Hochschule Hannover
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Digitalization of trainings in the Business environment

Using the example of an E-Learning production in the field of occupational safety and environmental protection

Bachelor's Thesis

in the Information Management course of study

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Abstract

This research focuses on the fundamental ideas and underlying principles of E-Learning technology, as well as theoretical considerations for an optimal learning environment. This theoretical exploration was then used as a basis for the design and construction of a new, interactive Web-Based ESH-Training. The quality and effectiveness of this new course was then compared with that of the existing analog PDF-Training via a test with a diverse sample of employee learners. Learners were later surveyed to ascertain their views on both trainings in terms of the quality of the content, facilitator, resources, and length. Results clearly showed that regardless of demographic factors, most employee learners preferred the new, Web-Based ESH-Training to the analog PDF-Training.

Contents

List of abbreviations

cf	Confer/Compare
CoE	Cone of Experience
Conti	Continental AG
CTML	Cognitive Theory of Multimedia Learning
DLA	Decentral Learning Administrator
EIT	Electronic Interactive Material
ES	Environment, Safety and Health
HR	Human Resource
Ibid.	Ibidem/ like citation above
ILO	Internal Learning Organizer
KEM	Kirkpatrick Evaluation Model
L&T	Learning and Training
LBP	Learning Business Partner
LD	Learning Designer
LMS	Learning Management System
n. d.	no date
NTTS	Neural Text -To-Speech
PDF	Portable Document Format
PDF-T	Portable Document Format-Training
PSD	People Services Deutschland
SME	Subject Matter Expert
SSML	Speech Synthesis Markup Language
TTS	Text-To-Speech
VVa	Vahrenwalder Strasse (headquarter’s location site of continental)
W3C	The World Wide Web Consortium
WBT	Web-Based-Training
XML	Extensible markup language

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1 Introduction

A business whose workers share the same values and attitudes towards environment, safety, and health (ESH) may be able to create a pleasant work environment where employees can do their duties without incurring excessive risk. But the evidence shows that analog PDF-Training does not aid employees' learning process or create a stimulating environment that is conducive to learning, and it is essential to address this shortcoming. A more effective training strategy is for every employee to have a stronger grasp of ESH and to communicate this information utilizing a manner that seeks to create the best learning environment possible. Digital education is becoming more important and more accessible than ever before as a direct consequence of technology breakthroughs. Due to the advent of internet resources, there is no dearth of data (cf. Spitzer 2007, S. 3). With the advent of digital technology, the way we interact, do business, and go about our everyday lives has experienced profound transformation (cf. Rachinger et al. 2019). As a result, the digital revolution has had a substantial influence on human resources (HR) and how HR is done. Personnel departments have transitioned from paper-based departments to data-driven departments that use technology to improve company management. Today, human resources departments are the backbone of every organization, ensuring that employees are more motivated, and that the firm works more efficiently (cf. Manuti and de Palma 2018, p.1).

This thesis provides a replicable case study for the effective digitization of an ESH-Training according to contemporary pedagogic theories and learning technologies. The focus is on the construction of a Web-Based-Training (WBT) sequence; hence, the emphasis is on the content production phase.

1.1 Background

Continental AG is one of the leading automotive, tire, and technology suppliers in Europe. The company was established in 1871, and it currently has several divisions that focus on cars on the one hand, and rubber manufacturing on the other (cf. Continental AG 2022a). One of the world's largest tire manufacturers, Continental, along with Bridgestone (Japan), Michelin (France), and Goodyear (USA), is a subsidiary of the Continental Group (cf. Statista 2022). Approximately 244,000 individuals are employed by the firm across 554 locations and 61 countries worldwide (cf. Continental AG n.d.). Since the beginning of the company's history, Hanover has served as the location for the group's administrative headquarters and supervisors (cf. Continental AG 2022b).

Opportunities for training and ongoing education are something that Continental AG strives to provide for its employees, and the company is continually seeking new methods to do so. In addition to this, workers are required to finish a significant amount of mandatory learning and training content, such as ESH (Environmental, Safety, and Health) instructions.

1.2 The Current and Target Situation

Digitalization has had a profound impact on the modern world, revolutionizing the way we communicate, do business, and live our lives (cf. Rachinger et al. 2019, p.1144). The automotive industry is undergoing massive transformations because of the rising importance of software development in vehicle development and transportation electrification. Consequently, Continental automobile manufacturers and suppliers are being driven to convert many of their conventional training settings to more modern digital formats to efficiently train employees. The firm is currently in the process of implementing a worldwide "Learning Management System" (LMS, see chapter 2.2.3.1) as part of an infrastructure that will serve as a centralized E-Learning platform for all employee groups. The new learning platform is expected to provide

benefits in the areas of tracking and access control; increasing the pressure on HR to ensure that employees participate in certain mandatory training courses, especially those related to ESH.

Health and environmental protection, as well as occupational safety and security, are becoming increasingly important for industrial enterprises to meet. Employers are responsible for providing safe working conditions and holding employees accountable for maintaining them in order to reduce the risk of workplace injuries and illnesses, protect operating facilities and equipment, and ensure business continuity (cf. BMAS 2021).

To successfully incorporate electronic media into ESH-Trainings, a methodical, scientific, and forward-thinking strategy is required (cf. Konermann and BG RCI KC Qualifizierung 2020, p.5). When a company decides to use WBT for ESH education, three legal conditions must be met: Firstly, training must be customized to the workplace; secondly, a comprehension test is necessary; and finally, contact information for questions must be supplied. Additionally, the instruction must be documented so that the business owner may demonstrate compliance. (cf. Kring 2021, DGUV 2014, p.26).

The problem is that many of the training settings that are now available in these areas do not match the company's ambition to train employees according to the most effective, digital technological and pedagogic frameworks. Current trainings provided by the firm are often static educational formats consisting mostly of large text sections that employees are expected to read and comprehend on their own (see Table 1.1).

To address this issue, the company's Learning and Training (L&T) department is constructing new learning to incorporate new technologies as well as learning and design theories. These new learning formats include interactive Web-Based-Trainings (WBT) as well as explanatory videos.

Recently, the company's ESH department in the Vahrenwalder-street location site (VVa) has decided to digitalize its annual ESH-Training in collaboration with the L&T- Team in the People Services Deutschland (PSD) department to enhance the learning experience and ultimately to improve the culture of the ESH internally. This would allow the company to comply with the European Council directive on health and safety at work, requiring all member states to guarantee that employees are informed and consulted on health and safety matters (cf. Council Directive 1989).

Employees are currently provided ESH guidance in an analog PDF format that is not based on didactic principles and does not meet the company's technical standards. For the wellbeing of the employees, this situation must be rectified by providing an interactive, theory-based, and Web-Based ESH-Training to the employees, which also meets the firm's technical requirements (see Table 1.1).

This thesis will demonstrate how electronic media can been used to develop a higher-quality Web-Based ESH-Training than the traditional analog PDF-Training.

Table 1.1 current and target situation

Current	Target
Analog PDF-Training	Interactive Web-Based-Training
Not based on didactic principles	Based on didactic principles (theorized)
Does not fulfill the technical standards of the company	Satisfy corporate technical requirements

1.3 Research Question

The experiment aims to find general indications for improved quality of learning measures. Therefore, an analog PDF-Training format will be compared to an interactive WBT. The two different learning formats will be assigned to the same sample of participants, and their evaluations will thereafter be compared. This leads to the following research questions:

1. Does a WBT improve the quality of an ESH-Training in comparison to an analog PDF-Training?

To answer this question. We first try to answer the following sub-questions

2. What is the optimal design for a WBT?
3. Is it possible to measure the quality of the training?

The analog PDF-Training will be referred to as (PDF-T) throughout this thesis, while the interactive Web-Based-Training will be referred to as (WBT).

1.4 Thesis Structure

The aim of this thesis is to determine if a WBT improves the quality of an ESH-Training in comparison to a PDF-T. A current ESH PDF-T is converted to an interactive WBT based on learning and design theories. The two learning sequences are then evaluated based on the qualitative feedback from the participants. The findings from this evaluation are then used to the research question.

The thesis is divided into three parts; The first part, “Theory & Literature Review” (see Figure 1.1) focuses on the theorical context of learning design as well as the learning and design theories that provide the theoretical backbone of this thesis. The second part, “Creation of Digital Learning Resources” (see Figure 1.2) describes how the WBT was developed utilizing the concepts and methodologies presented in the previous chapter. The final sections, “Experiment” and “Discussion of Results”) contains the analysis of the data collected and its implications for ESH-Trainings specifically as well as corporate learning programs in general.

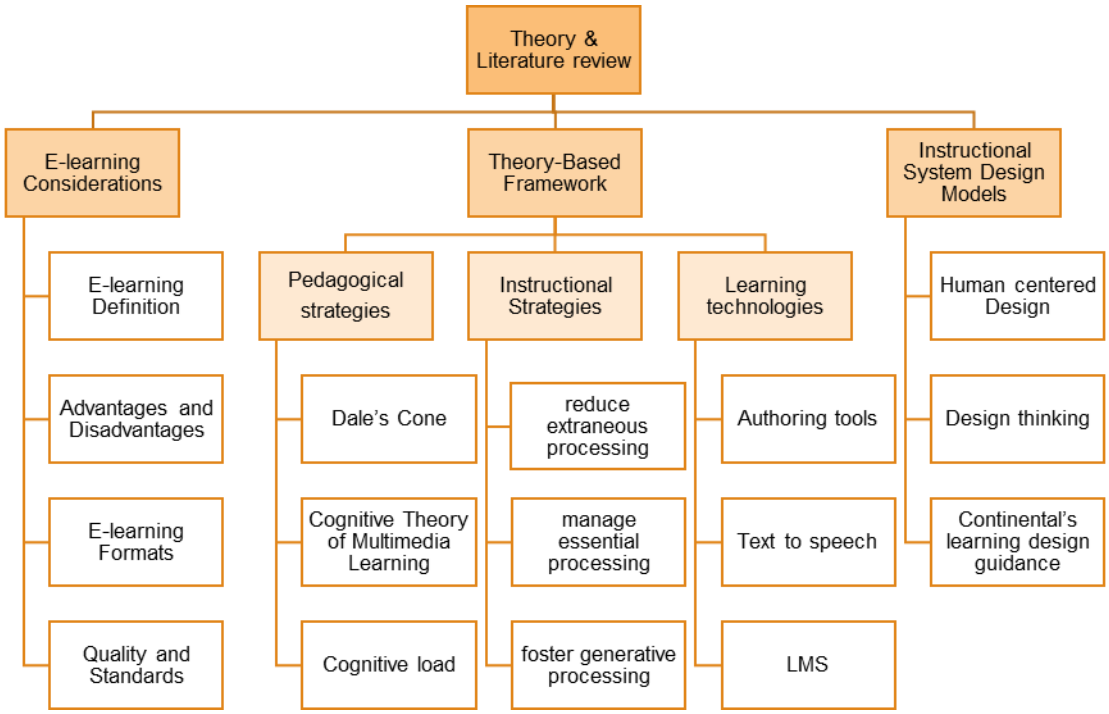


Figure 1.1 The Chart of the Theory and Literature Review chapter

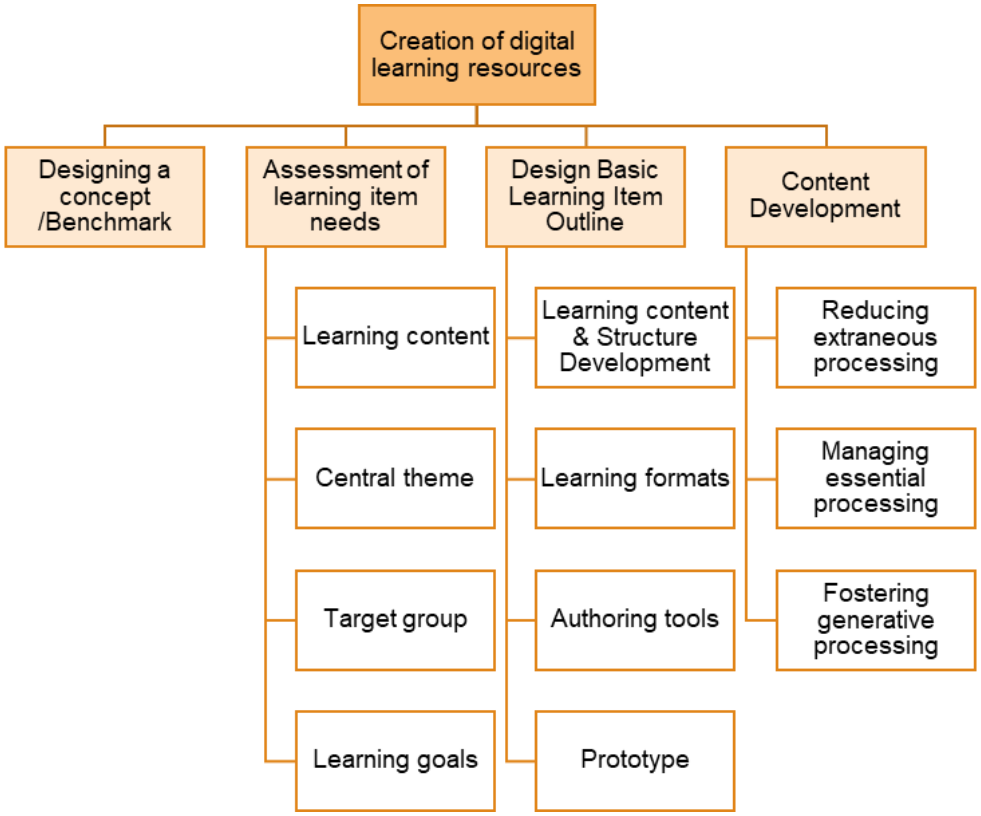


Figure 1.2 Chart of the creation of digital learning resources chapter

2 Theory & Literature Review

This chapter provides an overview of the different E-learning formats as well as an explanation of the pros and drawbacks of E-learning and why it is essential to examine its quality. The chapter also looks at various significant theories that were used to help in the development of the WBT in this study. In addition to a full description of the instructional System Design Model employed in the creation of the WBT.

2.1 E-Learning Considerations

E-Learnings are a cutting-edge method to facilitate learning processes and disseminate information that have gained widespread acceptance in recent years. Instructional programs for on-the-job training are plentiful and may be accessed by employees at any time. The promise is that businesses will be able to release their managers while still carrying out their legally necessary training (such as ESH-Training) in a way that is both effective and compliant. That is why so many businesses are already taking advantage of this opportunity (cf. Konermann and BG RCI KC Qualifizierung 2020, p.1).

The definition of E-Learning, its forms, benefits, and downsides, how to choose the best authoring tools for developing high-quality E-Learning, and the necessity to adopt standards are all discussed here.

2.1.1 E-Learning Definition

Electronic learning is another term for what is now more often known as E-Learning. The word refers to learning that is accomplished partly or totally via the use of electronic technology. E-learning is a catch-all term for any kind of education that may be facilitated in any manner by a technological, digital, or electronic medium. This involves the presentation and distribution of learning materials in the context of teaching and learning settings, as well as communication through electronic media. There is no widely agreed definition of E-Learning now (cf. SGD 2015). The fact that the term "E-Learning" is spelled in so many ways demonstrate the ambiguity around its meaning (cf. Grunder et al. 2013, p. 17). One of the numerous definitions of E-Learning in businesses is "a word that refers to teaching or information packages for (internal) further training that are delivered to the learners (workers) electronically as online commodities or by CD-ROM and are available regardless of time or place." This kind of instruction is known as "E-Learning." They feature easily consumable factual material, self-testing components, and a sequence of tests that allow for rapid (self-)checking of learning outcomes. The goal is to provide "just in time" access to information that is required on short notice and to make that knowledge learnable. The objectives are always placed within a level range for simple learning objectives (cf. Dichanz and Ernst 2001, p.7). In a business setting, E-Learning may also be referred to as "corporate training." Reaching the strategic goals of a business via the use of reliable learning is the most important aspect of E-Learning in companies (cf. Chen 2014, p.45).

2.1.2 E-Learning Formats

The advancement of technology influences how people learn and communicate. Currently, the Internet facilitates social networking and collaborative work. Information is made available on several learning platforms, and the learning environment is designed to enable a variety of independent or collaborative learning activities (cf. Rüter 2015). Several E-Learning formats, as well as combinations thereof, are implemented, including: "all online, blended or hybrid, asynchronous or synchronous." The online and asynchronous methods of learning allow learners to enhance their knowledge and abilities at their own speed. Asynchronous learning

differs from online learning in that there is some contact between learners and teachers. Blended or hybrid learning is a style of learning that combines face-to-face and online learning. The online part of this learning can come in many different forms, such as documents, interactive E-learnings, presentations, explanatory videos, screen recordings, and other interactive media (cf. Chen 2014, p. 45; Mitchell and Honore 2007, p.145).

The following chart (see Figure 2.1) provided by the mmb Institute (2019) illustrates the many tools and formats in a methodical manner. On the one hand, the graphic organizes the E-Learning modes according to "formal" (i.e., from top to bottom) and "informal" (bottom-up, organized from below). Individual learning (each for himself) and collaborative learning are distinguished along the left axis (learning together).

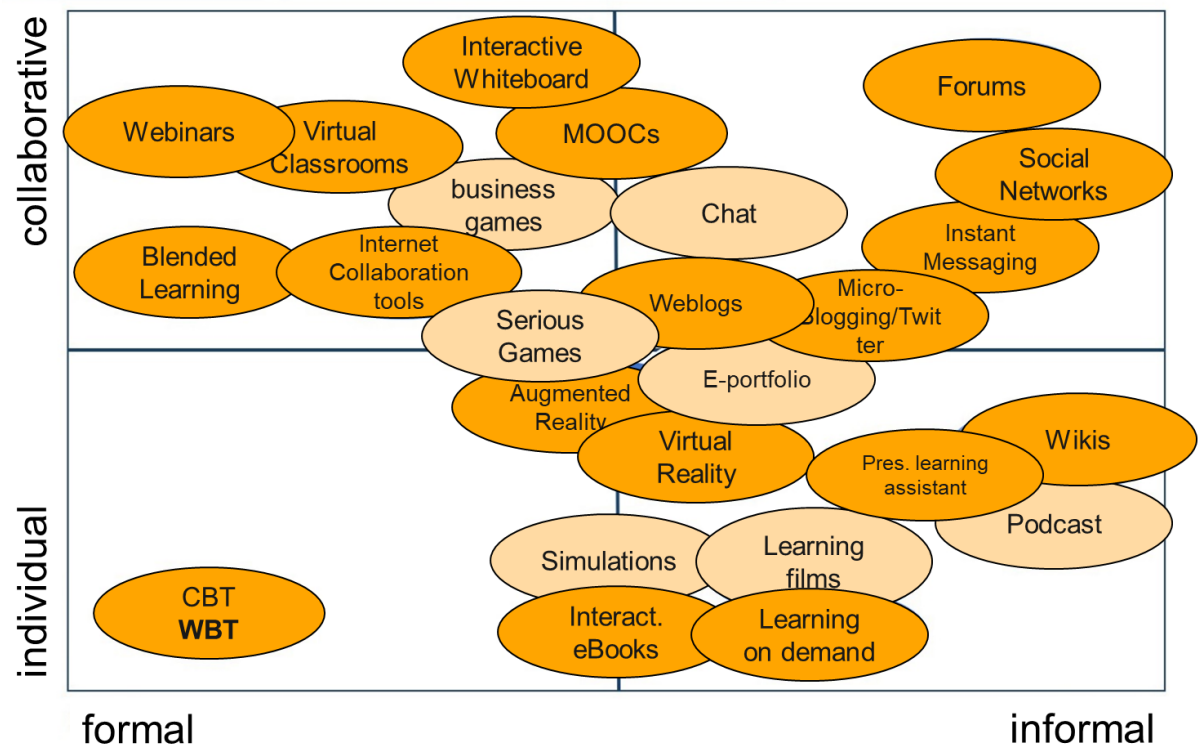


Figure 2.1 Overview of digital forms of learning

Most relevant in this thesis is the WBT that refers to multimedia-based and hyper-media-structured learning programs delivered through the Internet. They are regarded as an advancement of the Computer Based Trainings (CBTs) that are made accessible on a data carrier. WBTs, unlike CBTs, may be quickly updated and extended to incorporate connections to other websites, as well as integrated into (synchronous or asynchronous) communication processes between learners and instructors (cf. Lutz 2019).

