary of the essential feedback that emerged during the evaluations, together with changes that were made to the design, if any.

### 6.5.3. Design Guidelines v.4

The final revision of the design guidelines included summarizing the previously identified guidelines and defining design principles with associated guidelines. These are presented in 7.2. Design principles.

# 7

## Result

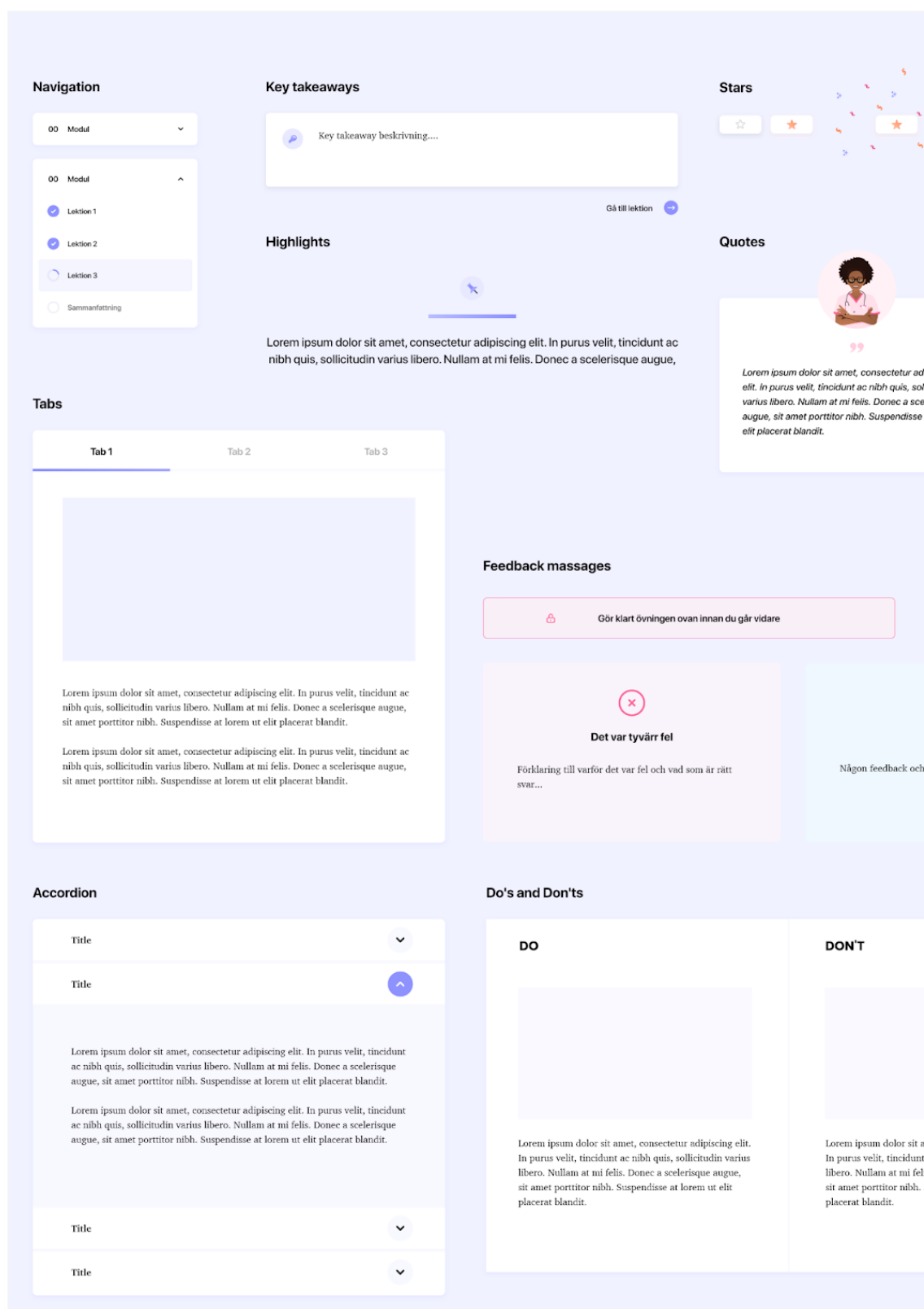
The results delivered in this chapter include the UI component library followed by a presentation of the final high fidelity prototype together with important design decisions. Finally, a set of design principles and guidelines suitable for creating a practice-oriented e-learning course are presented.

### 7.1. UI Components Library

Throughout the iterative design process a library of design components have been successively produced to create a reusable solution, guided by the principles presented in 7.3 Design Principles. The component library is a compilation of the activities that are expected to be included in the e-course and should explain the design blocks that one can build the course with. All of the activities have not been developed in high fidelity, however a complete list of components have been authored covering each activity with associated properties that should be used as a foundation for developers in future work (see [appendix E](#)).

The UI component library is a first draft of a comprehensive collection of design components that should lay the foundation for an e-learning design system. Continuous work is evidently needed in order to create a design system that covers all required parts to produce a fully functioning e-learning experience, according to the principles presented as a result of this thesis. A design system is an ever evolving collection of reusable components, guided by rules that ensure consistency and speed, by being the single source of truth for any product development. It is thus more than just a UI library. The whole purpose of a design system is to define the design principles, style-guide, patterns, content tone, and the rules and specifications of the “reusable” components.

Both the result of the final prototype and the principles together with the guidelines are thus part of a first step in creating the overall design system for the client to digitize their courses. Below is a collection of some selected design components from the library produced so far (see [figure 7.1](#)). Most of these components are presented more in detail in chapter [7.2 Final Prototype](#).



**Figure 7.1** Extract of some design elements from the UI library.

## 7.2. Final Prototype

The final prototype presented in this section is the result of several iterations involving the target group's, that is the learners', needs and requirements, as well as the client's goals and expectations. The prototype is a proof of concept, as not all content in the course has been sketched out in high fidelity. The prototype aims to convey the ideas and solutions that have emerged as a result of this project, as well as put the component library into practice. The final prototype could be seen as a first step in digitalizing the client's current training in transfer knowledge.

The prototype is in Swedish as it is aimed at assistant nurses working in Sweden.

### 7.1.1 Pre Steps and Landing Page

Imagine that the unit manager for a nursing home has registered the personnel to the e-course "*Basic course in transfer knowledge*". Each person has received a link to their job e-mail which provides them access to the course. After creating an account on "My HMC" on the client's website, the learner end up on the landing page of the course, as shown in [figure 7.2](#).

A.K


Anna-Karin Bokström

# Grundkurs i förflyttningskunskap

Starta kurs

ca 2h

Om kursen



I den här kursen får du kunskap om grunderna i förflyttningskunskap. Du lär dig om HMC Sveriges metod för säkra förflyttningar dygnet runt - hur du och vårdtagaren arbetar tillsammans, ibland med hjälpmedel, för att på bästa sätt använda vårdtagarens resurser och minska din fysiska belastning med upp till 70%!

Kursen ger dig kunskap i trygga, säkra och skonsamma manuella förflyttningar samt överflyttningar med personlyft. Du får konkreta verktyg för att kunna anpassa förflyttningar efter varje vårdtagares unika förutsättningar och utföra dem på ett sätt som är skonsamt och säkert för dig och din vårdtagare. Genom metoden får du också redskap för att lättare kunna kommunicera vårdtagarens behov till rehabpersonal.

Med den här utbildningen vill vi visa hur du kan arbeta på ett annorlunda sätt, ett mer medvetet, vetenskapsbaserat sätt, med att hjälpa människor att få ett så värdigt liv som möjligt och med en avsevärt mindre risk för dig som vårdare eller vårdpersonal att drabbas av arbetsskador. Tillsammans kan vi förändra synen på ämnet förflyttningskunskap.

Kursen är uppdelad i moduler med tillhörande lektioner, där varje lektion innehåller ett antal aktiviteter för att göra inlämningen mer engagerande och kul, på ett kvalitativt och pedagogiskt sätt! Nedan presenteras de lektioner som är med i kursen.

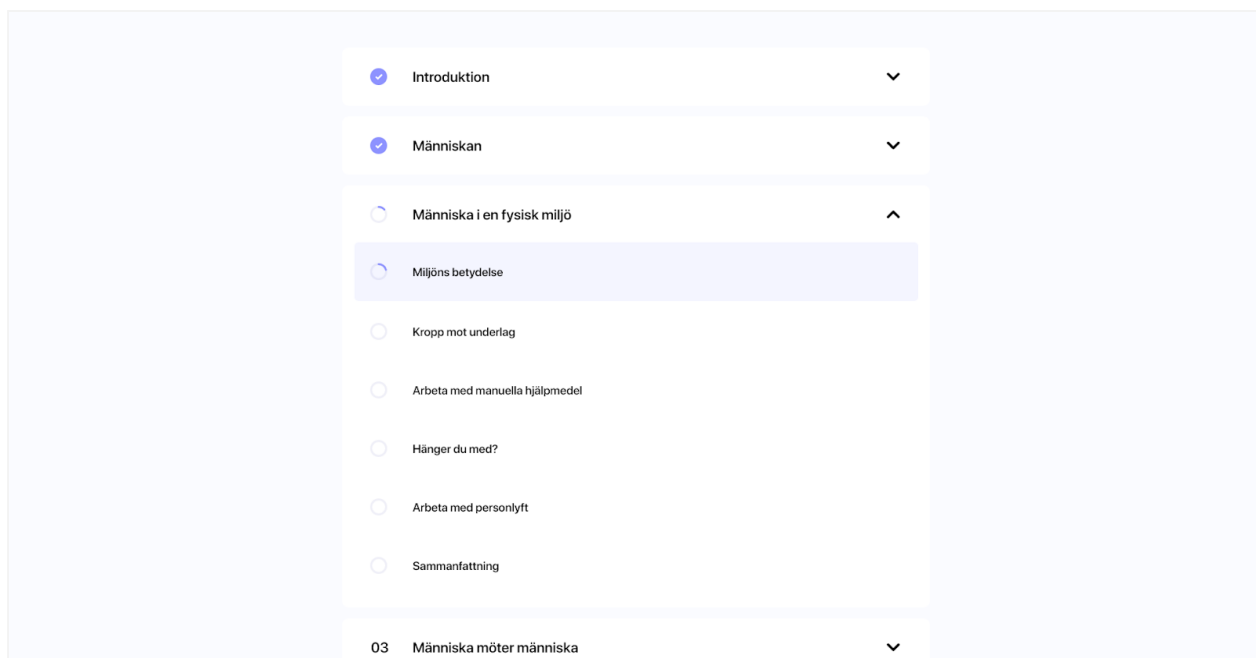
00	Introduktion	▼
01	Människan	▼
02	Människa i en fysisk miljö	▼
03	Människa möter människa	▼
04	Att arbeta rätt med vår kropp	▼
05	Praktiska exempel	▼
06	Kunskapstest	▼
07	Kursutvärdering	▼

**Figure 7.2.** The landing page for the e-course.

A short description of the course content is presented for learners as an introduction to what topics the course covers and what knowledge contribution it should provide. This is needed as many learners will not register for the course themselves, thus are not necessarily aware of what the course covers at this stage. It can be assumed that the learners will receive some type of description from the unit manager beforehand, but they should still get a brief introduction. It should be clear to the learners what they can expect to learn through the course, and what skills they should have acquired after completion.

To start the e-course, a call to action button is presented, allowing the learner to choose when to start. In this way, learners are in control of the situation and do not need to feel stressed about being thrown straight into the course. Throughout the course, the interface has been designed to minimize stress for learners, keeping them in control of the system's state, while still being as efficient as possible. As was shown in the context of use analysis, the target learners for this course have a stressful job, and the e-education should not add to this stress level.

In addition, the various modules with associated lessons are presented. For a first time learner, it provides an overview of the course's content and structure. If learners click on a module, it expands and associated lessons are presented. Learners that have begun the course and want to continue where they left off, can easily see how many modules and lessons that have been completed and which lessons that remain unfinished, see [figure 7.3](#).



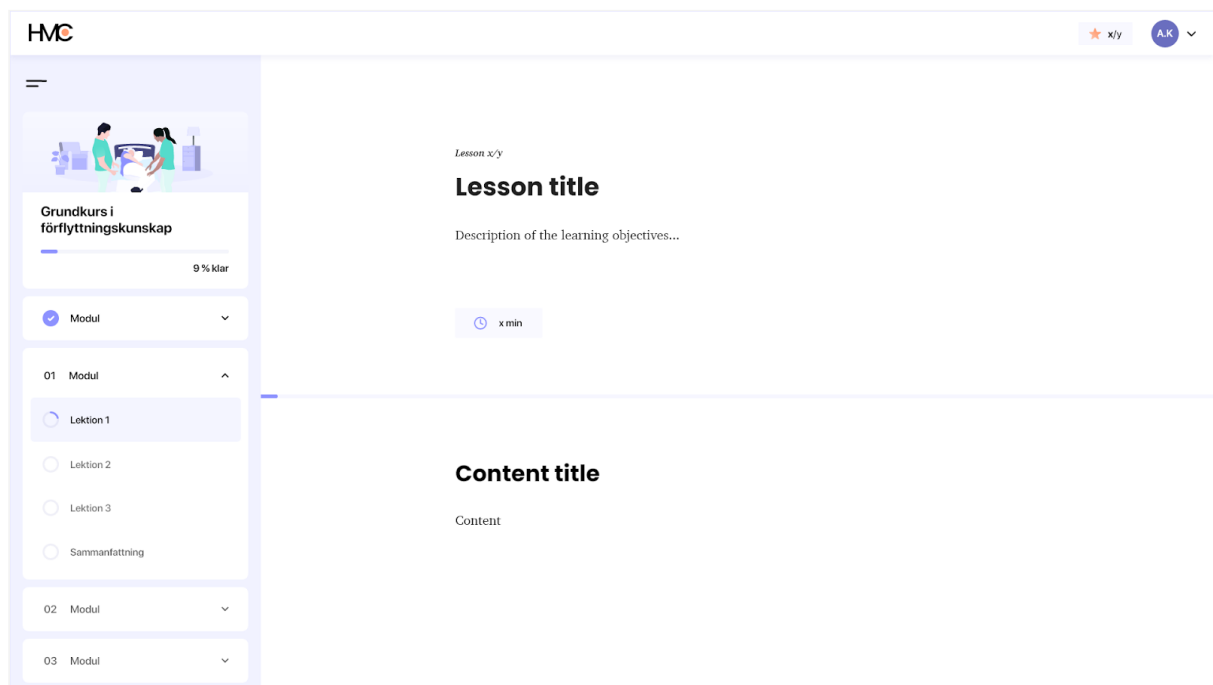
**Figure 7.3.** The state when the learner has started the course and wants to continue where they left off.

## 7.1.2 Navigation and Layout

As soon as the learners have clicked on “start course”, they will navigate to the first lesson in the first module (see [figure 7.3](#)). The idea is that learners are met by a guided tour here, where they will be presented with the main structure and functions of the course. Important information such as that learners can collect stars during their progression, and that the course includes a dictionary are presented here. Such information is easily missed before the learner has become comfortable and efficient with the interface, which is why it is good to guide the learners already at the beginning of the course.

### Overall layout

The overall layout of the course consists of a header (at the top), a navigation section (to the left), a lesson introduction section (to the right under header), and a content section (to the right under lesson section), shown in [figure 7.4](#).



**Figure 7.4.** The overall layout in the course. Here shown in the first lesson in the first module.

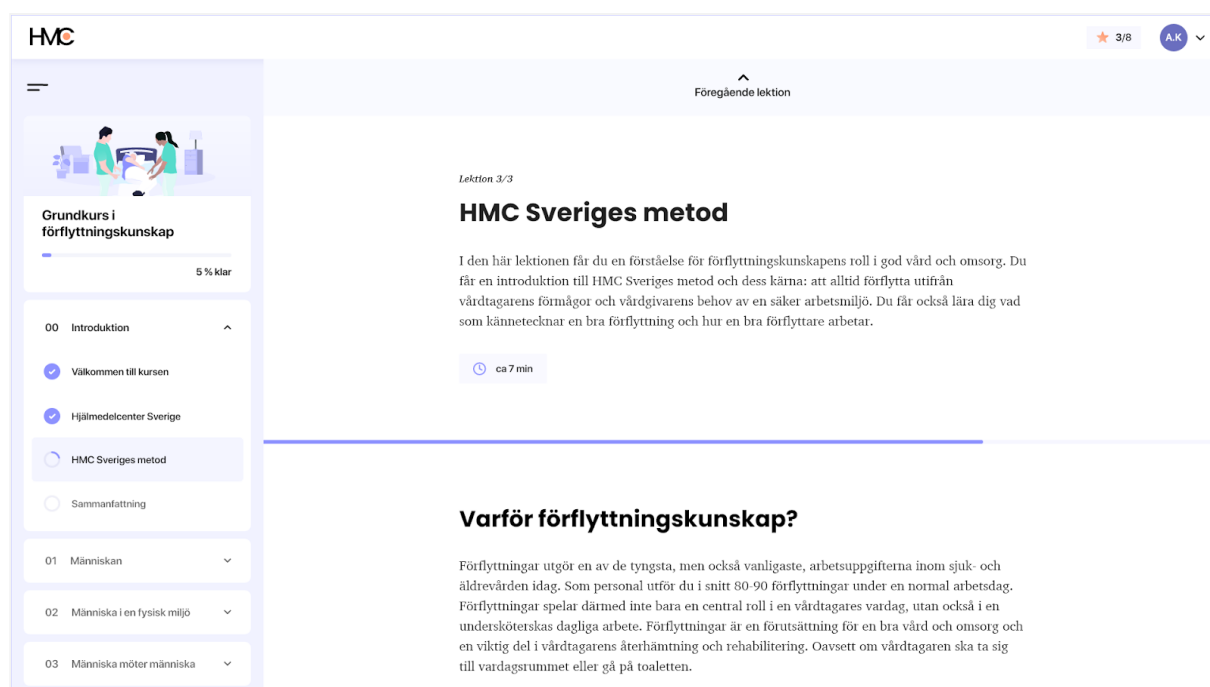
The header placed at the top of the screen is a fixed element, meaning it is always visible when scrolling. The header presents stars that have been collected by the participants, these aim to motivate the user to collect all of them. These stars are collected through completing exercises. This is described more in the following section. Under the profile, participants can leave the course, log out, etc.

On the left side, learners will find the navigation menu along with progress for the course. The card at the top consists of an illustrated image to make the interface more vivid. The card

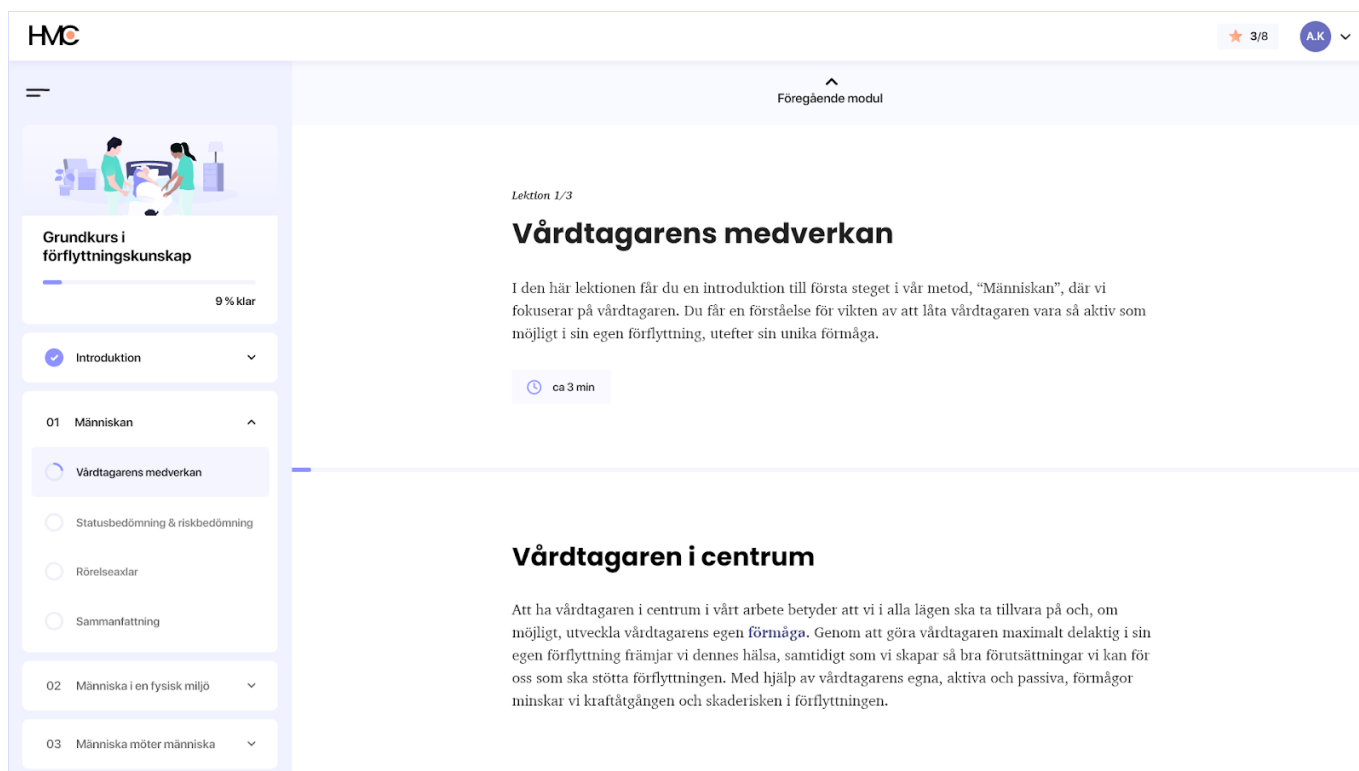
also contains a progress bar showing progress for the entire course, which was the most desirable progress to see according to evaluations. Once hovering the progress bar, learners should get an explanation that it is related to the whole course to minimize confusion of its indication that became apparent during evaluations.

Including the course menu with titles on modules and lessons help reassure learners where they are in the course, and where the course is headed. The active module is automatically expanded to show associated lessons. The active lesson is highlighted with a light purple color to stand out from other elements but not draw too much attention from the content in the course.

Each lesson also has a small indicator in the form of a circle describing whether the lesson has been started by the learner or not. Since progress for the lessons was not considered as most important for learners the progress indicator is quite hidden in the menu. Visual hierarchy in the form of size is used to highlight the most important things in the interface, which in this case is progress for the entire course rather than lessons. After completing a lesson, the circle is filled with a check icon (see [figure 7.5](#)). In the same way, after completing a module the same check icon appears next to the module title (see [figure 7.6](#)). The check icons give a sense of achievement and can trigger learners to continue to gain new knowledge by exploring the course further.



**Figure 7.5.** Display of the third lesson in the first module. Check icons indicate that the two previous lessons have been completed.



**Figure 7.6.** State of when the learner has reached the first lesson in the second module. The progress for the first module has been updated in the navigation menu to the left and the check icon has appeared.

Learners are restricted to following the chronological order in which the modules and lessons are presented, thus they can not navigate to lessons that are placed further ahead in the course. However, learners can open all modules in the navigation menu to display the titles of corresponding lessons, as requested by learners during evaluations. In this way, learners can be prepared for the next step, and receive an overview of course content, which allows them to plan the activities.

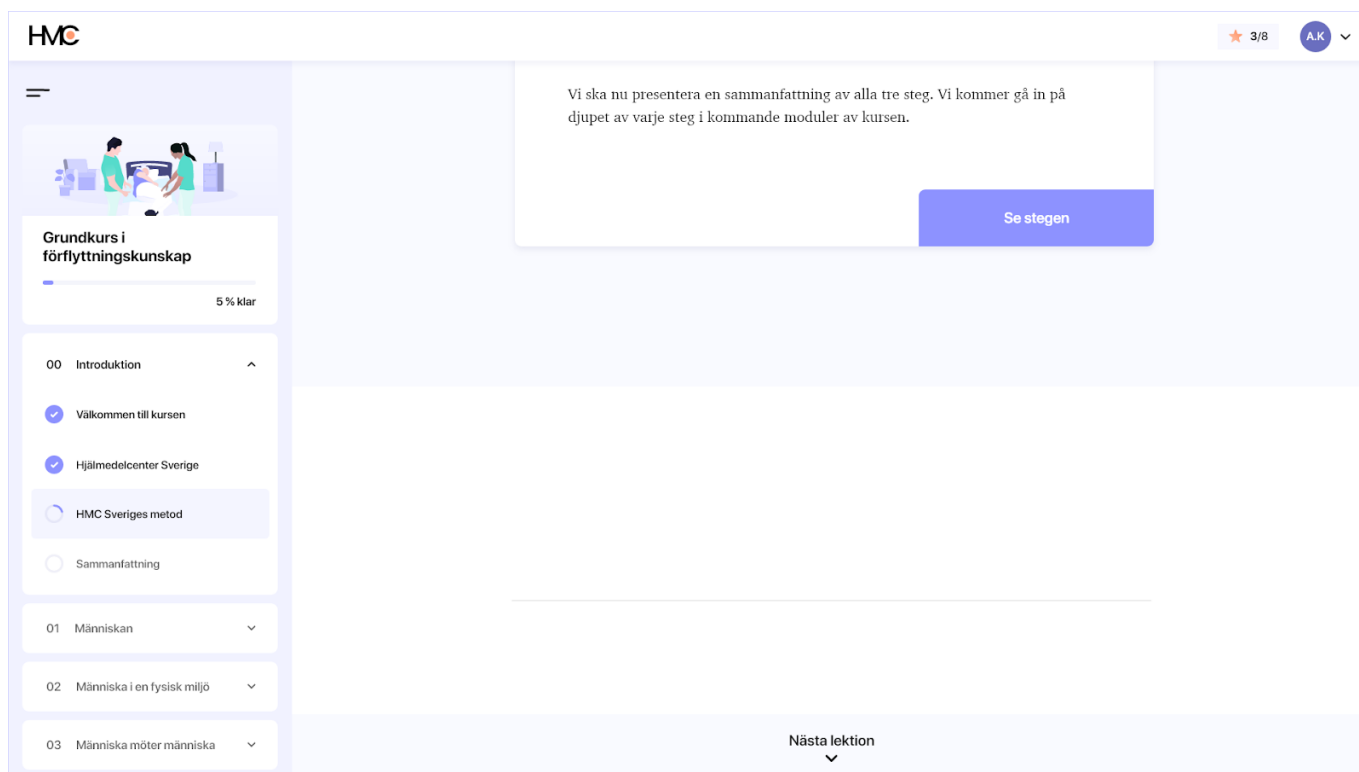
The choice of having content locked is motivated by the fact that the HMC method follows a clear chronological order and that content that is addressed later in the course depends on the content that is presented previously. It would be confusing for the learners to jump to the second step of the HMC method before gaining knowledge about the first step.

Learners can also minimize the navigation menu (see [figure 7.7](#)) if the learner wishes to focus on the content with minimum disturbing elements. This supports one of the usability attributes: flexibility. A flexible system should allow users to approach tasks in multiple ways to suit their preferences.

The screenshot shows a web interface for a course on HMC. At the top left is the HMC logo. At the top right, there is a star icon with '3/8' and a user profile icon with 'A.K.' and a dropdown arrow. Below the header, there is a navigation bar with a hamburger menu icon on the left and a 'Föregående lektion' button with an upward arrow icon in the center. The main content area has a sub-header 'Lektion 1/4' and a title 'Vårdtagarens medverkan'. Below the title is a paragraph of text: 'I den här lektionen får du en introduktion till första steget i vår metod, "Människan", där vi fokuserar på vårdtagaren. Du får en förståelse för vikten av att låta vårdtagaren vara så aktiv som möjligt i sin egen förflyttning, utefter sin unika förmåga.' Below this text is a small box with a clock icon and the text 'ca 3 min'. Further down, there is a section titled 'Vårdtagaren i centrum' followed by another paragraph: 'Att ha vårdtagaren i centrum i vårt arbete betyder att vi i alla lägen ska ta tillvara på och, om möjligt, utveckla vårdtagarens egen förmåga. Genom att göra vårdtagaren maximalt delaktig i sin egen förflyttning främjar vi dennes hälsa, samtidigt som vi skapar så bra förutsättningar vi kan för oss som ska stötta förflyttningen. Med hjälp av vårdtagarens egna, aktiva och passiva, förmågor minskar vi kraftåtgången och skaderisken i förflyttningen.'

**Figure 7.7.** Display of the first lesson in the second module. The navigation menu is hidden.

The main navigation in lessons is to scroll vertically through the content. To move to the next lesson learners must scroll to the bottom, forcing them to navigate through the content before going further in the course. Once reaching the bottom, a button is found with a call to action to continue to the next lesson (see [figure 7.8](#)), which also has a hover effect to make it more intuitive.