2.1.3 E-Learning Quality

E-learning quality is a wide-ranging subject matter. It all depends on the context in which it's utilized. There is no social, political, or scholarly consensus in any country on what constitutes a high-quality education. The use of market-oriented methods, government-driven consumer protection measures, accrediting concepts, and institutional endeavors seek to priorities quality. Approaches may be either explicit or implicit, depending on the professional competence of the person using them. As always, quality is defined in the context of norms. It is always a matter of what is in the best interest of the parties involved. Even in the areas of social and educational services, where we cannot rely on a set of "virtual laws of nature" and instead must

make compromises between diverse academic ideas and subjective, political, and social goals (cf. Ehlers and Pawlowski 2006, p.2).

2.1.4 E-Learning advantages and disadvantage

The digitization of business training has increased flexibility, which is especially significant for small enterprises whose owners may lack the time or funds to attend in-person training. Digital training also allows for more scalability, which is essential for larger companies that must provide mandatory trainings to managers and employees in numerous locations. Digital training is also available from any place at any time, allowing for just-in-time learning, which is helpful for those who want to study on the go. Furthermore, it eliminates the need for travel expenses or classroom facilities. E-Learning enables both standardized and self-directed learning, as well as flexible assessment techniques. However, E-Learning does have its drawbacks, the most notable of which being the prerequisites of having access to a computer and the Internet, as well as a certain degree of technical expertise. Inadequate levels of self-discipline and motivation are also potential stumbling blocks to overcome. In addition, there is no face-to-face contact, which results in response times that are longer than those in traditional learning. The following (Table 2.1, cf. Henry et al. 2014 pp. 2-3; Hosseindoost et al. 2022, p.2) is a concise list of its pros and disadvantages.

Table 2.1 Advantages and disadvantages of E-Learning

Advantages	Disadvantages
Enhanced scalability	Requires computer access
Just-In-time learning	Requires internet access
Reproducible & standardized learning	Requires basic computer skills
Autodidactic (Self-paced) learning	Lack of self-discipline or motivation
Flexible evaluation methods	Lack of Face-to-face communication
No travel charges	Delayed answers
No classroom facilities	Development takes a long time
Cost-effective	Requires self-motivation

2.2 Theory-Based Design Framework

Due to the variety of learning theories and interpretations of the learning process, it is difficult for a single perspective to realize the entire learning process and provide a comprehensive framework for it. As a result, the learning designer must answer numerous questions regarding the characteristics of learners and how they learn, the conditions that facilitate this learning, and the appropriate educational materials.

Coleman et al. (1997)'s definition of educational models and techniques, and Hannafin's (1992) work on tasking the learner with producing personal meaning representations, form the theoretical foundation for Dabbagh (2005)'s theory-based framework for developing an E-Learning, which identifies three primary components: pedagogical, instructional, and technological (see Figure 2.2, cf. ibid.).

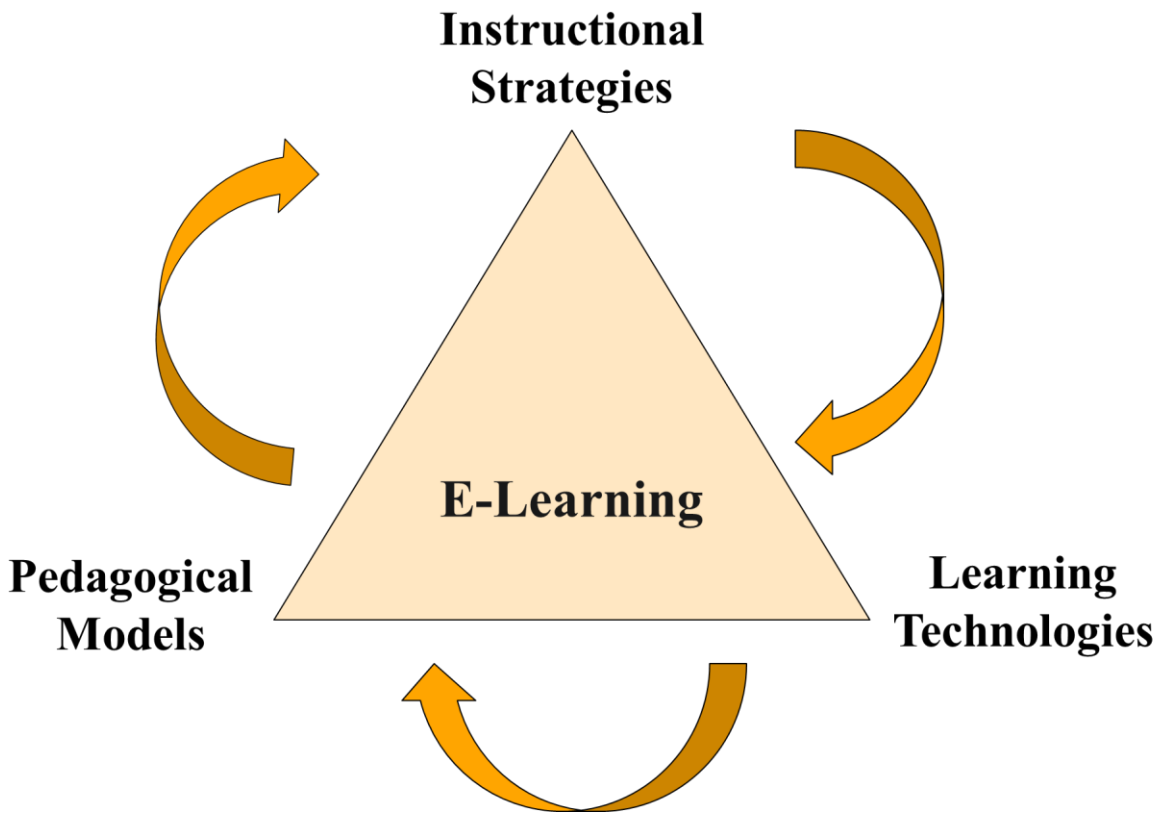


Figure 2.2 A Theory-Based Design Framework for E-Learning

Dabbagh (2005) says that the first stage in developing an E-learning course is to define the pedagogical model, which is a set of cognitive models and theoretical constructs derived from theories of knowledge acquisition and the foundations of learning theory. The second essential element of the theory-based design framework for E-Learning is the specification of instructional strategies based on the selected pedagogical models. Instructional strategies are the methods instructors and instructional systems use to assist students in learning. Only when a suitable pedagogical model and instructional strategy have been agreed upon can the proper technology be selected (cf. ibid.).

The three components of the theory-based framework for the development of the WBT will be outlined in the following chapters.

2.2.1 Pedagogical Models

Scientists have long been fascinated about whether and how our brains change as a result of acquiring and learning new skills throughout our lifetimes. Previous research has linked various abilities to specific brain modifications. A well-known study indicates that London taxi drivers acquire a bigger hippocampus (a memory-related brain region) as they understand the maze of London streets (cf. Spitzer 2007, S.31). Learning therefore, refers to a permanent change in a person's knowledge or behavior as a result of experience.

2.2.1.1 Dale’s Cone of Experience

Before delving into how the human mind learns, this section will briefly discuss Dale’s Cone of Experience (CoE), which illustrates the numerous ways in which information is transferred to the human mind, as determined by the number of senses involved in the learning process.

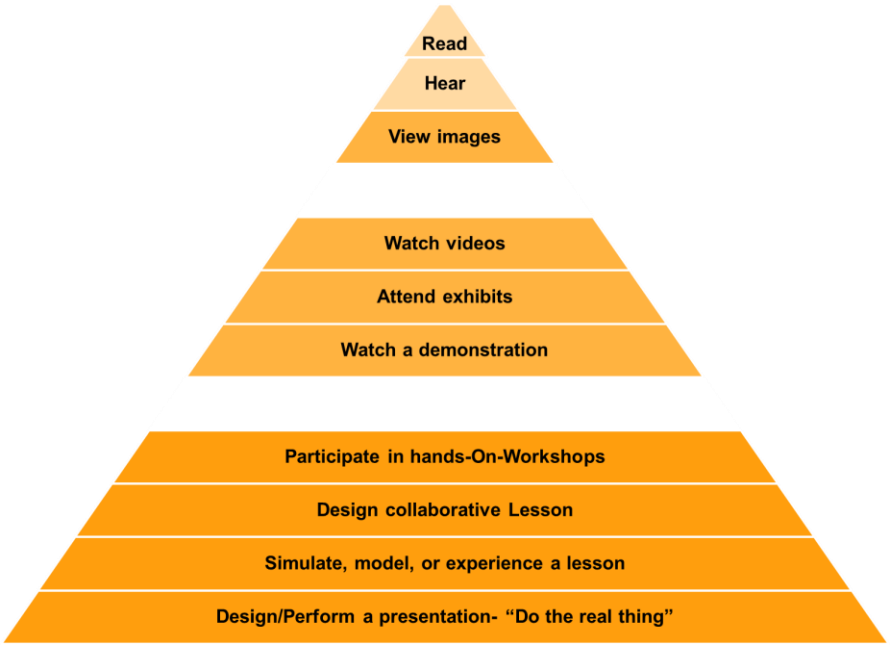


Figure 2.3 Dale's Cone of Experience

Dale's CoE (1969) moves from the concrete to the abstract (see Figure 2.3, cf. Ibid.). The level of abstraction goes from reading to direct deliberate experiences with the learning material (cf. Dale 1954, p. 42, as cited in Sang Joon and Reeves 2017). Thus, learners become active participants in their own education rather than passive observers (cf. Seels, 1997, as cited in Sang Joon and Reeves 2017).

Dale's CoE had a significant impact on instructional designers' theory and practice. Consider the Multimedia Cone of Abstraction (MCoA) constructed by Baukal, Auburn, and Ausburn using Dale's ideas as a foundation. The MCoA's objective is to help educational content developers choose appropriate multimedia for different learning contexts. These are listed in the following sequence, from abstract to concrete: "Symbol, Text, Narration, Nonverbal Audio, Image, Video, Virtual Reality" (cf. Baukal et al. 2013 p.19).

In conclusion, the more senses are engaged in the learning process by the learner, the more successful that learning might be. This concept may be used in E-learning via the use of multimedia instructional methods that engage more of the learner's senses.

2.2.1.2 The Cognitive Theory of Multimedia Learning

After providing a brief introduction to Dales' CoE (1969) and the various types of multimedia that can be used to enhance the learning process by incorporating additional senses (such as the eyes and ears), let's analyze how these sensory memories will process these various types of multimedia presentations. Figure 2.4 (cf. Mayer 2014, p.37) illustrates the cognitive theory of multimedia learning (CTML) that is intended to characterize the human information-processing system. It is believed that the cognitive theory of multimedia learning provides the theoretical basis for developing effective multimedia for E-Learning (cf. Mayer 2017, p.403).

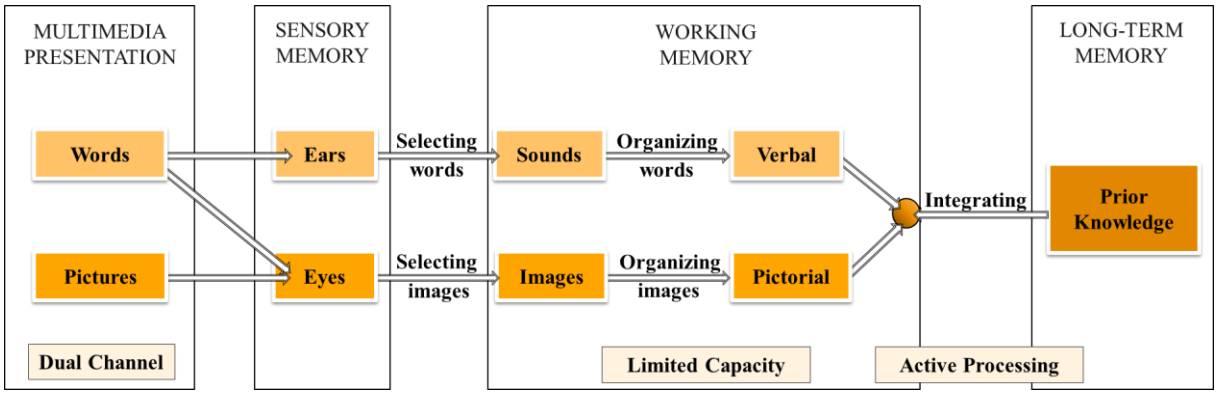


Figure 2.4 How Does Multimedia Learning Work? A Cognitive Theory of Multimedia Learning

The boxes represent different types of memory, such as sensory memory, working memory, and long-term memory.

Words and pictures from the outside world, including multimedia presentations, are first retained in sensory memory. If a learner chooses to maintain this information because it is significant, it will be stored in working memory, where it may be retrieved and updated later. This update is based on existing knowledge. This requires activating and transferring information from long-term memory to working memory. Long-term memory should only retain logically coherent information (cf. Mayer 2005, p.37; Mayer 2014, pp. 64-67; Moreno and Mayer 2007, p.313).

The CTML specifies five cognitive processes in multimedia learning (see Figure 2.4, Mayer 2017, p.403): "selecting relevant words from the presented text or narration; selecting relevant images from the presented graphics; organizing the selected words into a coherent verbal representation; organizing the selected images into a coherent pictorial representation; and integrating the pictorial and verbal representations with each other and with prior knowledge" (Mayer 2014, p.43).

The concept of multimedia learning is founded on three fundamental assumptions, one of which is the (dual-channel assumption), which asserts that humans have separate systems for processing verbal and pictorial information. and the (limited-capacity assumption), which asserts that the amount of data that can be processed by each channel all at once is limited by that channel's capacity. Finally, the (active-processing assumption) implies that meaningful learning includes cognitive processing (cf. Mayer and Moreno 2003, p.43).

The CTML is significantly influenced by cognitive load theory. The basic idea is that the sort of information encountered by learners during learning results in one of three forms of processing in the brain.:

- **"Extraneous processing":** any activity that is not directly related to the instructional objective.
- **"Essential processing":** that is required for the learner to comprehend the relevance of the provided information.
- **"Generative Processing":** that focuses on generating meaning from the material (Mayer 2017, p.403).

In conclusion, Dale's CoE (1969) hypothesis of multisensory learning states that learning is more effective when several senses are engaged. The cognitive theory of multimedia learning, however, states that this multisensory representation must not lead to cognitive load.

2.2.2 Instructional Strategies

After gaining an understanding of cognitive processes and how the human mind learns, it is essential to consider important instructional strategies that contribute to the development of higher-quality and more meaningful E-Learnings.

The creation of multimedia instructional messages that engage the three cognitive processes of selection, organization, and integration without exhausting the visual and verbal channels of the working memory is a major challenge for E-Learning developers (cf. Mayer 2017, p.407).

As previously stated in the cognitive theory of multimedia learning's limited-capacity assumption and active-processing assumption, each memory is restricted by the capacity of its associated channel, and active processing is required for meaningful learning throughout the learning process. (cf. Mayer and Moreno 2003, p.50, see chapter 2.2.1.2). In reaction to these assumptions, Mayer (2017) established three instructional goals must be addressed to prevent cognitive load. “(a) reduce extraneous processing, (b) manage essential processing (c) foster generative processing” (Mayer 2017, p.406)

2.2.2.1 Reduce Extraneous Processing

Extraneous processing refers to cognitive processing that occurs in instructional content but has no learning objective. The term "extraneous material" refers to anything that is irrelevant to the core purpose of the course. To decrease unnecessary processing, Mayer and Fiorella (2014) considers the following five principles:

1. “**Coherence**: Eliminate unnecessary words, sounds, or images.
2. **Signaling**: Highlight important words or images.
3. **Temporal Contiguity**: Present words and images that relate simultaneously.
4. **Redundancy:** Remove superfluous captions from the narrated animation.
5. **Spatial Contiguity**: Place key phrases near to their relevant images on the screen or page.” (Ibid. 2014, pp. 281-282)

These principles are believed to reduce unnecessary processing, allowing learners to devote their cognitive resources to required and productive processing.

2.2.2.2 Manage Essential Processing

When a compact multimedia course containing complex content is delivered quickly, cognitive overload known as essential overload may develop. Essential overload happens when a learner's cognitive capacities are exceeded due to the amount of essential processing required to grasp a multimedia instructional content. Mayer and Pilgard (2014) established three principles:

1. “**Segmenting**: Allow time between successive bite-size segments
2. **Pre-training**: Provide pre-training in the names and characteristics of components
3. **Modality:** Off-load some essential processing from the visual channel to the auditory channel” (Ibid. 2014, p.319).

These principles are thought to manage essential processing and prevent it from being overloaded, enabling learning to focus on just important information.

2.2.2.3 Foster Generative Processing

Generative processing is cognitive processing aimed to derive meaning from the information, one must first organize it into logical structures and then connect these structures to each other and to one's prior knowledge. The organizing and integrating arrows in Figure 2.4 from chapter (2.2.1.2) illustrate this type of processing. Learners may not participate in generative

processing if they lack the motivation to construct meaning from the material. For example, when the on-screen presenter is unfriendly or the material is given in a monotonous voice and formal tone, learners may be less motivated to attempt to comprehend the material. Mayer (2009) outlines four principles for promoting generative processing:

1. **"Multimedia:** Present words and pictures rather than words alone.
2. **Personalization:** Present speech in conversational style rather than formal style.
3. **Voice:** Present speech with human voice rather than machine voice.
4. **Image:** Present speaker's image on the screen during learning [not supported]" (Mayer 2009, p.222)

These principles are considered to motivate learners to comprehend the provided content.

All twelve principles will be used in the construction of the ESH WBT for this thesis (see chapter 3.4)

2.2.3 Learning Technologies

Since the pedagogical model and instructional strategies for creating WBT have been established, it is now necessary to describe which technologies facilitate WBT development.

This section presents important technologies used to develop and publish an E-Learning.

2.2.3.1 Learning Management System

A Learning Management System (LMS) is a software application that is used to support and manage E-Learning teaching and learning activities, as well as learning materials and user data. LMS can provide learning material, learning process structure, and communication between students and teachers (Bradley 2021). They serve as information and communication technology for many institutions' E-Learning infrastructure. According to Schulmeister (2003, as cited in e-teaching 2016), a learning platform or LMS, as opposed to simply collections of teaching scripts or hypertext collections on web servers, is a software system that performs a variety of functions, including: a user administration system (login with encryption), course administration (courses, content management, file management), An assignment of responsibilities and rights, each having their own set of rights, also includes tools for communication (chat, forums), and for learning (whiteboard, notepad, notes, calendar, etc.) as well as a network-enabled browser that shows course material, learning objects, and media (cf. Ibid. 2016)

2.2.3.2 SCORM

The acronym SCORM stands for Sharable Content Object Reference Model, and it is a collection of E-Learning technology standards. It gives E-Learning materials and Learning Management Systems the communication strategies and data models they need to function together. The most significant characteristic of SCORM is interoperability. As a result, anything created using this method is compatible with any LMS, and can be uploaded, launched, and tracked through it.