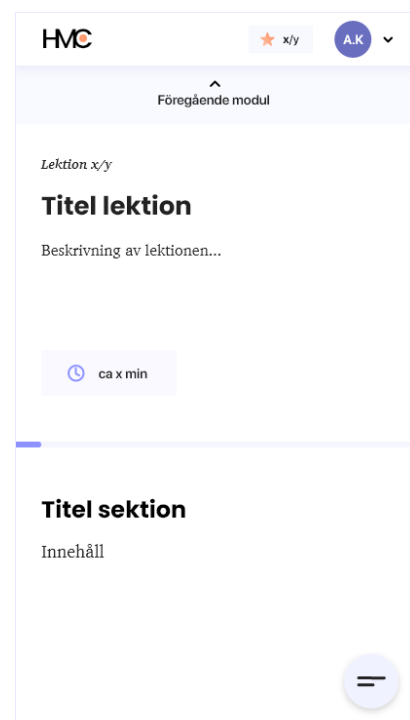
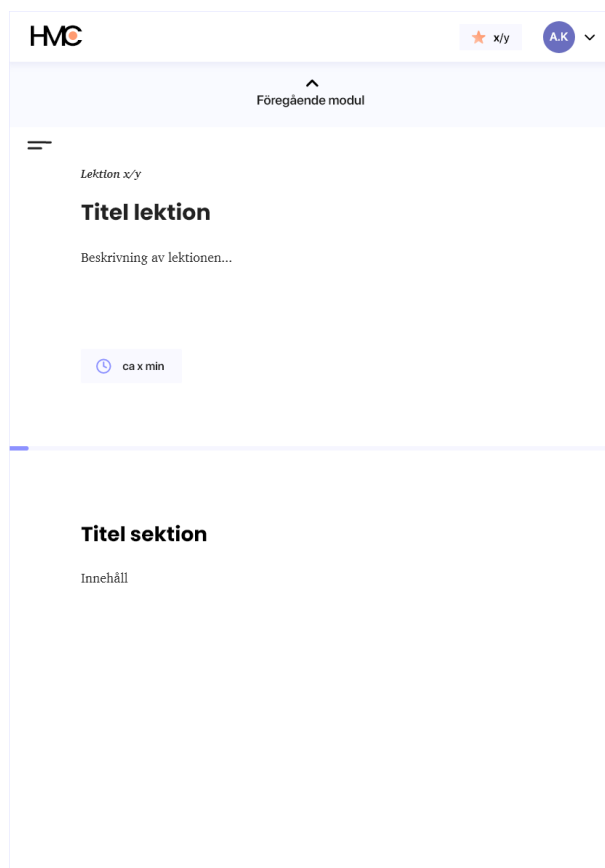
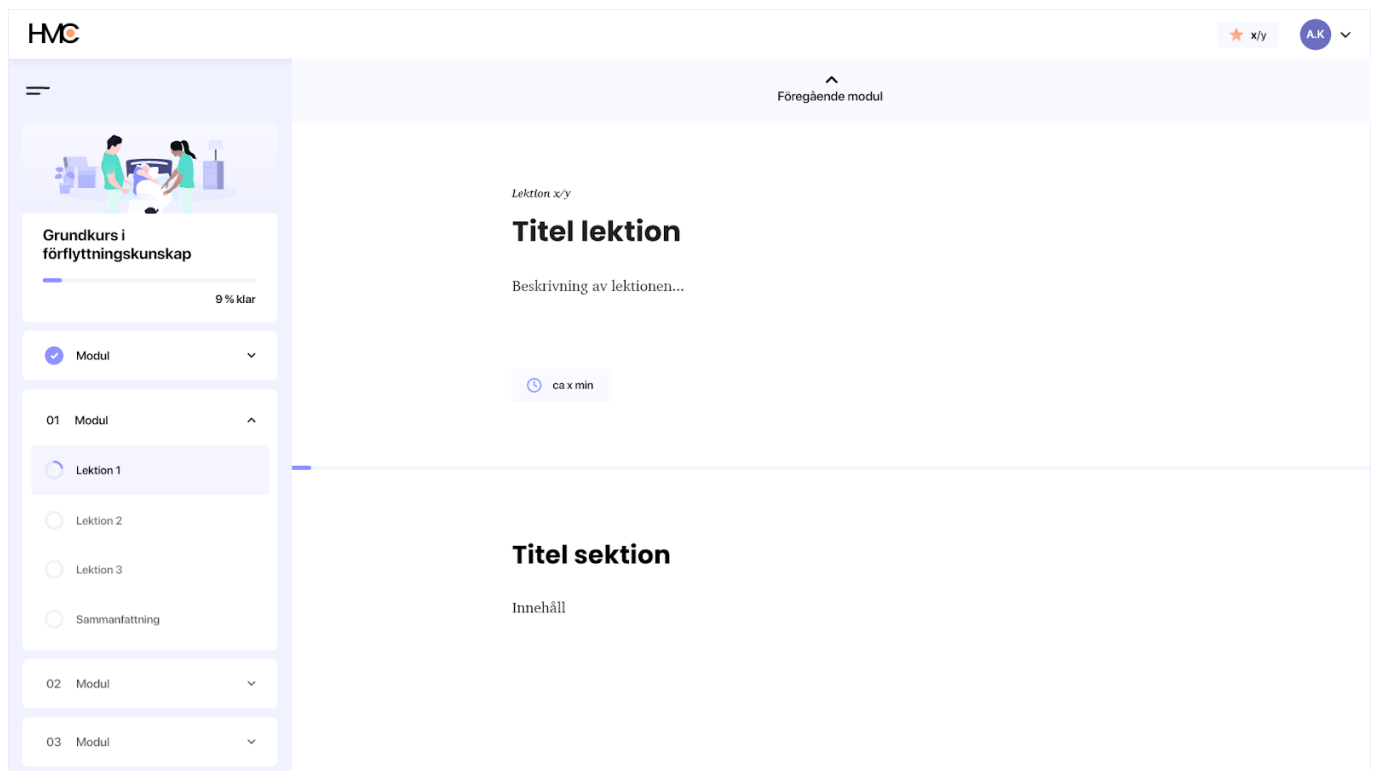


**Figure 7.8.** The state when the learner has scrolled down in lesson three to continue to the next lesson.

In the same way, learners can navigate to the previous lesson, where the button is located at the top of the screen which follows the same navigation path as scrolling. This means that the button is hidden if the learner is far down in a lesson, but when scrolling upwards, the button with the suggestion to go to the previous method will appear.

The main benefit of this layout and navigation is that it supports responsiveness, as shown in figure 7.9. The system has been designed as a web application primarily for computers, as the user studies suggest that the majority of learners will complete the test on a computer. However, to offer flexibility, the design has been produced to be scalable, as to support usage on other devices such as mobile. Still, further work is needed to establish whether it should be developed as an LMS, built in an existing LMS, whether it should be web-based (SaaS), or locally hosted, among other things.

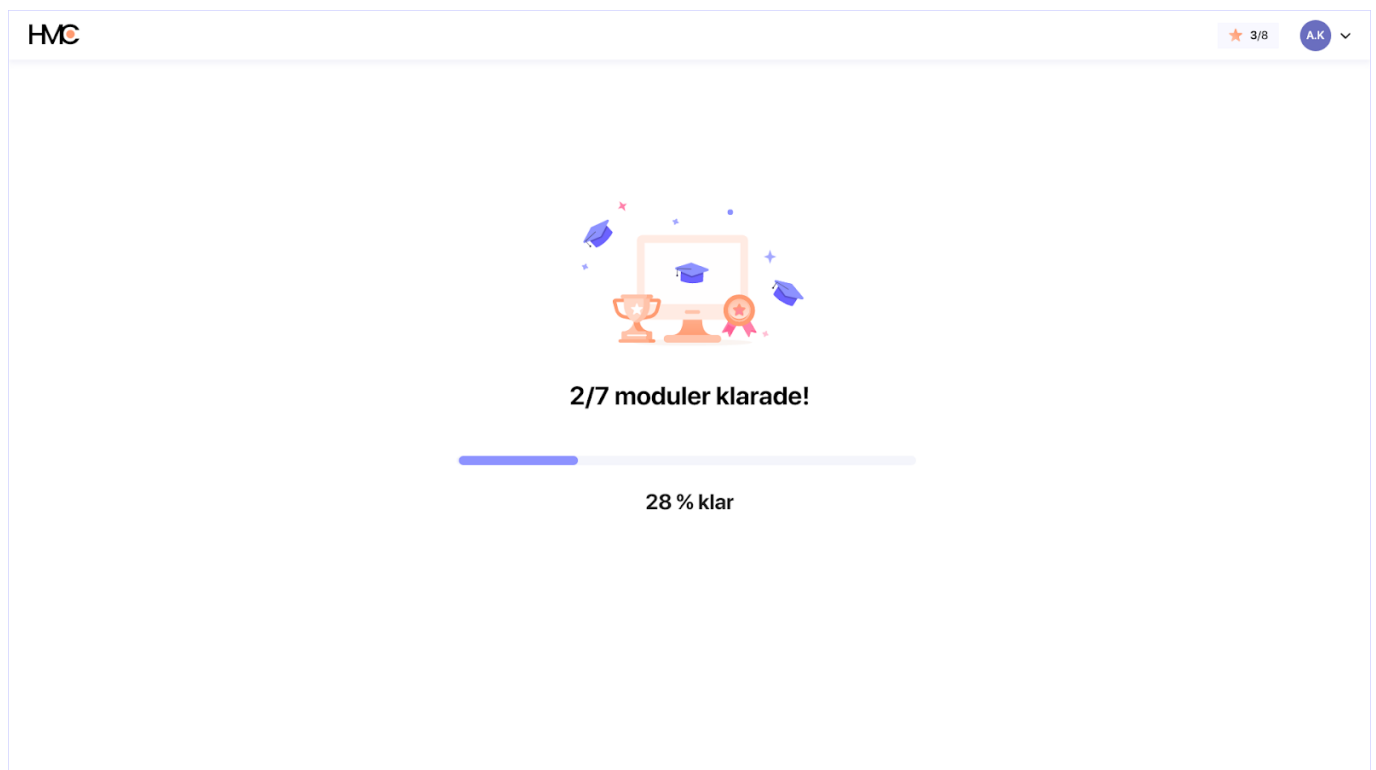
The idea of scrolling through the content instead of navigating horizontally supports the interaction pattern of mobile and tablet. However, lessons must not be too long contentwise. In those situations, it may be better to split the lesson in two.



**Figure 7.9.** Demonstration of the responsive layout (web, tablet, mobile).

## Navigation between different modules

A loading screen will be displayed during the navigation from one module to the following unit (see [figure 7.10](#)). This loading screen should involve a visual representation of achievement (GUI elements) and a presentation of the progress for the entire course (“You have completed x% of the course”). This pause and feedback aim to create a feeling of achievement that learners advance through levels. In addition to this, from a technical perspective the content needs to be loaded sometime, and in order to avoid an extensive loading time at the very start of the course, the loading of each module is packaged within the course, creating a natural shorter pause in between units.



**Figure 7.10.** Loading screen between modules.

Another gameplay element that has been included in the course is that learners can collect experience points (Olah, 2020), in this case stars, by completing assignments within the course. All assignments are equally valued, as learners get one star per assignment.

### 7.1.3 Lesson Activities

All lessons are presented in the same way for consistency. Each lesson is presented with an indicator to illustrate which lesson the user is currently at for the specific module (lesson 2/3 for example), a title, a short description of what to learn, and time estimation for the lesson (see [figure 7.10](#)). It is important to tell learners what they are expected to learn in each lesson so they can keep this in mind while going through the content. A time estimation should also be presented to help learners understand approximately how long each lesson takes, which

also provides a sense of control. A progress bar for the entire module is placed as a separator for the content. The progress bar will follow when learners scroll and "stick" to the header.



**Figure 7.11.** The lesson section.

Activities should feel varied and engaging to promote the best learning experience. Various activities in the form of design element blocks have emerged as a result of the prototype, which is presented below.

## Text, Highlights, Images and Videos

Lessons are mainly built up by expositive methods, that is methods that communicate conceptual and factual knowledge (Ghirardini, 2011), in terms of videos with demonstrations, text to read, and different types of infographics (see [figure 7.12](#)). Such content belongs to the category of absorbing content, which can be effective when learners should observe new information or be refreshed on existing knowledge (Horton, 2012). Thus, it is important not to exaggerate complete sequences of absorbing content, presenting one element after the other in a long series. To create an engaging and fun course, some activities in the form of interactive design elements are needed as interruptions of such a series.

Illustrations, over photographs, have been created and included in the prototype. This was partly motivated by a creative decision of the designers, but also as this was a more accessible approach compared to arranging photo sessions of the different elements needed at this point of time. Nevertheless, such images could potentially be arranged and included in a final product.

3/8
A.K

### Grundkurs i förflyttningskunskap

5 % klar

- 00 Introduktion
  - ✓ Välkommen till kursen
  - ✓ Hjälpmedelcenter Sverige
  - HMC Sveriges metod
  - Sammanfattning
- 01 Människan
- 02 Människa i en fysisk miljö
- 03 Människa möter människa
- 04 Att arbeta rätt med vår kropp
- 05 Praktiska exempel

## Vad är en bra förflyttning?

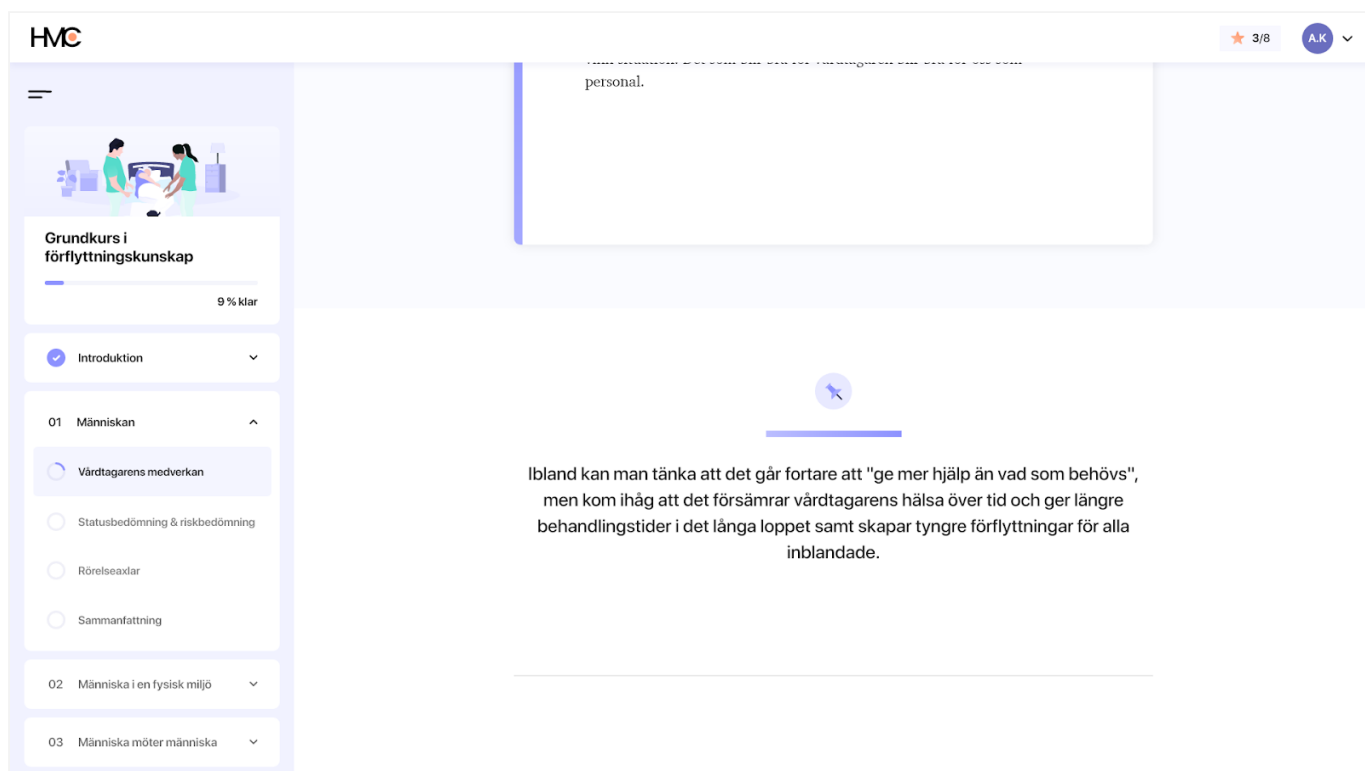
Vi börjar med att definiera vad vi menar med en förflyttning. Frågan kan verka enkel men har flera svar. När vi frågar får vi ofta höra att en förflyttning, kort uttryckt, är att ta sig från en plats till en annan, från ett underlag till ett annat. Exempelvis att flytta sig från en rullstol till en säng eller från en rullstol till en toalettstol. Ibland med tillägget att det också är en förflyttning när man rör sig, positionerar sig, på ett och samma underlag. Exempelvis flyttar sig längre upp i en säng eller sätter sig på ett annat sätt i en rullstol.

Internationellt har man ett bredare fokus när man pratar om förflyttningar. På engelska säger man “safe patient handling and mobility”. Översatt till svenska betyder det “säker patienthantering och (patient) rörlighet”. Förflyttningar sätts i relation till vård och behandling och får på så sätt en bredare betydelse för de inblandade: en arbetsuppgift ska vara säker och skonsam. En vårdtagare som har vård- och omsorgsbehov eller rehabiliteringsbehov ska också kunna bibehålla sin rörlighet (mobilitet).

I den här utbildningen kommer vi att fokusera på förflyttningar ur ett bredare och mindre teknisk perspektiv än vad som är vanligt inom svensk sjukvård. Vi kommer ge dig ett sätt att arbeta med förflyttningar som ger både dig och vårdtagaren bättre hälsa - vinn-vinn!

**Figure 7.12.** The design blocks *Images* and *Text*.

Critical content should be repeated to promote learning, which is supported by the design block *Highlights* (see [figure 7.12](#)). It is used to highlight important content in the course which are directly connected to the learning objectives and the final test. This section aims to “pop” in the interface to differ from “regular” content. This has been done by aligning the section in the center, making the text larger as well as using the purple color as an eye-catcher.

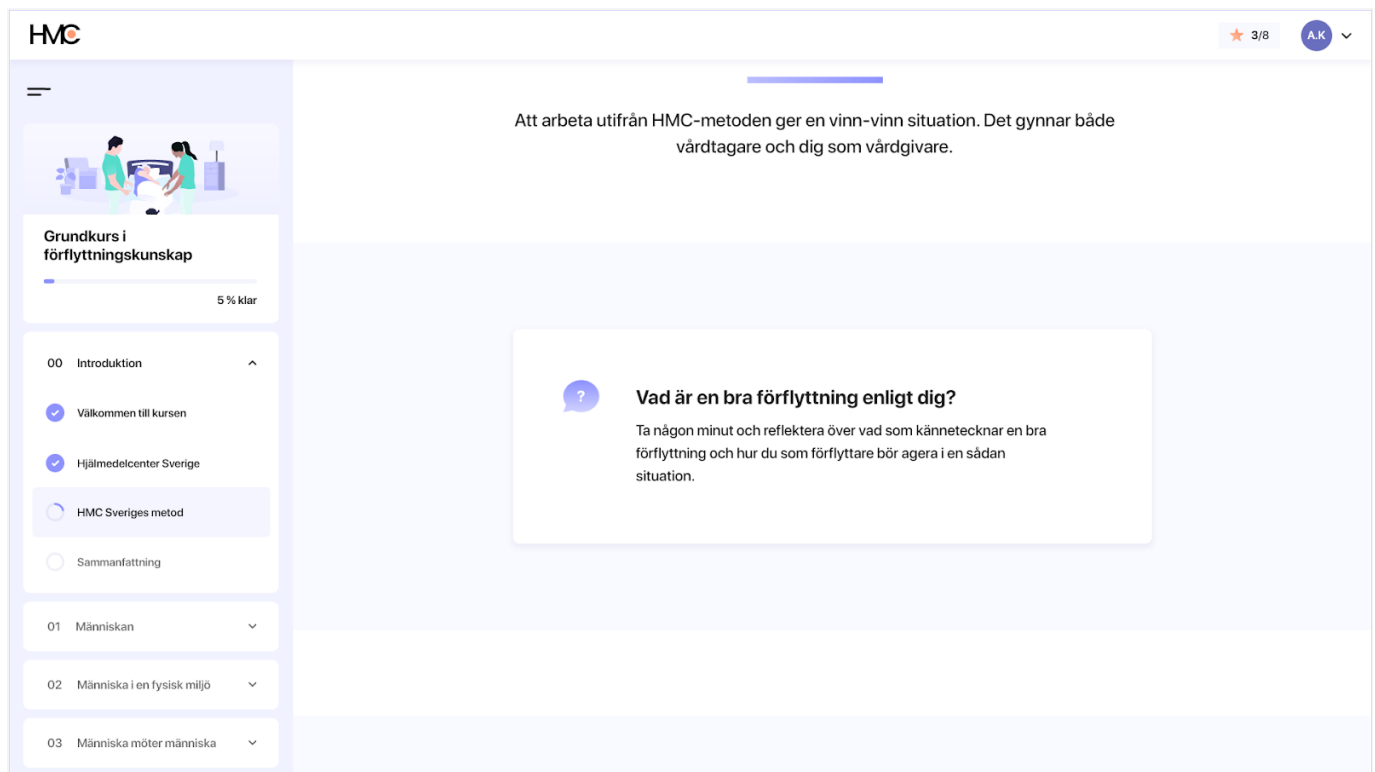


**Figure 7.13.** The design block *Highlights*.

As previously described, no videos have been developed in high fidelity. Videos should mainly be used for demonstrating movements and other tasks that require seeing the procedure in a whole sequence.

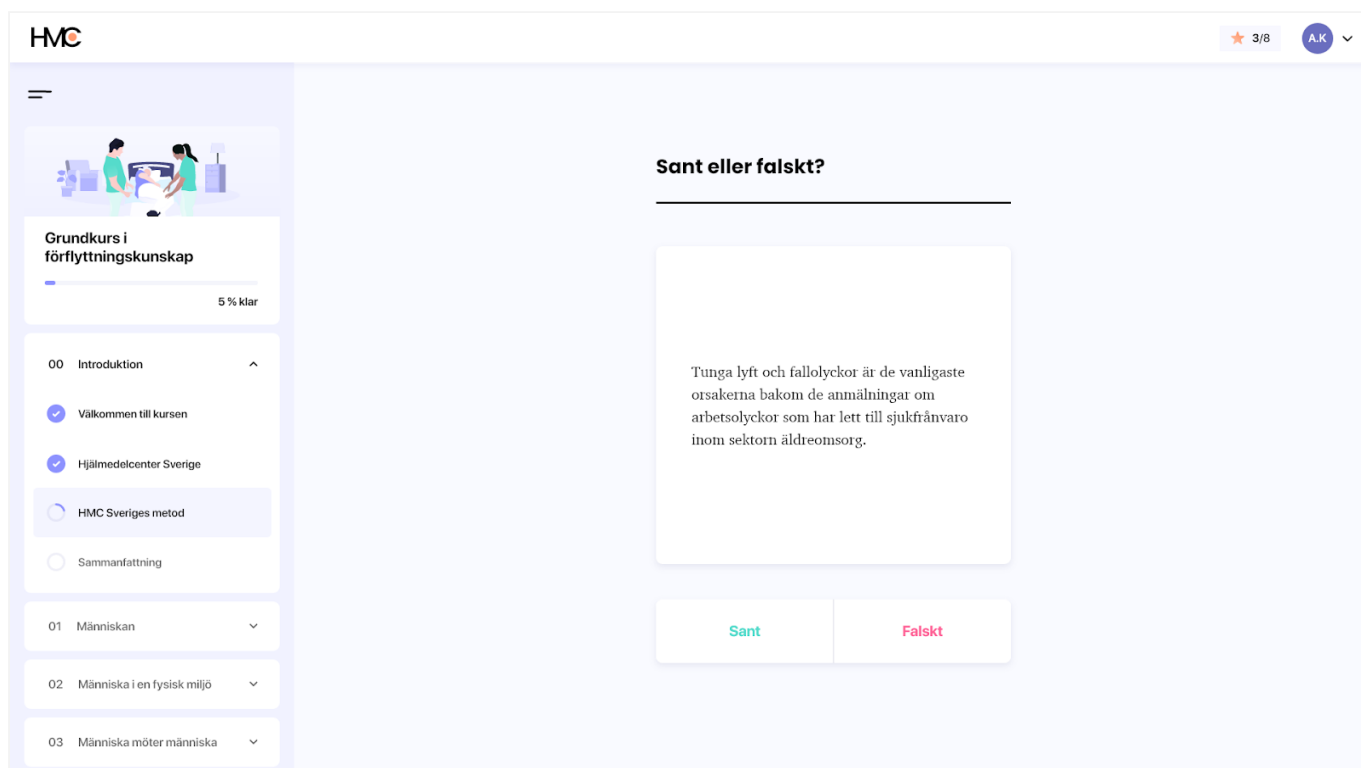
### Reflective question and True or false

Learning is promoted when learners activate relevant prior knowledge or experience. In many cases, the learners have limited previous experience of handling and moving care recipients. However, there may be those who have some experience of working with movement and in those cases, it is important to activate the relevant knowledge they already have. This is done by, for example, including an early reflection exercise (see [figure 7.14](#)) that touches on the definition of “what is a good transfer?”, which allows the learners to reflect on the knowledge they bring with them.



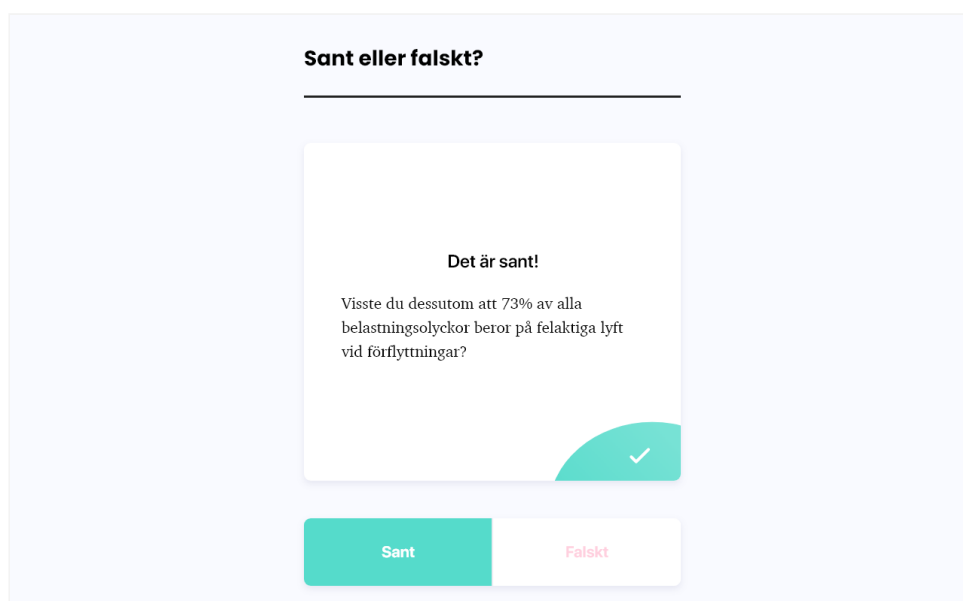
**Figure 7.14.** The design block *Reflection*.

Another reflective activity is the *True or False* design block as shown in [figure 7.15](#). It should be used to make the learners reflect by forcing them to make an active decision before getting the correct answer.



**Figure 7.15.** The design block True or False.

In these kinds of interactive exercises, it is important to give direct feedback to learners to sustain a positive experience, regardless of whether they answer the question correctly or not (see [figure 7.16](#)).