The technical specifics of SCORM are divided into three sub-sections (Content packaging, Run-Time, and Sequencing). The packaging and description of material is defined by content packaging. Run-Time defines how content should be deployed, as well as how data should connect with the LMS and the data model for such communication. Finally, sequencing describes how a learner might move between sections of a course (cf. SCORM 2022).

2.2.3.3 Text to Speech Technology

Text-to-speech (TTS) is an assistive technology that converts digital text into spoken language (cf. Microsoft 2022). Text narration using this technique is less expensive and takes less time than with human voice recording; therefore, it speeds up and automates the digitization process (cf. Afonso et al.2022). The following is a brief explanation of TTS technologies that assist in achieving a high-quality and more human-like voice.

Neural Text to Speech Technology (NTTS)

Neural TTS (NTTS) approaches the naturalness of the human voice; it produces the most authentic and human-like text-to-speech voices possible by using a novel machine learning technology to improve speech quality (cf. Trueba and Klimkov 2019; Amazon Polly n.d., p.1).

NTTS technology has two components (see Figure 2.5; cf. Qinying 2020):

- A neural network that converts phonemes into spectrograms.
- A vocoder which converts spectrograms to sound.

Initially, a sequence-to-sequence (STS) model is implemented. This model considers not only the inputs but also their order. The model generates spectrograms with frequency bands that highlight the acoustic components of speech processing. The model's output is sent to a neural vocoder. This converts spectrograms to voice waves. When trained on large data sets, this sequence-to-sequence technique creates voices with higher quality and a more natural tone. (cf. Amazon Polly n.d., p.3).

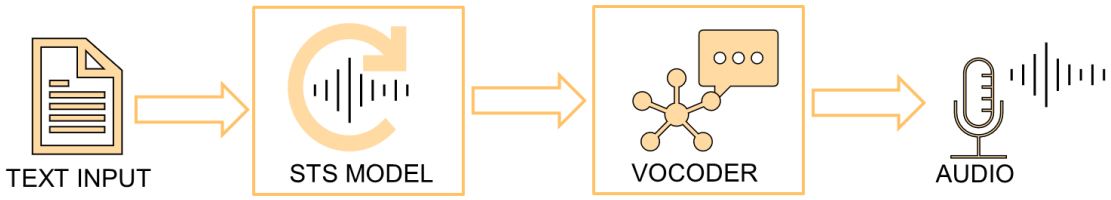


Figure 2.5 NTTS technology

Speech Synthesis Markup Language

Speech Synthesis Markup Language (SSML) is an Extensible Markup Language (XML)-based specified by the World Wide Web Consortium (W3C) that has been enhanced to include additional instructions for voice output. This establishes a standard method for regulating some features of voice synthesis, such as the volume, pitch, and speed of speech, add breath sound, whisper, etc. (cf. Amazon Polly n.d. p.112). It is possible to employ SSML tags to give the machine's voice a more human-like tone and to emphasize crucial words by employing a louder pitch to attract attention to important information. In this thesis, this technology will be used in the creation of the WBT (see The Voice Principle).

2.2.3.4 Authoring Tools for E-Learnings

Authoring tools are required to create E-Learning content. Online courses are created using authoring tools or learning-content management systems (LCMS). LCMSs are comparable to regular content managements CMSs, except that they specialize in the creation of online learning resources. They offer learning interfaces with interactive content, assessments, and quizzes, and no programming knowledge is required (cf. Lehnert 2021; Haghshenas et al. 2012, pp.259-260 ; Khademi et al. 2011, p.55). In recent years, authoring tools have increased in efficiency. Adapting to learner needs and customizing content gives authoring tools a more prominent position in the development of learning materials and promises a new generation of authoring tools with remarkable potential and capacities (cf. Taghiyareh 2007, p.77). Which

authoring tool is most suited to fulfill learning requirements? The following (See Table 2.2, cf. Lehnert 2021; Asgari and Mehrpouyan 2018; Khademi et al. 2012) are crucial aspects that should be included in an E-Learning authoring tool in order to develop high-quality content:

Table 2.2 Important E-Learning authoring tool features

Feature	Description
Responsiveness	displays all information responsively, so learners may work on desktop PCs, tablets, or smartphones.
collaborative	allows participants to collaborate on E-Learning initiatives.
Translation management	includes translation management to simplify and shorten creation duration
Sustainability	allows to create online courses with reusable content.
Course management	provides content development, media preparation, reviews, internationalization, and item changes. So, the company can track process stages.
Drag-&-drop editor	feature a drag-and-drop editor to make content creation easier
Templates	includes templates to help get started and an outline of how a successful course is constructed and what aspects may be employed
E-Learning standard	E-Learning courses must be exportable to all standard formats, from SCORM and xAPI to HTML5, so they may be used afterwards.
Integrated review process	makes it easy to flag individual elements that need to be reviewed and adjusted as necessary before publication
Easy integration of media	includes a media library where images, movies, and audio assets may be uploaded and maintained for usability
Interactive features	requiring special interactive features such as video breaks with calls to action, accordions to open, hotspots, matching exercises, and active exploration of on-screen features
Accessible	gives alternatives for developing courses with low barriers.
Range of question types	includes several question formats for assessing knowledge.
Multiple Educational Paths	e-courses are linear. Learners must be able to alter their course route based on educational goals, user preferences, learning style, etc.
Costs	authoring tools must be both efficient and affordable.

2.2.3.5 Interactivity in E-Learnings

Interactivity is defined according to Steuer, "as the extent to which users can participate in modifying the form and content of a mediated environment in real time" (1992, p. 14). An interactive E-learning is the "conversation" between learners and E-Learning technology that engages and involves them. It is an essential aspect of the E-Learning course creation process and provides excellent value. It requires that the learner acts or reacts to achieve a desired outcome or conclusion. Multiple choice quizzes, tests, E-Learning scenarios, simulations, animated videos, and so on help learners deepen their understanding of the subject matter by allowing them to explore, cope with unexpected situations, and learn from their mistakes (cf. Reeves 2012; Pappas 2015). The interactivity of E-Learning is a significant success element in virtual learning environments (Paechter et al. 2010).

2.3 Instructional System Design Models

With an instructional system design model, the previously described theories, can be put into practice since it gives structure and purpose to the learning content, which aids in visualizing and breaking down the creation of training material into phases (cf. IDC 2019).

2.3.1 Human Centered Design

During the development of a WBT, it must be kept in mind that the product is meant for educational purposes. Any technology meant for human use should be intuitive, useful, and enjoyable to employ. In 1985, Gould and Clayton identified three criteria to be considered while developing a human-centered system. This implies that designers must initially identify the intended users. Second, early in the development process, prototypes should be deployed by target users while their performance and responses are observed, documented, and evaluated. Lastly, any problems detected during user testing must be resolved (cf. Gould and Clayton 1985, p. 300).

The fact that these principles were updated and included in the European Standard 9241-210, adopted in July 2019, demonstrates that they are still relevant today. The standard proposes a model for interactive content creation, a very general model that can be easily adapted to the needs and circumstances of a business or organization. It does not require a formal specification because it may be methodical, but it is nevertheless a framework. This is how the model appears (see Figure 2.6, cf. DIN ISO 9241-210:2019, p. 21):

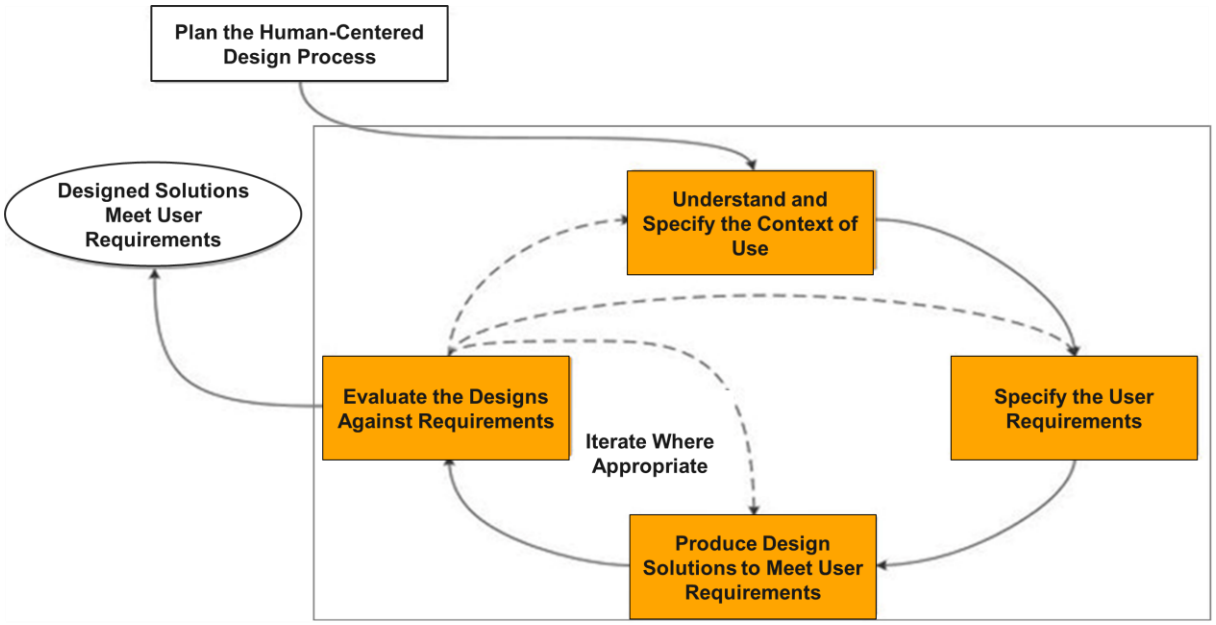


Figure 2.6 Human centered Design Framework

Observing the model, it employs cyclic iteration, signifying that some steps can be repeated several times. It distinguishes between stages. After planning a human-centered design process, it is important to understand and define the context of use. Based on this understanding, user requirements must be defined, a design solution that should meet the defined user requirements must be produced, and the system is then prepared for evaluation. Depending on whether the evaluation shows that the system meets the requirements, the product can be released, otherwise it must go through one or more previous stages (cf. DIN ISO 9241-210:2019 p.7).

2.3.2 Design Thinking

The development of needs-based solutions can be facilitated by Design Thinking. Design Thinking is a process that encourages designers to have an open mind to gain an understanding of what people truly require in specific circumstances and what contributes to the advancement of their reality. The method is distinguished by the creative cooperation of interdisciplinary teams in open working settings. These teams apply a design mentality as well as methodologies from other areas in order to develop fundamentally significant ideas, also known as real innovations (cf. Meinel and von Thienen 2016, p.1). The product design firms IDEO and d.school Bootcamp Bootleg identify the following as the five most important actions that comprise the process of design thinking (see Figure 2.7, cf. d.school n.d.):

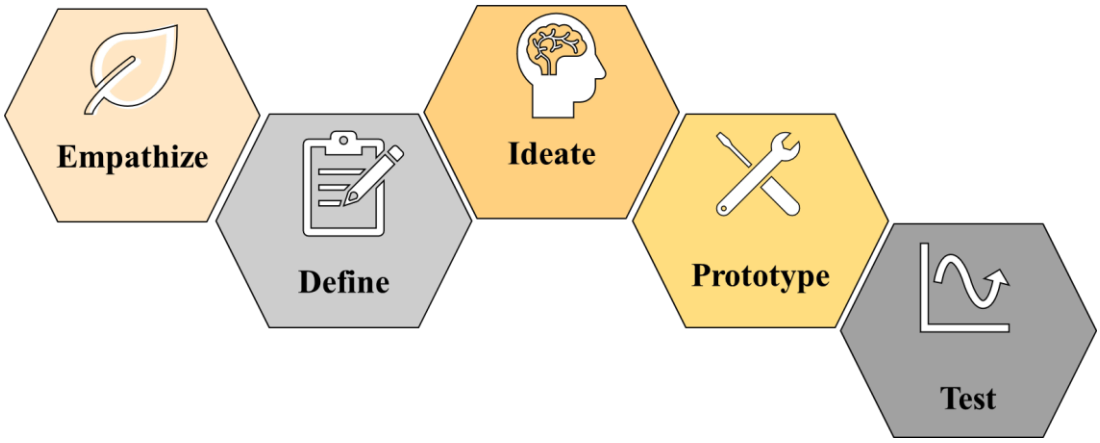
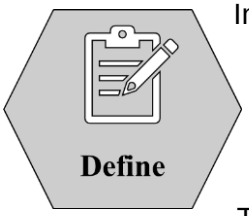
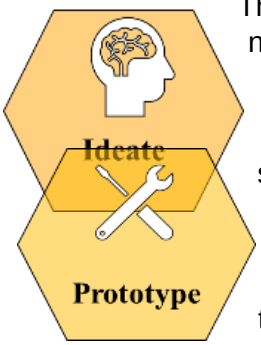


Figure 2.7 Design Thinking actions

The core of a human-centered design approach is empathy. To empathize with users, it is essential to examine their conduct in the context of their life. And to interact with users and conduct interviews through both scheduled and 'intercept' interactions, and finally, to experience the user's actions.

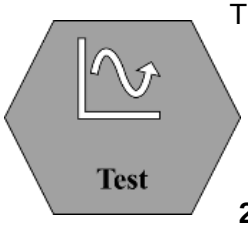


In the define mode, empathy is unpacked, results are synthesized into compelling requirements and insights, and a clear and meaningful issue is scoped. Two goals of the define mode are to get a comprehensive understanding of the user and the design space, and to formulate an actionable issue statement.



The goal of ideation is to explore a vast solution space, consisting of a huge number of diverse ideas. This enormous repository of ideas may be used to create prototypes for user testing.

Prototyping is the process of bringing ideas and experiments into the physical world. A prototype might consist of anything with a physical form. The resolution of the prototype should be proportional to the project's development. Prototypes are most successful when people (design team, user, etc.) can engage with and experience them. The knowledge gained from these interactions can foster greater empathy and design effective responses.



Testing is the opportunity to modify and improve the solutions. The test mode is an additional iterative mode in which low-resolution artifacts are contextualized into the user's life (cf. d.school n.d.)

2.3.3 Learning Design Guidance

Continental AG has created its own model for the process of developing a learning item. The model used by the firm is as follows (see Figure 2.8, cf. Continental AG 2020):

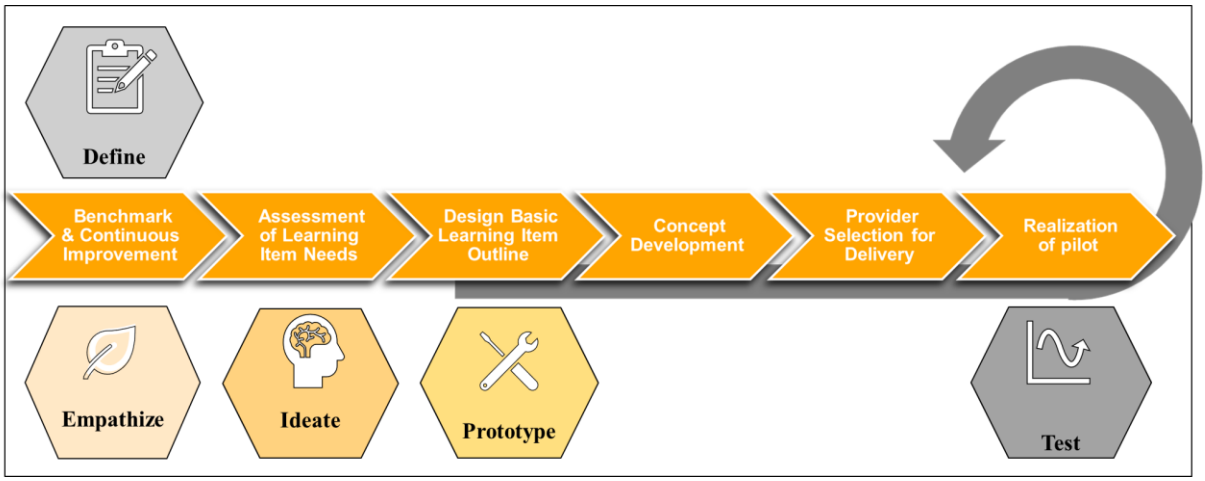


Figure 2.8 Continental AG's Learning Design Guidance

Initially, a benchmarking and continuous improvement phase is done, during which standards and key performance indicators (KPIs) are defined, benchmarking inputs are obtained, and the resulting data is then gathered using the empathize concept provided by the Design Thinking theory (cf. Design Thinking). An integrated structural problem-solving strategy is also defined at this point.

Following that, a needs assessment of the learning item is performed in which the existing situation is evaluated to determine the guidelines, target groups, and learning objectives of the learning objects. This phase step applies the ideate concept by examining the "why" of the learning element, resulting in a collection of ideas to be used in the prototype phase.

During the concept development phase, the learning journey will be planned by defining all the touchpoints that learners must follow throughout the learning process.

Design basic learning item outline phase is where all the ideas from the previous stage are applied to design a basic outline for the learning project. This phase provides instructions on creating the agenda, selecting the most suitable format, and deciding whether to create it internally or with the help of external experts. In the next stage, a supplier for project delivery is selected

Finally, a pilot of the learning program is realized where an evaluation test is undertaken to collect feedback and suggestions for enhancing solutions from one or more preceding phases(cf. Continental AG). This step makes the Learning Design Guidance process iterative by allowing it to iterate through multiple phases to achieve the greatest possible result.

Continental AG's learning design approach is evidently based on the methodology described in the European standard DIN ISO 9241-210 and the three guiding principles of Gould and Clayton (cf. chapter 2.3.1). The approach is developed in an iterative manner, with a focus on user requirements, prototyping, and continuous system development to achieve the desired outcomes. And to give learners with a meaningful learning experience through solutions that are engaging, enjoyable, and simple. Therefore, the design thinking components are incorporated into the learning design procedure.

A group of people are involved in the entire process of developing an E-Learning. The following a list of the roles that were involved who took part in the training design process:

The L&T department's Learning Business Partner (LBP) offered a full range of consulting services, from early demand analysis to contracting and delivery.

The Subject Matter Expert (SME) from the ESH department from the VVA location, determined the overall content strategy and learning approach for his area of responsibility and delivered feedback on the prototype.

The Learning Designer (LD-The Author) from the L&T department was responsible for the design and development of the WBT, applying didactical and technological perspective. Conducted the experiment and evaluated the results.

The Decentral Learning Administrators (DLA) from the L&T Department, who uploaded the PDF-T and WBT to the LMS, assigned them to the users, and gathered feedback input (cf. Continental AG).

Following the creation of the learning object employed in the case study for this project, the further steps will be addressed. From the perspective of a learning designer, all processes of the construction of a learning item are briefly described.

3 Creation of Digital Learning Resources

This chapter describes the technique employed to construct the WBT by using the concepts and methods given in the preceding chapter

3.1 Designing a Concept /Benchmark

Creating high-quality educational materials requires benchmarking and iterative improvement as initial steps. In this step, the current state of ESH-Training throughout the organization was assessed, and a target state was then outlined (cf. chapter 1.2). Before adopting a WBT, it is vital to define the key performance indicators that will demonstrate whether the new approach is more effective than the existing one.

Upon completion and user evaluation of the WBT, it is essential to establish if the current digitalization strategy for ESH-Training is more effective than the prior strategy and if additional digitalization of training is required across all corporate sectors.