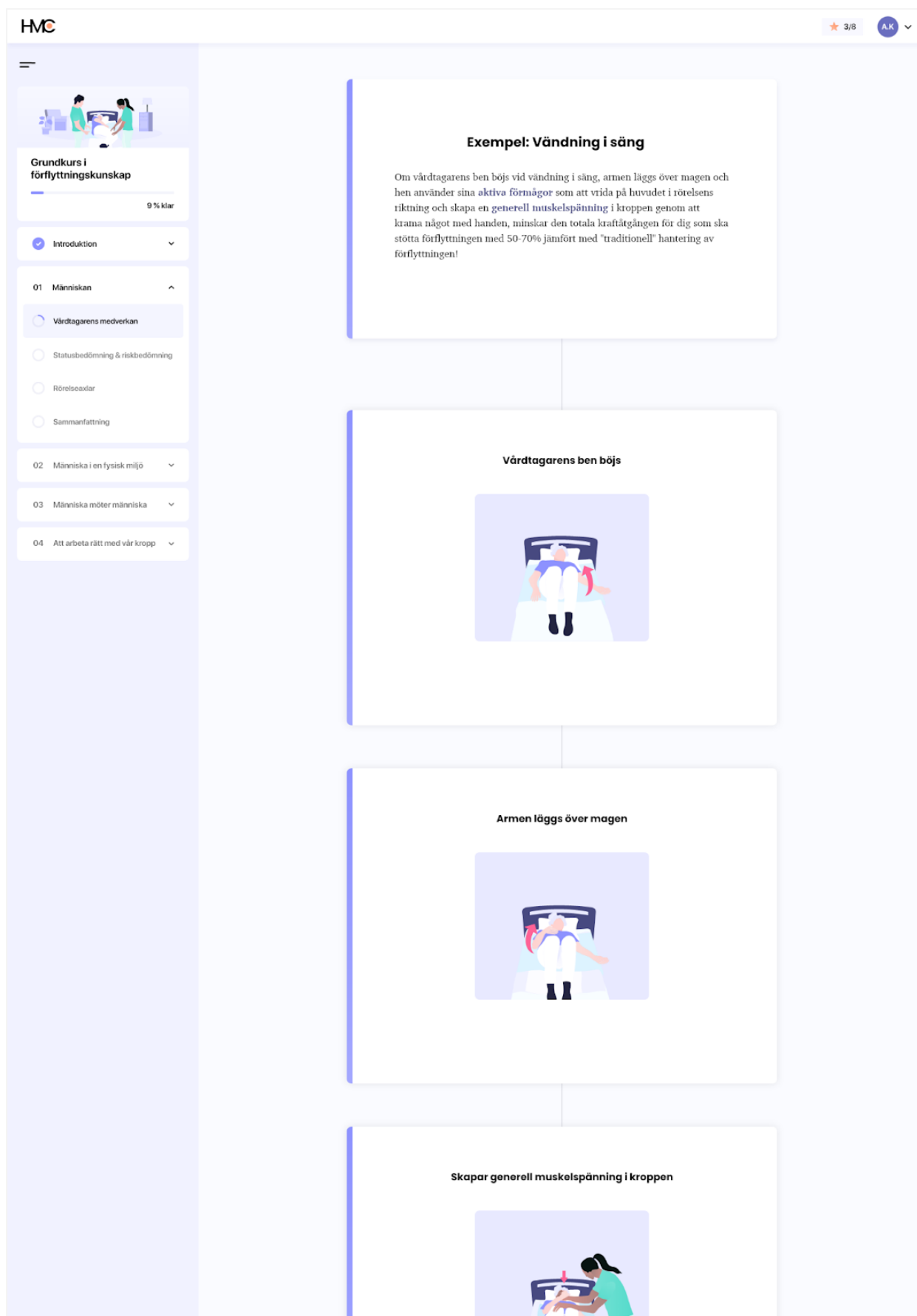


**Figure 7.16.** Feedback from selecting the correct answer in the activity *True or False*.

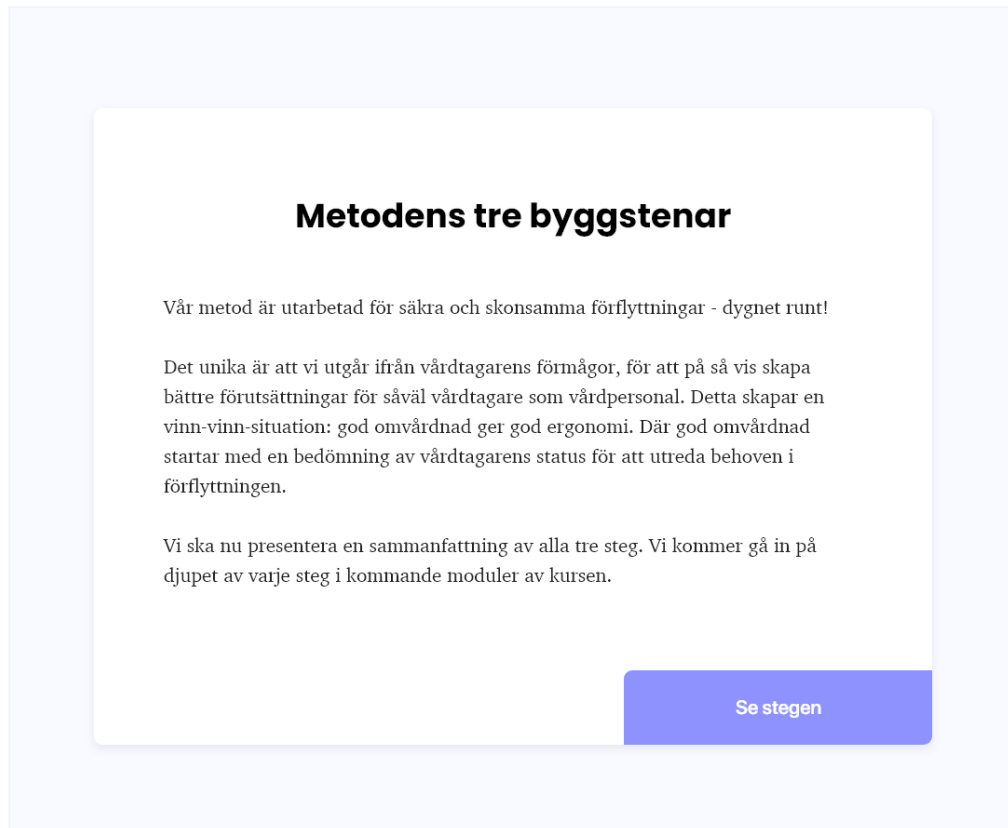
## Process

By applying a scenario-based framing of learning, scenarios from the relevant context are incorporated into the learning experience to promote a clear connection to the situations in which the knowledge should be applied. Scenario-based examples are preferably presented through the *Process* design block which comes in two layouts (see figures [7.17](#), [7.18](#), [7.19](#), [7.20](#)).

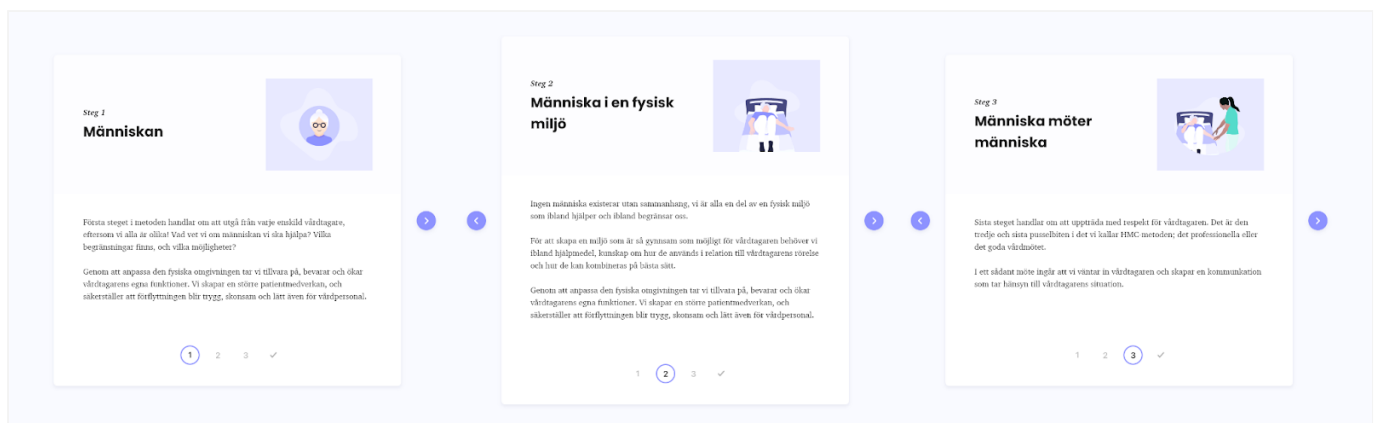
The *Process* design block is preferably used for demonstrating step-by-step processes. Each process starts with an introduction, followed by the steps in the procedure, ending with a summary for repetition. Process is designed to easily take in a procedure without being overwhelmed with information, minimizing the cognitive load for learners.



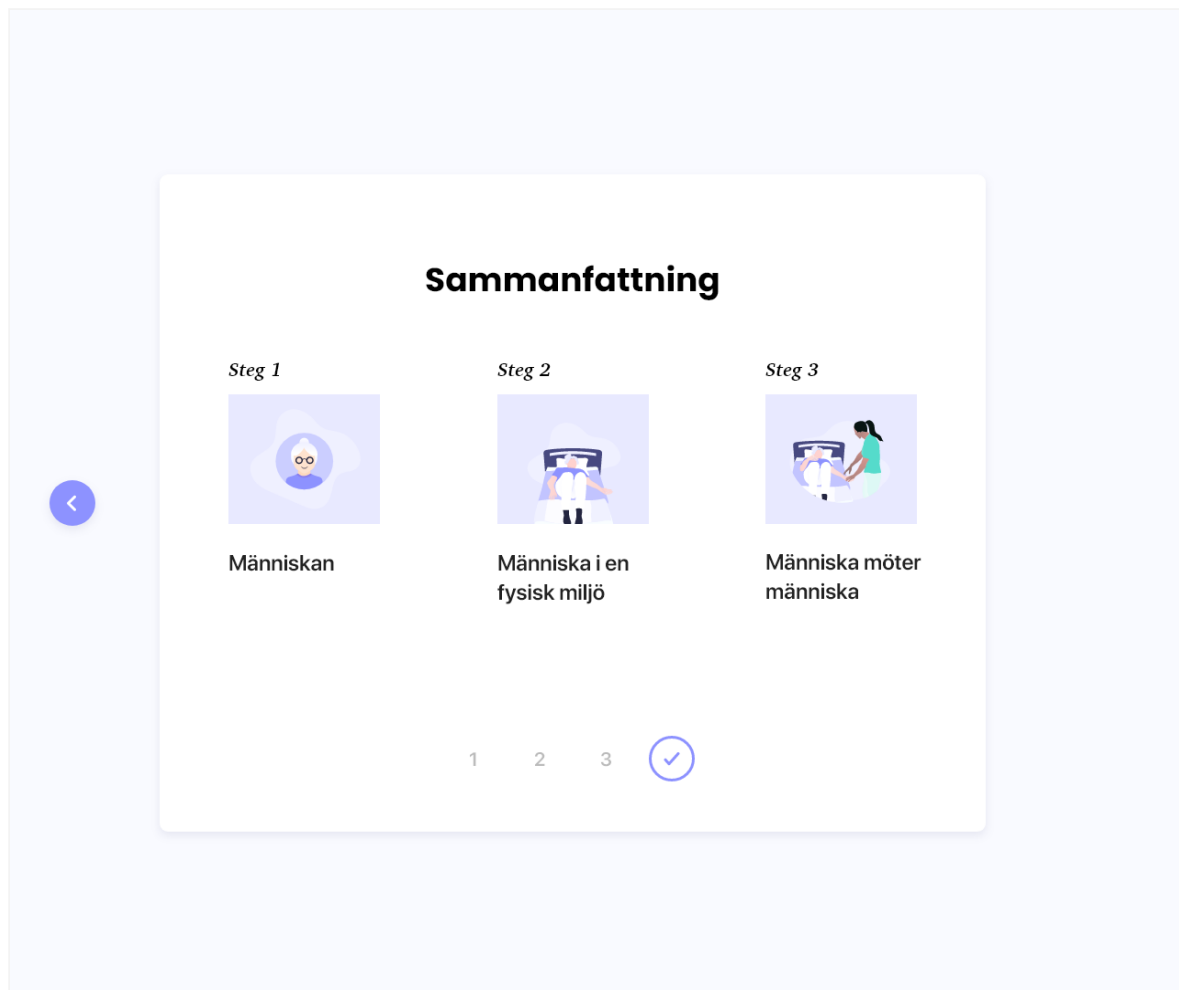
**Figure 7.17.** The design block *Process*. Here shown in the vertical way of presenting it.



**Figure 7.18.** The start state of an activity of the design block *Process*, displaying an introduction to the activity and its topic: the HMC-method's three steps.



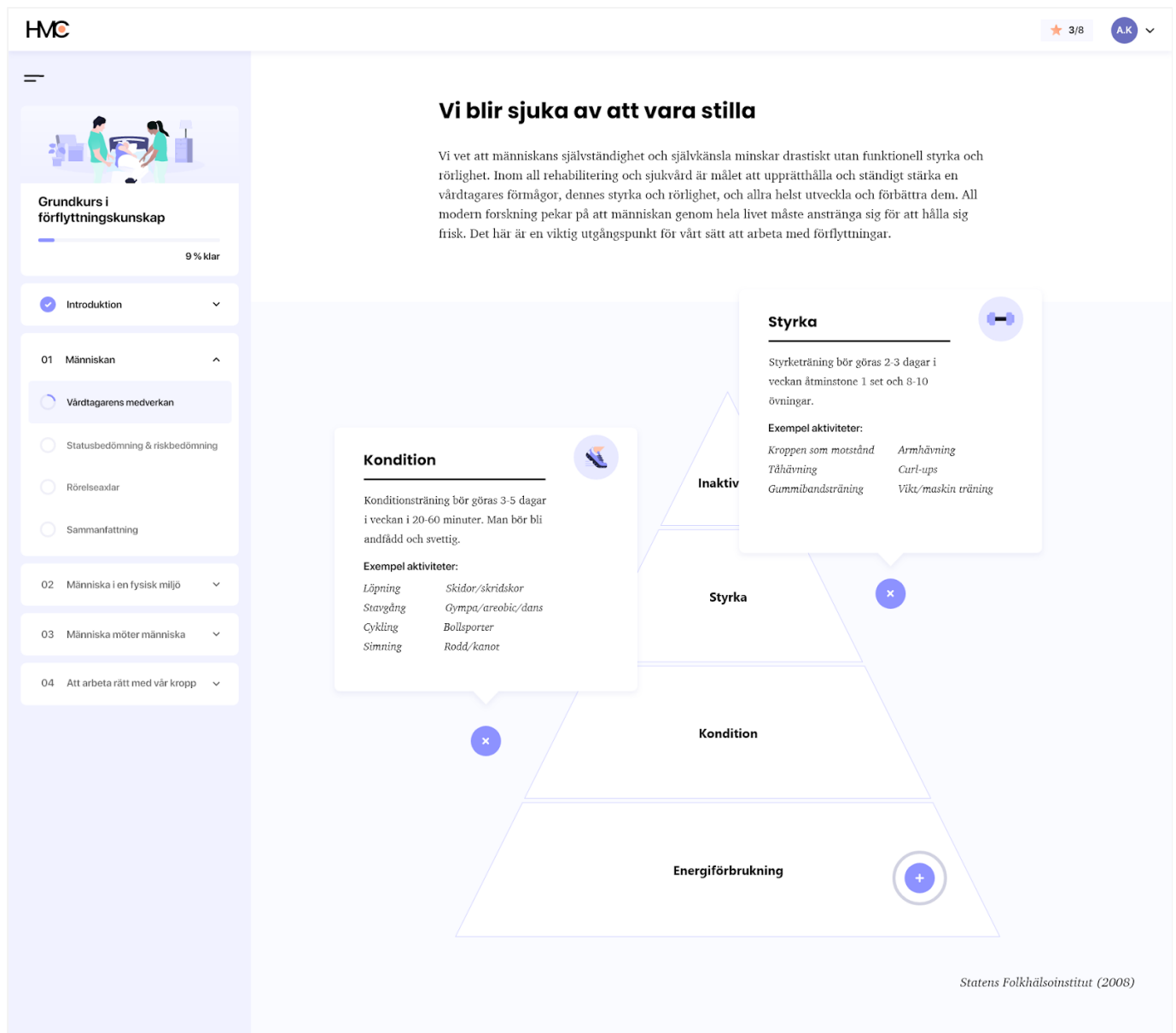
**Figure 7.19.** Demonstration the steps within one activity of the design block *Process*, including all states of the HMC-method's three steps. The element is presented within a horizontal scroll. Only one card is displayed within the scroll space.




**Figure 7.20.** Demonstration of the final state of the design block Process, showing the summary of the HMC-method's three steps.


### Hotspots, Tabs, and Flashcard

A learner-centered, or student-centered, approach, entails the participant himself/herself to be engaged in the material, offering flexibility for the participant to influence what content he/she absorbs by providing an in-depth track in the course. All critical information is presented statically, meaning the participant can not influence whether it is presented or not, while certain other information that is not as critical, but rather offers additional information, is hidden to some extent and requires the participant to explore it actively. The design blocks *Hotspots* (see [figure 7.21](#)) and *Tabs* (see [figure 7.22](#)) are two examples of interactive activities where content is hidden, forcing learners to actively explore the content. These kinds of elements are used to minimize the cognitive load by not overwhelming the learners with information, and to encourage learners with a deeper interest to explore the content further.



**Figure 7.21.** The design block Hotspots.


★ 3/8
A.K




**Grundkurs i  
förflyttningskunskap**

10 % klar

- Introduktion
- 01 Människan
  - Vårdtagarens medverkan
  - Statusbedömning & riskbedömning
  - Rörelseaxlar
  - Sammanfattning
- 02 Människa i en fysisk miljö
- 03 Människa möter människa
- 04 Att arbeta rätt med vår kropp
- 05 Praktiska exempel

## Att göra en statusbedömning i praktiken

Exempel 1
Exempel 2
Exempel 3

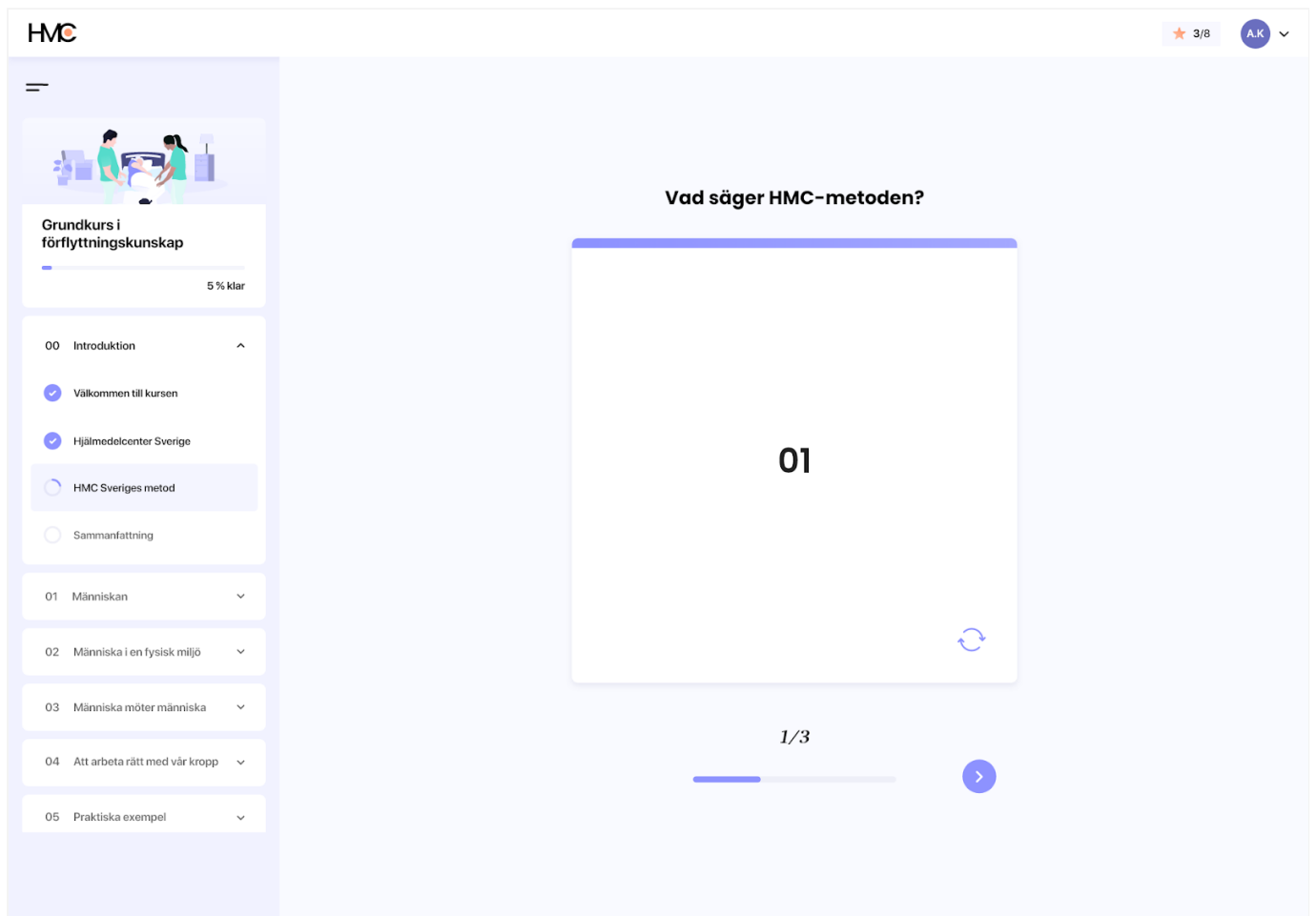


Vårdtagaren kommer in i rullstol. Vårdpersonalen tar bort fotplattorna och ber vårdtagaren trycka ner fötterna mot golvet och sträcka i knäna samtidigt. Då kan vi bedöma om vårdtagaren har två kraftkällor i benen, liksom förmågan att kommunicera, söka ögonkontakt och skapa muskelspänning.

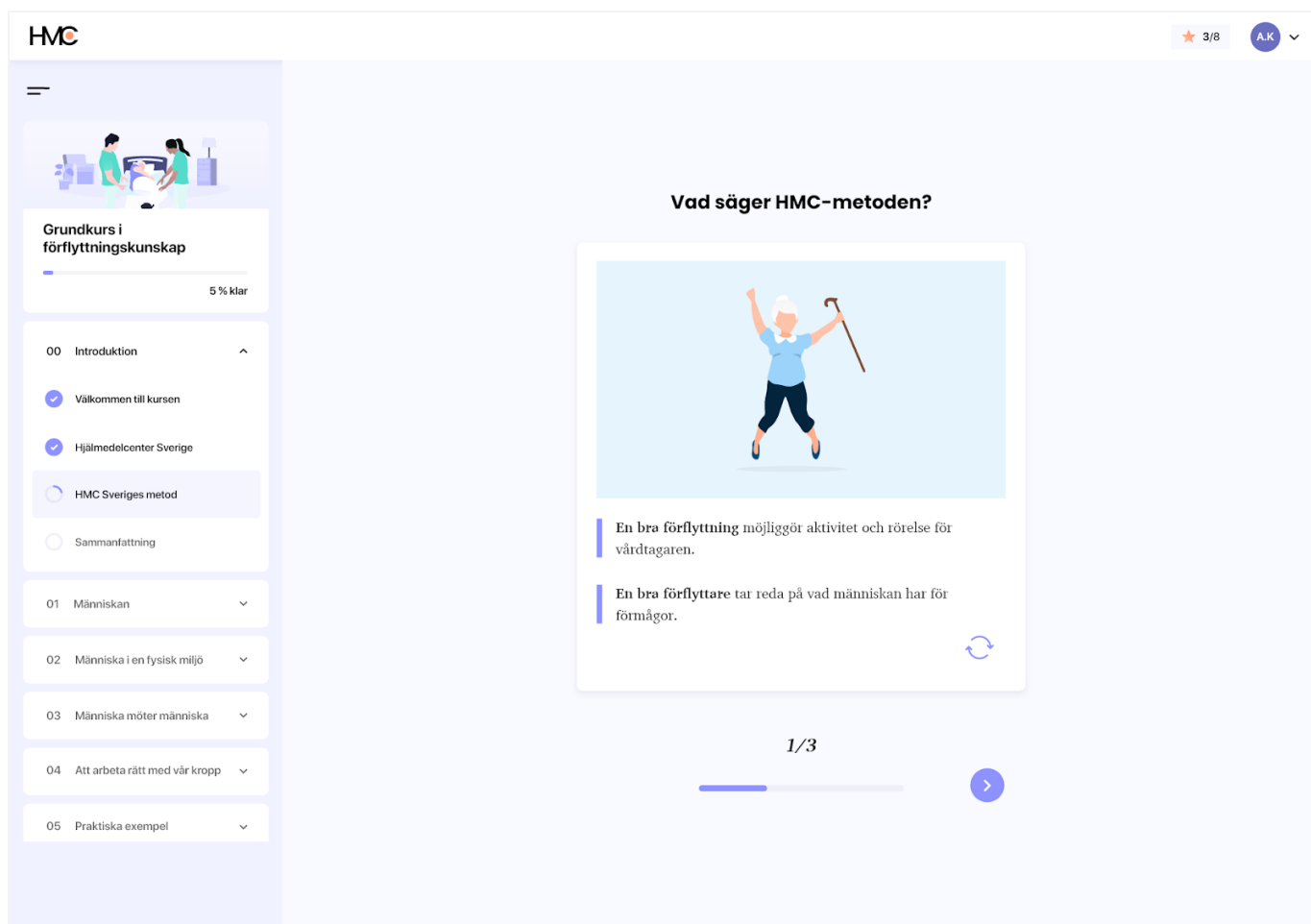
Exemplet visar om vårdtagaren har kraftkällor i benen (aktiva/passiva), förmågan att kommunicera / förstå instruktioner, vrida på huvudet (genom att följa med blicken) och generell muskelspänning i kroppen.

**Figure 7.22.** The design block *Tabs*.

Another explorative design element is the *Flashcard* which could preferably be used for question/answer exercises (see figures [7.23](#) and [7.24](#)). The card encourages learners to find out the answer by clicking (flipping) the cards.



**Figure 7.23.** The design block *Flashcard* in default state.



**Figure 7.24.** The design block *Flashcard* showing the result of clicking on the card.


## Knowledge checks

*Knowledge checks* are included in the e-learning course within lessons, in order to validate that the learner is meeting the learning objectives specific to that particular module and to repeat critical content. These are however not decisive for the learner's achievement of the whole course but rather incorporated for repetition, providing the learner with feedback during his/her progress.

*Knowledge checks* can come in different styles and activities such as through quizzes, both multiple-choice or multiple responses as shown in [figure 7.25](#). Another “test your knowledge”-exercise could be sorting, where the learner should categorize or sort content in a fun and engaging way.

All “test your knowledge”-exercises allow learners to collect a star, which must be communicated just by looking at the design component. Furthermore, just like any interactive activity in the course, it is super important to provide good and direct feedback to learners. The example of testing the learner's knowledge via quiz has thus three different states: default (see [figure 7.25](#)), selected state (see [figure 7.26](#)), and feedback state (see [figure 7.27](#)).

### Testa din kunskap



**Vad innebär det att vårdtagaren har en aktiv förmåga?**

A

Vårdtagaren behöver hjälp att utföra förmågan

B

Vårdtagaren kan själv utföra förmågan, utan hjälp

C

Att vårdtagaren kan förankra kraftkällan

D

Att vårdtagaren kan skapa muskelspänning

Svara

**Figure 7.25.** The design block *Knowledge check* in the form of a multiple response quiz. The exercise has not yet been completed by the learner.

## Testa din kunskap

**Vad innebär det att vårddtagaren har en aktiv förmåga?**

A

Vårddtagaren behöver hjälp att utföra förmågan

B

Vårddtagaren kan själv utföra förmågan, utan hjälp

C

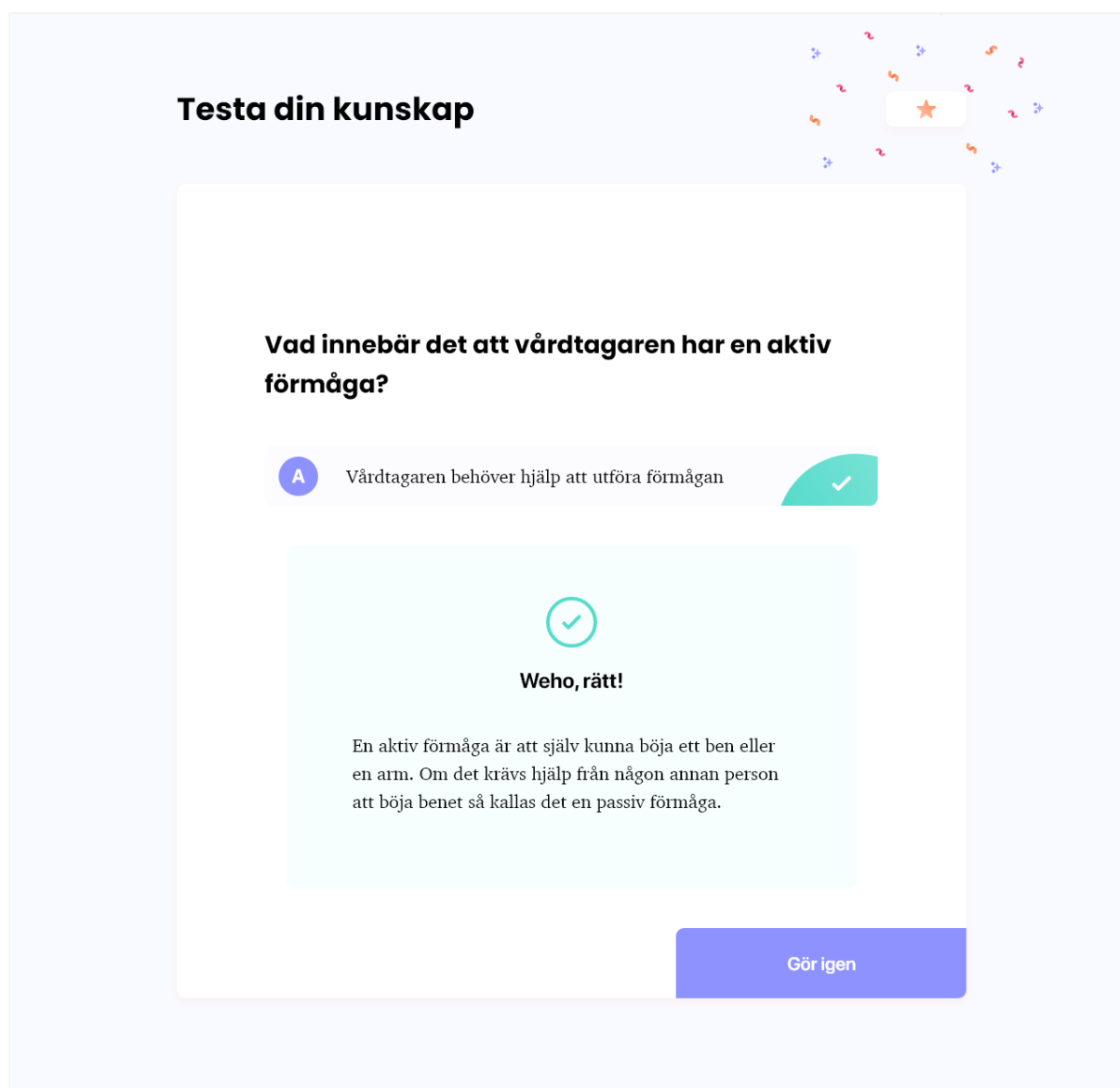
Att vårddtagaren kan förankra kraftkällan

D

Att vårddtagaren kan skapa muskelspänning

Svara

**Figure 7.26.** The design block *Knowledge check* in the form of a multiple response quiz. The learner has selected an alternative.

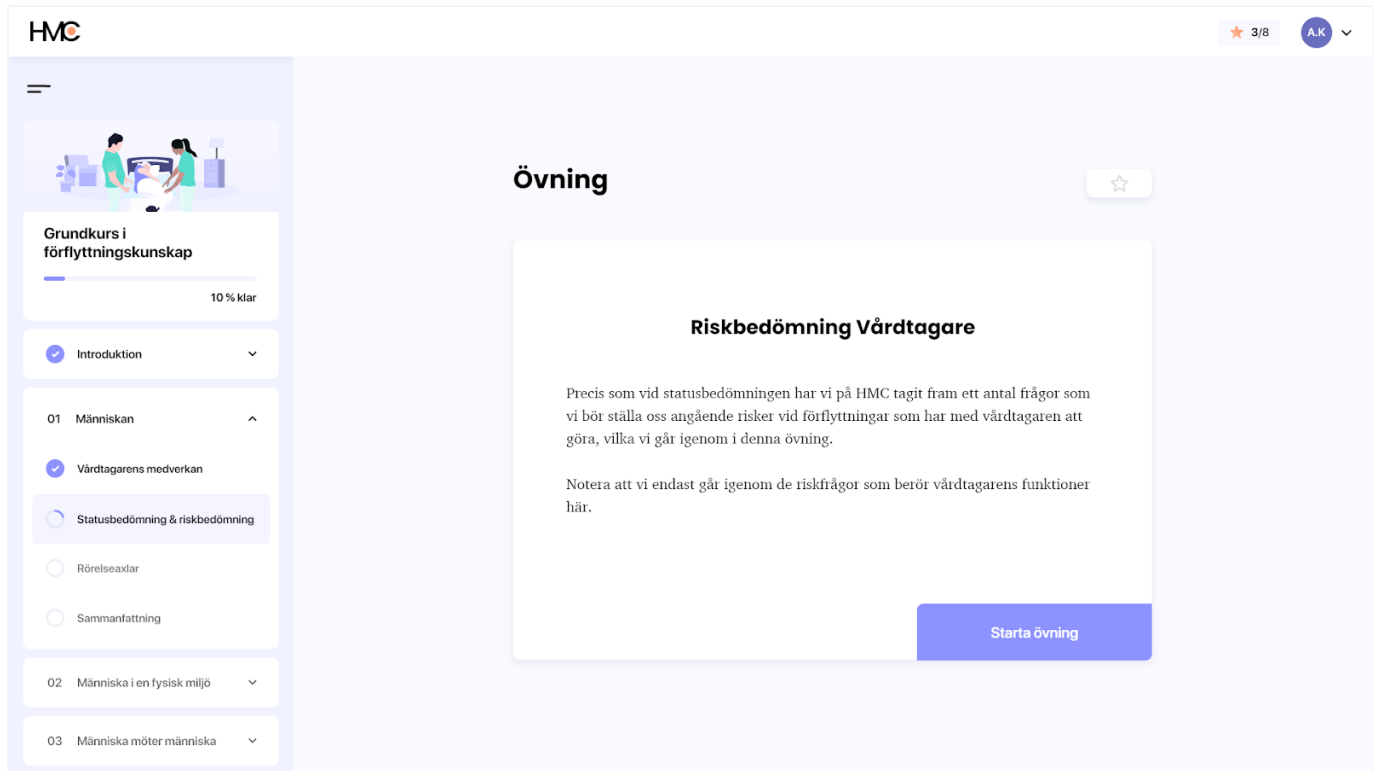


**Figure 7.27.** The design block *Knowledge check* in the form of a multiple response quiz. The learner has selected the right answer and is thus rewarded with a star.

## Walkthrough

*Walkthroughs* are the most advanced activity in the course and are used for bigger exercises such as demonstration how to perform risk assessments or status assessments (see figure 7.28). These activities require the full attention of the learners, which is why these are designed as a modal view. That is, the learners actively start the exercise and navigate to another view presenting only the exercise. The choice to navigate the learners to a new view also has to do with the fact that these exercises often are very long. Having too long lessons is something that needs to be avoided as the learners should not be forced to scroll through a lot of content in order to navigate the lesson. Imagine a scenario where one learner is at the end of one lesson and has scrolled through all the content. The learner then comes to the conclusion that she wants to go back and repeat something in the middle of the lesson, or at

the beginning. Then the content must be scrollable and not too long, otherwise, it would be ineffective.



**Figure 7.28.** The design block *Walkthrough*. The exercise has not started yet.

Furthermore, the idea is that characters, or avatars representing different care recipients, should be introduced early in the course and be used in all real examples. By introducing characters, or avatars, the idea is to further foster a connection between learners and care recipients and evolve the communication further. To promote this, only a few characters should be introduced in the course, which reflects different conditions in care recipients and that everyone is different. These are illustrated, named, and described with a few characteristics to further personify them and to promote empathy. In the final prototype, the care recipient Agda has been used for demonstrating most of the examples.

*Walkthroughs* are designed to go through a process step by step with learners, with the guidance of the interface, as in the example to make a risk assessment (see [figure 7.28](#)). Here, the learners are supposed to do a risk assessment of the care recipient Agda, where the interface explains and provides answers to the questions asked. This is done by giving invitations such as “select that Agda can sit without support and see what follow-up questions need to be determined”. The learners follow the instructions and interact with the design elements. The *Walkthrough* always ends with a summary and a call to action to go back to the lesson.

Tillbaka

Riskbedömning Vårdtagare


## Riskbedömning Vårdtagare

Nedan presenteras de riskfrågor vi alltid ska ställa innan vi ska utföra en förflyttning som har med vårdtagaren att göra. Gör vi som vårdpersonal alltid en riskbedömning av både vårdtagaren och miljön kan vi försäkra oss om att förflyttningen blir säker för alla inblandade!

Vi ska nu göra en riskbedömning på vår vårdtagare Agda.

### Kan Agda stå och belasta benen?

Om Agda kan stå och belasta benen är det även viktigt att ställa sig frågan hur länge hon kan göra detta? Kryssa i att Agda kan stå och belasta benen och ange en lämplig tid.




Stå och belasta benen med eller utan stöd av hjälpmedel

Kan	Kan ej
-----	--------


### Kan Agda sitta utan stöd?

Om vårdtagaren ej kan sitta stadigt utan stöd är det viktigt att ställa sig ett antal följdfrågor - Klicka i att Agda ej kan sitta utan stöd och se vilka följdfrågor som behövs fastställas.



Sitta utan stöd

Kan	Kan ej
-----	--------



Har du en situation där vårdtagaren behöver stöd i sittande position och dessutom faller åt någon sida? Då blir förflyttningen förstärkning med fler personer alternativt att använda förflyttningshjälpmedel i förflyttningen. Till

**Figure 7.29.** The design block *Walkthrough*. The exercise has been started by the learner showing the modal view.

## 7.1.4 Summary and Practical Example

At the end of each module, a summary is found to rehearse and highlight the most important content in each lesson and to put the knowledge learned so far in a practical example. The

summary should differ somewhat from the other lessons, both in terms of content and layout. The first to be presented is the key takeaways ([figure 7.30](#)).

*Key takeaways* are short sentences that summarize the most important things brought up in the module. In addition, learners have the opportunity to be linked back to the lesson that addresses the key takeaways. This is to give learners the opportunity to rehearse important content that for some reason may have been missed.

The screenshot shows a web interface for a course titled 'Grundkurs i förflyttningskunskap' (Basic course in moving knowledge). The interface is in Swedish. On the left is a sidebar with a list of modules: 01 Människan, 02 Människa i en fysisk miljö, 03 Människa möter människa, 04 Att arbeta rätt med vår kropp, 05 Praktiska exempel, 06 Kunskapstest, and 07 Kursutvärdering. The '01 Människan' module is selected and expanded, showing sub-topics: Introduktion, Vårdtagarens medverkan, Statusbedömning & riskbedömning, Rörelseaxlar, and Sammanfattning (which is the current page). The main content area is titled '01 Människan' and 'Sammanfattning'. It includes a progress bar showing '12 % klar' and a timer 'ca 10 min'. The 'Key takeaways' section contains four bullet points, each with a key icon and a link to the lesson. The first takeaway states: 'Första steget i HMC-metoden handlar om att ta tillvara på vårdtagarens kraftkällor och förmågor, och låta vårdtagaren vara så aktiv som möjligt i sin egna förflyttning.' The second takeaway states: 'Statusbedömningen består av att bedöma **kraftkällor** och **förmågor** hos vårdtagare. Vissa förmågor kan användas **aktivt** eller **passivt**!' The third takeaway states: 'Vårdtagers kraftkällor och förmågor kan variera beroende på när på dygnet förflyttningen ska göras, detta kallas **24h perspektivet**. Vi måste därför alltid göra en statusbedömning - vad klarar vårdtagaren av idag?' The fourth takeaway states: 'Inför varje förflyttning görs alltid en riskbedömning. De flesta riskbedömningsfrågorna har med vårdtagaren att göra, men hinder i den fysiska miljön så som platsutrymme kan också vara en risk.'

**Figure 7.30.** The summary of the first module in the form of *Key takeaways*.

The summary also includes an exercise that demonstrates a practical example of a real scenario of moving a care recipient, using the steps in the HMC method. The practical example should advance in difficulty and complexity gradually as the learners progress the course, and is therefore divided into three steps, corresponding to the HMC method. The example should be built on each time the learners come to the summary of related modules. To clarify, the three steps and exercises learners are expected to perform in the practical example are presented below.

(1) *Summary: The human*

The first step is about HMC's method: to take advantage of the care recipient's abilities and sources of power during the transfer. The first exercise will be to make a status assessment and a risk assessment related to the care recipient.

(2) *Summary: Human in a physical environment*

In the same way, at the end of the next module, the example will be built on and learners will do an exercise about step two in the HMC method, which revolves around the physical environment and what aids are available. In this part of the exercise, the learners will choose the right aids for the transfer, based on the care recipient's abilities, as well as doing a risk assessment of the physical environment.

(3) *Summary: Human meets human*

Finally, the last step explains how to perform a good and professional care meeting including the importance of taking time for the transfer and how to touch the care recipient with respect. In the last exercise, the learners will meet the care recipient and perform the movement.

When all three steps have been covered in the practical example, the learners have been given a good exercise that describes the main points of the whole course.

The screenshot displays the HMC (Hälsö och Medicin) course interface. On the left is a sidebar with a course overview titled 'Grundkurs i förflyttningskunskap' showing 12% completion. The sidebar lists modules: 01 Människan (expanded), 02 Människa i en fysisk miljö, 03 Människa möter människa, 04 Att arbeta rätt med vår kropp, 05 Praktiska exempel, 06 Kunskapstest, and 07 Kursutvärdering. Module 01 includes sub-items: Introduktion, Vårdtagarens medverkan, Statusbedömning & riskbedömning, Rörelseaxlar, and Sammanfattning. The main content area is titled 'Praktiskt exempel' and contains introductory text about helping a patient named Agda. Below the text is a modal window titled 'Steg 1: Människan' with the sub-header 'Vändning i säng' and the task 'Byte av inkontinensskydd med Agda'. The modal shows an illustration of a patient in bed with a urinary catheter. At the bottom of the modal are three numbered steps (1, 2, 3) and a 'Starta förflyttning' button. A star icon is visible in the top right of the modal area.

**Figure 7.31.** The summary of the first module in the form of the practical example. The exercise has not yet been started by the learner.

Just like the design block *Walkthrough*, the *Practical Example* requires the full attention of the learners and therefore designed as a modal view (see [figure 7.32](#)). Unlike *Walkthrough*, the *Practical Example* is divided into three steps, making the design element more complicated with more states (see [figure 7.33](#)). Each step has two states: default state and done state. After the learner has completed the first step, the check icon is displayed together with the opportunity to repeat the exercise.

Tillbaka
Vändning i säng med Agda

1
2
3

## Steg 1: Människan

Det är tidigt på morgonen, vid frukosten kändes Agda lite svagare än vanligt. Du och din kollega tänker på det första steget i HMC-metoden: att ta tillvara på vårdtagarens förmågor och kraftkällor. Ni vet också att vårdtagarens förmågor och kraftkällor kan ändra sig beroende på dygnetstidpunkt. Ni bestämmer er för att kolla om statusbedömningen som gjorts av en fysioterapeut som finns i Agdas **genomförandeplan** stämmer och svara på frågan - vad kan Agda bidra med just idag?

I många fall har du som undersköterska tillgång till en fullständig statusbedömning som gjorts av en fysio- eller arbetsterapeut. Ta dock alltid för vana att göra en egen statusbedömning på vårdtagaren som ska förflyttas genom att ta hänsyn till 24h perspektivet!

### Stämmer Agdas status fortfarande?

När Agda ska vända sig i sängen kan hon med lätthet vända sig från att ligga på rygg till att ligga på sidan genom att böja sina ben, vrida huvudet och föra armen över bröstet åt det håll hon ska vända sig och låta tyngdkraften göra det mesta av jobbet. Men för att Agda självständigt ska kunna justera sin position i sängen behöver hon använda sig av minst två kraftkällor - båda armarna eller båda benen. Dessutom behövs det hjälpmedel som minskar friktionen som uppstår mellan kroppen och madrassen.

Du och din kollega läser i statusbedömningen som gjorts tidigare att Agda inte har några aktiva kraftkällor i sina armar eller ben men kan vrida på huvudet och krama med handen (**aktiva förmågor**). Ni går in till Agda för att se om det stämmer och hur hon mår idag. Som stöd tar ni upp HMC:s bedömningsunderlag som är mobilanpassad. Ni hittar den under mitt kursmaterial i mitt HMC.

### Kraftkällor

När Agda ska vända sig i sängen behöver hon inte använda några kraftkällor som att trycka ifrån med fötterna eller händerna. Därför låter ni de kraftkällorna vara i bokade som kan ej.

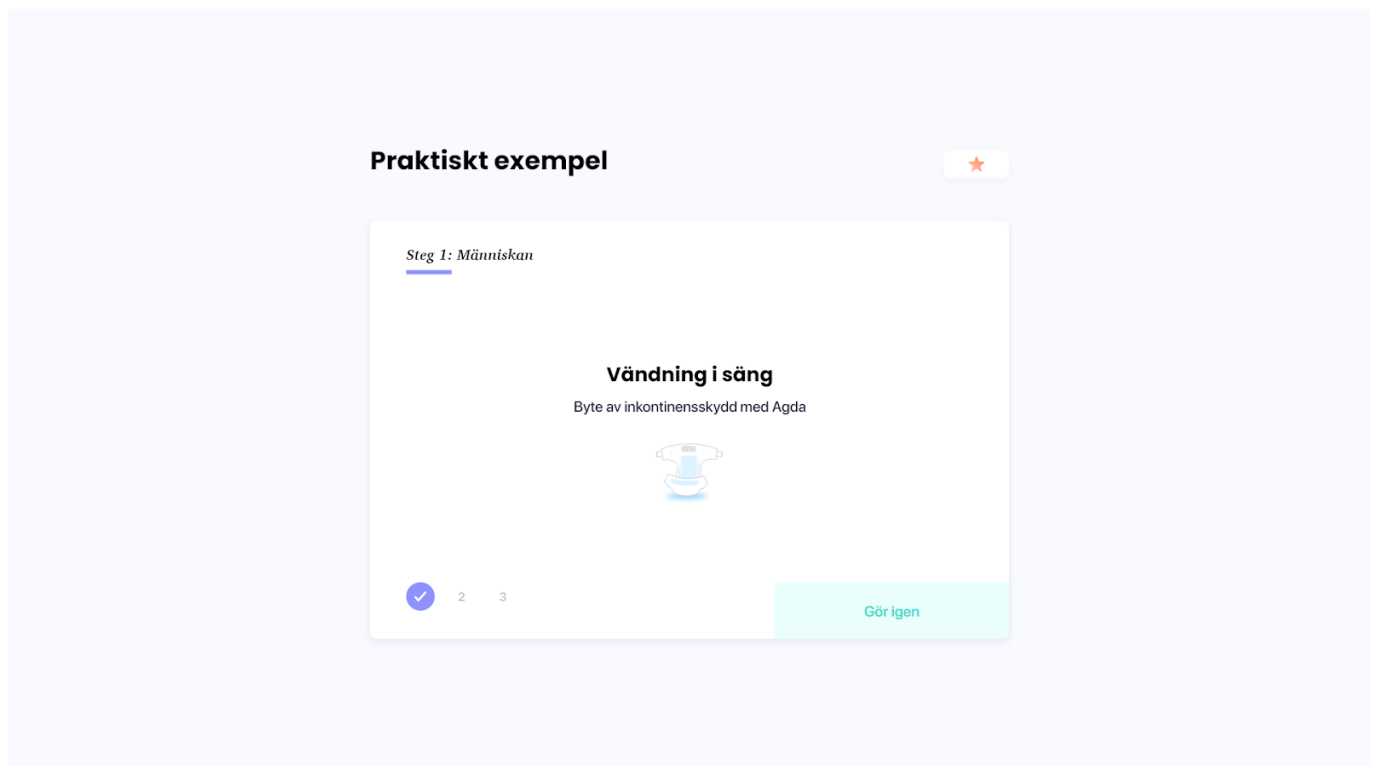
Trycka ifrån med höger fot

Kan
Kan ej

Trycka ifrån med vänster fot

Kan
Kan ej

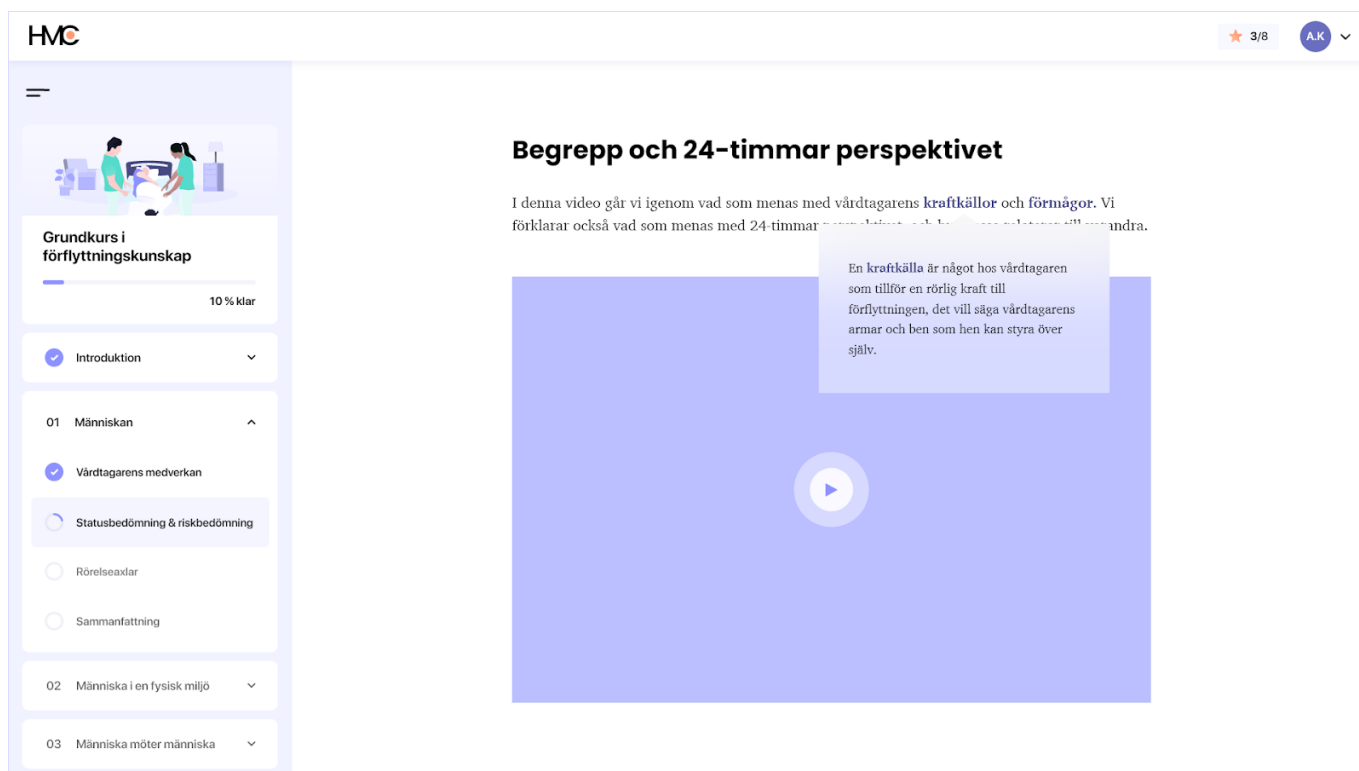
**Figure 7.32.** The design block Practical Example step one. The exercise has been started by the learner.



**Figure 7.33.** The design block *Practical Example*, done state.

### 7.1.5 Other Features

A dictionary is included in the course to offer those with less experience and knowledge constant access to support, thus giving them some knowledge that may be lacking. This is included directly in the course content, where difficult concepts and words are highlighted with bold weight and a dark purple color. When hovering the mouse over the word, learners get an explanation of the term as shown in [figure 7.34](#).



**Figure 7.34.** The dictionary function.

Furthermore, course material in the form of assessment matrices should be available for learners after the course to download and use in their practice. Such aids are referred to and highlighted in the course.

## 7.3. Design Principles

The final activity of the RtD process, apart from iteration of process, is to reflect on and disseminate the insights that have risen during the project (Zimmerman and Forlizzi, 2014). One of the main goals of this thesis work was to define design principles and guidelines, applicable in the design of an e-learning course based on an existing in-class education for a practice oriented topic, such as transfer techniques. The design principles provide a general point of direction, while the guidelines reveal how to approach the principle (Interaction Design Foundation, n.d.a).

We need to stress that these principles and guidelines are not exclusive. In the process of designing and developing an e-learning education there are several other standards, design principles and frameworks that are helpful in order to create a successful learning experience. The principles and guidelines presented here cover some of the important aspects of creating an e-learning experience, but there is potential for further elaboration and revision of them as this is a complex process.

In this section we present the written design principles with some associated guidelines, followed by some elaboration on the principle.

*Note that the numbering for guidelines might have shifted during this revision, compared to the guidelines presented in iteration 3.*

**Principle 1: Provide a transparent and clear connection to the (working) context to promote learning and knowledge application**

*G1.1. Write clear statements explaining the purpose and goals of the course*

*G1.2. Write clear descriptions of the course content*

*G1.3. Ground the learning content, such as practical examples, in the working context in which the knowledge should be applied in*

*G1.4. Apply a scenario-based content structure*

In order to promote learning and foster practical use of the course content, there should be a clear association between the presented learning material in the course and the situations, that is the context, in which the acquired knowledge and skills should be applied (Brown, Collins & Duguid, 1989; Herrington, Oliver, Herrington & Sparrow, 2001; Merrill, 2002). This setup was clearly favored by target users as participants in user studies commented on this as a critical aspect in order to make use of the education in practice. The practical examples included in the e-course are thus based on common activities and transfers with care recipients, described by the client and validated with the assistant nurses themselves, to promote this connection. A case-based approach fosters situated learning (Canonico, n.d.) as it places learners in situations and presents them with challenges similar to those that should be solved in a real context, increasing the probability for learners absorbing and understanding the information (Pappas, 2017; Merrill, 2002).

It is essential that learners are informed on what they are supposed to learn in the course, that is what they are expected to know or be able to do after completing the course which puts pressure on clear statements in the form of learning objectives that are grounded in the context (Ghirardini, 2011). Those should be authored in a way that makes it clear what level of performance the learner should reach, as defined by Bloom's Taxonomy, and what learning content it concerns (Ibid.). This is reflected in the final prototype in various aspects. For example, before the participants start the course, they get a clear introduction to the course content and what they are expected to learn after completing the course as shown in [figure 7.2](#). In the first lesson in the course, participants are presented with an introductory video to further explain what is covered in the course. In addition, for each lesson, a short description of the lesson and the specific learning objectives are presented (see [figure 7.4](#)).

For this particular project the context is to be defined as a *working context*, however it is not exclusively applicable to a working context per se, but can be any context in which knowledge and skills acquired through a course should be applied. As incorporated in this prototype in the form of the design block *Process*, (see figures [7.17](#), [7.18](#), [7.19](#) and [7.20](#))

scenarios reflecting the situations the learners will find themselves in is one method for promoting reflection of the context, fostering a valuable presentation of the knowledge and skills in practice.

**Principle 2: Provide learners with an engaging learning experience**

- G2.1. *Create a varied experience by varying learning activities and instructional media to provide various perspectives to the information*
- G2.2. *Include visual elements to support the conveyed information*
- G2.3. *Strive for an appealing and consistent content presentation throughout the experience*
- G2.4. *Construct an encouraging tone of voice throughout the learning experience to support and motivate the learner*
- G2.5. *Include interactive activities to encourage active engagement from the learner*
- G2.6. *Explore opportunities for social interaction*
- G2.7. *Explore opportunities of incorporating gamification elements in the learning experience*
- G2.8. *Increase the level of advancement and decrease the level of support successively as the learner progress in the course*
- G2.9. *Create a red thread throughout the learning experience by evolve the scenarios so as to connect content within the course, building on scenarios gradually when appropriate, to create an interesting and coherent experience*
- G2.10. *Provide individual flexibility by enabling the learner to be in control of what content to immerse in by creating an explorative path in the course*

A variation in learning activities for the learner to engage in is essential, in order to keep the motivation up and to provide learners with various perspectives to a task, as learning a new skill is favored by alternative challenges (Pappas, 2017). Aiming for a variation in the presentation of content is important, so that the course does not promote a monotonous experience, as variance forsters a continuous surprise. Choosing instructional methods and building a structure in the course that supports variation is therefore critical. In this project, sketching out the course flow with potential activities in the form of user flows was effective to get an overview of the flow and this enabled analysis of the variation of interactive and static activities. The work resulted in the UI component library that covers a variety of activities for learners to engage in, providing designers with flexibility to create a learning experience that is engaging.

This UI component library further helps to create a consistency in the design. Aesthetics is, according to the e-learning usability properties framework, a central concern for creating a successful digital learning experience, where all content, including colors and visual contents but also content writing should be mindfully addressed and selected (Koohang & du Plessis, 2004). By deciding on a graphical profile and creating components within this graphical palette a consistency is promoted that should foster a more appealing service.

The framework further stresses the communicative possibilities within the learning experience, both in between participants and educators/facilitators but also between the learner and the content, and its consequences for the user experience (Koohang & du Plessis, 2004). Within this prototype external requirements and limitations restricted the opportunities for exploring such social interaction within the prototype. However, there is evidence for the worth of investigating how this can add to the learning experience within a digital space (Heirdsfield et al., 2011; Kite et al., 2020; Wu et al., 2010). The communication between content and learner should be constructed with an appropriate tone of voice. For an educational context, it should be motivating and using positive reinforcement to encourage learners in their progress. User studies revealed appreciation for the visual elements included in the prototype, and learner representatives reported that the visual content, in terms of illustrations, were clear and understandable, and that they perceived them as useful complements to the written content.