Comparisons will be made between the following KPIs of the training's quality: Facilitator, Content, Methods, Materials & Length, Learning Application, Organization, and Overall. These must improve as a result of the new training digitalization strategy.

3.2 Assessment of Learning Item Needs

In this stage, all the requirements of the learning item are analyzed by identifying its central theme, target groups and learning objectives.

3.2.1 Central Theme

To construct a WBT, it is crucial to describe its central theme with precision and clarity. The following has been determined as the ESH-Training's central theme:

Training title: Arbeitssicherheit 2022 – Sicherheitsunterweisung – Vahrenwalder Str. 9, Fernroder Str. 9, Brühlstr. 9, Hans-Böckler-Allee 26, Gebäude 33a Va.

Subject's importance: All workers must be reminded annually of the ESH requirements by law, and it is essential that they actively engage in and adhere to the ESH standards (cf. chapter 1.2)

Desired outcome: Participants must successfully finish the ESH-Training and demonstrate comprehension of the material by passing the questions at the end of the training to get the desired result.

3.2.2 Target Group

The target audience is comprised of all present or potential persons (recipients) who will be impacted by a certain measure. (cf. Kirchgeorg 2010). Target-group-oriented teaching and learning exemplifies the pedagogical concept of relating instruction to participants' needs, interests, and experiences. The study of target groups assists in organizing learning opportunities for each target group. Insights into target groups and their learning styles may provide ideas for effective learning and teaching (cf. Quilling 2016).

In this stage, the target group for the ESH-Training was determined to be all 850 workers of Continental's headquarters department, who have diverse educational backgrounds and business-related qualities. According to the fact that this training is required annually for all firm workers, some participants may be familiar with the topic, but there will also be newly hired participants who may be unfamiliar with it. This broadens the target audience.

3.2.3 Learning Goals

Learner goals are critical to the selection of acceptable teaching methods, and they are essential to the design of learning processes (cf. RUB n.d.) Learning objectives aid in the creation of course material, the selection of relevant learning resources, and the assessment of how well learners accomplish the course's set learning objectives (cf. Gundermann 2016, p.2).

By using company-specific standards, the following goals were established.

Learning Objectives

After completing the ESH-Training, the learners know…

…why workplace security is essential

…what causes workplace accidents, how to prevent them, how to react, and how to report them.

…what each emergency sign means.

… the consequences of improper sitting posture and how to sit correctly.

…the associated applications, concerns, and insurance for mobile work.

…how and when to evacuate, as well as how to help.

…how to get first responder, evacuation, or firefighter training and who the primary contact is for each concern.

3.3 Design Basic Learning Item Outline

Following the Benchmark and Continuous Improvement- and learning object re-requirements assessment stages, where the concepts of design thinking theory “empathize, define, and ideate” were utilized to develop the learning object's guidelines, target group, learning goals, and format. The next step is to design a basic learning item outline and implement the prototype action.

3.3.1 Learning Content & Structure Development

Instructional materials are the subjects, themes, ideas, behaviors, concepts, and facts that are intended to be learned and form the basis of teaching and learning (cf. UNESCO n. d.).

The content covered in the ESH-Training was separated into three sections: basic instruction, mobile working, and fire protection and emergencies. A knowledge exam was also included at the end of the training to assess whether the defined learning objectives had been met. See Table 3.1 for an overview of the learning material that was defined for the ESH-Training.

Table 3.1 content table of the ESH-Training

	Subject Content
Basic Instruction	Occupational safety and why it is important Workplace accidents: what causes them and how to prevent them Physical, psychological, and legal consequences of accidents How to respond in the case of an accident Crucial phone numbers When and how an accident report may be filed Where to locate first responder directories

Mobile Working	Information on office space. Lighting for workspaces. Working environment Ergonomics in the workplace. Chair adjustments Posture-related stress and illness, as well as tips on how to sit properly while working How to apply for mobile work, what to consider, and mobile work insurance. How to act and who to call if a functioning computer is damaged. Ergonomics contacts
Fire Protection	Memorizing VVa evacuation spots How are evacuations notified? Where is VVa's collecting point? Identify safety pathways Behavior by fire alarms In an emergency, how do you report yourself? eScooter and pedelec workplace information How to become a First Responder, Evacuation and Fire Responder
Comprehension Questions	Multiple choice questions to check whether learner: Is aware of the obligations of the supervisors and employees. Understands the reporting deadline for an internal accident. What options are there for adjusting an office chair? What should they focus on when remote working? In which scenarios is trade association insurance coverage available when working remotely? Knows How do you find assembly spots in the event of an alert? Can recognize emergency signs and their relevant significance.

3.3.2 Learning Format(s)

Given the numerous factors to consider, such as budget, workforce size and type, location, period, and goals, selecting a training delivery system may be a difficult undertaking. There are many ways to deliver training today, which adds to the complexity and makes it harder to make decisions (cf. Gautam, 2019).

Based on the data gathered in the preceding stages, we determined that the learning material should be developed as a WBT that includes explanatory videos, graphics, voice narration, and interactive features to actively engage the learner. Without learner participation or engagement with the learning content, the digital method is no more effective than reading a textbook (cf. Konermann and BG RCI 2020).

3.3.3 Authoring Tools

The LBP and the SME decided the format of the new digital training to be a WBT incorporating interactions, images, narrated text, and animation videos in the previous stage, associated authoring tools must be selected to produce each.

The following (see Table 3.2) were selected as authoring tools for the learning object and its multimedia components.

Table 3.2 chosen authoring tools for the development

Learning content	Authoring tool
Web-Based-Training	Articulate storyline 3
Videos	Vyond
Voice-over (audio)	Amazon Polly
Photo editor	GIMP

The table (Table 2.2) in chapter (2.2.3.4 “Authoring Tools for E-Learnings“) was used to assess whether the various writing tools meet all the criteria necessary to create a high-quality learning experience.

Articulate Storyline: An E-Learning development software based on Microsoft PowerPoint's user interface. It allows the construction of complicated and engaging training courses (cf. Articulate 2022). This tool will be used to create the WBT for ESH instruction. As it meets all of the important criteria for designing a high-quality learning environment (in Table 2.2), including providing a wide range of interactions, from basic quizzes to animations, and multimedia such as photos, videos, and audio, all other media required for this training can be incorporated into this WBT.

Vyond. A web-based authoring tool for creating dynamic explanation videos or video-based learning. The software offers many combinations of whiteboard animations and current casual settings.

Relevant aspects of this tool:

- It offers an integrated review process that enables the creation of videos that may be shown on many screen sizes. (Responsiveness)
- It enables the development of videos with reusable materials (sustainable).
- It contains a drag-and-drop editor, templates, and an extensive library of media (easy to use).
- It provides efficient and inexpensive E-Learning standard format video downloads (such as see SCORM) (cf. Vyond 2022).

GIMP: The contraction GIMP is the abbreviation for the GNU Image Manipulation Program. It is a worldwide, free image editor. The software generates icons, graphic design elements, and graphics for user interface components and mockups. GIMP also contains high-quality editing and retouching capabilities. (cf. Gimp 2022). Therefore, it is an ideal tool for modifying the photos given for the development of this course.

Amazon Polly: Is a Text-to-Speech service available in a variety of languages, accents, and tones. The service employs powerful deep learning technology to synthesis natural-sounding human speech. It also provides Neural Text-to-Speech (cf. chapter 2.2.3.3) voices that provide advanced improvements in speech quality using a new machine learning technique. It also supports many SSML tags, to make spoken text sound more human (cf. chapter 2.2.3.30). The generated voice tracks may be downloaded as mp3 files, which can then be simply integrated into the Storyline project.

3.3.4 Prototyping

Prototyping enables designers to evaluate the practicability of the existing design and maybe discover how trial consumers feel about the product. It permits adequate testing and exploration of design concepts before excessive expenditures are used (cf. chapter 2.3.2Design Thinking)

A base material is required to create a prototype. The ESH PDF-T base material was delivered in the form of a 47-page PowerPoint presentation containing text and photos.

In this step a storyline learning template is constructed. This stage involves specifying the training's layout and structure.

3.3.4.1 Training Layout:

The master slide may be constructed similarly to how it is in PowerPoint by setting the general style, font style, size, and colors, as well as the logo's location. In this step, the ESH-Training slides have been defined (slides with only text, with text and an image, questions- and feedback slides).

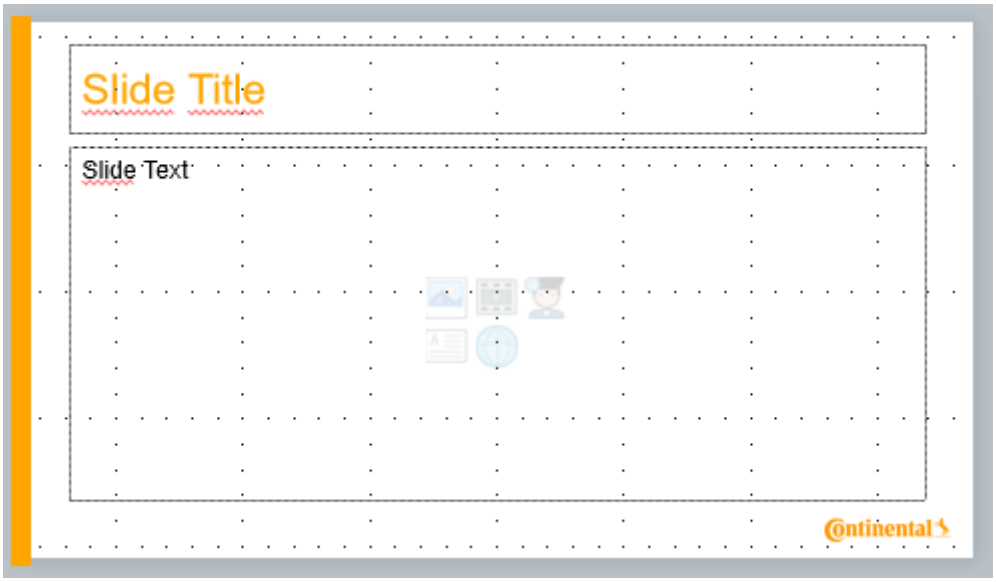


Figure 3.1 Training Layout

Every content developer must adhere to a set of guidelines and standards. It is difficult to learn when forms are not organized. Standardized training enhances E-Learning participation (cf. Timbi-Sisalima et al. 2022).

To produce a positive user experience, the title and body text's typography (location, font, color, and size) was developed in a user-friendly fashion (Shank 2017). The layout's hue was determined using Continental's color code (orange, gray, and black). In order to guarantee that the content is legible on a range of devices, the text size for headers (24 point) and body text (18 point) was specified (responsive). This is important given the increasing number of consumers who complete trainings on their smartphones (Siepmann 2018, p.40). In addition, a progress indicator was placed on the left side of each slide so that users could easily identify where they are in the course and the range of material available (Penfold 2017).

3.3.4.2 Training Structure

The training structure was developed in Articulate Storyline with help from data acquired during the Learning Contents & Structure Development phase (cf. chapter 3.3.1). This consist of three chapters (see cf. Table 3.1) then a comprehension exam that the user must complete and pass. The structure of the training is as follows (see. Figure 3.2):

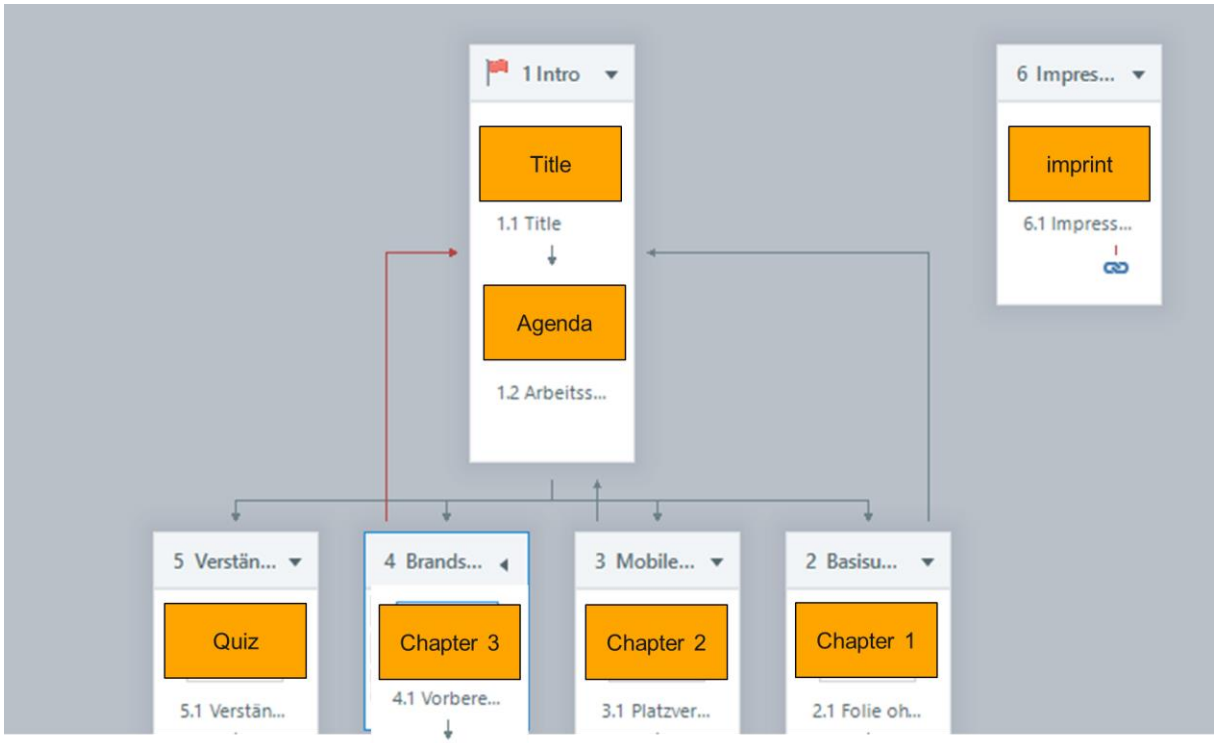


Figure 3.2 Training structure prototype

The training starts with a cover-slide containing the training's title, as determined while establishing the training's central theme (see Chapter 3.2.1). By clicking the next button, the user is directed to the agenda screen, where the three chapters are presented as a menu alongside the quiz. By clicking on the chapter's title, the user can select which chapter to begin with. However, the quiz will not display until all three chapters have been completed (see Figure 3.3.).

Upon completion of each chapter, the user is returned to the agenda, where a checkmark denotes that the chapter has been completed. This will assist the user in keeping track of how many chapters have been completed. Finally, in accordance with the technical framework, once the learner has completed all the chapters, he/she must take a quiz.

Figure 3.3 WBT Agenda

To prevent the user from skipping important portions of the training without completing the required tasks. ' (for example, clicking on specific areas to see information or answer questions etc.). A Trigger Wizard (see Figure 3.4) is used.

The trigger wizard in Articulate Storyline enables developers to specify in JavaScript which actions should be executed when a specified condition is fulfilled. The trigger wizard built in this example (see Figure 3.4) prevents users from proceeding to the next slide if the required task on the current slide has not been done, and instead prompts them to finish the task before continuing.

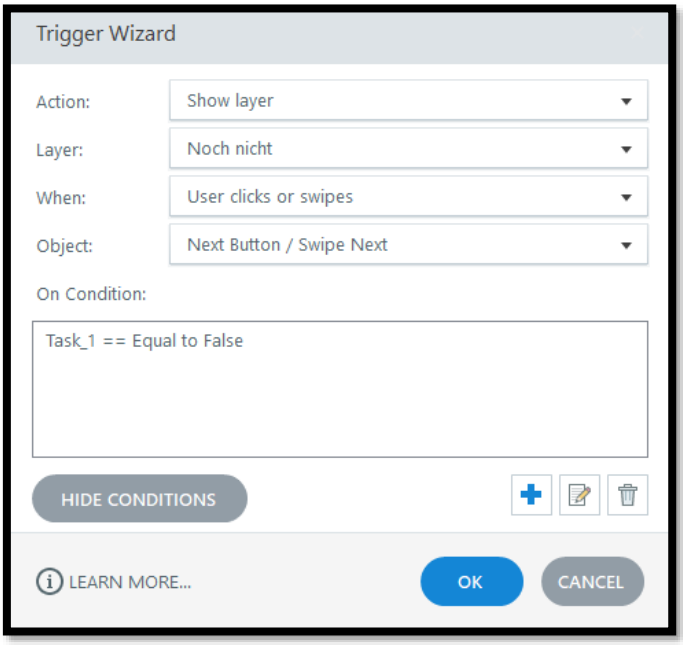


Figure 3.4 Trigger Wizard

The training will only be reported as complete in the LMS when the user hits the (End E-Learning) button, which appears only when the user completes all chapters and the final quiz (see Figure 3.5). After completing the quiz, the user's scores will be shown as a percentage. Users can review the quiz, retake the quiz, or end the E-Learning.

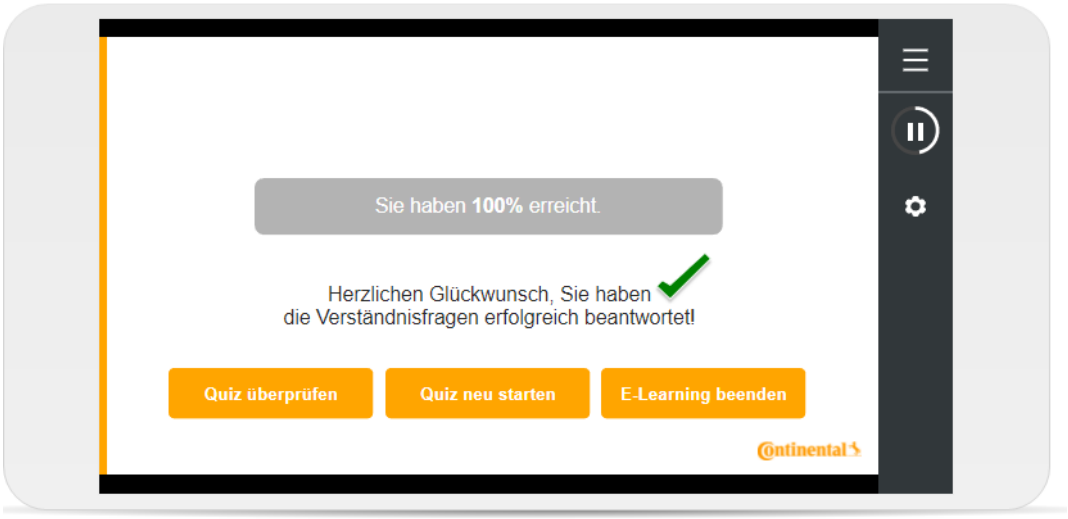


Figure 3.5 End of E-learning submissions

The LMS then issues a personalized certificate for the learners confirming that they have finished the ESH course. This offers an overview of the current state of systematizing occupational safety inside the business. As the documentation of workplace safety trainings helps to legal certainty to verify compliance with occupational health and safety regulations (see chapter 1.2). Therefore, the WBT exported as SCORM package and published on the LMS aids in meeting company technological requirements (see Table 1.1).

After the overall structure and layout of the training have been designed, the LBP, the SME and the LD arrange a meeting during which the prototype training is briefly presented to get general feedback. Following the meeting, a prototype copy is provided to the SME for extensive feedback.

In this instance, the ESH SME from the VVA department was satisfied with the prototype and approved the finalization and development of the WBT.