Gamification should be investigated during the design of an e-learning experience, as it has shown to be effective for engagement among other things (Buckley & Doyle, 2016; Poondej & Lerdpornkulrat, 2019; Kapp, 2012). Kapp (2012) argues that game elements can add meaning to the experience and promote a more candid trial and error behavior that could favor learning, while Anadea (2018) explains that it can exhort motivation, however it needs to be appropriately balanced (Interaction Design Foundation, 2020). Even more so if it is incorporated as a social activity, encouraging learners to engage in group tasks (Mulkeen, 2018). An interest for gamification elements within the learning experience was identified in this project, although the number of participants were low and thus affect the validity of that interest as representative of the target group. It should also be noted that the interest was divided, as some representatives in user studies reported enjoying the idea of game elements, while others did not perceive it to add any additional value to the course. Nevertheless, some gamification elements were incorporated in the presented prototype, in terms of for instance challenges in terms of exercises, rewards for completing exercises (see [figure 7.27](#)), and badges in the form of a diploma for completing and passing the course, that have the potential of resulting in a positive effect on some learners' engagement and learning. Furthermore, progress bars of various kinds are presented in the interface to motivate participants to fulfill the course, as shown in [figure 7.4](#) and [figure 7.10](#). For the exercises, feedback cycles, informing the learner on her performance and presenting correcting information if needed, are rapid and stakes are ranked low, as the learner does not lose anything if answering wrongly, in order to sustain motivation, as suggested by Lee and Hammer (2011).

The course should be structured in a way that it is advancing the difficulty in the form of exercises and content, based on how far learners have come in the course. Thus, the level of

difficulty should increase as learners complete lessons and build on the knowledge learned in previous ones (Merrill, 2002). Through such a structure, learners can build self-confidence at the beginning of the learning experience and experience development and a feeling of accomplishment during the course's progress. In this project, a gradual degree of difficulty has been implemented throughout the course. The course is built on the HMC method which consists of three main steps, and the participants learn specifically about these steps individually. After reviewing all three steps, these are put together in a common context, which would have been too difficult to present at the beginning of the course, without learning about each step individually. An example of an activity that is built on in degree of difficulty is the practical example found in each summary of each module, as shown in [figure 7.33](#). This method is what contributes to a red thread throughout this learning experience, which is advantageous in order to create a coherent process. The client for this project, as well as learner representatives participating in user studies, did comment on this as crucial in order for learners to follow the course in an effective and understandable way.

Moreover, to promote engagement, course content should be adapted to the individual learner to the extent possible (Jenewein, 2020). This also connects to the fourth principle connected below. A way to cater to this is to let the individual learner be in charge to some extent of what content to explore and focus on. This can for instance be achieved through hiding uncritical, but interesting and or helpful, information in different ways so that the learner needs to perform an action such as clicking to present it. The system should be designed to nudge the learner to perform certain tasks, rather than force them to, to promote user control (Interaction Design Foundation, 2020). User studies showed a variance in motivation, as some learners solely want to complete the course with no additional effort than to pass, while others are motivated to perform well and above what is expected as base level. This tendency was also noted by the SMEs who reported commonly seeing this variances in participants for their traditional course. This “deepening path” is included in the prototype by the use of, for instance, the design clocks *Hotspots* (see [figure 7.21](#)), *Tabs* (see [figure 7.22](#)), and *Flashcard* (see [figures 7.23](#) and [7.24](#)), allowing learners to engage in “extra” activities.

### **Principle 3: Adapt the course content and structure to the target group's prerequisites**

- G3.1. Conduct a context of use analysis covering the target learners' characteristics, goals, task, constraints and knowledge level of relevant topic, as well as the environment to reach an understanding for the target group and context*
- G3.2. Choose the structure of the course based on user studies of the target group, in terms of conditions in their environment, learning context, and work setting*
- G3.3. Create content that is relevant to the learners' professional life*
- G3.4. Adapt the level of advancement to the prior knowledge of the learners*

### *G3.5. Take account of the technical habits and skills of the learners*

As in any HCD project and web design process, the design should take a starting point in an understanding for the people that should use the service and engage in the experience, and the context in which they should do so (ISO, 2021; Shneiderman, 2006). Here, this entails that the structure of the course should be decided based on what user studies show of the target group's conditions for education and an understanding for the tasks, as well as for other relevant requirements from additional stakeholders (Dilloughery & Schneeberger, 2021). In this particular project, the target learners were assistant nurses, who generally have restricted time for education. Therefore the course was structured into modules that offered a clear distinction between different parts of the course, making it convenient for learners to pause their progress at different states to assume their work at a different time. This enables the learner to be in control of their time spent, while still promoting a clear structure of the content. Dillon (2018 in Kapp & Defelice, 2019) stresses the importance of accounting for the workflow of the learners when designing a learning experience, as it should fit into the learners' context, otherwise creating unnecessary practical obstacles.

Ghirardini (2011) explains the importance of keeping content relevant for learners, meaning that their needs, roles, responsibilities and tasks in their professional life should be considered during content creation. In order for learners to make use of the knowledge and skills acquired through the course, it is crucial that the content is relevant and adapted to their prerequisites and practice.

The skills involved in reaching a goal, as well as the previous skill and knowledge of the learner, should be taken into consideration in order to not risk creating a significant gap between the learner's prior level and the starting level of the course content (Gagné et al., 1992; Al-Chalabi and Hussein, 2020) and give learners sufficient support prior and throughout the learning experience (Merrill, 2002; Koohang & du Plessis, 2004). Furthermore, part of this work includes conducting an instructional analysis and a survey of the target group's entry behaviours and characteristics, as suggested by ID theory (Gagné et al., 1992). The possibilities to explore the flexibility regarding this within a product are diverse, however for this particular project the expected level of prior experience was fixed as the course is aimed at the specific target group of new or inexperienced assistant nurses. To determine common characteristics and levels of skill within a group, but also on an individual level (Gagné et al., 1992; Ghirardini, 2011), weaknesses and progression can be identified and attended to. Examples of activities to include to make use of and meet prior competences are through real world examples and stories that incorporate previous knowledge with new (Pappas, 2017), which are included in the presented prototype in terms of scenarios of transfers with personas (see for example [figure 7.17](#)).

The technical literacy of the target group is one important aspect of prior knowledge to acknowledge in the development of an e-learning course. The learners should be provided with enough support to be able to complete the course without spending unnecessary time on technical related obstacles.

#### **Principle 4: Allow for a personalized experience for the individual learner**

- G4.1. Provide sufficient support for the learner in the beginning of the experience, and successively decrease the level of support as the learner proceeds*
- G4.2. Cater to different levels of individual prior knowledge*
- G4.3. Provide a variety of instructional methods and learning activities for the learner to engaged in to accommodate for individual motivation and preferences for learning style*
- G4.4. Structure the course into distinct elements rather than into a continuous unit*
- G4.5. The course should provide language support*

The LXD perspective suggests that differences between groups but also individuals should be considered in the creation of a learning experience (Floor, 2016; Learning Experience Design Organisation, 2021). Individuality of learners add a challenging dimension to any e-learning environment in terms of preferences, needs and qualities (Al-Chalabi and Hussein, 2020; Normadhi, et al. 2019). Individuals within a target group will typically bring different levels of prior knowledge and skills connected to the topic of the online course, as well as potentially the setting of education, therefore it is important to embrace an individual perspective as suggested by ID theory (Gagné et al., 1992; White & Ploeger, 2004) and LXD (Jenewein, 2020). This includes providing sufficient support for those who need it, without disturbing the experience of other more experienced learners.

In this prototype, this is done for example through the inclusion of definitions of topic specific words as they appear in the text, shown when hovering over the word (see [figure 7.34](#)).

Additionally, learners are in need of more support from the system, with regards to how to navigate the course and other activities concerned with the experience and not the content, in the beginning of their learning experience. As they proceed in the course, this support should decrease as they learn how the course is structured and they become increasingly fluent in their interaction. This supports the problem identified during user tests where participants had difficulty grasping navigation and features just by looking at the interface, without getting any explanation. But as soon as the facilitator gave an explanation the learners expressed it to be clear and understandable. Therefore, it is important to explain navigation and hidden functions at the beginning of the course, and then let the learners interact freely with the interface. Catering learners with appropriate level of guidance, from the system and or the facilitators, is critical for a successful learning experience (Merrill, 2002). In this project, an onboarding should be included at the beginning of the course to highlight important functions and navigation of the interface and the course structure. Through the onboarding, the participants should be presented with the major interactions and become familiar with the

functions and navigation, and thereby manage to complete the course in an effective fashion as they become more comfortable with it.

Individual preferences for learning styles should be accommodated by incorporating different ways of presenting information to the learner and varying ways for the learner to manipulate and engage with the content. Moreover, individuals have different sources for motivational drive which need to be addressed. Adding elements of gamification to the learning context is one strategy for motivating competition driven learners (Olah, 2020).

Structuring the course into modules, rather than presenting the course as a whole unit, promotes a structured overview over the content while at the same time giving the learner flexibility to pause their learning experience at appropriate places. For this particular case, the learner was restricted to follow the linear structure of modules and lessons due to the step by step procedure of the method taught, however when possible, the learner can advantageously be given some freedom to engage in the content in more explorative ways when suitable. Furthermore, being prepared for what will come next promotes a level of comfort that enables learners to better enjoy the process and actions leading up to the final test.

To accommodate for variances in language skills which emerged during user studies and decrease language barriers, the system should provide learners with language support to some degree. Primarily, the content should be authored with accessibility in mind. Meaning that the information should be straightforward, and adapted for the audience. If possible, different language versions would be ideal, however, as this is a highly comprehensive adjustment, other less advanced alternatives could be sufficient. For instance, adding subtitles for videos, providing an extensive glossary, and a possibility to adjust the content to some degree of “easy-Swedish” mode can increase accessibility.

**Principle 5: Provide support continuously after completion of course to foster consolidation of knowledge and skills (acquired through the course)**

- G5.1. Translate practical tasks into digital job aids that are available at any time*
- G5.2. Digitize course material that is otherwise published in paper form*
- G5.3. Encourage learners to do practical tasks using job aids outside the e-course*
- G5.4. Provide job aids in digital format responsive for different screen resolutions to promote easy access in practice*

User studies showed that the assistant nurses struggle with applying the knowledge they learn during courses in transfer skills into practice as they easily fall back to old working patterns. To collect the most value out of an e-course, and to transfer the knowledge into their working context, learners must engage in activities where they apply the knowledge (Merrill, 2002; Pappas, 2017).

To support learners in applying the knowledge gained in the digital course in a real context, certain course material should be easily available even after taking the course by expanding the learning process. It takes time to learn new ways of working and to change old working habits of techniques and patterns. One way to support learners - before, during, and after training - is through job aids. Job aids can come in many forms: checklists, summaries, reference material, guides, worksheets, glossaries, and more. This provides learners with supporting resources outside the course. Digital job aids should be seen as a support to change the mindset progressively and support learners to remember what was covered in the course. When used as a tool in their practice, it can support consolidation of procedural knowledge as learners perform tasks in which they apply the acquired skills (Norman, 2013).

By digitizing course material that might otherwise be distributed in paper form makes it more accessible to learners. Also making it responsive for other devices, such as mobile, increases the accessibility additionally, as it results in an adaptable design usable on the go in working practice. For this particular project this involves suggestively designing the digital guide for assistant nurses to retrieve digitally when needed. Due to the time limitations of this project, no job aids were produced but left for future work.

When analyzing HMC's current education in transfer skills, a large portion of practical activities were identified. During interviews, learners were also very skeptical about not being involved in any practical activity in the digital course as they argued that it was the most crucial to experience in the current education. Since learners will not have the opportunity to try and practice different transfers in the digital course, they should be offered a guide that could be seen as a support to apply the knowledge in a real transfer situation. Ideas emerged during the project such as digitizing the customer's current assessment material in paper form into a digital tool that can be reviewed directly on the mobile phone, to make it more accessible.

**Principle 6: Provide technical stability and transparency to promote a seamless interaction**

- G6.1. Offer an easy access to the course through a hasslefree login experience*
- G6.2. Provide the function of autosaving and clear feedback on this to the learner, in order to counteract uncertainty of the software and the feeling of unreliability to the system*
- G6.3. Provide clear feedback on system state to minimize confusion and to promote the learner's perception of being in control*
- G6.4. Follow established design standards and principles*

During the competitor analysis a pattern was identified regarding inaccessible digital courses in transfer knowledge with unclear registration and login processes. This resulted in a loss of

motivation before even starting the course. It is therefore important to address the whole user experience, even those steps taken before starting the course. The login experience should be simple, effortless and smooth as guideline 6.1 suggests.

Technical issues can create friction in the experience, either by their emergence or by the fear of them emerging. Koohang and du Plessis (2004) argue that a system needs to be transparent in regards to what is happening. It is for example important to create a stable technical software environment to ensure learners that their work is not lost if they leave the course, and to not frustrate learners with a complicated or confusing access to the course, as is accounted for within the prototype through an autosave function and clear feedback on savings, as this otherwise can nurture an unneeded stress in learners, reported through user studies. The intention with the prototype is to save the status of the system, so that the learner can leave the course and resume the course at the specific lesson where they left off and allow them to easily take up the same activity at a later time, as shown in [figure 7.3](#). It became clear during user studies that the assistant nurses' stressful work makes it difficult for them to fit course participation into their daily work, and do the course on one occasion as they have short breaks. Therefore, a common scenario will be that they need to pause the course and resume where they left off at a different time. It is therefore crucial that the systems provide clear feedback on this and that it feels reliable.

Clear feedback must be given during all interactive activities to minimize confusion and unawareness. This was taken into consideration while developing the UI Component Library where different states were sketched out as shown in figures [7.25](#), [7.26](#) and [7.27](#). This also applies to other interactive elements in the interface such as navigation (see [figure 7.5](#)), which should be clearly structured to minimize the occasions for incorrect operations as suggested by the e-learning usability properties framework (Koohang & du Plessis, 2004). At the same time, the system should be tolerant to occurring incorrect operations made by the learner to foster a flow in the experience (Ibid.).

Providing clear feedback can change a confusing experience to a pleasant experience by teaching learners how the system works. In the prototype feedback for why a certain answer was incorrect is incorporated to educate learners while at the same time inform them on the system status. The feedback should be used to engage and explain, in order to decrease the risk of frustration and dissatisfaction.

During user tests, positive feedback emerged regarding clear feedback in activities where users actively needed to choose something such as in the *Knowledge check* exercises (see [figure 7.27](#)). In those activities users are presented with explanations why the answer was right or wrong to promote a seamless interaction.

All in all, there is a great quantity of design principles and standards that cover important technical and other aspects, among those Nielsen and Molich's user interface design principles (Nielsen, 2020), and thus should be considered in the design of any digital learning experience.

# 8

## Discussion

In this chapter, important aspects that emerged during the project are discussed. This includes discussions about the result, process, generalizability and limitations, as well as ethical aspects. Lastly, a discussion about future work is presented.

### 8.1. Final Result

The final result is a proof of concept in the form of a partially finalized high fidelity prototype, that shows the service's potential by communicating the intended message, concerning functionality, mood and tone of voice and pedagogic approach. In addition to this, the final result also includes a component library of important and or interesting design elements suitable for e-courses within practice oriented contexts, as well as design principles covering some diverse aspects that could be of value to consider in the design process.

While the possibilities for participating in an e-course online from the home was more constrained amongst workplaces, the conducted user studies revealed a possibility for participating in the course at the workplace in the vast majority of cases, as technology, such as computers, tablets, and smartphones were reported available at most workplaces, as well as private rooms for performing the course were available, and regulations accepting such a setup. The conclusion could be drawn that a digital course is well suited to the assistant nurses' current work situation, and in fact, could be argued to fit better in comparison to participating in physical education often stretching over several days, as it is more easily accessible and time efficient.

#### 8.1.1. High Fidelity Prototype and UI Component Library

The existing need for education of caregivers in transfer knowledge, and for making it more accessible, became clear during quantitative user studies. The interviewed unit manager confirmed the absence of standards for education, and explained that variances in requirements and routines between different organizations and sectors are apparent. The presented proof of concept shows potential for meeting this need, by providing learners with an accessible alternative to traditional education, developed to fit the constraints and needs of the organization and their personnel.

The course is mainly focused on providing learners with a comprehensive theoretical introduction to transfer knowledge as well as straightforward techniques and tips to apply directly in their work situations. At the same time, the course has the potential to cover training in practical skills to some extent, as it is a central part of the course, by including job aids and exercises for the learners to use and engage in.

Within the ID approach, a central step of creating a learning experience is to develop and select instructional materials in terms of media that should convey the information (Gagné, Briggs & Wager, 1992). This was done through the creative process of producing the library of design components which mainly consisted of the activities expected to perform in the course. The choice of media type was chosen primarily from research, but a testing phase is required to ensure that the media is suitable for the learning step for which it is intended. To be able to do this, the prototype must be further developed, videos must be produced and more activities designed interactively. Suitable learning activities need to be selected and designed with extra care in order to maintain quality of learning.

Other elements in the form of buttons, progress indicators, feedback messages, icons, illustrations, sections divider, etc, also formed a large part of the design library. All of which should follow the same look and feel. Creating design elements in blocks and sections promotes a uniform structure throughout the course. Developing and using design components benefit both prototyping by streamlining the process, but also the generalization of the design, as the library covers activities that are of value to the digitalization of a practice oriented course in general. The generalization of the library is further supported as the potential need for customization of design components for a specific course have been considered throughout the process, and contributed to the design decisions made.

Nevertheless, it should be mentioned that this is an initiated work process. The library is not to be considered as a finalized design system, and has not been used or evaluated in an extensive way.

## Instructional Strategy and Structure of the Course

For the instructional strategy, or pedagogical approach, for this learning experience a learner-centered approach, in combination with scenario-based learning was chosen. This was motivated by theory arguing for the value of focusing on the learner's needs and skills (White & Ploeger, 2004; Norman & Spohrer, 1996; Ghirardini, 2011) and the opportunities of providing the learners with situated learning within the relevant context (Brown, Collins & Duguid, 1989; Herrington, Oliver, Herrington & Sparrow, 2001; Canonico, n.d.; Lundeberg, 2008, p. 1 in National Research Council, 2011; Pappas, 2017; Merrill, 2002).

The instructional strategy was one of the key issues to address during the design process, as it shapes the learning experience and the quality of the course. Merrill's principles (2002) acted as guidance for the instructional strategy. The first principle was acknowledged through the implementation scenarios derived from the target group's working situations. This is part of the HMC method which is the very foundation of the education in this particular case, so the

scenarios needed not to be authored from scratch by the designers, but were derived from the course material provided through the SMEs. Problem progression, as suggested as a part of this first principle (Merrill, 2002), was applied throughout the practical example incorporated in the summary of the modules presenting the HMC methods three building blocks. The HMC method covers three essential steps that all together contribute to each transfer situation, therefore, the scenario demonstrating an example transfer situation was progressively built on, advancing the scenario until covering the full transfer situation.

The second principle concerning connection of new knowledge to previous knowledge in learners is covered to some extent. As the target group of learners is assistant nurses with little to no experience in transfer skills, the knowledge level brought within the field should be limited for participating learners in general. Therefore the particular course translated naturally covers the basic knowledge level needed. The incorporation of definitions of central terms (see Figure 7.32 in 7.1. Final Prototype) provides some support for learners with insufficient knowledge within the topic. Furthermore, an activity encouraging the learner to reflect on their current perspective on what is defined as a successful transfer situation (see design block *Reflection* in 7.1. Final Prototype) is included at the initial part of the course to activate the learners current knowledge. During other circumstances, such as if several e-courses were provided, it could be an idea to include a pre-assessment test (Ghirardini, 2011) to confirm the individual learner's knowledge level and adjust the possible services thereafter. Lack of time restricted this project from further exploration of how previous knowledge could be activated.

In terms of demonstration of knowledge, as discussed by Merrill's (2002) third principle, relevant media has been selected with consideration to the informational content it should convey as well as the cognitive level of performance defined along Bloom's taxonomy (Anderson et al., 2001; Lasley II, 2016). The combination of this with clearly stated learning objectives reflecting the intended learning outcome, and a variety of learning activities to foster demonstrations from different points of view, is intended to promote learning. The scenarios demonstrating tasks derived from the context are restricted to focus on a few common transfer situations, to promote repetition and demonstration from several perspectives.

The self-assessment tests in terms of *Knowledge checks* included in the test allow the learner to apply the knowledge, as suggested by Merrill's (2002) fourth principle. During knowledge checks, clear feedback of the learner's answer is given in combination with correcting or confirming information depending on the learner's answer, to promote learning. A variety of types of activities and types of questions, such as asking the learner to identify new examples within a topic, describe a certain matter, or predict consequences of a situation, should be included in the final product to promote learning (Ibid.).

The fifth principle presented by Merrill (2002), connected to integration of the acquired knowledge into learner's practice is one of the most challenging factors of this project and most complex to encounter in the e-learning course, as the SMEs can not be present and observe the learners in practice. Suitable learning activities need to be selected and designed

with extra care in order to maintain quality of learning and ensure that the learners actually can and do make use of the acquired knowledge and skills. As of now, the course is mainly built around expositive methods, as defined by Ghirardini (2011), resulting in the learners primarily observing learning material through videos, texts and images of various structures and combinations. However, as previously mentioned, applicational methods (Ibid.) such as digital aids can also be advantageous to include in order for learners to be supported in the active use of the knowledge gained directly at work. The variety of instructional learning methods is crucial in order to successfully convey both declarative and procedural knowledge respectively, as explained by Norman (2013), to promote consolidation of different types of knowledge.

One idea that emerged during the design process but was not further investigated due to time and scope, is to offer a database of examples in the form of scenarios, similar to the ones included within the course, demonstrating various transfer situations with solutions according to the HMC method. The learners could also be encouraged to participate in collaborative methods (Ghirardini, 2011), such as role play where they practice transfers in groups based on the method, but also to participate in discussions with colleagues sharing their knowledge, in order to address the social aspect of education, which is an important part of fostering an engaging and successful learning experience (Chen et al., 2010; McFarland & Hamilton, 2005; Heirdsfield et al., 2011; Wu et al., 2010).

An additional idea is to encourage learners to tacitly reflect on the method in their work individually. This could potentially be done by including prompts such as *"Remember to anchor your power sources in your next transfer"*, or *"Try this yourself the next time you are on a bus or train, and feel the difference when you anchor your power sources and when you do not"*, or asking them to reflect on the new knowledge in relation to their own job context, through questions such as *"How could this apply to your practical work?"*.

To sum up, there is great potential for investigating various instructional methods, however this is left for future work at this point.

## Design Principles and Guidelines

The design principles presented are derived from theory and insights brought through the process of the project. These summarize and concretize several central aspects that are of importance to consider during the translation of a practice oriented course. The associated guidelines are examples of how these principles can be approached. The principles are the results of the reflection on the project, as advocated by RtD, and contribute to the area of e-learning as they can aid in the design process.

Nevertheless, it is important to emphasize following best practices and guidelines that are already well established, both regarding user experience, learning experience and instructional design in addition to the guidelines presented in this thesis. Although the principles and guidelines provided in this thesis to some extent cover essential aspects, there are more attributes that need to be taken into account to create a qualitative and engaging

e-course. In addition, all of these specific principles do not necessarily apply to all learning experiences.

## Gamification

The decision to explore and include gamification was motivated by research supporting its potential in learning contexts, as well as quantitative user data derived through the questionnaire for the target group, revealing that 55% played games on their smartphone, tablet or computer everyday to once a week.

In this version of the prototype rewards are included in terms of *experience points* (Olah, 2020). Nevertheless, there is potential in exploring other solutions, such as valuing individual activities differently. *Immediate feedback cycles* (Lee & Hammer, 2011) are included within assignments to keep learners' motivation up, although they might answer incorrectly. The stakes are kept low, as suggested by Lee and Hammer (2011), as the learner is always rewarded with an experience point (one star) for completing the challenge, no matter the answer.

Further evaluation is however needed in order to determine its effects with more certainty. User evaluations with two assistant nurses during the third iteration revealed a divided interest for gamification, as one was positively interested in this, while the other found very little motivation in collecting points, but rather saw the value in completing the course for acquiring knowledge. Regardless, this shows evidence of individual differences in learners, thus quantitative studies and prototyping should be performed to explore this potential.

## 8.2. Process

### 8.2.1 Combining various Design Process Frameworks

The decision to combine different design frameworks was grounded in an intention to approach the design challenge from different perspectives, in order to create a successful solution in regards to quality of learning, client's expectations and goals, as well as the learners' and other users' needs and preferences. This added complexity to the design process, as the HCD approach contributed with a clear structure for the design process and a particular guide for researching and understanding the user group, ID provided a focus on learners' individuality and a learner centered approach as well as instructional aspects, and LXD a holistic view of the learning and creating process involving design perspectives and theories of human learning, while RtD fostered an reflective approach to the design process.

However, it did complicate the process to some extent, resulting in some confusion at times regarding what to do when. At the same time, several similarities exist between the frameworks and several steps or phases are overlapping between them, why not all phases or steps of each approach was necessarily conducted in detail if it was considered not to add any

additional value. It could therefore possibly be argued that the different frameworks did not contribute to a significant change, compared to if only a few would have been combined, for instance HCD and ID. Although, overall it did enrich the process and added value to the project, in the opinion of the designers.

## Content analysis and creation

As the course design and the delivery of content has been identified as amongst the most crucial factors related to student satisfaction and perceived learning rate (Barbera, Clara & Linder-Vanberschot, 2013) a large portion of the time for the project was dedicated to the content analysis of the existing educational content provided by the client, and to translation of this into the e-learning course. Mapping and structuring the content was more time consuming than anticipated, which resulted in changes to the project's time estimation. At the beginning of the project, it was determined during the pre-study that the main focus should be on developing visual solutions. However, due to the extensive work regarding content, this was not deemed suitable at the time being, as the full body of high quality content should be created at first.

## Data Collection

### *Reaching stakeholders in terms of decision makers*

There was a low answer rate for unit managers and a very low interest in participating in interviews, resulting in ten answers to the questionnaire, and one interview participant. Those are not the target users of the service in terms of the e-course, however, they have decision making power in what education should be provided to their personnel, and are thus a key stakeholder of the project. More thorough field studies of organizations and unit managers could reveal other insights important to consider in order to create a user experience suitable for the context.

### *Questionnaire*

Some questions asked in the questionnaire were guided, with the answers *yes*, *no*, or *I don't know*, for example "*Would you like to participate in an education in transfer skills online?*" with the answers "Yes, that would be flexible and effective", "No, ", or "I have no opinion", which could have been formulated differently. Questions that are less framed in nature could entail using a likert-scale and questions such as "How likely are you to...", in combination with the option to elaborate on answer in free text could potentially have revealed other answers.

## Evaluations

During the project, evaluations have been conducted with learners, experts and the client to ensure that the design solution goes in the desired direction.

Validating content in the course with SMEs often is a must to achieve the goal of offering a qualitative course. In retrospective reflection, this could have been done even earlier in the process and more frequently, in order to decrease the extent of each validation and to ensure content quality throughout the process.

All user evaluations were conducted remotely which degraded the quality of testing. The constraints on testing were fewer and less apparent at the beginning of the project, during testing of ideas and more abstract concepts presented in more open discussions. As the prototype reached higher fidelity, the more difficult it became to evaluate and extract accurate feedback from learners, especially regarding usability. The evaluations with the UX-/front-end expert on the other hand were conducted face to face, resulting in a more qualitative evaluation and a more fair result. However, it is worth noting that as he is an expert, he might be affected by bias resulting in him interpreting the interface as straightforward while representatives from the target group of learners do not necessarily share this perception.

Using the e-learning usability properties framework as a basis for the final evaluation was perhaps not the optimal evaluation method for this particular project, as the final prototype does not cover the entire course, and no final summative evaluation was conducted. However, the framework was applied to some extent, revealing a first estimate of the system's usability.

### 8.3. Generalizability and Validity

Throughout the project, a holistic perspective has been taken to think scalable and reusable. The approach to thinking in design components for a potential LMS resulted in creating more general solutions than just specifically for this course.

Activities in the form of design components have been developed that are suitable for digitizing the subject of transfer skills, more specifically the HMC method. However, these activities could be used in other contexts as well. Each element can be customized to fit the subject well.

Regarding the guidelines and principles that were developed, they are specific to the subject of transfer skills and assistant nurses as a target group. However, one could argue that many of them can be used in other educational contexts as well, in particular practice oriented contexts. Needless to say, the presented principles and guidelines are by no means exclusive for this kind of translation, but cover some aspects that are potentially important to consider in the process.

## 8.4. Limitations

Due to the prevailing pandemic of Covid-19 all practical work, such as user studies and evaluation, was limited to a strictly online setting due to national restrictions, resulting in some design methods not being possible to conduct. This could potentially have had an effect on the results, that would align differently if repeated in a face to face setting.

The main limitation of this study is the inadequacy of more extensive user evaluations. More controlled forms of evaluations are necessary to conduct in order to establish the proof of concept's quality, as the user evaluations at this stage did only cover walkthroughs.

## 8.5. Ethical Aspects

Ethical concerns were initially addressed during the planning phase in order to guide the process throughout the project. Guidance by the VSD approach (Friedman, Kahn & Borning, 2003; Cummings, 2006) aided in the process by concretizing ethical concerns.

### 8.5.1 Participation in User Studies

One key concern is connected to participant data during data collection. All participants were informed of their participation rights and privacy before participating in any user study (questionnaire; interview).

In the questionnaires, participants were informed in text before actively starting the questionnaire. Answers were kept anonymous, and personal data was stored only in terms of e-mail address (when the participant actively input this). The questionnaire did not explicitly remind the participant upon request that if they were to input their e-mail, they would no longer be completely anonymous. This was assumed clear, but a clarification on this could have been done in order to be completely transparent about the conditions.