3.4 Content Development

The LD may continue designing the WBT's content once the SME has validated the prototype. This thesis recommends that further design of the prototype should consider the risk of inducing cognitive processes' (extraneous, essential, and generative) overload (as per the CTML). It is also recommended that LDs recognize the value in individualizing content to reflect cultural, social and educational factors as well as learning styles and prior knowledge (Mantiri 2013). The WBT's interactions (see chapter 2.2.3.5) were thus designed to be user friendly to people of all ages and educational backgrounds.

To create understandable content, a learning designer must have a thorough understanding of the topic area. After analyzing each slide, important information was gathered, and CTML principles were then applied. The following in this chapter are examples of this procedure.

3.4.1 Reducing extraneous processing:

For a high-quality WBT, it is necessary to keep the learner from becoming overwhelmed by too much information, which can be accomplished by removing superfluous text from the narrated animation, emphasizing the most important words or images, and placing key phrases next to their corresponding images on the screen or page. Therefore, the coherence, signaling, temporal, redundancy, and spital contiguity principles must be implemented. The following are instances of how each principle was implemented during the development of the WBT.

3.4.1.1 The Coherence Principle

The Coherence principle states that people learn best when they aren't distracted by extraneous or irrelevant elements like words, pictures, or sounds that interrupt their concentration (cf. Mayer and Fiorella 2014, p. 281).

Info: Employees who choose to volunteer as first responders in the case of an emergency can undergo a free certification training provided by the company. providing a general description of the first responder course and contact information.

Presentation- Before: This information was provided on two slides: the first slide describes the first responder course, and the second slide contains the contact information for each location's responsible party (see Figure 3.6 , Before cf. Kern 2021 pp.18-19).

Presentation- After: One slide gives a course overview and contact information. Providing an outline of the course (cost, duration, and availability). And a button for learners who are interested in viewing the contact information, so that they are not exposed to extraneous information if they are not interested (see Figure 3.6 after).

Figure 3.6 The Coherence Principle example

3.4.1.2 The Signaling Principle

This principle states that humans learn best when key words or concepts are highlighted on the screen to signify what to pay attention to (cf. Mayer and Fiorella 2014, pp. 281).

Info: Employees should be warned that improper sitting posture at work can lead to major health issues, such as a dangerous inflammatory illness known as Carpal Tunnel Syndrome (CTS).

Presentation-Before: The CTS problem is then stated at the end of the material concerning the negative effects of poor sitting posture (see Figure 3.7, Before Leverenz 2022, p.18).

Presentation-After: Due to the importance of emphasizing the CTS syndrome, its description and affected area have been highlighted in the text and illustration to draw the learner's attention to its significance.

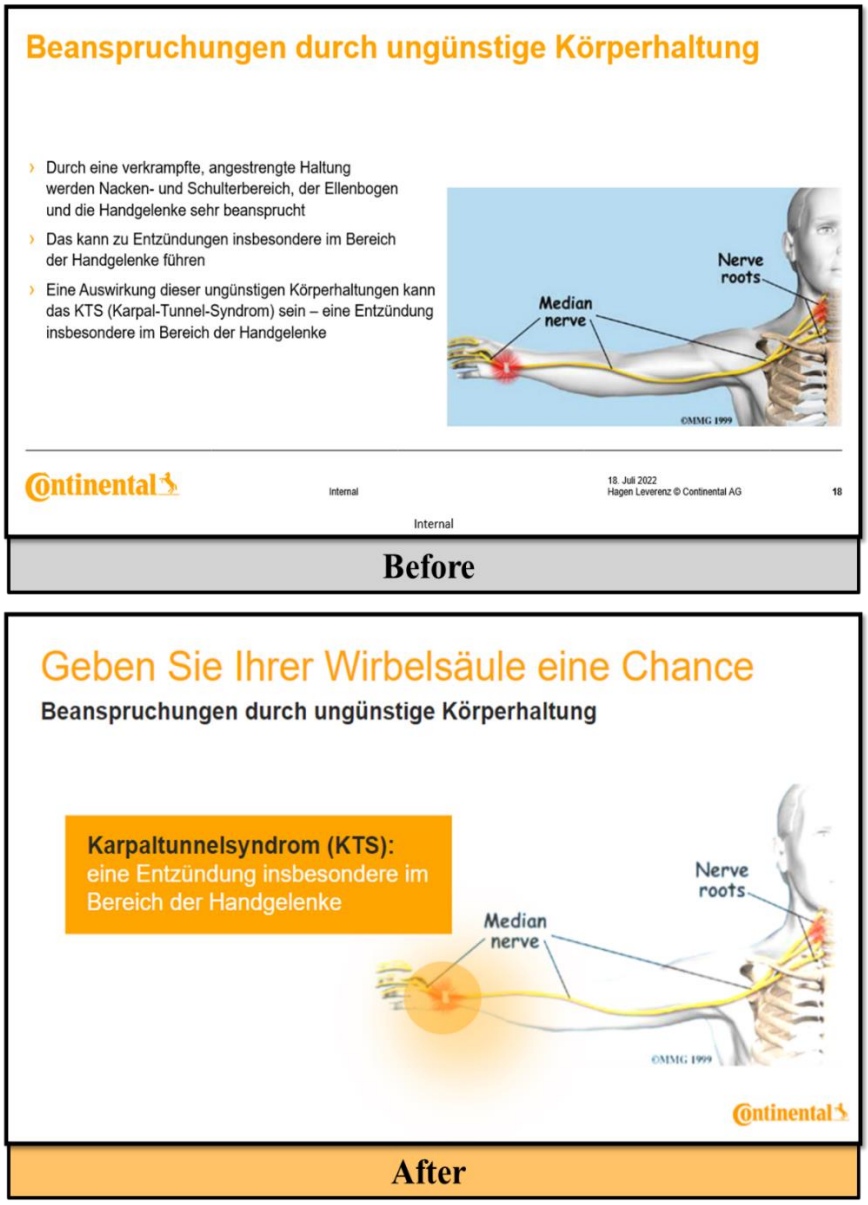


Figure 3.7 The Signaling Principle example

3.4.1.3 Temporal Contiguity

According to the Temporal Contiguity Principle, the most effective way for people to learn is for related words and pictures to be given simultaneously (cf. Mayer and Fiorella 2014, pp. 281).

Info: It is crucial that the student understands the posture of healthy sitting, including how to place the hands and legs when seated, as well as how to sit dynamically (see Figure 3.8, Before Leverenz 2022, p.19).

Presentation-Before: A set of instructions on how to position the hands and legs and how to sit dynamically is displayed next to a photograph illustrating a healthy sitting position.

Presentation-After: The image of a healthy sitting posture is utilized as a model, and the user is instructed verbally to click on a keyword (arms, legs, dynamic sitting) to view the corresponding instruction. The textual and visual instructions will be displayed simultaneously.

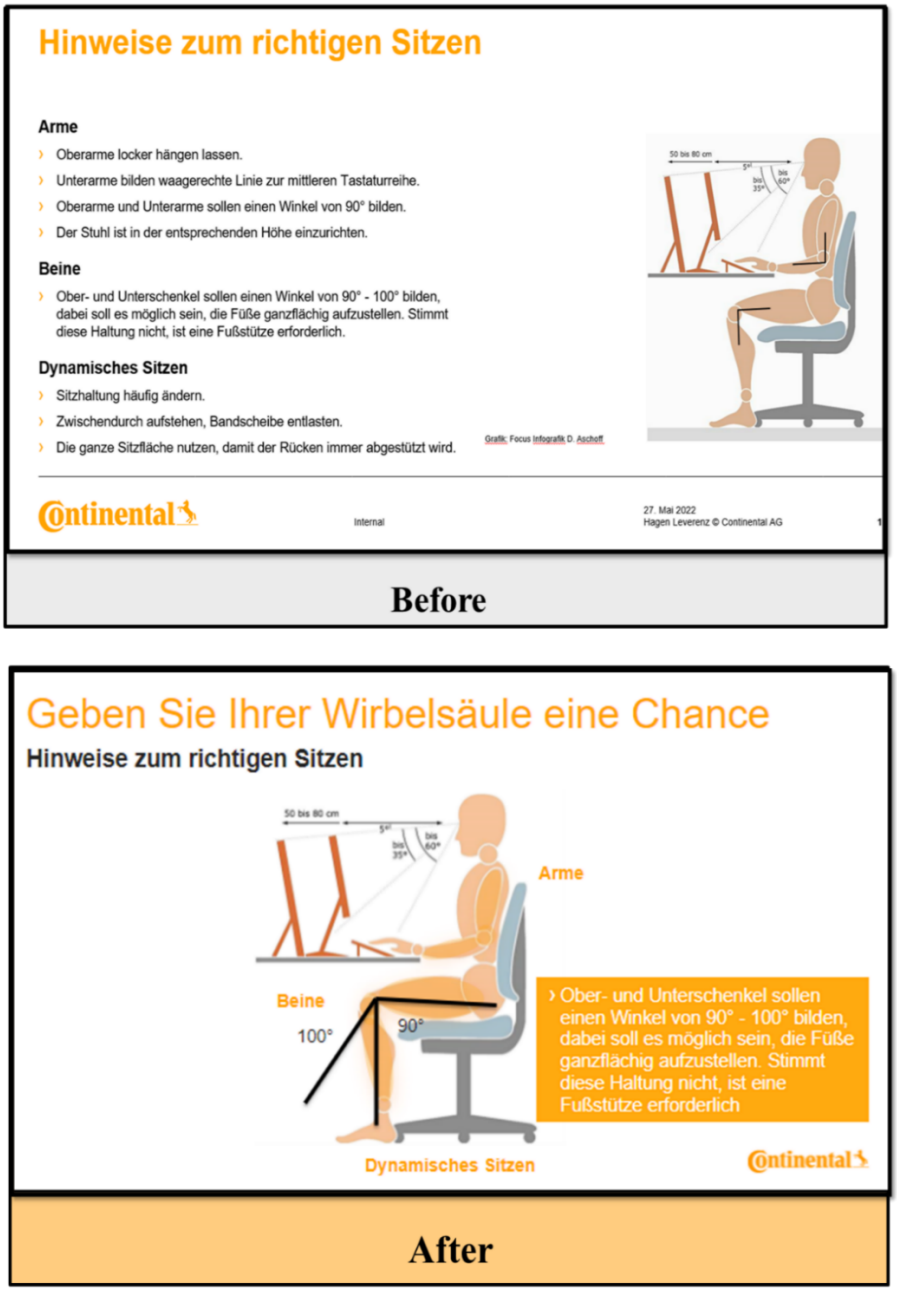


Figure 3.8 Temporal Contiguity Principle example

3.4.1.4 The Redundancy Principle

According to the redundancy principle, individuals learn better via story and visuals rather than narration, pictures, and text (cf. Mayer and Fiorella 2014, pp. 282).

Info: To prevent workplace accidents, it is essential to recognize that they are not random occurrences. Most workplace accidents are avoidable and have identified causes. causing permanent mental or physical impairments may be the employer's culpability. And they cost everyone involved a substantial amount of money and can have legal consequences for the employer/supervisor.

Presentation-Before: All information displayed as a list of phrases, together with an image of a cleaning equipment set (see Figure 3.9, Before Leverenz 2022, p.4).

Presentation-After: As it is crucial to understand the seriousness of fetal accidents that occur at work or on the way to work. A one-minute video was made for this slide: The video opens

with a worker character moving packages through a warehouse. On his way, he comes across a red-marked box (indicating that it was not in its proper location), leading him to fall and get harmed. The worker then exclaims, "What a shame!" A female character (representing the training's speaker) then enters and says, pointing to the red box: "stop! Accidents are not random events; they have a cause and may be prevented." The speaker then goes on to explain: "On the way to and from work, car accidents typically result in more severe injuries and can lead to lifelong mental and/or physical damage," while illustrating a scenario of a person rushing to work, getting into a car accident, and passing out. The narrator then states, "Accidents can lead to lifelong mental and/or physical impairments" while presenting a scenario of the worker sitting in a hospital and suffering physically and mentally (weeping)." Accidents can also have legal consequences for the employer/supervisor and cost everyone concerned a lot of money," she says. The worker character is then seen sitting in court, followed by a scene of several characters paying large sums of money.

Figure 3.9 The Redundancy Principle example

3.4.1.5 The Spatial Contiguity Principle

This principle states that people learn better when important information and pictures are physically near together on the screen. (cf. Mayer and Fiorella 2014, pp. 282).

Info: Employees must be aware of the health risks that improper sitting posture may cause to various parts of the body.

Presentation-before Listed next to a picture of a bad sitting posture are the various health issues that can be brought on by poor posture in the body (see Figure 3.10, Before Leverenz 2022, p.17).

Presentation-after: The health issues caused by improper sitting posture have been categorized based on where in the human body they may occur, and the user will be able to see them by clicking on the relevant point in each region. Facilitating the association between the affected body part and the afflicted condition.

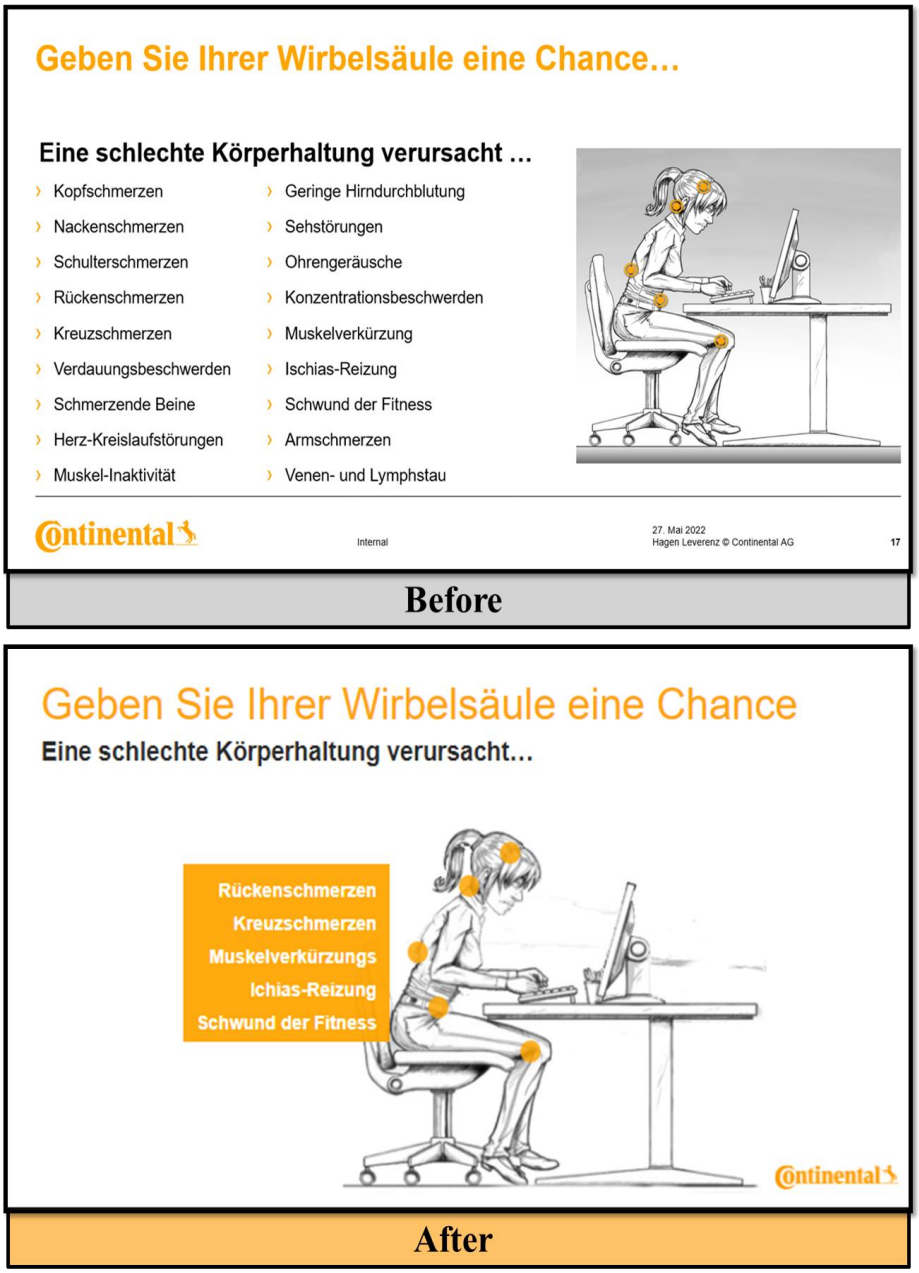


Figure 3.10 The Spatial Contiguity Principle example

3.4.2 Managing Essential Processing

Learner “essential overload” (see chapter 2.2.2.2) must be avoided to produce a high-quality WBT, and thus by providing learners with small chunks of relevant information, familiarizing them with the content prior to diving into it, and by using a combination of visuals, narration, and less text to convey the information. Therefore, the (Segmenting, Pre-training, and Modality) principles must be implemented (cf. Mayer and Pilgard 2014, p.319).

3.4.2.1 The Segmenting Principle

According to the Segmenting Principle, individuals learn more effectively when they get knowledge in little chunks as opposed to a continuous stream. Mayer found that students performed better in learning when they had more control over their own learning speed (cf. Ibid.).

Info: Learners must be aware of the supervisors' legal obligations under the occupational safety law.

Presentation-before: In one section, six different legal requirements for supervisors are enumerated, each based on a different paragraph of the occupational safety law (see Figure 3.11, Before Leverenz 2022, p.5).

Presentation-after: The paragraph number is used to divide the six legal requirements, which are then presented when the learner clicks on the rectangle containing the paragraph. A little animated short illustrates the legal obligation. To further empower learners, the WBT authoring tool's (Articulate Storyline) player provides several features and controls that allow users to pause and restart playback of the displayed learning content at their own learning pace.