Interview participants were orally informed upon their rights and the conditions, and an oral consent was mandatory for participation and for recording (video and audio), respectively.

Raw data has been stored in terms of answers to questionnaires (in Google Forms) and interviews (designers notes and recordings locally on one designer's computer), but not made available to anyone except the two designers. All raw data will be saved until the Master's thesis is submitted and published, thereafter it will be deleted.

Any data from participants that is included within the report has been anonymized.

## 8.5.2 Ethical Concerns for the Design

Application of WCAG is, according to Swedish law, mandatory for software systems aimed at the public sector (DS 2017:60). This has been addressed to some extent, however there is a need for further work regarding this. This is further discussed in [8.6. Future work](#).

Conceptual ethics analysis, as part of the VSD approach, was done during the phase of identifying stakeholders. The value of *human welfare* and *physical and psychological well-being* were considered important for this project. This demarcation does not imply that other values are not relevant, however, the decision to narrow the focus was motivated by time and scope. Human welfare is a key concern and value for the indirect stakeholders in terms of care recipients in this particular case, as the system affects care recipients that are in need of assistance, and *physical and psychological well-being* applies to both care recipients and caregivers. By educating caregivers the system can contribute to a safer, mindful and more comfortable assisting experience, for both caregiver and care recipient.

Empirical ethics analysis, as suggested by the VSD approach, has been addressed during the user studies. Values, motivations and regulation of direct stakeholders in terms of organizations, which should buy and educate their personnel through the service, have been investigated as these aspects affect the design possibilities. Another important issue here is data privacy issues connected to usability. As the system should autosave the learners progress in the course, this needs to be addressed. However, as the scope of the project excluded issues regarding login and access to the course, further investigation of this is needed before implementation in order to explore data privacy questions.

The VSD approach's technical ethics analysis was also addressed through user studies, as organizations' technical routines and availability were investigated. The available and suitable technology was weighed against the value of *universal usability*. It was established that the education should be performed on a computer, as this was the main routine at the investigated organizations, and as it supports usability.

Context specific ethical concerns, for instance connected to the meeting with care recipients, are addressed through the client's method. As the method incorporates an ethical perspective to the meeting, and as it lays the foundation for the education, these values should be incorporated. Validation of this has been done through evaluation with the SMEs.

## 8.6. Future Work

Due to constraints put by the project scope and time, there is still comprehensive work left before the course is finalized for implementation. In this subchapter we list some of the work that still needs to be performed.

## 8.6.1 Design Iteration and Content Creation

Further iterative work then needs to be completed in order to finalize the design for implementation. Part of the primarily prioritized work should include aligning on a decision on where the solution should be hosted and how it should be made available to learners. In order to continue with the development for implementation it must be made clear what platform the solution should be available on.

More evaluation and iterative work is needed regarding the course content. There is for example a need to create the video content that should be included in the course, as it at this stage is only represented in the form of movie storyboards. New content in the form of images, videos, and transfer examples may be needed from the SMEs. A final summative evaluation also needs to be done with the SMEs to ensure quality and establishment of the final version.

Due to time constraints, some part of the course was excluded from the design in this project. For example, a post-assessment test should be included at the very end of the course, to determine the learner's passing of the course. This is argued for by literature (Ghirardini, 2011) and is stated as a requirement by the client as they need to assess and thereby confirm that the individual learner has reached the learning objectives for the course. Type of questions and structure for the assessment test was not investigated during the project due to time constraints. However, the potential to accommodate Merrill's (2002) fourth principle, promoting learning through application of the new knowledge, would increase by development of the final assessment test that is intended to finish the course.

Potential additional features to the solutions arose during the project, such as offering digital job aids by digitizing course material (in the form of guides, assessments, etc) to support assistant nurses directly in their work, in situations where they should apply the knowledge. This can be a good alternative for guiding learners to apply the practical skills of the HMC method in transfers of and with care recipients. Instead of, or as complement to, performing practical exercises on each other, as assistant nurses typically do today, digital job aids can act as a guide to apply the knowledge directly on the task at hand. The potential of such application instructional methods and collaborative methods, and exactly what types of activities should be offered in this course and how, needs to be further explored. Moreover, in line with this, there is potential for investigating how microlearning instructional methods can be applied, not least connected to such support of learners after completing the course, to foster consolidation of knowledge, as suggested by Thalheimer (2017 in Kapp & Defelice, 2019) and Dillon (2018 in Kapp & Defelice, 2019).

## 8.6.2 Evaluations

Future work on evaluating the quality of learning of the e-learning system in comparison to the client's face to face education is needed, as no such evaluation was conducted during this project.

Moreover, further evaluation of the presentation of the content is needed, in order to determine the efficiency of the information elements, such as combinations of text and visual illustrations connected to cognitive load.

Due to time, scope and access to participants this study included three numbers of different evaluations with six individual learner representatives participating over seven sessions (thus, one representative participated in two different sessions). Therefore, additional user tests, in more controlled forms, with an increased number of individuals, are necessary to ensure a high qualitative learning experience.

### 8.6.3 Gamification

There is potential in exploring the gamification possibilities further by other game elements, such as *competition*, as any social interaction among peers or others within the course was actively excluded in this project. Other interesting gamification techniques that could be explored are *levels*, and *easter eggs* for hidden activities as discussed by Olah (2020).

### 8.6.4 Social Aspect

Due to time constraints and scope there was no possibility to explore the opportunities to create a social experience within the course, although previous studies (Heirdsfield et al., 2011; Kite et al., 2020) show that it is a key concern for successful e-learning and our user studies suggest an interest for this. At this stage some minor activities were incorporated in order to promote the feeling of being part of a community by the possibility to share one's own perception of what characterizes a "good transfer" and reading others' contributions. The potential for a more social experience should in future work be further explored, by exploring the possibilities of incorporating collaborative methods, as suggested by Ghirardini (2011).

### 8.6.5 Learner centered perspective

Further investigation and development of the learner centered potentials within the service, as this is a central concern for ID (Gagné, Briggs & Wager, 1992). As of now, the service acknowledges the learner's prior knowledge and goals, in a fixed way as it is aimed at assistant nurses with little to no experience, that are in need of a basic level knowledge within transfer skills. As suggested by Al-Chalabi and Hussein (2020), other adjustments according to the individual learner's preferences and characteristics, such as learning style, can stimulate learning and promote an appreciated experience and could possibly be achieved by developing a flexible solution. This would be interesting to investigate further.

### 8.6.6 Accessibility

Further analysis of relevant accessibility guidelines needs to be conducted and implemented in the design and throughout implementation, as only a few were applied in the design at this stage. Due to time scope focus was kept mainly on *perceivable*, *operable* and *understandable* guidelines (WCAG, 2018), that is concerned with *perceivable presentation of information and user interface components*; *operability of user interface components and navigation*, and *understandability and readability of content* respectively. As a large portion of the users operate within the public sector, it becomes important to acknowledge the WCAG standards in the creation of the e-learning system, as systems used within the public sector should reach the level AA of WCAG according to Swedish law (DS 2017:60).

### 8.6.7. LMS and Admin Interfaces

If the client decides to digitize additional courses and or potentially develop their own LMS, more interfaces are needed to design for. In addition to the interface for learners, an admin interface is needed for the client to build their courses. In addition, an admin interface for unit managers or similar is needed to follow up their personnel.

### 8.6.8. Generalizability

Data collection for this project was limited to health care professionals in Sweden, due to scope of the project and as it is the customer's main market. However, the customer wished to spread their knowledge and method globally. Future work could thus explore to what extent these findings apply to and this service meets the needs of other cultures and countries, but also other contexts in terms of different educational topics.

# 9

## Conclusion

The following thesis has explored the opportunities for translating a practice oriented education within the topic of transfer skills into e-learning.

The research questions posed were: What should be considered in the translation of a traditional education of practice oriented topic into a digital learning environment? As well as the sub questions: How can we assure that e-learning education can be applied to the learner's current work situation; How can we translate practical elements of an education while assuring high quality learning online; How can we assure that the learning outcome is applicable in the learners' working situation?

The main research question, of what should to be considered in this type of translation, is answered through the full body of design principles and guidelines presented, stating important factors that should be acknowledged in the process, as well through the developed design component library, which can be used as a tool box for creating an online learning education. The design principles are as follows:

*Principle 1: Provide a transparent and clear connection to the (working) context to promote learning and knowledge application*

*Principle 2: Provide learners with an engaging learning experience*

*Principle 3: Adapt the course content and structure to the target group's prerequisites*

*Principle 4: Allow for a personalized experience for the individual learner*

*Principle 5: Provide support continuously after completion of course to foster consolidation of knowledge and skills (acquired through the course)*

*Principle 6: Provide technical stability and transparency to promote a seamless interaction*

The first sub-question covering the issue of how to verify that the e-learning course is applicable in the learner's work situation is answered by principle 1, 3, 4 and 5. Through a comprehensive context of use analysis and user studies the conditions in the specific working context can be explored and identified, and the course structure can be adapted to these conditions. To exemplify, in this particular case of education in transfer skills aimed at assistant nurses in Sweden, the conditions of time constraints put a demand on the course for flexibility. Therefore the course was structured in modules, with no time limit (other than

potentially external deadlines such as set by the company at which the particular learner works). This enables the learner to start, pause and resume the course whenever needed.

The second sub-question, covering the issue of how to translate practical elements of an education while assuring high quality learning online, is answered by all principles. This was one of the main challenges in the project. The user studies revealed some constraints which made it difficult to include practical exercises in the course. For example, it became known that learners are constrained by the inaccessibility of materials (in this case transfer aids) as well as time and place for practical training together in groups. Therefore, encouraging learners to participate in practical training through the e-course solely is not an optimal solution. Instead, the e-course should primarily focus on providing learners with theoretical knowledge and skills to some extent, that favorably could (and should) be completed with practical training that is not performed remotely.

The third sub-question, concerned with the issue of how to assure that the learning outcome is applicable in the learners' working situation, is answered by principle 1, 4, 5 and 6. A comprehensive understanding of the learners and the context is important to empathize in the course. It is crucial to include learning objectives that are derived from the context in which the knowledge should be applied. This means that course content should have a clear connection to the context to promote learning, and entails including scenarios derived from the setting, in this case working context, demonstrating the knowledge and skills in practice.

The e-course has potential to contribute to the described need of a standardized education and goal of providing all base level personnel a basic understanding, and thereby foster good conditions for further practical training by transfer instructors. It can also contribute to a more efficient spread of education within an organization.

To summarize, the proof of concept, in terms of the high-fidelity prototype demonstrating how the e-course could be structured and visually designed, in combination with the component library describing all activities proposed for the course, and the principles suggesting how to approach the challenge, can be used in future research in the development of digitalizing practice oriented educations.

# References

- Al-Chalabi, H.K.M., & Hussein, A.M.A. (2020). Analysis & Implementation of Personalisation Parameters in the Development of Computer-Based Adaptive Learning Environment. *SAR Journal*, 3(1), 3-9.
- Anadea. (2018). *How to Use the Power of Gamification in e-Learning*. Medium. <https://anadea-inc.medium.com/how-to-use-the-power-of-gamification-in-e-learning-d550f9e0bb8e>.
- Anderson, L.W., Krathwohl, D.R., Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J. & Wittrock, M.C. (Eds.). (2001). *A Taxonomy for Learning, Teaching and Assessing - A Revision of Bloom's Taxonomy of Educational Objectives*. Addison Wesley.
- Apostolopoulos, A. (2019, August). *The 2019 Gamification at Work Survey*. TalentLMS. <https://www.talentlms.com/blog/gamification-survey-results/>.
- Arhipova, A. (2016). Color Matters: 6 Tips on choosing UI Colors. *Tubik Blog*. <https://blog.tubikstudio.com/color-matters-6-tips-on-choosing-ui-colors/>
- Arhipova, A. (2017). Color in Design: Influence on Users' Actions. *Tubik Blog*. <https://blog.tubikstudio.com/color-in-design-influence-on-users-actions/>.
- Ascanio, P. (2019). *A UX guide to designing better mood boards*. UX Collective. <https://uxdesign.cc/a-mood-board-strategy-for-cohesive-visual-design-5620dec3fed7>.
- The Association for Computing Machinery (ACM). (2018). *ACM Code of Ethics and Professional Conduct: Affirming our obligation to use our skills to benefit society*. <https://www.acm.org/binaries/content/assets/about/acm-code-of-ethics-booklet.pdf>.
- Babich, N. (2018). *Why Sketching Is an Essential Skill for UX Designers to Master*. Adobe. <https://xd.adobe.com/ideas/process/wireframing/sketching-essential-skill-every-ux-designer-master/>.
- Babich, N. (2020). *Web Page Design: A Comprehensive Guide*. Adobe XD. Adobe. <https://xd.adobe.com/ideas/principles/web-design/web-page-design/>.
- Barbera, E., Clará, M., & Linder-Vanberschot J.A. (2013). Factors influencing student satisfaction and perceived learning in online courses. *E-Learning and Digital Media* 10. 226–235.
- Bergstrand, K., & Savage, S.V. (2013). The Chalkboard Versus the Avatar: Comparing the Effectiveness of Online and In-class Courses. *Teaching sociology*, 41(3), 294–306.

- Brown, J., Collins, A., & Duguid, P. (1989). Situated Cognition and the Culture of Learning. *Educational Researcher*, 18(1), 32-42.
- Buckley, P., & Doyle, E. (2016). Gamification and student motivation. *Interactive Learning Environments*, 24(6), 1162-1175.
- Cameron, J. (2020). *How UX storyboards can transform your creative process*. UX Collective. <https://uxdesign.cc/ux-storyboarding-2ce43875f3de>.
- Canonic, M. (n.d.). *5 Pedagogical Techniques for eLearning success*. Learning Culture Magazine. <https://www.docebo.com/blog/5-pedagogical-techniques-elearning-success/>.
- Cavanaugh J.K., & Jacquemin S.J. (2015). A large sample comparison of grade based student learning outcomes in online vs. face-to-face courses. *Online Learning Journal* 19(2), 1-8.
- Chen, P., Lambert, A., & Guidry, K. (2010). Engaging online learners: The impact of Web-based learning technology on college student engagement. *Computers and Education*, 54(4), 1222-1232.
- CommLab India. (2019). *Where Does Microlearning Fit in Your Learning Strategy?* Available at <https://resources.commlabindia.com/ebook/microlearning-101-success?submissionGuid=5b75cd64-12e1-4db1-baca-9e1c4e7526d7>.
- Cone, T. (2018). *An Introduction to Stakeholder-Centered Design Taking a systems approach to human-centered design*. Medium. <https://medium.com/@taylorcone/an-introduction-to-stakeholder-centered-design-819d2d7c5d11>.
- Cummings, M. L. (2006) Integrating Ethics in Design through the Value-Sensitive Design Approach. *Science and Engineering Ethics*, 12, 701–715.
- Dalrymple, B. (2017). Surveys - User research resources for beginners and pros. Medium. <https://medium.com/user-research/user-research-resources-10-surveys-587ee73ca1f2>.
- Dalrymple, B. (2018). *Competitive Analysis - User research resources for beginners and pros*. Medium. <https://medium.com/user-research/competitive-analysis-b02daf26a96e>.
- Dilloughery, C., & Schneeberger, C. (2021). *Do's And Don'ts For Successful eLearning Projects*. eLearning Industry. <https://elearningindustry.com/successful-elearning-projects-leaders-dos-donts>.
- Douglas, S. (n.d.). *How To Do A UX Competitor Analysis: A Step By Step Guide*. UsabilityGeek. <https://usabilitygeek.com/how-to-do-ux-competitor-analysis/>.
- Driscoll, A., Jicha, K., Hunt, A., Tichavsky, L., & Thompson, G. (2012). Can Online Courses Deliver In-class Results?: A Comparison of Student Performance and Satisfaction in an

- Online versus a Face-to-face Introductory Sociology Course. *Teaching Sociology*, 40(4), 312-331.
- DS 2017:60. *Genomförande av webbtillgänglighetsdirektivet*. Finansdepartementet. <https://www.regeringen.se/rattsliga-dokument/departementsserien-och-promemorior/2017/11/ds-201760/>
- Ds 2020:15. *Reglering av undersköterskeyrket: kompetenskrav och övergångsbestämmelser*. Socialdepartementet/Regeringskansliet. [https://www.regeringen.se/49d084/contentassets/5cc1911ee32b4040a4d0fd3473945758/ds-2020\\_15-reglering-av-underskoterskeyrket--kompetenskrav-och-overgangsbestammelser\\_anpassad.pdf](https://www.regeringen.se/49d084/contentassets/5cc1911ee32b4040a4d0fd3473945758/ds-2020_15-reglering-av-underskoterskeyrket--kompetenskrav-och-overgangsbestammelser_anpassad.pdf).
- The European Parliament and the Council of the European Union 2016/679 of the 27nd April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). *Official Journal of the European Union*, L 119, 1-88. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679> .
- Experience UX. (n.d.). *What is wireframing?* Experience UX. <https://www.experienceux.co.uk/faqs/what-is-wireframing/>.
- Floor, N. (2016, September). *This is Learning Experience Design* [Post]. LinkedIn. <https://www.linkedin.com/pulse/learning-experience-design-niels-floor/>.
- Fontdesk. (2020). *Charter Typeface*. Retrieved from: <https://fontesk.com/charter-typeface/>
- Friedman, B. & Kahn, P. & Borning, A. (2003). *Value Sensitive Design: Theory and Methods*. Paul G. Allen School of Computer Science and Engineering. <https://faculty.washington.edu/pkahn/articles/vsd-theory-methods-tr.pdf>.
- Friis Dam, R, & Siang, T.Y. (2021). *Personas - A Simple Introduction*. Interaction design foundation. <https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them>
- Gagné, R.M., Briggs, L.J., & Wager, W.W. (1992). *Principles of Instructional Design* (4th ed). Holt, Rinehart & Winston. ISBN: 0-03-034757-2.
- Gaver, W. (2012). What Should We Expect From Research Through Design?. *Conference on Human Factors in Computing Systems - Proceedings*. DOI: 10.1145/2207676.2208538.
- Ghirardini, B. (2011). *E-learning methodologies - A guide for designing and developing e-learning courses*. Food and Agriculture Organization of the United Nations (FAO). ISBN: 978-92-5-107097-0.

- Gibbons, S. (2019). *Cognitive Maps, Mind Maps, and Concept Maps: Definitions*. Nielsen Norman Group. <https://www.nngroup.com/articles/cognitive-mind-concept/>.
- Greany, K. (2019). *Elearning best practices*. Elucidat. <https://www.elucidat.com/elearning-best-practice/>.
- Hamari, J., Koivisto, J. & Sarsa, H. (2014). Does Gamification Work? — A Literature Review of Empirical Studies on Gamification. *Proceedings of the Annual Hawaii International Conference on System Sciences*. 10.1109/HICSS.2014.377.
- Heirdsfield, A., Walker, S., Tambyah, M., & Beutel, D. (2011). Blackboard as an online learning environment: What do teacher education students and staff think? *Australian Journal of Teacher Education (Online)*, 36(7), 1-16.
- Henderson, M., Selwyn, N., & Aston, R. (2017). What works and why? Student perceptions of 'useful' digital technology in university teaching and learning. *Studies in Higher Education (Dorchester-on-Thames)*, 42(8), 1567-1579.
- Henriksson, J., & Sundberg, C.J. (2008). Allmänna effekter av fysisk aktivitet. In *FYSS 2008 - Fysisk aktivitet i sjukdomsprevention och sjukdomsbehandling* (pp 11-37). Statens Folkhälsoinstitut. <http://www.fyss.se/wp-content/uploads/2018/02/FYSS-2008-hela-boken.pdf>.
- Herrington, J., Oliver, R., Herrington, T., & Sparrow, H. (2001). *Towards a New Tradition of Online Instruction: Using Situated Learning Theory to Design Web-Based Units*. Retrieved from [https://www.researchgate.net/publication/2376757\\_Towards\\_a\\_New\\_Tradition\\_of\\_Online\\_Instruction\\_Using\\_Situated\\_Learning\\_Theory\\_to\\_Design\\_Web-Based\\_Units#fullTextFileContent](https://www.researchgate.net/publication/2376757_Towards_a_New_Tradition_of_Online_Instruction_Using_Situated_Learning_Theory_to_Design_Web-Based_Units#fullTextFileContent).
- Holmes, K., & Prieto-Rodriguez, E. (2018). Student and Staff Perceptions of a Learning Management System for Blended Learning in Teacher Education. *Australian Journal of Teacher Education*, 43(3), 21-34.
- Horton, W. (2012). *E-Learning by Design* (2nd ed.). Pfeiffer.
- Ideo. (n.d.a). *How Might We*. DesignKit. <https://www.designkit.org/methods/3>.
- Ideo. (n.d.b). *Secondary Research*. DesignKit. <https://www.designkit.org/methods/secondary-research>.
- Interaction Design foundation. (2016). Making Your UX Life Easier with the MoSCoW. <https://www.interaction-design.org/literature/article/making-your-ux-life-easier-with-the-moscow>.
- Interaction design foundation. (2020). *Gamification*. <https://www.interaction-design.org/literature/topics/gamification>.

- Interaction design foundation. (2011). *What is Brainstorming?*.  
<https://www.interaction-design.org/literature/topics/brainstorming>.
- Interaction Design Foundation. (n.d.a). *Design Guidelines - What are Design Guidelines?*  
<https://www.interaction-design.org/literature/topics/design-guidelines>.
- Interaction Design Foundation. (n.d.b). *What are User Scenarios?*  
<https://www.interaction-design.org/literature/topics/user-scenarios>.
- International Organization for Standardization (ISO). (2019). *Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems* (ISO 9241-210:2019). <https://www.iso.org/standard/77520.html>.
- IDEO. (2021). *What is Human-Centered Design?* DesignKit.  
<https://www.designkit.org/human-centered-design>.
- Ishtaiwa, F., & Abulibdeh, E. (2012). The Impact of Asynchronous E-Learning Tools on Interaction and Learning in a Blended Course. *International journal of instructional media*, 39, 141-159.
- Jaggars, S. (2014). Choosing Between Online and Face-to-Face Courses: Community College Student Voices. *The American Journal of Distance Education*, 28(1), 27-38.
- Jenewein, T. (2020, March). *Learning Experience Design as a New Paradigm for Learning & Education* [Post]. LinkedIn.  
<https://www.linkedin.com/pulse/learning-experience-design-new-paradigm-education-thomas-jenewein/>.
- Johnson, J. (2016, March). *What is Learning Experience Design and Why Is It Important?* [Post]. LinkedIn.  
<https://www.linkedin.com/pulse/what-learning-experience-design-why-important-james-johnson/>.
- Kaplan, K. (2019). *5 UX Workshops and When to Use Them: A Cheat Sheet*. Nielsen Norman Group. <https://www.nngroup.com/articles/5-ux-workshops/>.
- Kapp, K.M. & Defelice, R.A. (2019). *Microlearning: Short and Sweet*. Alexandria: ATD Press.
- Kaufmann, E., Cappé, O., & Garivier, A. (2014). On the complexity of A/B testing. *Journal of Machine Learning Research*, 35, 461-481.
- Keefe, G., & Wharrad, H. (2012). Using e-learning to enhance nursing students' pain management education. *Nurse Education Today*, 32(8), E66-E72.
- Kilgore, W. (2016, June). *UX to LX: The Rise of Learner Experience Design* [Post].  
 DIGITAL LEARNING IN HIGHER ED.  
<https://www.edsurge.com/news/2016-06-20-ux-to-lx-the-rise-of-learner-experience-design>

- Kite, J., Schlub, T., Zhang, Y., Choi, S., Craske, S., & Dickson, M. (2020). Exploring lecturer and student perceptions and use of a learning management system in a postgraduate public health environment. *E-learning and Digital Media*, 17(3), 183-198.
- Kommittédirektiv 2017:03. *Reglering av yrket undersköterska*. Socialdepartementet/Regeringskansliet.  
[https://www.riksdagen.se/sv/dokument-lagar/dokument/kommittedirektiv/reglering-av-yrket-underskoterska\\_H5B1103](https://www.riksdagen.se/sv/dokument-lagar/dokument/kommittedirektiv/reglering-av-yrket-underskoterska_H5B1103).
- Komninos, A. (2020a). *7 UX Deliverables: What will I be making as a UX designer?* Interaction Design Foundation.  
<https://www.interaction-design.org/literature/article/7-ux-deliverables-what-will-i-be-making-as-a-ux-designer>.
- Komninos, A. (2020b). *How to improve your UX designs with Task Analysis*. Interaction Design Foundation.  
<https://www.interaction-design.org/literature/article/task-analysis-a-ux-designer-s-best-friend>.
- Koohang, A., & du Plessis, J., (2004). Architecting Usability Properties in the E-Learning Instructional Design Process. *International Journal on E-Learning*, 3(3), 38–44.
- Krause, R. (2019). *Storyboards Help Visualize UX Ideas*. Nielsen Norman Group.  
<https://www.nngroup.com/articles/storyboards-visualize-ideas/>.
- Leavitt, M. O., Shneiderman, B., Bailey, R. W., Barnum, C., Bosley, J., Chaparro, B., Dumas, J., Ivory, M. Y., John, B., Miller-Jacobs, H., Koyani, S. J., Lewis, J. R., Page, S., Ramey, J., Redish, J., Scholtz, J., Wigginton, S., Wolfson, C. A., Wood, L. E., & Zimmerman, D. (2006). *Research-Based Web Design & Usability Guidelines* [2006 edition]. Usability.gov.  
[https://www.usability.gov/sites/default/files/documents/guidelines\\_book.pdf](https://www.usability.gov/sites/default/files/documents/guidelines_book.pdf).
- Lee, J., & Hammer, J.. (2011). Gamification in Education: What, How, Why Bother?. *Academic Exchange Quarterly*. 15. 1-5.
- Lasley II, T.J. (2016, May 20). *Bloom's taxonomy*. Encyclopedia Britannica.  
<https://www.britannica.com/topic/Blooms-taxonomy>.
- Lowenthal, P., Bauer, C., & Chen, K.-Z., (2015). Student Perceptions of Online Learning: An Analysis of Online Course Evaluations. *The American journal of distance education*, 29(2), 85–97.
- LXD. (2021). *The origin of learning experience design*. Learning Experience Design (LXD). LXD Org.  
<https://lxd.org/fundamentals-of-learning-experience-design/the-origin-of-learning-experience-design/>.
- MacDonald, J. (2016). *Stakeholder Identification and Analysis Made Easy for Project Managers*. Business 2 Community.

- <https://www.business2community.com/strategy/stakeholder-identification-analysis-made-easy-project-managers-01440041>.
- Maguire, M. (2001a). Context of Use within Usability Activities. *International Journal of Human-Computer Studies*, 55(4), 453-483.
- Maguire, M. (2001b). Methods to support human-centred design. *International Journal of Human-Computer Studies*, 55(4), 587-634.
- Malamed, C. (n.d.). Types of Analysis for eLearning - Six Lenses for Looking at Analysis. The e-learning coach. [https://theelearningcoach.com/elearning\\_design/analysis-for-elearning/](https://theelearningcoach.com/elearning_design/analysis-for-elearning/).
- Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist*, 38(1), 43-52.
- Mcfarland, D., & Hamilton, D. (2005). Factors Affecting Student Performance and Satisfaction: Online versus Traditional Course Delivery. *The Journal of Computer Information Systems*, 46(2), 25-32.
- Merrill, M. (2002). First principles of instruction. *Educational Technology Research and Development*, 50(3), 43-59.
- Moran, K. (2019). *Usability Testing 101*. Nielsen Norman Group. <https://www.nngroup.com/articles/usability-testing-101/>.
- Morton, J. (2019). *Why Color Matters*. Colorcom. <https://www.colorcom.com/research/why-color-matters>.
- National Research Council. (2011). *Promising Practices in Undergraduate Science, Technology, Engineering, and Mathematics Education: Summary of Two Workshops*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/13099>.
- Nielsen, J. (2001). *113 Design Guidelines for Homepage Usability*. Nielsen Norman Group. <https://www.nngroup.com/articles/113-design-guidelines-homepage-usability/>.
- Nielsen, J. (2005). *Putting A/B Testing in Its Place*. Nielsen Norman Group. <https://www.nngroup.com/articles/putting-ab-testing-in-its-place/>.
- Nielsen, J. (2012). *User Satisfaction vs. Performance Metrics*. Nielsen Norman Group. <https://www.nngroup.com/articles/satisfaction-vs-performance-metrics/>.
- Nielsen, J. (2020). *10 Usability Heuristics for User Interface Design*. Nielsen Norman Group. <https://www.nngroup.com/articles/ten-usability-heuristics/>.
- Normadhi, N., Shuib, L., Nasir, H., Bimba, A., Idris, N., & Balakrishnan, V. (2019). Identification of personal traits in adaptive learning environment: Systematic literature review. *Computers & Education*, 130, 168-190.

- Norman, D. (2013). *The Design of Everyday Things - Revised and Expanded Edition*. Basic Books. ISBN 978-0-465-00394-5.
- Norman, D., & Spohrer, J. (1996). Learner-centered education. *Communications of the ACM*, 39(4), 24-27.
- Olah, Z. (2020, September). *Gamification Design Elements For Learning*. eLearning Industry. <https://elearningindustry.com/gamification-design-elements-for-learning>.
- Pant, A. (2014). Distance Learning: History, Problems and Solutions. *Advances in Computer Science and Information Technology (ACSIT)*, 1(2), 65-70.
- Pappas, C. (2017). *Merrill's Principles Of Instruction: The Definitive Guide*. eLearning Industry. <https://elearningindustry.com/merrills-principles-instruction-definitive-guide>
- Parmelund, N., & Reifeldt, K. (2020). *Arbeta med manuella förflyttningar*. Hjälpmedelcenter Sverige.
- Paas, F., Renkl, A., & Sweller, J. (2003). Cognitive Load Theory and Instructional Design: Recent Developments. *Educational Psychologist*, 38(1), 1-4.
- Pernice, K. (2018). Affinity Diagramming for Collaboratively Sorting UX Findings and Design Ideas. Retrieved from: <https://www.nngroup.com/articles/affinity-diagram/>
- Pernice, K. (2016). *UX Prototypes: Low Fidelity vs. High Fidelity*. Nielsen Norman Group. <https://www.nngroup.com/articles/ux-prototype-hi-lo-fidelity/>.
- Pernice, K. (2018). *User Interviews: How, When, and Why to Conduct them*. Nielsen Norman Group. <https://www.nngroup.com/articles/user-interviews/>.
- Pierzchała, B. (2018). *What they are and which one to choose for your project*. Medium. <https://medium.com/7ninjas/low-fidelity-vs-high-fidelity-prototypes-903a7befaa5a>.
- Plaut, A. (2014, January). *Elements of Learning Experience Design* [Post]. <https://boxesandarrows.com/elements-of-learning-experience-design/>
- Pompeii, L., Lipscomb, H., Schoenfisch, A., & Dement, J. (2009). Musculoskeletal injuries resulting from patient handling tasks among hospital workers. *American Journal of Industrial Medicine*, 52(7), 571-578.
- Poondej, C., & Lerdpornkulrat, T. (2019). Gamification in e-learning: A moodle implementation and its effect on student engagement and performance. *Interactive Technology and Smart Education*, 17(1), 56-66. doi:<http://dx.doi.org.ezproxy.ub.gu.se/10.1108/ITSE-06-2019-0030>
- Prasad, R.K. (2020). *Gamification + Microlearning: 7 Steps To Deliver Top-Notch eLearning*. eLearning Industry. <https://elearningindustry.com/combining-gamification-with-microlearning-deliver-top-notch-elearning-content>.

- Preece, J., Sharp, H. and Rogers, Y. (2015). *Interaction design: beyond human-computer interaction*. (4th ed.). John Wiley & Sons. ISBN 978-1-119-08879-0.
- Rojas, J. (2020). *Etch A Sketch: How to Use Sketching in User Experience Design*. Interaction Design Foundation. <https://www.interaction-design.org/literature/article/etch-a-sketch-how-to-use-sketching-in-user-experience-design>. <https://www.nngroup.com/articles/how-might-we-questions/>.
- Rosala, M. (2021). *Using “How Might We” Questions to Ideate on the Right Problems*. Nielsen Norman Group.
- SCB. (2020, March 5). *30 största yrkena - Förvärvsarbetande anställda 16–64 år efter antal i yrket, år 2018*. Retrieved 2021-01-29, from <https://www.scb.se/hitta-statistik/statistik-efter-amne/arbetsmarknad/sysselsattning-forvarvsarbete-och-arbstider/yrkesregistret-med-yrkesstatistik/pong/tabell-och-diagram/30-storsta-yrkena/>.
- SCB. (2015, December 16). *Tema: Vård och omsorgsutbildade – idag och i framtiden*. Retrieved 2021-02-01, from <https://www.scb.se/hitta-statistik/statistik-efter-amne/utbildning-och-forskning/analyser-och-h-prognoser-om-utbildning-och-arbetsmarknad/analyser-om-utbildning-och-arbetsmarknad/pong/publikationer/tema-var-d-och-omsorgsutbildade--idag-och-i-framtiden/>.
- SFS 2014:821. *Patientlag*. [https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/patientlag-2014821\\_sfs-2014-821](https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/patientlag-2014821_sfs-2014-821)
- Shneiderman, B. (2006). *Research-Based Web Design & Usability Guidelines*. Usability.gov. [https://www.usability.gov/sites/default/files/documents/guidelines\\_book.pdf](https://www.usability.gov/sites/default/files/documents/guidelines_book.pdf)
- Shaded, R. (2019). *3 simple steps to design and analyze user-centric surveys*. UX Collective. <https://uxdesign.cc/designing-a-great-survey-with-3-simple-steps-283abaa67ad6>.
- Socialdepartementet. (2021, 4 March). Skyddad yrkestitel för undersköterskor. [Press release]. <https://www.regeringen.se/pressmeddelanden/2021/03/skyddad-yrkestitel-for-underskoterskor/>.
- SOSFS 2012:3. *Värdegrunden i socialtjänstens omsorg om äldre*. <https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/foreskrifter-och-allmanna-rad/2012-2-20.pdf>.
- Stappers, P.J., & Giaccardi, E. (n.d.). Research through Design. In: Soegaard, M., & Friis Dam, R. (Eds.) *The Encyclopedia of Human-Computer Interaction*, 2nd Ed. The Interaction Design Foundation. <https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/research-through-design>.

- Swahn, C., & Söderlund, T. (2020, June 8). *Så snabbt utbildas personal till vård och omsorg*. Kommunalarbetaren.  
<https://ka.se/2020/06/08/sa-snabbt-utbildas-personal-till-varld-och-omsorg/>.
- Sweller, J., Van Merriënboer, J.J.G. & Paas, F. (1998). Cognitive Architecture and Instructional Design. *Educational Psychology Review*, 10(3). 251-296. DOI: 10.1023/a:1022193728205.
- Tubik Studio. (2017). *Color Theory: Brief Guide for Designers*. UX Planet.  
<https://uxplanet.org/color-theory-brief-guide-for-designers-76e11c57eaa>.
- Wallén, J. (2019). *Förflyttningshjälpen - Design av en app för utbildning och stöd vid förflyttningssituationer inom vården*. Retrieved from Chalmers Open Digital Repository. (257177).
- Waters, T.R., Nelson, A., & Proctor, C. (2007). Patient handling tasks with high risk for musculoskeletal disorders in critical care. *Crit Care Nurs Clin North Am*. 19(2). 131-43.
- World Wide Web Consortium (W3C). (2018). Web Content Accessibility Guidelines (WCAG) 2.1.  
<https://www.w3.org/TR/2018/REC-WCAG21-20180605/#audio-only-and-video-only-prerecorded>.
- Wharrad, H. (n.d.). *Reusable learning objects: what are they and do they work?* [Video]. FutureLearn. <https://www.futurelearn.com/info/courses/e-learning-health/0/steps/17121>.
- White, G., & Ploeger, F. (2004). Cognitive Characteristics for Learning Visual Basic. *The Journal of Computer Information Systems*, 44(3), 58-66.
- Whitenton, K. (2013). *Minimize Cognitive Load to Maximize Usability*. Nielsen Norman Group. <https://www.nngroup.com/articles/minimize-cognitive-load/>.
- Wåhlin, C., Stigmar, K., & Nilsing Strid, E. (2019). Säkrare personförflyttningar: Åtgärder i arbetsmiljön för medarbetare inom hälso- och sjukvård samt omsorg. (Kunskapssammanställning 2019:6). Arbetsmiljöverket.  
<https://www.av.se/globalassets/filer/publikationer/kunskapssammanstallningar/sakrare-personforflyttningar-rap-2019-6.pdf>.
- YOW! Conferences. (2017, 28 December). *YOW! 2014 Jeff Patton - User Story Mapping: Discover The Whole Story* [Video]. Youtube.  
<https://www.youtube.com/watch?v=AzBuohuOU6g>.
- Zimmerman J., & Forlizzi J. (2014). Research Through Design in HCI. In: Olson J., & Kellogg W. (Eds.) *Ways of Knowing in HCI* (167-189). Springer, New York, NY. DOI: 10.1007/978-1-4939-0378-8\_8.

# A

## Appendix: Questions for questionnaires

*The questionnaires were authored in Swedish. A translation of questions is presented here.*

- Question
  - alternative answers

This first question asked the participants about their work position, and divided the participants in two groups: base level personnels and decision makers, receiving different following questions.

*Who are you?*

- What is your professional title?
  - Nursing staff (e.g. assistant nurse, personal assistant, nurse)
  - Unit manager / Decision maker

### **Base Level Personnel**

*About you*

- What is your age?
  - 16-29 years
  - 30-49 years
  - 50+ years
- How long have you worked in healthcare?
  - Less than 1 year
  - 1-5 years
  - More than 5 years
- Where do you work?
  - Home care services
  - Retirement home
  - Other (e.g. personal assistance, hospital)
- Do you work within the public or private sector?
  - Public
  - Private
- What is your basic education?
  - Nursing-related high school education
  - Nursing-related higher education
  - Other upper secondary education
  - Other higher education
  - No education
- Have you ever participated in an e-learning education, for example been enrolled in an online course?
  - Yes

- No

*Technology habits/literacy in the everyday life and at work*

- How often do you use technology such as computers, tablets or smartphones in your everyday life?
  - Never
  - Very rarely
  - Once a month
  - Every week
  - Every day
- How often do you do the following things with the help of a computer, smartphone or tablet in your everyday life: *(The same list of alternative answers were given to all the following questions respectively)*
  - Searching for information (e.g. on Google)
    - Never
    - Very rarely
    - Once a month
    - Every week
    - Every day
  - Pays bills
  - Shop (e.g. clothes or ordering food)
  - Communicates (e.g. chats or use social media)
  - Play games
  - Use for work

*Motivation for education*

- Do you feel a need to educate yourself in movement knowledge?
  - Yes, I feel I need more knowledge in movements
  - Yes, I feel safe in mine knowledge but always want to learn more
  - No, I already have the knowledge required to implement safe and ergonomic transfers
  - No, I'm not interested
- Have you studied transfer knowledge? (e.g. as part of your undergraduate education or as a course via your workplace)
  - Yes, several times
  - Yes, once in a while
  - No never
- Would you want to study transfer knowledge online?
  - Yes, it would have been smooth and effectively
  - No, I'd rather go to education in a physical environment
  - I have no opinion
- Motivate your answer
  - *Free text*
- If you were to be offered an e-learning training in transfer knowledge, how would you like to implement it? (Assume that you get paid working hours for the training even if it takes place at home)
  - I'd rather do it at home than at the workplace
  - I'd rather do it at the workplace
  - It does not matter to me
- Motivate your answer
  - *Free text*
- Imagine that you are going to participate in a course in transfer knowledge through an e-learning course. How would you have preferred the course to be structured?

- A concentrated training opportunity (e.g. 1-2 hours online)
- A module-based education that you complete in your own pace (e.g. three different units with different contents)

*If you have studied transfer knowledge*

- Do you feel that it is enough to participate in the course on a single occasion, or would you like to be reminded of what you learned on later occasions?
  - I think I get enough basic knowledge at one time
  - I would like to go to mor occasions over a period of 6-12 months
  - I would like to take a basic course and then be reminded continuously
  - I do not know have never taken a course in transfer knowledge
- Do you benefit from the knowledge you have learned in performing transfers?
  - Yes, I'm actively thinking about that apply the knowledge I have learned
  - I try, but not always
  - No, I'm not thinking about how I perform transfers

*Conditions in the workplace*

- What type of technology is available in your workplace? (Several options possible)
  - Computer (one or more)
  - Tablet (one or more)
  - Work phone (smartphones)
  - Work telephone (only for e.g. calls or alarms)
  - Other
- Have you digitalized anything in your workplace? (e.g. signing in an app instead of on paper)
  - Yes
  - No
  - I don't know
- If so, can you specify what?
  - *Free text*
- If you were to complete an online training at your workplace, do you have the opportunity to sit somewhere secluded in peace and quiet?
  - Yes
  - No
  - I don't know

*Thank you!*

- Should you be interested in participating in an interview with us to talk further about the possibilities for e-learning in transfer knowledge, please enter your email below and we might contact you.

**Unit Managers**

*About you*

- What is your age?
  - 16-29 years
  - 30-49 years
  - 50+ years
- How long have you worked in healthcare?
  - Less than 1 year
  - 1-5 years
  - More than 5 years

- Where do you work?
  - Home care services
  - Retirement home
  - Other (e.g. personal assistance, hospital)
- Do you work within the public or private sector?
  - Public
  - Private

#### *Conditions in the workplace*

- What type of technology is available in your workplace? (Several options possible)
  - Computer (one or more)
  - Tablet (one or more)
  - Work phone (smartphones)
  - Work telephone (only for e.g. calls or alarms)
  - Other
- If any of the above technology is used in the workplace, who is using it? (Several options possible)
  - Nursing staff such as assistant nurses
  - Unit managers or other managers
  - Administration
  - Others
- Do you have access to wifi in the workplace?
  - Yes
  - Yes, but it is unstable and or slow
  - No
- Have you digitized anything in your workplace? (e.g. signing in an app instead of on paper)
  - Yes
  - No
  - I don't know
- If so, can you specify what?
  - *Free text*
- If the staff were to conduct an online training at the workplace, could the staff have access to a computer?
  - Yes
  - No
- If the staff were to complete an online training at the workplace, is it possible to sit secluded in peace and quiet?
  - Yes
  - No
- If the staff were to conduct an online training, is there an opportunity for them to sit at home and complete it?
  - Yes
  - No
  - I don't know
- Motivate your answer.
  - *Free text*
- Are the staff at your workplace offered education or training? (In transfer knowledge or other areas).
  - Yes, regularly
  - Yes, as needed
  - No
- Motivate your answer.
  - *Free text*

- If the opportunity for education exists, who takes the initiative for education?
  - Every employee can ask for education/training
  - It's the manager (or similar) who decides who may/needs to complete education/training
- Motivate your answer.
  - *Free text*
- If the opportunity for education exists, who chooses the level of education?
  - Determined according to the individual's needs and or interests
  - Determined by the manager (or similar)
  - The unit manager is responsible for ensuring that there is a needs-adapted transfer training depending on where the employee is located in terms of competence
- Motivate your answer.
  - *Free text*
- How do you perceive the need for training in transfer knowledge in your workplace in general?
  - scale 0 - 5 (where 0 = No need and 5 = Great need)
- Motivate your answer.
  - *Free text*

*Thank you!*

- Should you be interested in participating in an interview with us to talk further about the possibilities for e-learning in transfer knowledge, please enter your email below and we might contact you.

# B

## Appendix: Questions for interviews

*The interviews were conducted in Swedish. A translation of questions is presented here.*

### **Base Level Personnel**

#### *Demographics*

- Can you tell us a little about yourself, we can start with how old you are?
- How long have you worked in healthcare?
- Where do you work today? (Workplace / sector)
- Have you worked at any other workplace in healthcare before?
  - If so, are there any major differences between the workplace?

#### *Experience transfer knowledge*

- Have you ever been educated in transfer knowledge?
- How many times?
- Where did you complete the training?
- Is it a requirement for your workplace(s) to attend training in movement knowledge?
- How do you perceive the level of knowledge regarding this to be at your workplace?
- What did you learn during the training? (Theoretical/practical exercises)
- If you have attended many different educations, do they differ? Why have you attended different educations?
- Do you think it is important to receive a receipt, such as a diploma or certificate, on that you have completed and passed the education?
- Can you tell us a little about what you think you got out of your education(s) in transfer knowledge?
- Do you feel that you have received use of the education in your work with transfers?
- After the training, do you actively think about what you learned when you perform transfers?
- If so, tell us more about how you apply the knowledge when assisting care recipients?
- If not, what is stopping you from using the knowledge, what obstacles are there?
- Do you feel a need to be updated and follow up on the knowledge you have learned after the training?
- If so, how often would it be reasonable to be reminded/repeat?
- Do you want to decide for yourself when you want to be reminded or should it be predetermined?
- What do you feel is the most important thing an education in movement knowledge gives/teaches you?
- What do you think is "most difficult" when it comes to transfers in your work?

#### *Experience in online training and related questions*

- Do you have any experience of online education?
  - If so, can you tell us a little about what it was about?
- What level was the education at?

- Did it feel rewarding to you?
  - If not, what do you think was missing?
- What was the design of the online course like? Was it e.g. a lot of videos, text to read?
- Can you tell us a little about how it worked, what worked well/not so well?
- Did you miss something particular in the education?
- Do you use any digital systems today at your workplace?
  - If so, for what? How do you think it works?
- Do you use any LMS in your workplace?
  - If so, for what? How often do you use it? How do you think it works?
- Do you have a job email at your workplace?

#### *Expectations on online training*

- If you were to attend an online movement education course, what focus would you prefer it had?
  - Theoretical vs. practical
  - New knowledge vs. repetition of knowledge
- What would you like the layout to look like?
- Would you prefer a module-based approach, i.e. that you can carry out the training at your own pace, or would you prefer a time limit?
- Would you prefer to carry out the training alone and or in a group?
- Do you prefer to sit by a computer, tablet or mobile phone when you participate in the training?
- Is your choice available at your workplace today?

#### *Scenarios of use*

- Imagine that the opportunity to participate in a basic course in movement knowledge is offered online, who do you think would have the greatest use for it? (Brand new assistant nurses who have no prior knowledge, or more experienced ones who need to be reminded)
- Say that your employer decides that some of the staff should attend training in moving knowledge online, is it possible to sit in peace and quiet somewhere in your workplace?
  - If so, where was it?
  - If not, do you think it could be solved in some other way?
- When during the work shift would it be appropriate to perform such a course at your workplace?
- If the training was to offer you to perform practical exercises as well, is it possible to perform transfer on each other in your workplace?
- If not, do you think you can solve this in some other way?
- What do you require from an online education for you to attend it? Appreciate it?
- What does it take for you to appreciate it?

### **Unit Managers**

#### *Demographics*

- Can you tell us a little about yourself, we can start with how old you are and where you work?
- Where do you work today? (Workplace/sector)
- How long have you worked in healthcare?
- How long have you been a unit manager?

#### *Routines for education in transfer skills*

- What are your routines for training staff in movement knowledge?
- Is it a requirement for all staff to attend transfer training?
- What are the routines for new staff?

- The staff who are already trained in transfer knowledge, do they get any follow-up afterwards?
- Do they attend the same training several times?
- Does the training advance in “difficulty”?
- How do you choose training for the staff?
  - Level-adjusted? Standardized?
- How do you experience the need for training in movement knowledge at your workplace in general?
- Does it happen that certain staff who work do not have any form of training in movement knowledge?

#### *Motivation or interest in implementing online training in the workplace*

- What is your experience of educating staff online, in transfer knowledge or something else?
- How would you interpret the interest in online education at your workplace?
- What advantages/disadvantages do you see with it?
- If the staff at your workplace were to attend an online training, is it important for you as a manager to follow up the participation and or the result?
  - e.g. by collecting statistics?
- Would you like to have an admin interface for this?
- What are your routines for following up the training today?
  - How do you keep track of the staff's experience and the like?

#### *Prerequisites for online training in the workplace*

- If you were to imagine that your staff would carry out an online training, would you be able to describe what such a scenario would look like if it were implemented in the workplace?
- What are the conditions for conducting online training if it were to be done in the workplace?
- What technology is available at your workplace? Do you have computers, tablets, work phones?
- Is it possible to sit in peace and quiet?
  - Alone? in Group?
- When and how much time would the staff set aside time to participate in the online training, based on their current schedule?
- If you were to imagine that your staff would carry out an online training, but carry it out at home, would you be able to describe what such a scenario would look like?
  - Would it be possible?
- What are the conditions and or requirements for it to be possible to complete an online education at home?
  - What rules / routines are there?
  - Paid working hours?

#### *Technology habits and routines around LMS and education*

- Do you use any LMS in the business today?
  - Which? For what?
- Do the assistant nurses use this, if so, how?
- If you have trained or would train staff online, would you like it connected to your existing LMS or do you want it to be standalone? In the form of e.g. a web page you visit or your own program.
- Do you have an employee who is responsible for staff training?
- Who identifies the need?
- Who registers the staff for training?
- How many participants approximately do you usually apply for education? What is the scoop?
- What is your budget for education?

## Appendix: Personas



### Rubika

#### Hard facts

Rubika is 61 years old and lives in a medium sized apartment in Gothenburg, Sweden. She lives with her husband and three children. She is originally from India but has lived in Sweden for almost 10 years now. She still has some difficulty understanding and communicating in Swedish. The apartment is located just above a kindergarten and a playground, so one of her youngest children can play with her supervision from the window.

In India, she owned a grocery store together with her husband, so Rupika is really serviceminded and good with people. When she came to Sweden, she applied for jobs in healthcare immediately. She started her career in the home care service, but thought it was far too stressful and hectic. She also did not like working alone, she wanted colleagues close at hand. Today, she works at a nursing home, owned by the municipality where she lives.

#### Interest and Values

Rubika loves music, both listening to and singing. She often sings at home, and sometimes she gets requested to sing at parties with relatives. She also usually sings at the nursing home she works at, especially during holidays, which the old people love!

When she has time (which she tries to prioritize every week), she sings in a choir. This is her most grateful moment of the whole week, it's where she gathers energy and motivation. Rubika also loves to go for long walks in nature with her husband, preferably having a picnic.

Rubika loves her job, according to her, it is the best job in the world. She has a great commitment to her role as assistant nurse. She also has empathy and respect for all care recipients or "friends" as she calls them. Her ambition is to, in every situation, treat all care recipients equally and look at them in a human perspective, not just by their oldness or illness. This comes from her big interest in people and care for them, and that different meetings give her unique experiences. She takes every chance to help other people, as a result she often forgets about her own feelings and wellbeing.

Rubika likes to stick to routines and does not really like big changes in her life or everyday chores. However, since she has moved from one country to another, she is still good at adapting to changes, but that is only in situations where she really has to.

#### Prior Knowledge

Rubika has a basic education in healthcare, which she attended in Sweden the same year she arrived. Since she took care of her old parents for a long time while living in her home country, it was no wonder to start working in elderly care as she feels competent and comfortable with taking care of old people.

She has very good practical knowledge of care, but unfortunately lacks the theoretical part, especially when it comes to moving knowledge. Besides that, she also has a very hard time concentrating when she reads for a long time. She prefers more practical activities and likes to talk and discuss learning topics. She trusts the approach "learning by doing" more than reading. In addition, it takes much longer for Rubika to read in Swedish than her mother tongue, which causes her to lose patience and start other tasks instead.

Rubika has attended training in moving knowledge a number of times, about once a year since she started working as an assistant nurse. However, she does not feel that she can apply the knowledge she has learned in a good way. After only a few weeks after the education, she is back in old movement patterns, even though she knows she's doing something wrong as she has pain in both her back and feet.

Rubika has requested to attend training and get help with moving and handling care recipients more often, but her boss argues that they lack time and that staff must be on site and provide care. However, she found some videos on youtube about how to move care recipients in a gentle and safe way, so she looked at them regularly instead.

#### Work Situation

Rubika has been working at the same elderly home for several years now and is very happy. She has created a strong relationship with most of the care recipients and knows her colleagues very well. The only thing she can really complain about is that the spaces in the care recipients apartments are a bit cramped and have poor space when passing with aids such as wheelchairs or lifts.

When Rubika started working, all documentation was done on paper, but now her workplace has digitized the task and switched to writing documentation digitally in an app instead, which works much better and more smoothly. Most of her colleagues do the documentation with their phones, however, Rubika prefers to go to the computer as she sees the content and can concentrate better in a close room.

Rubika sees her job as an assistant nurse as very important, she wants to be there for people who need support and help them in their everyday life. She is therefore very keen to always do her best to promote the care recipient's best interest and see to their needs. But sometimes she feels that her motivation is not enough, she needs better education on how to meet care recipient's individual needs. It makes her sad that there is no opportunity for her to develop her skills during working hours.

Rubika is proud to follow the elderly in their everyday life and see the joy she spreads, especially when doing activities together. She easily forgets about the stressful environment as the days just fly by, it is due to her empathy and involvement with care recipients during the day. It is not until she comes home and sits on the couch that she realizes how physically heavy and mentally stressful her working days actually are, but that she will never show in front of the care recipients.

#### A Typical Working Day

- Rubika starts her day with a cup of tea and sandwich at home
- She has a morning routine to listen to music and write in her diary, where she writes things she appreciates with her life. This makes her stay positive minded throughout the day!
- She then takes a good morning walk to work, as it only takes 15 minutes to walk!
- The first thing to do when arriving at work is to have a morning meeting with her colleagues and prepare for the day - who will help whom
- After the morning-round, she starts helping the care recipients who need assistance right in the morning. Rubika helps them out of bed, gives them medicine and breakfast. She wants to do this as fast as possible so the elderly can start their day!
- During the day, she carries out various activities with the elderly, which she absolutely loves and think is the highlight of the whole day.
- She also assists the care recipients who want and are in need of support when moving from one place to another. She helps them go to the toilet, shower, and other regular working tasks during the day.
- Rubika ends each working day with documenting important events that happened during the day. She also always says goodbye to every care recipient before going home, even if they are currently sleeping.

## Technical Habits

Rubika is not a big fan of any technical stuff really. She likes to live in the present and integrate with humans rather than with her phone. However, she owns an Iphone 8 plus which she use daily, mostly for calls and messages, but also for searching the internet or identifying herself with mobile BankId. She likes that her phone is easy to use and has a big screen so she can see everything properly. At work, on the other hand, they have work phones that are much smaller than her own (Iphone 7), where Rupika struggle with reading all documentation.

Rupika and her husband share a Macbook Air at home, even though she don't use it very often. Once she uses the computer, it is often to pay bills, explore videos on youtube, or do some internet shopping. They also have a tablet at home, mostly used to search for information fast (such as finding food recipes), facetime with family, but also to play games on. Her husband is a big fan of app games. However, Rubika does not like when the screen time takes over other more important situations in life.

## Future Goals

Rupika thinks that giving care to people is the best way to create value in everyday life, both to herself and to the care recipients. However, she wishes she could give more. One dream she has is to attract more people to the profession, and that assistant nurses receive more credit and attention for the work they do. She thinks that all care personnel should be offered good working conditions, so one goal she has before retiring is to drive change somehow.

## User Quotes

- ”You easily fall into old habits.
- ”At its best, a positive spiral arises, when me and a co-worker, who think the same way as I do, and a care recipient meet in a trinity, where the old person takes part in the work.
- ”I really want to develop my working skills, and in my role as a caregiver.

**Figure C.1.** Persona 1: Rubika.



## Emelie

### Hard facts

Emelie is 19 years old and just graduated from high school. She is not yet certain about what kind of career she would like to pursue, but she would like it to be more practical rather than theoretical. Neither has she decided whether she'd like to get a graduation from a university or not. Until she makes up her mind, she has decided to work in healthcare in the local retirement home. She feels that it is a valuable job, even though she's quite certain she will not pursue it as a lifelong career, and she got hired quite smoothly as her aunt works as a unit manager within the municipality, but at the department for home care.

Emelie lives at home with her mother, stepdad, younger brother (16) and two small dogs.

### Interest and Values

Emelie is generous and helpful in general, and likes talking to the care recipients in the retirement home. They often make her laugh, and she sometimes shares anecdotes from her working day with friends and family, but she always tries not to leave out too much information on the care recipients as she knows she's not allowed to.

Emelie's interests revolve to a great extent around nature, as she lives in a small community, 20 minutes from Gothenburg. She likes horses and riding, and enjoys calm movie nights with her friends and boyfriend.

She is quite self-going, and does not rely on her parents to take care of her (other than providing her with lodging).

### Prior Knowledge

In high school Emelie studied care and nursing, so she does have some prior knowledge within the field of healthcare. It is however on a basic level, and she has no prior working knowledge.

### Technical Habits

Being a kid of generation Z Emelie feels very competent using electronics such as computers, smartphones, etc. She has no further technical interests, but does not need any heavy technical support. She is used to being presented with new technology and navigating different softwares.

### Work Situation

Emelie has been working in the retirement home for a couple of months. She sometimes feels neglected by permanent staff and the unit managers, as she has tried to ask for education within moving skills, but it has not been settled. Education is by default given once a year, but it is done in the late spring and Emelie started during the summer so she did not have the opportunity to participate in the latest run.

Emelie relies to a great extent on her more experienced colleagues for advice and support. She knows she lacks a lot of competencies and sometimes it makes her work very hard.

Depending on who she is working with she asks more questions, as some colleagues are more helpful than others. She feels that sometimes it is hard knowing how to handle certain situations, as individuals (of the permanent staff) do things differently. This results in her having to relearn and change her routines continuously.