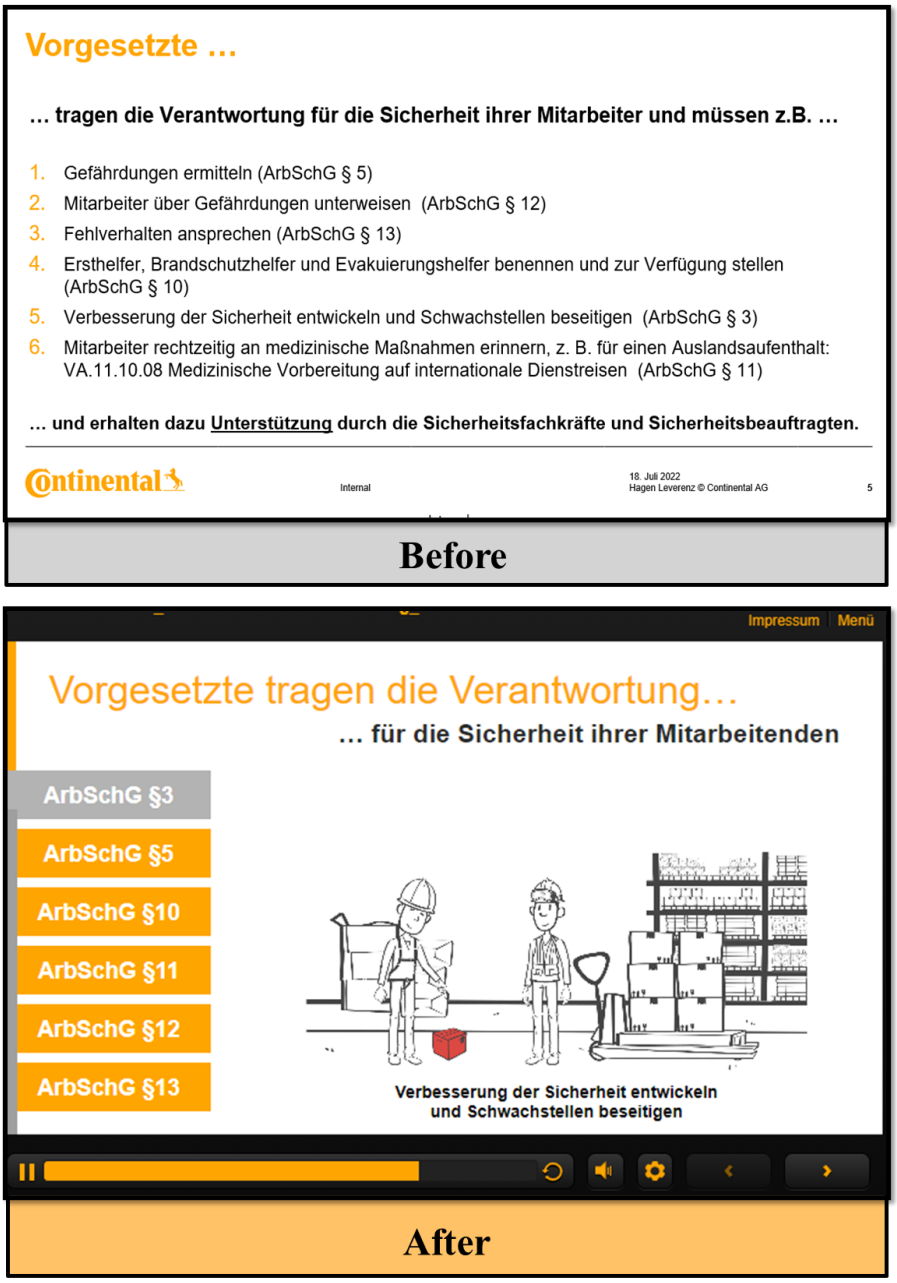


Figure 3.11 The Segmenting Principle example

3.4.2.2 The Pre-training Principle

According to the Pre-training Principle, people learn better if they are already familiar with some of the fundamentals. This sometimes involves comprehending fundamental definitions,

terminology, or ideas prior to beginning the learning process (cf. Mayer and Pilgard 2014, p.319).

Info: It is preferable that the learner begin the course having some prior understanding of the subject matter.

Presentation-before: On the first slide of the PDF-T, the training's title, date, department name, and relevant locations are to be read, then the training's content begins directly on the following page (see Figure 3.12, Before Leverenz 2022, p.1).

Presentation-after: The WBT begins with a brief opening video in which a female character introduces the training and displays the first slide. This character's voice accompanies the learner throughout the entire training, reading out all the content presented and acting as the trainer's mentor. Additionally, there is a menu at the beginning of the training that offers an overview of the titles of the subjects that will be addressed in the training.

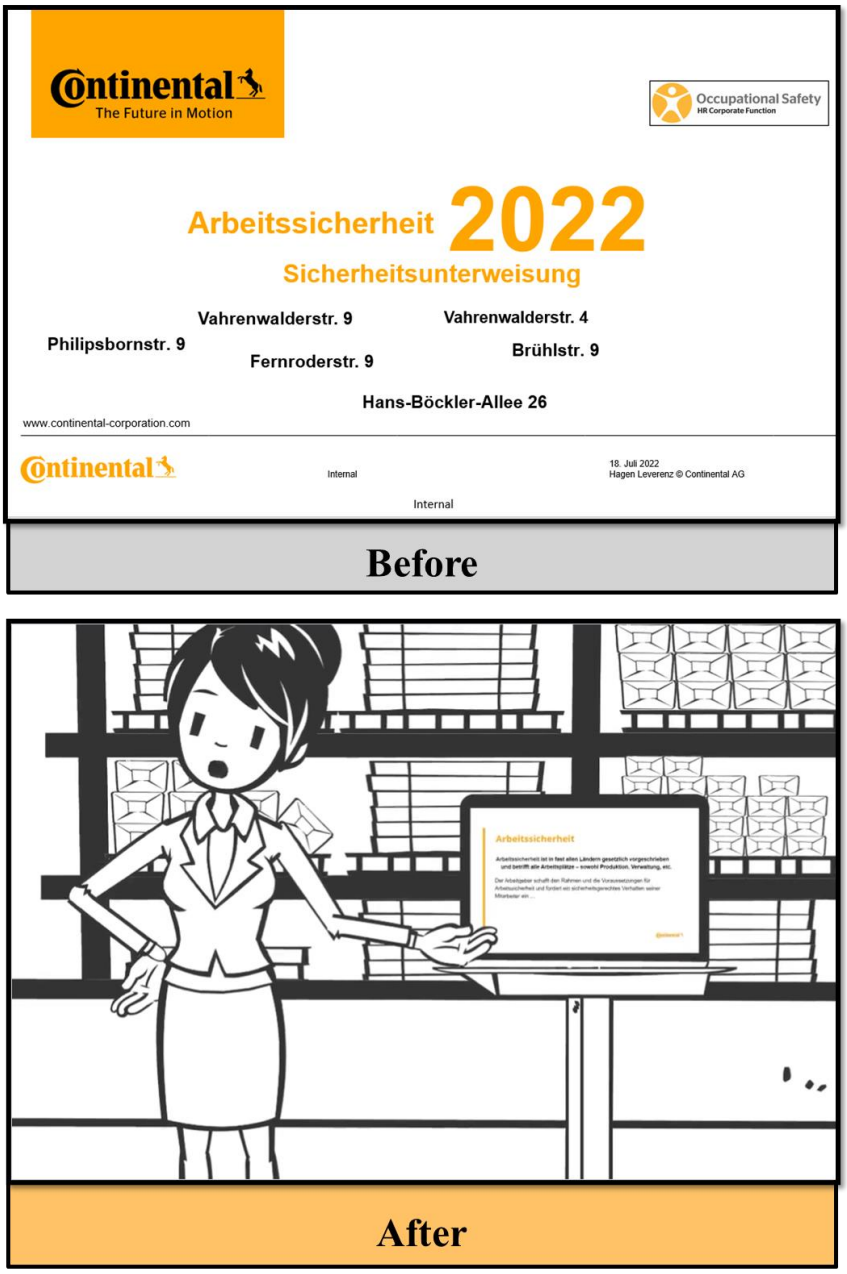


Figure 3.12 The Pre-training Principle example

3.4.2.3 The Modality Principle

According to the Modality Principle, visuals and spoken words are preferable to written words and images for learning. If there is an excess of text, learners may become frustrated (cf. Mayer and Pilgard 2014, p.319).

Info: In Germany in the year 2020, stairway accidents were one of the leading causes of mortality when compared to automobile, drowning, and fire accidents. Important to note that nearly all deaths may have been prevented by using the railing.

Presentation-before: Listed are the causes of death and the overall number of deaths. The conclusion is that more people die annually from falling downstairs than from car accidents, drowning, and fires. With a tragic conclusion that virtually all stair falls might have been avoided by using the handrail. a photograph shows a chalk outline of a dead person on stairs (see Figure 3.13, Before Leverenz 2022, p.7).

Presentation-after: Using a bar chart to visualize the data helps learners to easily identify stair falls as one of the leading causes of death. In addition, the fact that using the handrail may have saved lives in the majority of instances is highlighted to emphasize the importance of its usage.

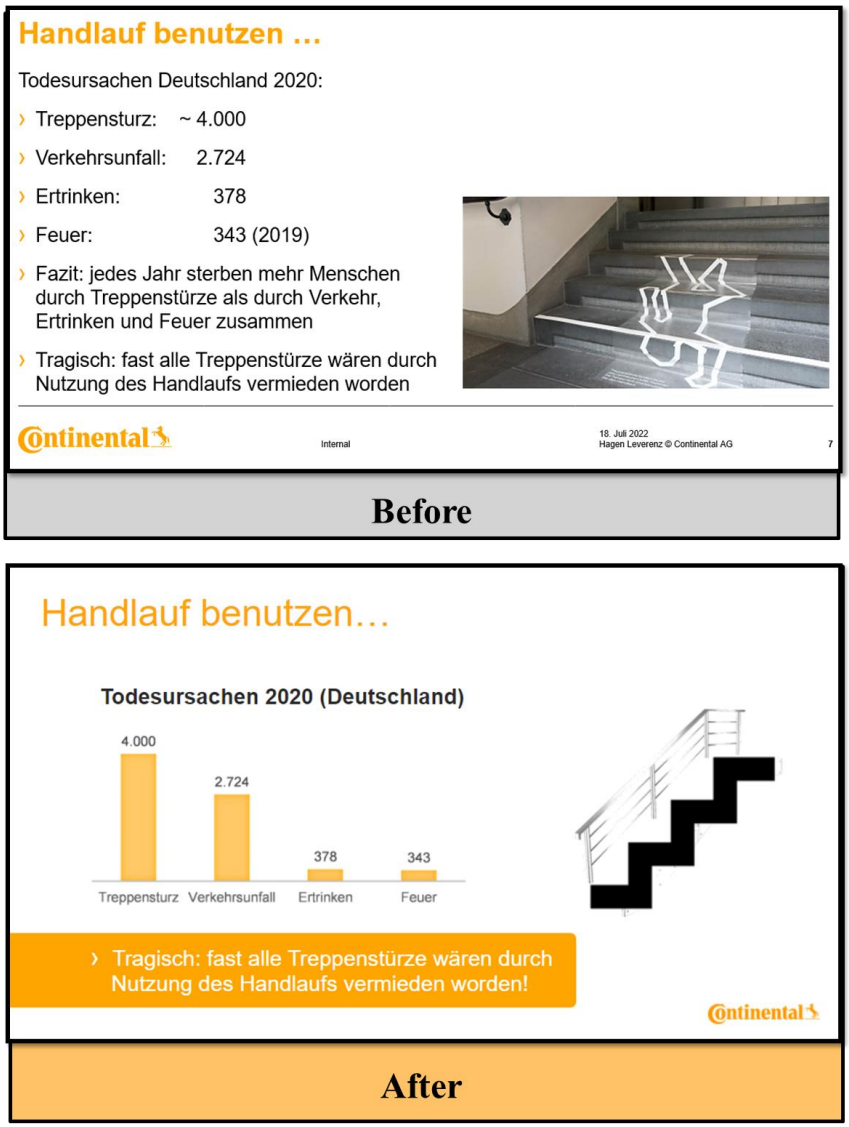


Figure 3.13 The Modality Principle example

3.4.3 Fostering Generative Processing

Lastly, it is essential that the offered material stimulates the learner to comprehend it. This can be achieved by increasing the use of visuals, presenting speech in a conversational manner and with a human voice, and reducing the use of talking heads in the training, as they do not encourage the learner (cf. Mayer 2009, p.222; Mayer 2017 p.314). Therefore the (Multimedia, presentation, voice, and imager) principles must be implemented like follows:

3.4.3.1 The Multimedia Principle

According to the Multimedia Principle, people learn better when they are provided with a combination of text and visuals rather than simply text. Mayer's whole point of view is built on this concept, which he utilizes to support his claim that pictures and words function better together than they do alone (cf. Ibid.).

3.4.3.2 The Personalization Principle

According to the Personalization Principle, people learn best through casual, conversational language as compared to highly formal language. A more informal tone significantly enhances the learning process. (cf. Ibid.)

The vocabulary used in the ESH WBT was kept basic and straightforward. No complex terminology was used to guarantee that the language was always clear. Keeping in mind that this training is intended for a diverse range of company workers, all of whom will have diverse educational and demographic backgrounds, the course must be designed to accommodate these differences.

3.4.3.3 The Voice Principle

According to the Voice Principle, humans learn better from a human voice than from a computer voice (cf. Ibid.).

In this scenario, a Text-To-Speech (TTS) was utilized to provide the narration for the WBT, allowing the same training to be used in future years in compliance with training sustainability. Voice narrations may be modified more quickly and cost-effectively with TTS technology then those recorded by a real human. In this approach, any changes to the company's regulations can be easily reflected in the training.

However, when generating the voice, the voice-principle was taken into account to improve the voice quality to sound more like a human voice This was accomplished utilizing the Amazon Polly tool's NTTS service and the SSML tags feature (as explained in Speech Synthesis Markup Language). Following is a brief illustration of how the voice was generated using SSML tags.

```
<speak>
     <amazon:auto-breaths volume="x-soft">
         <prosody pitch="high">
            Mitarbeiter sind nach dem Arbeitsschutzgesetz, paragraphen 15 und 16 verpflichtet:
         </prosody>
              <p> konzentriert und aufmerksam ihre Tätigkeit auszuführen </p>
              <p> aufgefallene Mängel und Gefahrenstellen ihrer Führungskraft und dem Sicherheitsbeauftragten
                  bzw. der Fachkraft für Arbeitssicherheit zu melden </p>
             <p> ihre Kollegen auf deren möglicherweise arbeitssicherheitswidriges Verhalten hinzuweisen </p>
              <p> geltende Gesetze, Vorschriften, Regeln und Anweisungen einzuhalten  </p>
       </amazon:auto-breaths>
</speak>
```

Figure 3.14 The Voice Principle example- applying SSML-Tags

The SSML tags used in this example generate a human-sounding voice by adding a pause for breathing between each paragraph and emphasizing key words by raising the speaker's prosody on those words.

3.4.3.4 The Image Principle

A video with a talking head does not necessarily help with learning, according to the Image Principle. It is better to show relevant images on the screen than an instructor's talking head (cf. Mayer 2009, p.222; Mayer 2017 p.314).

A talking character only appears three times during the WBT: when training begins to greet and advise users, when quizzes begin, and when training ends to thank the user for completing this training. During WBT, the user can only hear this character's voice and view animated images.

3.4.4 Quality Assurance Process

Before moving on to the next phase of the project, the material uploads must first pass through the quality gate, which is a project milestone that needs certain predetermined criteria to be met. The purpose of this document is to provide benchmarks for quality standards. To successfully release material, LBPs and Content Releasers use this quality gate, which requires sign-off from either a SME or stakeholder, LBP, or a Content Releaser.

The quality gate checklist evaluates the E-Learning material based on its overall framework, general content, structure, visuals, audio, and learning management system (LMS) configuration.

After developing a WBT, it should be submitted to the LBP for a comprehensive examination. The SME and LBP must next do a quality gate check on the WBT by examining its overall framework, structure, general content, and multimedia components, as well as the LMS Setup, utilizing a checklist (see Table 3.3, cf. Continental AG):

Table 3.3 Quality-Gate Checklist

Quality Dimension	Quality Criteria
Overall Framework	Analyzes if the content's ownership (SME) is apparent within the governance system, if the learning lifespan is clearly defined and aligned with content, if the content is fully functional on all target devices (mobile app, laptop), and if the content's security is validated (no confidential information on app).
General	Examines if learning goals are clearly defined, if task descriptions and completion criteria for tasks based on "applied knowledge" or "hands-on experience" are complete and understandable, if the learning format is suitable for the defined learning goals and target group, if the language used in the learning item is understandable, and if the learning is delivered in the languages required by the relevant target group.
Structure	Learning materials are evaluated based on how effectively they are organized, how easy they are to navigate, and how engaging they are to participate in. This is especially true for online courses, which may be assessed using several metrics. And the LBP also checks to see if the material can be finished, whether learners always know where they are in the E-Learning (timing and navigation), and whether the most relevant information is consistently summarized.
Visual	The images of the instructional material are scrutinized to ensure that all materials / text elements are simple to read and comprehend, and whether the E-Learning design adheres to the E-Learning design guidelines.
Audio	The audio in the learning material is analyzed to see whether the E-Learning animations are coordinated with the audio material and if the E-Learning audio track meets high quality criteria (adequate volume, good understandability, no background noises, etc.)

LMS Setup	The LMS setup of the E-Learning material, is checked to see if there is a title and a detailed description of the item that includes the intended audience, prerequisites, timeframe, price, and any other relevant information.

After passing all quality tests on the checklist, the WBT was exported as a SCORM package for uploading to the LMS.

4 Experiment

The last stage of Continental's learning design guide is the implementation of the learning program's pilot, during which an assessment test is conducted to gather feedback and ideas for strengthening solutions developed in earlier stages. In this thesis, a pilot for both WBT and PDF-T is implemented concurrently as an experiment to determine if the digitalization of training improves its quality. This chapter describes the experimental techniques and procedures used to answer the thesis question.

4.1 Data Collection

To determine whether a WBT improves the quality of an ESH-Training in comparison to a PDF-T, a small experiment has been conducted.

The Methodology of the experiment resembles A/B testing, which is based on the concept of evaluating two variants of a system, in which the original version is compared to a newly modified version in order to achieve a specified objective (cf. Kreutzer 2021, p.155). In this example, a select number of employees from the company have been tasked with testing and evaluating both the existing PDF-T version of the ESH-Training as well as the newly developed WBT to determine which of the two formats provides a superior quality of the overall learning experience.

The approach requires a demographically varied group of participants to complete three steps: testing and evaluating the PDF version of the training, testing, and evaluating the WBT version of the training, and completing a detailed survey (see Figure 4.1).

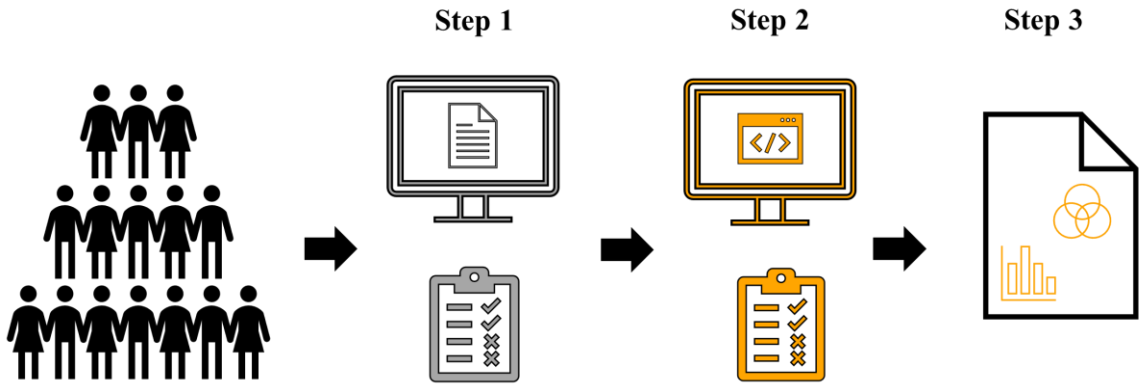


Figure 4.1 Experiment steps

As a result, the outcome of this procedure serves as an evaluation of both trainings, which will help choose which training is preferable. The demographic survey determines how motivated employees are to use WBT for future learning after experiencing both training formats, and how this varies (or not) according to demographic factors.

4.1.1 Materials and Methods

This experiment requires the use of specific materials and methods. Both PDF-T and WBT formats are required for the initial comparison of two research item materials. The ESH department of the VVA provided the initial PDF instruction, which was converted into a WBT. To evaluate the quality of the training, an evaluation method is required. The Kirkpatrick Evaluation Model (KEM) was chosen because it was already being used throughout the organization for all trainings.

The KEM, developed by Donald Kirkpatrick, is the most popular approach for evaluate the effectiveness of a training program. The model analyzes trainings based on four levels of criteria:

Reaction: measures how the participants felt and their individual responses to the training or learning experience.

Learning: measures the quantity of knowledge or intellectual capability gained by learning.

Behavior: measures the degree to which learners implemented the acquired knowledge and modified their conduct.