### A Typical Working Day

- Emelie normally wakes up about 1h before she needs to leave for work.
- She has some coffee and breakfast in front of the TV before she makes herself ready. She typically doesn't put on much make up for work, but always wears mascara.
- She usually takes her bike to work, which takes approx. 10 minutes.
- When arriving at work she makes sure to greet everyone, caregivers and care recipients.
- She prepares for the day's work by going through the planning in a short meeting with the colleagues. The night personnel brief them on the current state of care recipients.
- The typical activities for the morning are assisting care recipients out of bed, making them ready for breakfast. Emelie gladly let the care recipients take their time in the morning, as many of them are tired and can be a little weak in both knees and head before being up for a while.
- Together with her colleagues she serves and assists care recipients in their meal, someone typically needs being fed while others need less assistance.
- Emelie usually volunteer to clean up after the meal, and afterwards go to assist her colleagues if needed, or keep the care recipients company.
- Almost everyday someone needs assistance to shower, which is typically done on a schedule. It is a critical task, as the risk of falling is quite high. Therefore Emelie usually let other more educated colleagues do this firsthand, and otherwise she prefers doing it in pairs.
- At the end of her working day, Emelie takes some time for documenting. Although she hasn't worked in the nursing home that long she has been trusted with a lot of responsibility for documentation as she handles the systems fast and hassle free, compared to many other colleagues.

When the day is done, she greets her colleagues and care recipients before leaving

### Future Goals

Dreams of building a house together with her boyfriend. Still not sure about her career path, but enjoys her working situation for the time being. Wishes however to get the opportunity to receive some education, e.g. on transfer skills and delegation of medication, to advance in her work and feel more secure in her daily work.

### User Quotes

I want to learn more, but we as new staff, or people coming in as substitute personnel, are not prioritized.

I want to provide the best help I can, but I don't get the opportunity to improve.

My aunt continually reminds me to think about how I perform my job in the best way possible so that I don't hurt myself or anyone else.

Figure C.2. Persona 2: Emelie.



## Erik

### Hard facts

Erik is 37 years old and lives in a house with his wife, two children and dog in Halmstad, Sweden. Erik and his family live about 30 minutes outside the city as they all love nature and having it calm and quiet. However, Erik's both children however love to hang out with friends, so it's always a full house.

Erik has worked as an assistant nurse for 10 years now. He started working in a nursing home within the municipality, but now works at a privately owned home care service. He thinks that his current job has better working conditions and fits him better as it's more independent.

Erik studied nursing and care in high school, but he also has a specialist education in dementia and geriatric psychiatry. Erik got tired of working in elderly care for a while and retrained as a sports teacher for a few years. However, he got tired of that as well and returned to elderly care, with more experience of how the body works and the importance of moving our bodies, even for elderly people!

### Interest and Values

Erik is 37 years old and lives in a house with his wife, two children and dog in Halmstad, Sweden. Erik and his family live about 30 minutes outside the city as they all love nature and having it calm and quiet. However, Erik's both children however love to hang out with friends, so it's always a full house.

Erik has worked as an assistant nurse for 10 years now. He started working in a nursing home within the municipality, but now works at a privately owned home care service. He thinks that his current job has better working conditions and fits him better as it's more independent.

Erik studied nursing and care in high school, but he also has a specialist education in dementia and geriatric psychiatry. Erik got tired of working in elderly care for a while and retrained as a sports teacher for a few years. However, he got tired of that as well and returned to elderly care, with more experience of how the body works and the importance of moving our bodies, even for elderly people!

### Prior Knowledge

Erik has a big interest in sport and training, he takes good care of his body and is very well aware of the importance of an active lifestyle in order to live a healthy and long life. He enjoys outdoor activities the most, such as hiking or fishing.

Erik also finds it really interesting to read about psychology and how the human mind works. Everything with humans and the human body takes his attention. He often watches documentaries about humans behaviors and lifestyles, as well as about the human revolution. Getting old and weak scares him a little, but he also knows that it belongs to life.

Ever since Erik was a little kid, he has had the ability to feel empathy for other people that are struggling somehow. He has always felt a special need to help people who are in need of extra support in their everyday life. Especially those people whose brains do not function as normal, such as dementia.

Erik likes to be close to people but it's important for him to be for himself sometimes, why the home care service works better for him than working in a nursing home.

### Technical Habits

Erik owns a smartphone and computer but does not use it to a greater extent. He has never found a greater interest in technical stuff, nature and humans attracts him more. Typically turn to his kids for help when needed, as his own interest in technology is very low. However, he uses his smartphone almost daily for Social Media such as FB, and plays some games occasionally. He uses the computer mainly for emails and paying bills, approx. every other week. He also just bought a smartwatch to keep track of his heart rate and other interesting statistics about his body during the day. Such technology finds him more interesting to learn.

Erik also uses a smartphone daily in his work, as it's used to unlock/check in at residents houses, and is used for delegation of medicine/signing, which he thinks works smoothly and well.

### Work Situation

At Erik's job, they are quite far ahead with digitalisation compared to other workplaces. His bosses has started an intern project that involves digitizing and streamlining the assistant nurses' work as much as possible. Erik is a bit skeptical about this as he thinks his way of working works well today, even if it is a bit stressful at times. He argues that it takes longer to learn a lot of new technology and new ways of working.

Erik's supervisor is very concerned that all staff should feel competent and secure in their role as assistant nurses, not least when performing heavy lifts. All staff are therefore offered to attend training in movement knowledge often, too often if you ask Erik. The problem is also that these educations are often located in Gothenburg, at a company named HMC Sweden, as they are the best on the market, which is time consuming and makes Erik's job even more stressful.

Since Erik works in the home care service, he is usually on the go, or at care recipients' homes. However, his job has an office where he usually starts and ends the working day. It also happens that he stops there for coffee and food. It's not a big office, it's mostly admin staff and managers who works there, but on the other hand there are some computers, coffee machine, and a cozy corner for everybody to use.

### A Typical Working Day

- Bikes to the office to start the working day.
- On some days during the week Erik meets up with colleagues for a meeting before travelling to care recipients, other days he just parks his bike, collects whatever material he knows he will need during the day and drives off to the first stop.
- Arriving at a care recipient's house Erik either unlocks the door with his smartkey in his smartphone, or checks in the arrival on the device mounted inside the home after being let in by the resident/family, depending on the routines for the particular individual.
- He greets the resident(s) and typically helps them with showering, shaving, getting dressed, going outside for a walk or performing rehabilitation activities prescribed by rehab.
- The time spent at each stop varies depending on activities for the meeting and the status of the care recipients, however Erik often feels stressed and sometimes needs to leave early due to alarm from other care recipients.
- Erik typically enjoys his day, as most care recipients are very nice and often offer him snacks such as cookies after his visit. However, some are more hostile and do not enjoy "having strangers in their house" as they say.
- After the working day is done, Erik returns to the office for potential documentation, sometimes has a chat with colleagues, parks the car, and bikes home.

### Future Goals

Would like to advance within his career, receiving more responsibility for administrative tasks, such as scheduling or the like. Potentially even become unit manager as he believes to have ideas that can contribute to the working place.

Figure C.3. Persona 3: Erik.

# D

## Appendix: Requirement Specification

Color coding for priority: (N) = Necessary (D) = Desirable (I) = Interesting

User requirements				
Summary descriptions of the tasks that the system will support and the functions that will be provided to support them.				
	Requirement	Comment	Benefit	Source
	Learners should be walked through how to make a caregiver “status”	Learners should be presented with the status-sequence and after they should understand the importance of it and be familiar with the tasks involved	Users	Client/SMEs
	Learners should be able to carry out the training in their own pace	Module based structure	Users	User studies
	Provide a clear understanding for what knowledge and skills the user should acquire through the course	Communicate that users will not be “finished with their learning” after participating in the course Make it clear that these skills need continuous repetition and training Communicate to the user that this is one part (theory) of movement knowledge, continuous practical training is also needed → state clear learning objectives (Push for Client’s other courses/services)	Users Client	Client/SMEs User studies
	Cater to needs of different learners based on knowledge level	The learning and content can be on the right level of difficulty for the individual user. Provide additional support for learners who need it → glossary/definitions	Users	Theory User studies Client/SMEs
	Learners should be able to see your own progress and test result	Clear progress feedback throughout course	Users	Theory
	Be able to mark a question or section in the course	Offers learners overview and easy navigation, to easily go back to something interesting or something that the student did not understand	Users	Competitor analysis

Offer engaging content experience	To promote an engaging user experience, that supports learning, and that stands out from competitors.  Provide interactive exercises during course progress ( <i>Knowledge checks</i> )	Users	Theory Competitor analysis Client
Repetitive learning	Repeat critical content to promote learning - Stick to a few examples of typical transfers  Include highlights of important points/information  A clear red thread throughout the course (reconnect to previous content: learning objectives-highlights-takeaways)	Users	
Easy navigation between activities and modules	Support frictionless navigation between elements (and understandable feedback on what is accessible and not and why (locked modules))	Users	Theory Competitor analysis
Informative and clear feedback throughout the course		Users	Theory Competitor analysis
Clearly show what type of content each module/lesson consist of	So users get a feeling over next step, get a nice overview over course structure and content, and be able to plan the activities ahead	Users	Theory Competitor analysis
Offer exercises along the content	Provides repetition and supports users' reflection on the knowledge presented in each module,  direct feedback to acknowledge correct/incorrect answers  gives the user a chance to revisit content before going forward in course	Users	Theory Competitor analysis
Include a final assessment test	Determines whether you have completed the course or not	Users Stakeholders Client	Requirement from client
Enable rating and reviewing of course	Providing a course evaluation is necessary  to enable the Client to follow users' rating of the course, for improvement and promotion of their service	Client	Client/SMEs
	The reviews are not critical to display within the course, for learners to read user reviews, but interesting	Users	Client/SMEs
The course must provide users with knowledge in transfer skills	Users must rate the course as sufficient for basic knowledge in transfer skill  Must be evaluated through a course evaluation	Users Stakeholders Client	Client User studies

Presentation of the Client and the people behind the service	Providing a presentation of the client and their values is desirable, but not critical for the course.	Client Designers	Client/SMEs
Personified representation of the caretakers	Provide users with a presentation of the caretaker in order to promote a more empathic connection to the caretaker → by including an avatar → by using a representation of an individual Let the user customize the caretaker	Users	Client/SMEs
Offer discussion exercises	Discussions in group (possible both synchronous with the content (i.e. as the particular module is being completed) or afterwards (i.e. discussion after everyone has completed the entire course) → encourage participation in groups	Users	Research User studies
Personalized experience	Enable user to further explore content that is not critical for the learning objectives ( <i>“Fördjupningsspår”</i> ) Enable personalized customization of content, based on what the learner is interested in Individual overviews of progress and results (promote better collaboration and management support)	Users	User studies Research
Offer practical exercises	Encourage users to try transfer techniques in groups/with colleagues Maybe not feasible due to lack of space and moving aids available	Users	User studies (questionnaire)
Offer a glossary (or “read more”) sessions in the course	Especially important for users who do not have any prior knowledge and thus need further support	Users	Theory Competitor analysis
Offer to participate in practical training both at home and in the workplace		Users	User studies
Make it personal by adapting the course to different conditions	Based on workplace, what moving aids are available, colleagues	Users	Research User studies
Offer “follow-up” of moving knowledge	After taking the “basic course”, be able to follow-up and update their knowledge continuously	Users	User studies
Be able to preview courses	Preview in Mitt HMC of other (relevant) courses that have not been published yet	Users Client	User studies

Be able to delete a course	After completing a course the user should be able to delete or hide it from her dashboard	Users	User studies
Be able to see the average result/grade on the course		Users Client	User studies
Communicate with <i>Förflyttningshjälpen</i>	Not prioritized at this point, future goal.	Users Client	Client / SMEs

## Usability requirements

Requirement and goals, set performance goals that include success rates and the time it takes users to find specific information, or preference goals that address satisfaction and acceptance by users

	Requirement	Comment	Benefit	Source
	Short learning curve of navigation	Users must quickly learn the course structure and how to navigate it  Provide clear mapping between headings - content → provide guided tour if needed	Users	Theory
	The application should be easy to understand and learn	Learnability - how easy is it for users to accomplish basic tasks the first time they encounter the design?	Users	Theory
	The application should be efficient to use	Once users have learned the design, how quickly can they perform tasks?	Users Managers	Theory User studies
	The application should support memorability	When users return to the design after a period of not using it, how easily can they reestablish proficiency?	Users	Theory

# E

## Appendix: Component Library List

Content (static)				
Block	Alternatives	Customize	Settings	Comment
Text	<ul style="list-style-type: none"> <li>– Paragraph with heading</li> <li>– Paragraph</li> <li>– Paragraph with subheading</li> <li>– Heading</li> <li>– Subheading</li> <li>– Two column paragraph</li> </ul>	<ul style="list-style-type: none"> <li>– Change font</li> <li>– Change size</li> <li>– Select bold, italic, underline, strikethrough</li> <li>– Change color</li> <li>– Alignment</li> <li>– Ordered list</li> <li>– Unordered list</li> <li>– Emojis?</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Background Color</li> <li>– Animations?</li> </ul>	
Statement / Highlight	<ul style="list-style-type: none"> <li>– Statement A</li> <li>– Statement B</li> <li>– Statement C</li> <li>– Statement D</li> </ul>	<ul style="list-style-type: none"> <li>– Text</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Background Color</li> <li>– Animations?</li> </ul>	<p><i>Must be linked to the learning objectives and the final test</i></p> <p><i>The design component should "pop" from the remaining elements and text in the course.</i></p> <p><i>Laws - do you want to be able to refer to sources?</i></p> <p><i>(Develop different design solutions so you can choose from a variety of alternatives)</i></p>
Chart	<ul style="list-style-type: none"> <li>– Bar chart</li> <li>– Line chart</li> <li>– Pie chart</li> </ul>			
Note / info				<p><i>Sidenotes, info</i></p> <p><i>Potentially hidden?</i></p>
Quote	<ul style="list-style-type: none"> <li>– Quote A</li> <li>– Quote B</li> <li>– Quote C</li> <li>– Quote D</li> <li>– Quote on image</li> <li>– Quote carousel</li> </ul>	<ul style="list-style-type: none"> <li>– Quote</li> <li>– Name</li> <li>– Avatar</li> <li>– Source?</li> <li>– Add quotes</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Background Color (block section)</li> <li>– Border (show or not)</li> <li>– Background Image (quote)</li> <li>– Animations?</li> </ul>	<p><i>User quotes</i></p> <p><i>Laws - add sources?</i></p> <p><i>(Develop different design solutions so you can choose from a variety of alternatives)</i></p>
List	<ul style="list-style-type: none"> <li>– Numbered list</li> <li>– Checkbox list?</li> <li>– Bulleted list</li> <li>– Text &amp; image</li> </ul>	<ul style="list-style-type: none"> <li>– List item</li> <li>– Content text</li> <li>– Image</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Background Color</li> <li>– Dot / number color?</li> <li>– Image size</li> </ul>	<p><i>"Designed" list in course</i></p>
Image	<ul style="list-style-type: none"> <li>– Image centered</li> <li>– Image full width</li> <li>– Image &amp; text</li> <li>– Text on image</li> <li>– GIF:s</li> </ul>	<ul style="list-style-type: none"> <li>– Image</li> <li>– Add a caption</li> <li>– Content text</li> <li>– Add alt tag (alt text for accessibility)</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Background Color</li> <li>– Zoom on click?</li> <li>– Animation hover?</li> </ul>	<p><i>For only one individual image</i></p>

Gallery	<ul style="list-style-type: none"> <li>– Carousel</li> <li>– Two column grid</li> <li>– Three column grid</li> <li>– Four column grid</li> <li>– Right vs wrong</li> </ul>	<ul style="list-style-type: none"> <li>– Images</li> <li>– Captions</li> <li>– Add text</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Background Color</li> </ul>	<p><i>For more than one individual image</i></p> <p><i>For right vs wrong-images, highlight with icons</i></p>
Multimedia	<ul style="list-style-type: none"> <li>– Audio</li> <li>– Video</li> <li>– Embed</li> <li>– Attachment</li> </ul>	<ul style="list-style-type: none"> <li>– Upload content</li> <li>– Add a caption</li> <li>– Add relevant/ next / show more videos</li> <li>– Add alt tag (alt text for accessibility)</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Video Width (small, medium, full width)</li> <li>– Border</li> <li>– Cover image</li> </ul>	<p><i>Is there a scenario where you would just want a sound?</i></p> <p><i>Must follow accessibility laws</i></p> <p><i>You should always allow expanding the video</i></p> <p><i>Have smaller videos on the side that are relevant but selectable to watch (discussed with SME → see more examples)</i></p>
Question - answer	<ul style="list-style-type: none"> <li>– Only text</li> <li>– Text &amp; Images</li> <li>– Two-column grid</li> </ul>			<p><i>Ask a questiond, and provide answer</i></p>
Timeline		<ul style="list-style-type: none"> <li>– Date</li> <li>– Event Titel</li> <li>– Description</li> <li>– Media (image and video)</li> <li>– Record audio</li> </ul>		<p><i>Scroll</i></p>
Process				<p><i>Scroll, highlight the current state, but also display the others?</i></p>
Demonstration				<p><i>Visual examples?</i></p> <p><i>(Potentially very similar to Process)</i></p>
Example / Scenario / Demonstration	<ul style="list-style-type: none"> <li>– Recurring example that is successively built up</li> <li>– Stand-alone examples</li> </ul>			<p><i>Highlight these in the course → easier to follow the red thread throughout?</i></p>

## Content (interactive)

Block	Alternatives	Customize	Settings	Comment
Accordion		<ul style="list-style-type: none"> <li>– Item (title)</li> <li>– Description</li> <li>– Add image</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Accordion behavior (keep items open or open only one item at a time)</li> <li>– Zoom on click? (image)</li> <li>– Background Color</li> <li>– Change icon?</li> </ul>	<p><i>Able to change icons (plus; arrow)</i></p>
Tabs		<ul style="list-style-type: none"> <li>– Item (title)</li> <li>– Description</li> <li>– Add image</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Zoom on click? (image)</li> <li>– Background Color</li> </ul>	
Interactive Images				<p><i>Images that are clickable, displaying larger image + descriptive text upon click.</i></p> <p><i>Pro for the exploratory part and e.g.to gather many alternatives for grips in one place but the opportunity to read more about them. Same for lifts.</i></p>
Labeled graphic (hotspots)		<ul style="list-style-type: none"> <li>– Place hotspots on image (drag and drop?)</li> <li>– Edit hotspot: Item (title) Description (text) Marker style (icon)</li> <li>– Add Media (image or video file)</li> <li>– Record audio?</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Image width (small, medium, full-size)</li> <li>– Marker Color</li> <li>– Background Color</li> </ul>	<p><i>Provide different icons on the hotspot</i></p> <p><i>(e.g. plus, arrow, heart, question mark, right, wrong, number)</i></p>

Process	<ul style="list-style-type: none"> <li>– Different layouts</li> <li>– Different progress bars</li> </ul>	<ul style="list-style-type: none"> <li>– Introduction</li> <li>– Step 1</li> <li>– Step 2</li> <li>– ...</li> <li>– Summary</li> </ul> <p>Each section: Titel Description Media (image or video) Audio</p>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Step label</li> <li>– Zoom on click? (image)</li> </ul>	<i>Provide flexibility for choosing various types of layouts and progress bars?</i>
Scenario	<ul style="list-style-type: none"> <li>– Text</li> <li>– Dialogue</li> </ul>	<ul style="list-style-type: none"> <li>– Divided into different scenes</li> <li>– Create different scenes</li> <li>– Choose background and character for each scene</li> <li>– Add dialogue text</li> <li>– Create different feedback and follow-up questions</li> <li>– Select where the specific answers will navigate users (go to which scene)</li> <li>– End scenario</li> </ul>		<p><i>Dialogue with the participants, explanations, questions + answer options, choices, we give feedback</i></p> <p><i>Part of the end of the course?</i> <i>Go through a whole movement sequence?</i></p> <p><i>Allow for retrying.</i> <i>If they answer wrong if there is right or wrong, let them try again, otherwise they will be forwarded to the next view</i></p>
Flashcard (flip)	<ul style="list-style-type: none"> <li>– Grid (horizontally aligned)</li> <li>– Stack (vertically aligned)</li> </ul>	<ul style="list-style-type: none"> <li>– Add cards</li> <li>– Each card, decide what content to include front and back: text, image full card width, text &amp; image</li> </ul>	<ul style="list-style-type: none"> <li>– Padding Top</li> <li>– Padding Bottom</li> <li>– Interactive card hint (flip icon) (checkbox include or not)</li> </ul>	<p><i>On each card decide what should be on the front and back.</i></p> <p><i>Stack if you want bigger cards.</i></p> <p><i>Allow for adding images.</i></p>
Cards	<ul style="list-style-type: none"> <li>– About us</li> </ul>			<i>Read more by expanding the card through click.</i>
Timeline				<i>Interactively, when you hover / pull on something, the content changes</i>
Cause and effect	<ul style="list-style-type: none"> <li>– Step-by-step, ends with result</li> <li>– Interactive image with filter</li> </ul>			<i>Showing how much a certain action affects the result, as e.g. when you let the patient be involved in the transfer, it becomes so much easier, if we also have the right aids, it becomes so much easier, if you are also right with your body, it becomes even easier.</i>
Link	<ul style="list-style-type: none"> <li>– Button</li> <li>– Link</li> </ul>			<i>Link to another lesson or sections in the lesson (in the summary)</i>

## Content (input)

Block	Alternatives	Customize	Settings	Comment
Reflective question				<p><i>Question / answer section, we ask a question, the participant answers it and submit an answer</i></p> <p><i>Display the answers of others.</i></p>

## Exercises

Knowledge check	<ul style="list-style-type: none"> <li>– Sorting activity</li> <li>– Multiple choice</li> <li>– Multiple response</li> <li>– Fill in the blank</li> <li>– Matching?</li> <li>– True or false</li> </ul>	Sorting activity: <ul style="list-style-type: none"> <li>– Add categories</li> <li>– Feedback - shake element when wrong, correct icon when right</li> <li>– Add points/achievements to knowledge checks</li> </ul>		<i>Gamification?</i>  <i>It is important to give feedback on all knowledge checks even if users answer incorrectly.</i>  <i>Show how many cards there are in total and how many you have left.</i>  <i>Completing the activity → receive an achievement?</i>  <i>Collect rewards during the course?</i>  <i>Enter the number of points that you should be able to collect when creating a test your knowledge exercise</i>
Walkthrough/scenarios	<ul style="list-style-type: none"> <li>– Status assessment</li> <li>– Risk assessment</li> </ul>			(Quite specifically for the client)  <i>Start an exercise?</i>  <i>(If they become too bulky and you want 100% focus on this particular exercise, plus if it should be optional so not all content needs to be loaded if you still do not intend to do the exercise?)</i>

## Test

Block	Alternatives	Customize	Settings	Comment
Quiz	<ul style="list-style-type: none"> <li>– Multiple choice</li> <li>– Multiple Responses</li> </ul>		<ul style="list-style-type: none"> <li>– Add pictures (hotspots?)</li> </ul>	<i>Choice between multiple choice and multiple responses</i>  <i>Add alternatives/answers</i>  <i>Check correct answer</i>  <i>Add feedback on:</i> <ul style="list-style-type: none"> <li>– Any response</li> <li>– Correct / Incorrect</li> <li>– By choice</li> </ul>

## Layout

Block	Alternatives	Customize	Settings	Comment
Lesson Header	<ul style="list-style-type: none"> <li>– Lesson</li> <li>– Summarize</li> <li>– Final test</li> </ul>	<ul style="list-style-type: none"> <li>– Change content in selected templates</li> <li>– Add a challenge?</li> </ul>		<i>Layout by default?</i>  <i>When you create a new lesson and go to add content, there is always a header there by default with Title, Description, Time, etc</i>  <i>Alternatively, you can choose between having a lesson layout, summary or final test layout.</i>
Divider	<ul style="list-style-type: none"> <li>– Spacer (tom - white space)</li> <li>– Divider line</li> <li>– Divider dots</li> <li>– Numbered divider</li> </ul>			<i>To separate the content, give the participants breathing space, also makes it much easier to scan the content</i>
Loading screen	<ul style="list-style-type: none"> <li>– Between lessons</li> <li>– Between modules</li> </ul>			

Background	<ul style="list-style-type: none"> <li>– Color</li> <li>– Image</li> </ul>	<ul style="list-style-type: none"> <li>– Size</li> <li>– Place</li> </ul>		<i>Background for the whole lesson?</i>
Button content	<ul style="list-style-type: none"> <li>– Label (vad som ska stå i knappen)</li> <li>– Completion Type (always show button, complete block directly above, complete all blocks above)</li> </ul>			<i>Button in the course to "start" or "continue" to the course</i>
Summary				<i>The summary sections should stand out from the remaining lessons</i>  <i>Provide alternatives to either start a new lesson, summary, final test, or evaluation.</i>

## Other features

Block	Alternatives	Customize	Settings	Comment
Highlights in the course	<ul style="list-style-type: none"> <li>– When talking about step 1 in the HMC - method</li> <li>– When talking about step 2 in the HMC - method</li> <li>– When talking about step 3 in the HMC - method</li> </ul>			<i>Highlight throughout the course when talking about step 1, step 2 and step 3 in the course.</i>  <i>Be able to change the opacity / highlight design components</i>

# F

## Appendix: Feedback from Users: High Fidelity Prototype

**Table F.1**

*Summary of various feedback from user evaluations mapped towards the E-learning Usability Properties Framework, including eventual adjustment to prototype.*

Category of Usability Properties	Usability Attribute	Feedback	Adjustments
<b>Works well-paradigm</b>			
Communicate enablement	Effectiveness	<p>The activity “process” is clear. It is clear what to do and the buttons to navigate to the next step calls for action.</p> <p>The activity “reflection” is clear as it stands exactly what to do. However, it is probably very individual if participants really stop and reflect here, or just scroll further.</p>	
	Efficiency	<p>The activities become clearer as you go through the course, or when the test leader explains it.</p> <p>Activities in the beginning of the course are harder to grasp just by looking at them. However, after having an activity explained to you, it becomes easier to understand the next one.</p>	Add clear and simple exercises in the beginning of the course and gradually increase the degree of difficulty.

	Flexibility	<p>Good to be able to minimize the navigation window if you want all your focus on the content, and maybe see better.</p> <p>The activities that navigate to a modal view are felt unclear and confusing at first. Participants did not even notice the change of navigation as they were so focused on the content.</p> <p>It would be nice to be able to enlarge the text if needed to.</p>	<p>In the modal view, all focus should be on the task, the navigation menu should be hidden and a clear back to the course button should be visible at all times.</p>
	Memorability	<p>After going through one lesson you understand the overall structure in the e-course. That it is divided into different sections with content and activities.</p> <p>Remember that the needle icon indicates that there is something in the content that is extra important to remember.</p>	<p>Add a guided tour at the beginning of the course.</p>
	Operability	<p>The activity “flip cards” is super clear, and fun. It is clear that the arrow is clickable, and that clicking it results in information being presented.</p> <p>The activity “tabs” is super clear.</p> <p>The activity “true or false” is really clear, not so advanced.</p> <p>The activity “risk assessment” was unclear and confusing. The participants wanted to click and interact with the design elements before reading the descriptions.</p> <p>The activity “check your knowledge” is clear. Understandable that you should answer the question and be rewarded a star.</p> <p>The activity “hotspots” was super clear. Good to read more about topics if you want.</p>	<p>Changed the order of elements in the risk assessment activity so that the text with a description (what to do) comes first and then the interactive design elements.</p>
Navigation	Effectiveness	<p>The navigation menu feels clear.</p> <p>Understand what happens if you click on a module or lesson in the navigation menu.</p> <p>Too small text on the button that navigates to the next lesson.</p>	<p>Made the button to go to the previous or next lesson bigger and clearer. Added a hover to highlight that the button is clickable.</p>

	Understandability	<p>A little bit confusing that the prototype didn't start at the first lesson in the course (jumped straight into the course during the evaluation)</p> <p>Unclear how to pause or end the course.</p> <p>If you have paused or end the course, it would be nice to see which lesson and module you are at and start from there.</p>	<p>Added the first lesson in the e-course to the high fidelity prototype.</p> <p>Added to future work that it should be clear how to go back or end the course (as platform has not been decided yet). Also that the system automatically updates and presents where you left off.</p>
	Flexibility	Good to see the lessons for each module, even though they are locked. Then you get a feeling of what comes next, for those who are interested.	
	Learnability	After going through one lesson you understand the overall navigation in the e-course.	
	Memorability	Wants the system to automatically save where you left off but also have the opportunity to redo the entire course for repetition.	
Technical functionality	Effectiveness		
Learner Support	Efficiency	<p>Direct feedback is good and desirable when conducting activities. You definitely want to see the correct answer immediately here so you can learn until the final test.</p> <p>Really good to highlight difficult words and offer explanations for those who have not heard them before. Great function!</p>	

	Understandability	<p>Problem understanding what the different progressbar stands for (lessons, modules, entire course). When the test leader explains, it becomes super clear.</p> <p>It is not so important to see progress for every lesson or module. The most important progress to see is for the entire course, maybe that's enough.</p>	Added hovers explaining progress bars.
<b>Looks good-paradigm</b>			
Presentation	Attitude and satisfaction	<p>Clear and good illustrations and images. Including arrows and highlights in the images are really nice.</p> <p>It feels like a qualitative and fun course.</p>	
	Attractiveness	Lovely colors, they feel calming and motivating!	