Results: measures the effect of the learner's enhanced performance on the business or environment. (cf. Falletta 1998; Kirkpatrick Partners 2022).

To answer the thesis question of whether or not WBT increases the quality of an ESH-Training in comparison to a PDF-T, only the first level of this evaluation method must be performed and analyzed. In the first level of the Kirkpatrick approach, participants' responses are gathered using questionnaires known as "Happy Sheets" The company's standard Happy Sheets consists of 14 questions about the facilitator, content, methods, materials, length, and overall training experience (see Table 4.1, Original in Appendix 3).

Table 4.1 Happy Sheet assessment questionnaire based on first-level evaluation of KEM

	Question	++	+	0	-	- -
Facilitator	The content was delivered understandably (intonation, pace).					
	Questions and/or technical problems were answered/ resolved on time.					
Content	The content was relevant and of current interest.					
	The content was adapted to my previous knowledge.					
Methods, Materials & Length	The amount of content covered was appropriate for the learning item.					
	The set-up as virtual/ online learning worked well for the topic and content covered.					
	The interactivity level was satisfactory and appropriate for the content covered.					
	The learning item's length was appropriate for the content covered.					
Learning Application	The knowledge/methods that were taught in this learning item apply directly to the type of work that I do.					
	The knowledge/methods gained from this learning item will be useful on my job.					
Organization	The learning item was well organized, and I have received all logistical information (time/date/location etc.) on time.					
Overall	My personal expectations and learning goals were met during the learning item.					
	Overall, I was satisfied with this learning item.					
	I would recommend this learning item to others.					

For both training distribution and evaluation, an LMS platform is required. All educational actions performed by or on behalf of the organization are held in the specialized LMS (MySuccess), which also supplies the assessment findings as a CVS dataset, which are exported and imported into a standardized Excel template for easy analysis.

To provide more accurate results regarding the intended audience, it is also necessary to do a demographic study; consequently, a Microsoft Forms-based online survey was created (see Appendix 4-5) to collect data about the demographics of the learners.

The following table summarizes all the materials and methods used in this experiment (see Table 4.2).

Table 4.2 Materials and methods used in the experiment

Requirements	Used material and methods	Status
Research item 1	The existing PDF-T	Existed
Research item 2	The newly developed WBT	Had been created
Evaluation sheet	Kirkpatrick -Level 1 (Happy Sheets)	Existed
Evaluation Report	Standard-Template in Excel	Existed
Demographic Survey	Microsoft Forms Online Survey	Had been created
LMS platform	MySuccess	Existed

4.1.2 Pilot Study

The decentral learning administrator (DLA) uploaded both trainings (PDF-T and WBT) to the LMS, and they were ready to be assigned to the participants of the experiment. Due to the limited time available for the experiment, only the first two modules (Basic Instruction and Mobile Working) of the Training were chosen for assessment (see Table 3.1).

The team head of Recruiting Center Germany sent an email to VVA Department employees inviting them to take part in an experiment (see Appendix 1). Nineteen workers volunteered to take part in the experiment. A follow-up email has been then sent to those individuals explaining the objective and methodology of the study (see Appendix 2).

Participants' usernames and email addresses were given to the DLA in order for them to be assigned to both LMS Trainings. When users were assigned to both research items on the LMS, they received an email as well as a notification on their LMS profile (see Appendix 6). Links to both trainings were automatically added to the "My Learning Assignments" section of the user's LMS profile where the user can access them (see Appendix 7). After completing each training, participants were requested to provide feedback via an online form accessible via their LMS account.

A week after the experiment's inception, 15 participants had completed all the required steps. Consequently, an email was sent to all participants encouraging those who have not yet finished the assignments to do so (see Appendix 11).

But then end of the second week, all the 19 participants had completed the required steps. The DLA then supplied a CSV-formatted dataset of the feedback results of both (PDF and WBT) provided by the LMS, which was incorporated into a standard Excel template used by the organization to visualize the outcome data.

4.2 Results

Demographics survey findings and the outcomes of both trainings' happy sheets questionnaires will be provided in this chapter.

4.2.1 Results of the Demographics Survey

Only 16 of the experiment's 19 participants completed the demographic survey (n=16):

Women make up 88% of the participants (n=14), while the remaining 2% (n=2) are men (see Figure 4.2).

Figure 4.2 Gender representation of participants

Participants varied in age from 21 to 50 years old. More than two-thirds (69%, n = 11) of respondents are between the ages of 21-30, while just 19 % (n = 3) of those polled are between the ages of 41 and 50 (see Figure 4.3).

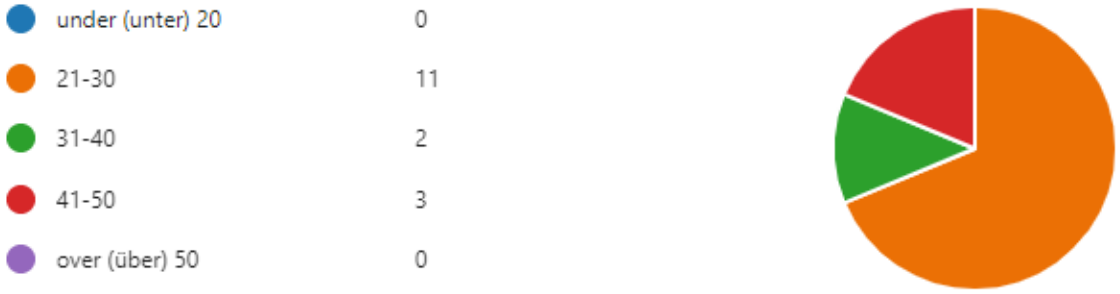


Figure 4.3 Age representation of participants

Most participants (56.25 %, n =9) had a bachelor or master's degree, while just one person had a PhD, one had a high school certificate, and the other two participants added "Diploma and specialist" to their highest degree (see Figure 4.4).

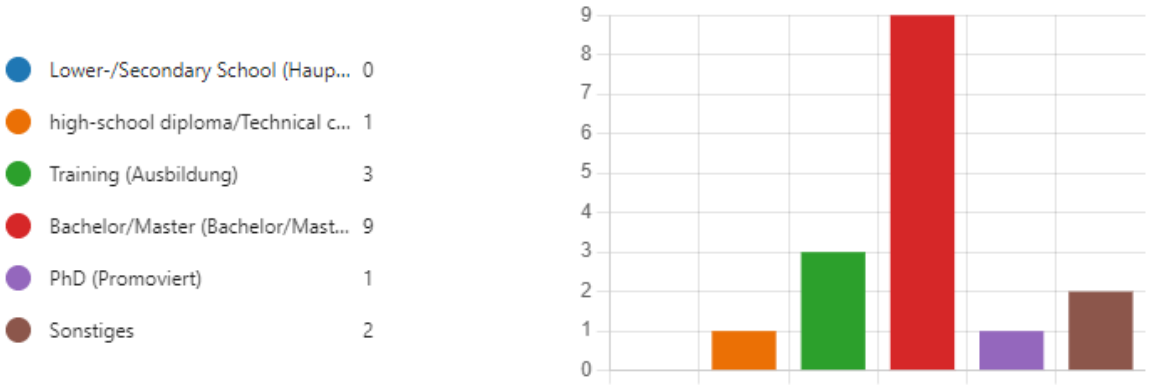


Figure 4.4 Education level representation of participants

In all, 16 of the participants (63 %) had been employed by the firm for at least a year, while just three (19 %) had been employed by the company for more than five years and three (19 %) had been employed by the company for less than a year (see Figure 4.5).

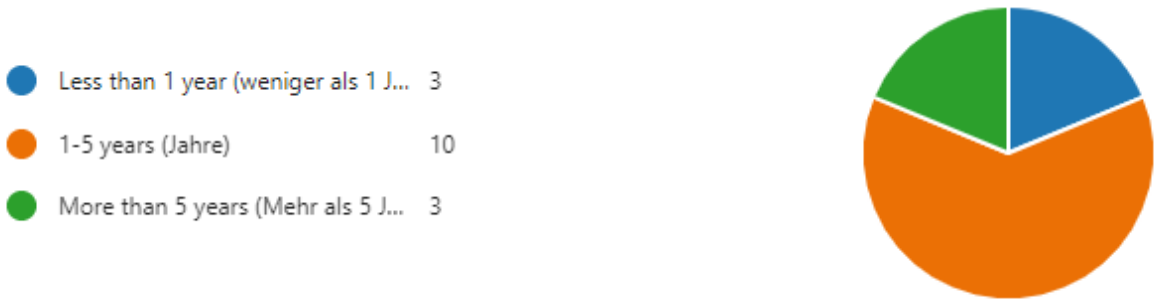


Figure 4.5 period of employment representation of participants

Most participants (75 %, n=12) said that the felt motivated to adopt a Web-Based learning for training and knowledge improvement; three participants were somewhat motivated, and one person said he/she was neither motivated nor unmotivated (see Figure 4.6).

Figure 4.6 Participants' motivation for web-based learning

4.2.2 Results of the Happy Sheets

The results of satisfaction surveys “Happy Sheets” are shown in this chapter, utilizing an Excel template for visualization.

The template provides information on the number of participants and their responses in form of a table (see Appendix 13, 15) presenting the average scores for each of the fourteen question and the overall average for each of the six criteria (Facilitator, content, Methods, Materials, and length, learning application, Organization, and the training overall, cf. chapter 4.1.1). The Overall average score ranges also from 1 to 5; if the aggregate average score is at least 4,3, it is regarded as an exceptionally high score. A score between 3,1 and 4,2 is deemed good, whilst a score of 3,0 or below is deemed poor. The template provides a radar chart visualizes the average of each criterion.

These six criteria of the learner's degree of satisfaction are the KPIs established for the benchmark phase. The results will assist in determining if the digitization of existing training has enhanced its quality.

4.2.2.1 Evaluation Results of the PDF-Training

On the radar map, the quality of the PDF-Training is apparent, with the average rating of all six quality categories ranging from 3 to 3,9. The highest average score of 3,9 out of 5 points was awarded to the content and organization. In spite of this, the training obtained an overall score of 3 out of 5, meaning that the user's expectations and learning goals were not fully met throughout the learning item (see Figure 4.7Figure 4.7). Indicating that users were not completely

satisfied with this learning item and that would be unlikely to suggest it to others (cf. Table 4.1; Appendix 13).

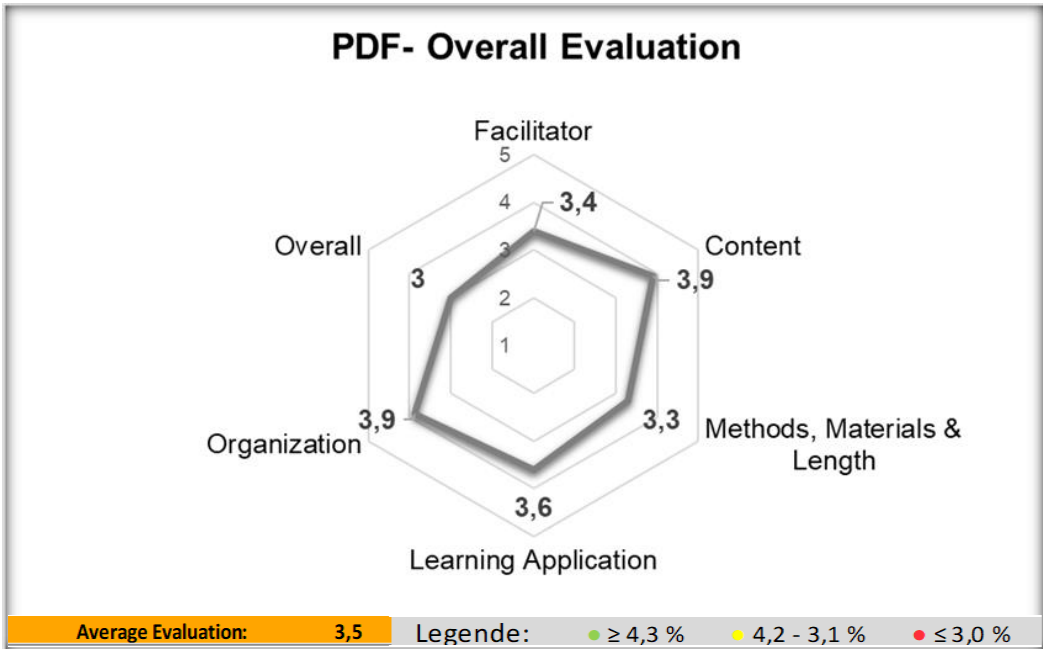


Figure 4.7 PDF-Overall Evaluation

The average rating for PDF-Training is in the center of the yellow category with an overall average of 3,5 which indicates that the training was just moderately competent.

4.2.2.2 Evaluation Results of the Web-Based-Training

An ideal hexagonal shape is formed through WBT in terms of the six criteria; the average rating values of all six criteria are in close proximity to each other. The average is between 4,2 and 4,3. Signifying a general satisfaction with the learning materials from the participants.

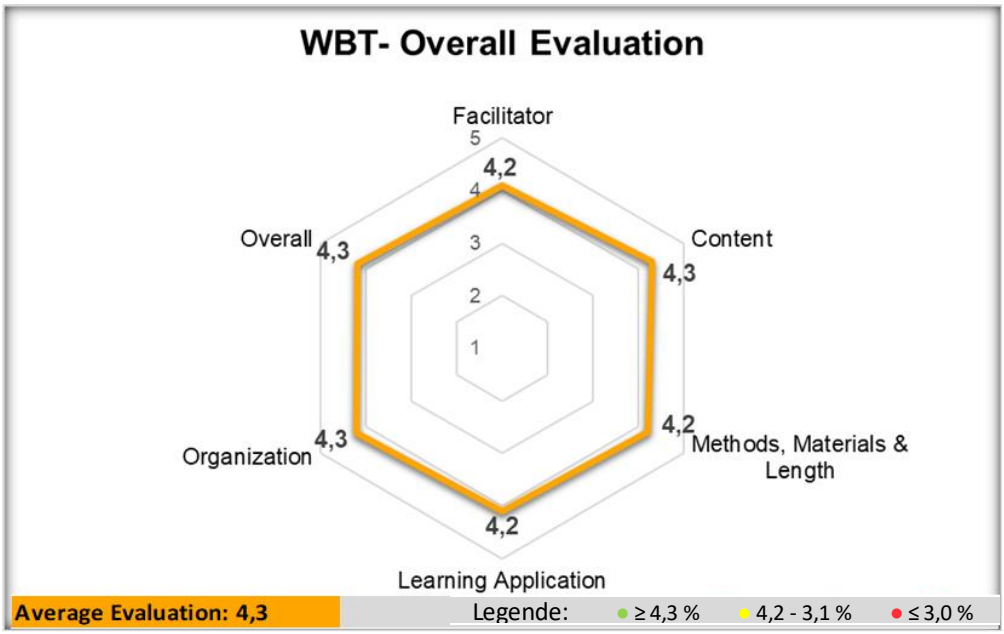


Figure 4.8 WBT -Overall Evaluation

Overall, the WBT is in the green zone (see Figure 4.8), which denotes excellent training.

In conclusion, after analyzing the rating of each training format separately and determining that WBT is favored by users over PDF-T, it is important to get a big-picture view of the differences in quality between these trainings. Both learning formats were compared using a line graph (see Figure 4.9) based on the average score for each assessment criteria (facilitator, content, methods, materials, and length, learning application, organization, and the training overall).

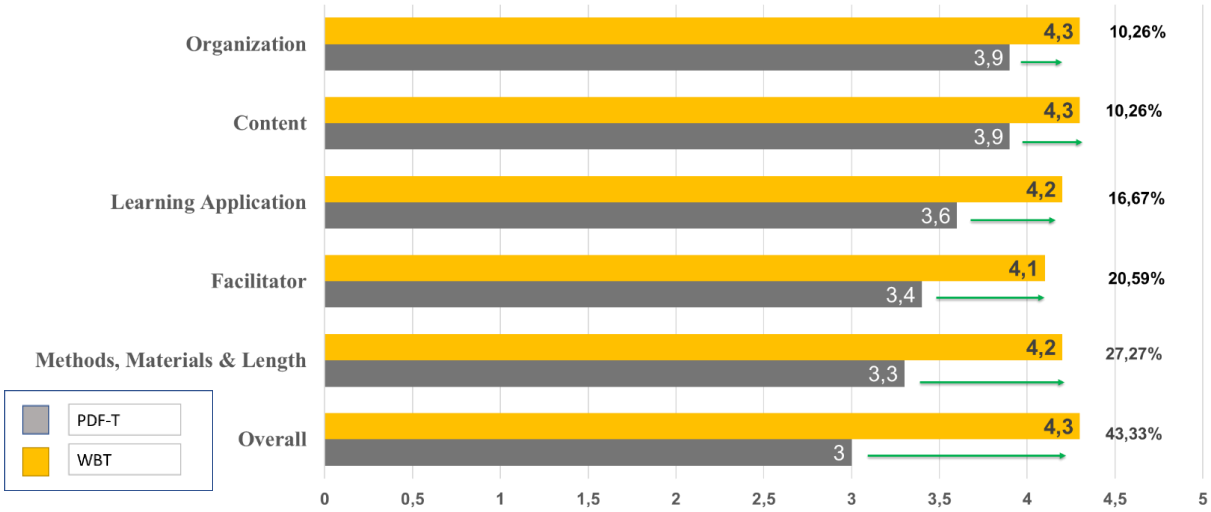


Figure 4.9 Comparation of PDF-T and WBT

Across all six criteria, the average grade for WBT is consistently higher than for PDF-T. Using a WBT as opposed to a PDF-T program resulted in a remarkable 40% increase in overall

satisfaction. Also worth mentioning is the increase of 27% in the average ratings for training methods, materials, and length, as well as the increase of 20,59% in the rating of WBT Facilitator.

5 Discussion of Results

In this chapter, the results of the demographic survey and the happy sheet surveys for both trainings will be discussed.

5.1 Demographics' Results Discussion

The demographics survey offered a summary of the demographics of the participants and their intention to use WBTs for learning. It came out that most employees who volunteered for these experiments were female. It was also evident that the vast majority of participants would like to use more WBTs.

This section examines the association between the participant's (age and employment at the company) and their (degree of motivation to use WBT).

According to the findings of the demographic Survey, all respondents between the ages of 31 and 50 felt highly motivated by the of WBTs. This assertion was shared by 64% of those between the ages of 21 and 30, while 28% felt somewhat motivated and one was neither motivated nor unmotivated. (See Figure 5.1).

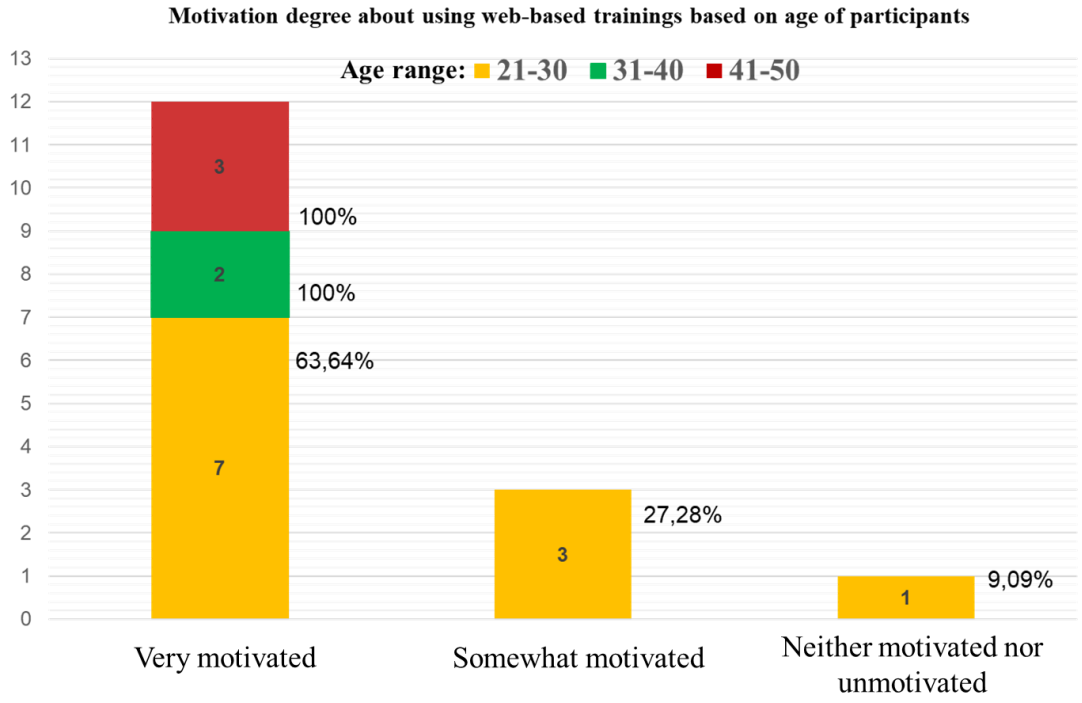


Figure 5.1 Level of motivation to use WBTs, based on age of participants

This assertion, however, cannot be generalized owing to the small sample size and the fact that the number of participants between the ages of 21 and 30 is much bigger than the number of those between the ages of 31 and 50, hence increasing the probability of divergent opinions.

An examination of the motivational degree of utilizing WBTs for organizational learning and knowledge development based on length of employment at the company revealed that those who have worked for less than one year, those who have worked for more than five years, and six out of ten participants who have worked for one to five years are all highly motivated to use WBTs for these purposes. Only one of the participants felt neither motivated nor unmotivated (See Figure 5.2).

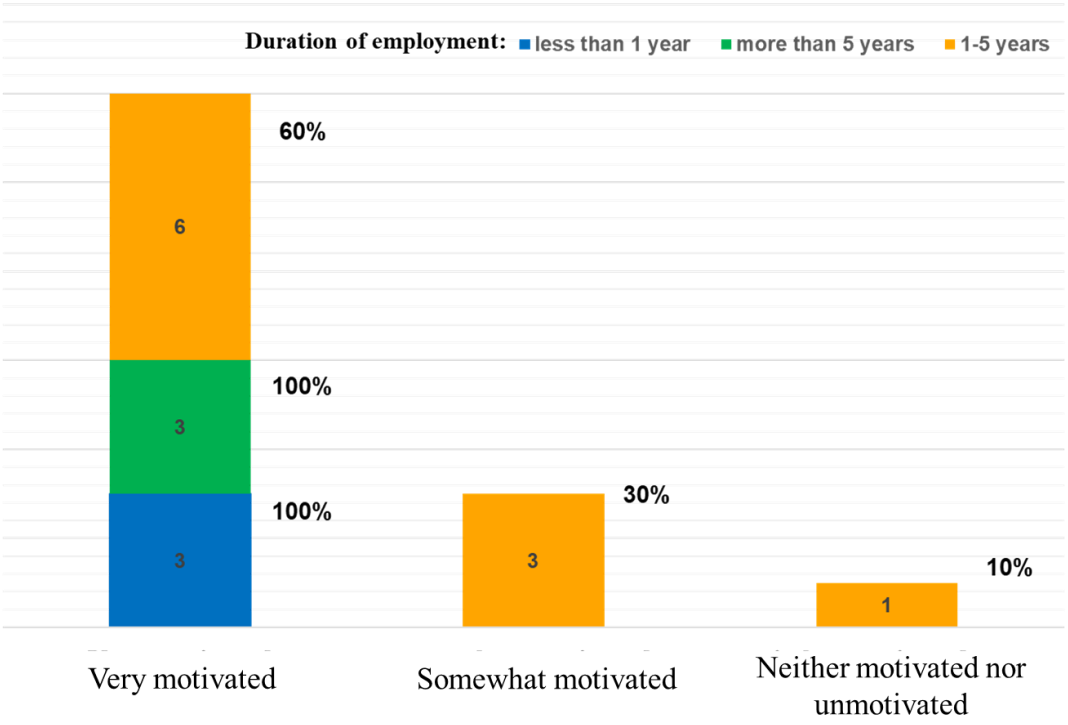


Figure 5.2 Level of motivation to use WBTs based on length of employment

Also here, since the number of participants in each group varied so much, it was hard to make conclusions about the association between work duration and willingness to use WBT.

Gender may or may not influence the willingness to utilize WBT, however this survey only had two male participants, making it impossible to draw any conclusions on the topic.

According to the findings of the demographic survey, the majority of participants are motivated to use WBT for their knowledge growth inside the organization. Moreover, despite the limited sample size and random selection of individuals, this research demonstrates that the participants' levels of education differ from each other's. Therefore, the WBT content must strike a balance between not being too challenging for certain people and not being too dull for others.

5.2 Happy Sheets' Results Discussion

The average responses to all fourteen questions on the Happy Sheets survey (see Table 4.1) are shown together with the standard error indicator in the following chart (see Figure 5.3)

Table 5.1 Happy Sheets questions and average results for both WBT and PDF-Training

Quality criteria	Question ID	Question	Avg. WBT	Avg. PDF-T
Facilitator	F1	The content was delivered understandably (intonation, pace).	**4,1**	**3,2**
	F2	Questions and/or technical problems were answered/ resolved on time.	**4,3**	**3,6**
Content	C1	The content was relevant and of current interest.	**4,4**	**4,1**
	C2	The content was adapted to my previous knowledge.	**4,3**	**3,7**

Methods, Materials & Length	M1	The amount of content covered was appropriate for the learning item.	**4,3**	**3,6**
	M2	The set-up as virtual/ online learning worked well for the topic and content covered.	**4,6**	**3,4**
	M3	The interactivity level was satisfactory and appropriate for the content covered.	**4,1**	**2,5**
	M4	The learning item's length was appropriate for the content covered.	**4,0**	**3,7**
Learning Application	A1	The knowledge/methods that were taught in this learning item apply directly to the type of work that I do.	**4,0**	**3,4**
	A2	The knowledge/methods gained from this learning item will be useful on my job.	**4,3**	**3,9**
Organization	O1	The learning item was well organized, and I have received all logistical information (time/date/location etc) on time.	**4,3**	**3,9**
Overall	S1	My personal expectations and learning goals were met during the learning item.	**4,3**	**3,1**
	S2	Overall, I was satisfied with this learning item.	**4,3**	**3,1**
	S3	I would recommend this learning item to others.	**4,2**	**2,9**

The calculation of the standard error is preceded by the calculation of the standard deviation of each question for both Web-based and PDF-Training, it is possible to evaluate at a glance how near the responses are to the mean. Thus, we can determine if the result's reliability is high or whether it was a coincidence. As the standard error is derived from the standard deviation, a smaller variation in the sample will result in a smaller standard error. Significant differences between the two trainings formats may also be inferred using the standard error.

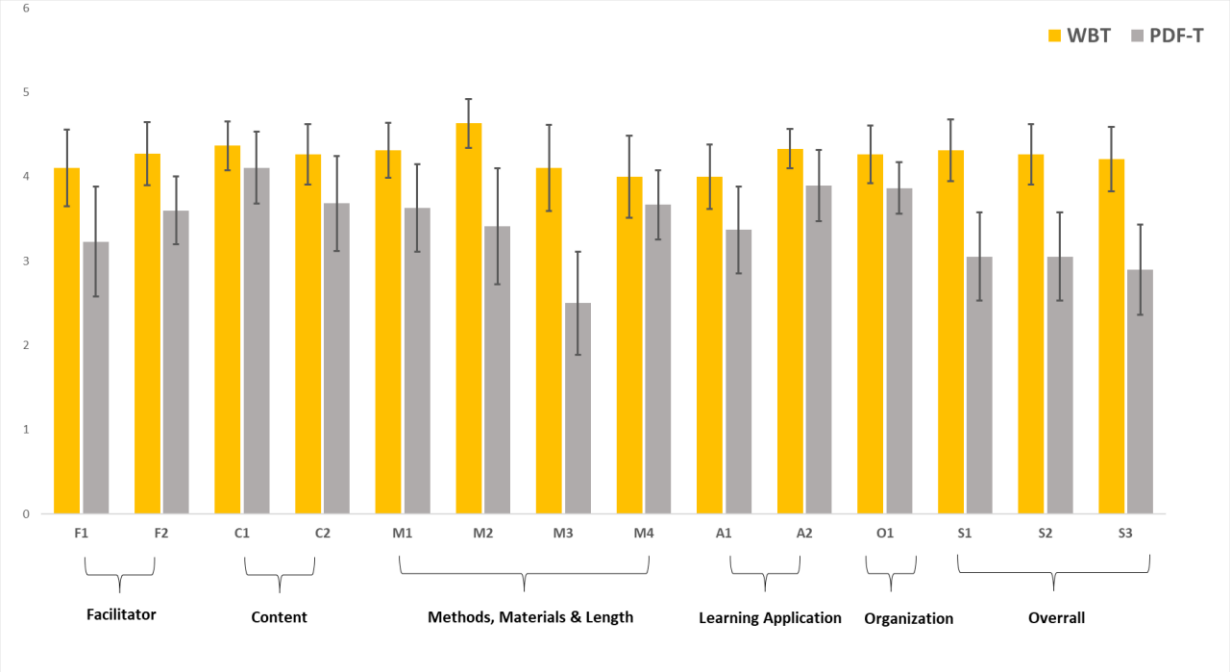


Figure 5.3 Results of Happy Sheets with standard deviation of the mean

It can be gathered from the graph that there is a significant difference between the two training formats in terms of the methods and materials used in training and the overall satisfaction with the trainings.

The majority of the data points, as shown by the graph, fall between the line's extremes, suggesting that the experiment's findings could be credible.

The large increase in user overall satisfaction with the WBT can be linked to the implementation of principles designed to foster the learner's generative processing (Fostering Generative Processing), hence facilitating the learner to gain a full understanding of the studied topic.

Even though both materials had identical learning goals and content, participants revealed that the knowledge they obtained from the WBT was more likely to be valuable in their jobs and had a direct application in their work. It is possible that the implementation of principles aimed at reducing superfluous processing and managing essential processing has contributed to an increase in user satisfaction with the learning content and application, which may have led learners to believe that the content of this WBT is more understandable and that the knowledge they have gained from the training can be applied in real life situations. The increase in average satisfaction may also possibly be attributable to Dale's CoE (cf. chapter 2.2.1.1) that the WBT requires learners to engage more senses (dual-assumption), in addition to the interactions featured in the WBT, compared to a PDF document.

Despite the fact that both trainings had the same content structure, the WBT had a higher degree of organization, which may be attributed to the learner's ability (through interactivity feature) to navigate between modules and maintain track of the learning journey.

The Methods, Materials & Length criterion examines the set-up as well as the interactivity level and the length of the learning item. Since the PDF-T lacked interactive elements, this may explain why the WBTs scored higher on this criterion.

The facilitator criterion looks at how effectively the material was presented. The WBT scored better here as well, which might be related to the execution of the 12 principles in overall, that seek to reduce cognitive processing and make information more understandable for learners.

Concurrently with the writing of this paper, the whole ESH module was officially piloted in a Web-based version and assigned to all VVA site business personnel (n~350). More than 170 employees have finished and evaluated the training. The total training evaluation score yielded the same result as the small sample experiment undertaken for this experiment. Which demonstrates that the results of the experiment with a small sample size are generally accepted as accurate.

However, while evaluating the whole WBT module, the focus was on four key criteria (Content = 4,3, Overall = 4,2, Learning Application = 4,1, and Methods, Materials and Length = 4,4). Comparatively, the outcomes of the experiment are very similar.

6 Conclusion and Further Work

As digitalization becomes increasingly crucial to all industries, it is essential to understand how the adoption of modern digitalized trainings can impact the quality and effectiveness of a training.

Answering the thesis's overarching question requires resolving two subsidiary inquiries. The question of the optimal WBT design must first be addressed. There is evidence that constructing instructional strategies for ESH-Training using a theory-based framework (see chapter 2.2) and leveraging technology for learning is advantageous. Using a combination of Dale's CoE Theory (see chapter 2.2.1.1) and the cognitive theory of multimedia learning (see chapter 2.2.1.2), a WBT was developed that required learners to employ more senses to learn without overburdening cognitive processes.

Moreover, the company's iterative instructional system design model (see chapter 2.3.3) was used to visualize and break down the development of training material into stages, providing structure and purpose to the learning content and making the user the focus of the experience by putting, their diverse needs at the center of the analysis, planning, development, implementation, and evaluation phases of the creation of WBT (see chapter 2.3). The five actions of design thinking theory were used at different stages in the system design model to generate significant ideas (see chapter 2.3.2).

The second question that must be addressed is whether training quality can be measured. Using a questionnaire based on the first level of the Kirkpatrick model (see chapter 4.1.1), one may examine a learner's reaction to a training by examining how well it satisfies several quality criteria. 19 employees were randomly selected for an experiment comparing the quality of the WBT and PDF-T. It was determined that the WBT was clearly preferred by the participants. The outcomes revealed an improvement in quality across all specified quality criteria.

This experiment has some limitations. The sample size for this study was small. Nonetheless, when the training was piloted with a larger number of workers and evaluated by more than 170 employees, the evaluation of the degree of satisfaction was remarkably similar to the experimental results. Due to the absence of access to personal data of participants in the company's evaluation process, it was challenging to get a better understanding of the correlation between the demographics of the target group and their degree of satisfaction. It would have been desirable if the same satisfaction surveys had been combined with responses to demographic data to create a correlation. Furthermore, the experimental design of the study is solely qualitative, and the results can only be used for the generation of quantitative hypotheses to further interpret results based on statistical probabilities.

Having addressed the two subsidiary questions of the thesis, the major question of whether a WBT increases the quality of an ESH-Training compared to an analog PDF-Training may be answered positively based on the data presented. By switching from analog PDF training settings to digital interactive trainings, the quality of the company's training will improve, and the learning experience will be enhanced. In addition, the technological needs of a business are met using WBTs.

Future research on the digitalization of ESH-Trainings in the business environment should build a clearer picture of how modern digital trainings influence employee performance in the execution of environmental, safety, and health guidelines.

Furthermore, while this experiment measured the improvement in the quality of WBT in comparison to analog PDF-Trainings, observational studies are required to gain a deeper

understanding of different patterns of behavior; for example, to determine if the format in which a training is presented to employees is related to its learning effectiveness.

In the experiment conducted for this thesis, men were less likely than women to respond to the invitation to participate in the pilot project. Is this an indication of a challenge that the HR team needs to address in encouraging men to take mandatory training seriously?

It can also be investigated if employees are more likely to complete and recall WBT content than typical analog PDF-Trainings. This has substantial ramifications for mandated trainings in topics like EHS, Ethics and Compliance, and Anti-Bribery and Corruption. Indeed, it appears that WBTs are a potent tool for organizations like Continental and others who wish to make their workplaces safer, more compliant, and more cohesive.

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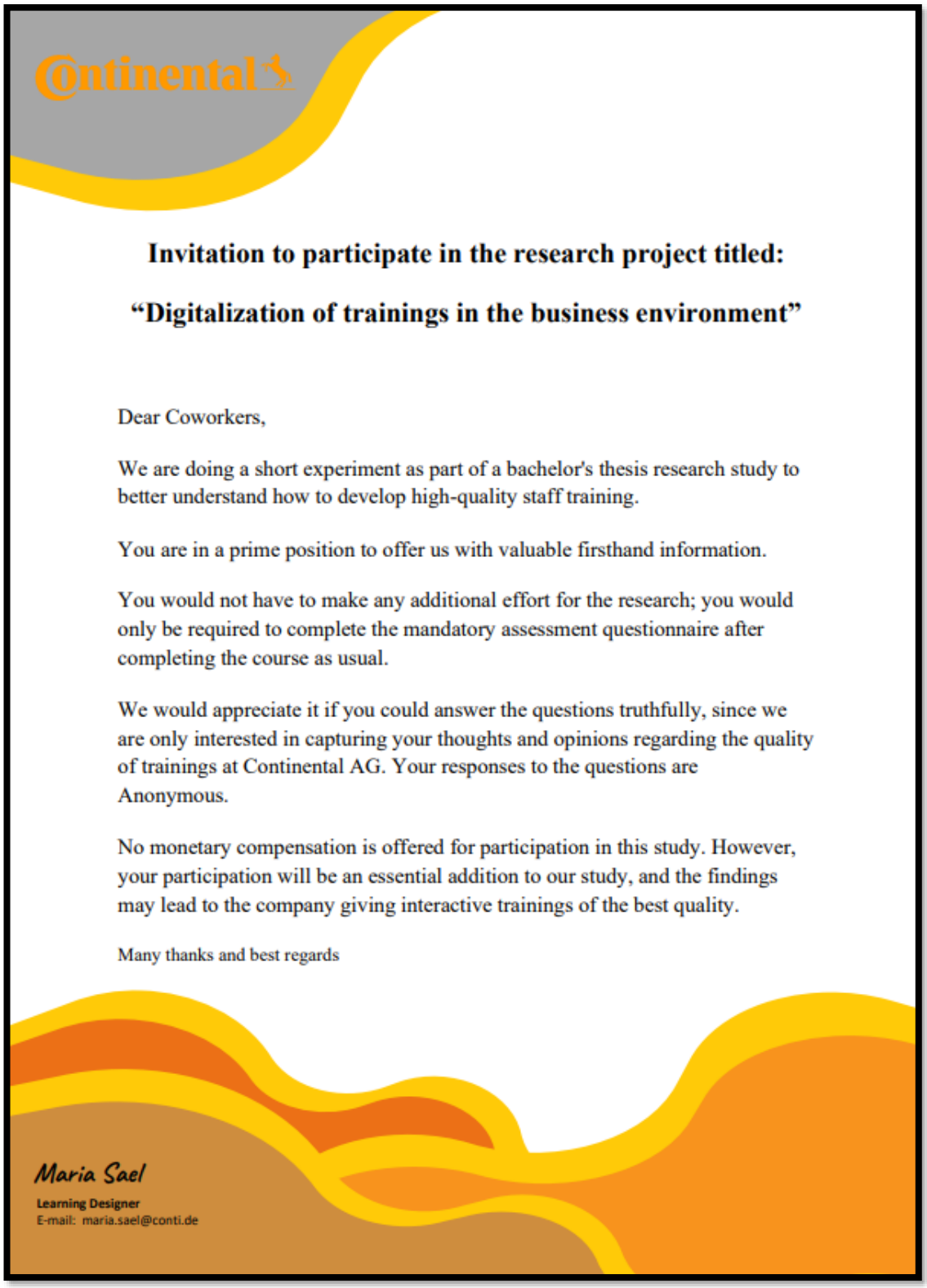
Appendix

Appendix 1 An invitation to participate in the experiment



Invitation to participate in the research project titled:

"Digitalization of trainings in the business environment"

Dear Coworkers,

We are doing a short experiment as part of a bachelor's thesis research study to better understand how to develop high-quality staff training.

You are in a prime position to offer us with valuable firsthand information.

You would not have to make any additional effort for the research; you would only be required to complete the mandatory assessment questionnaire after completing the course as usual.

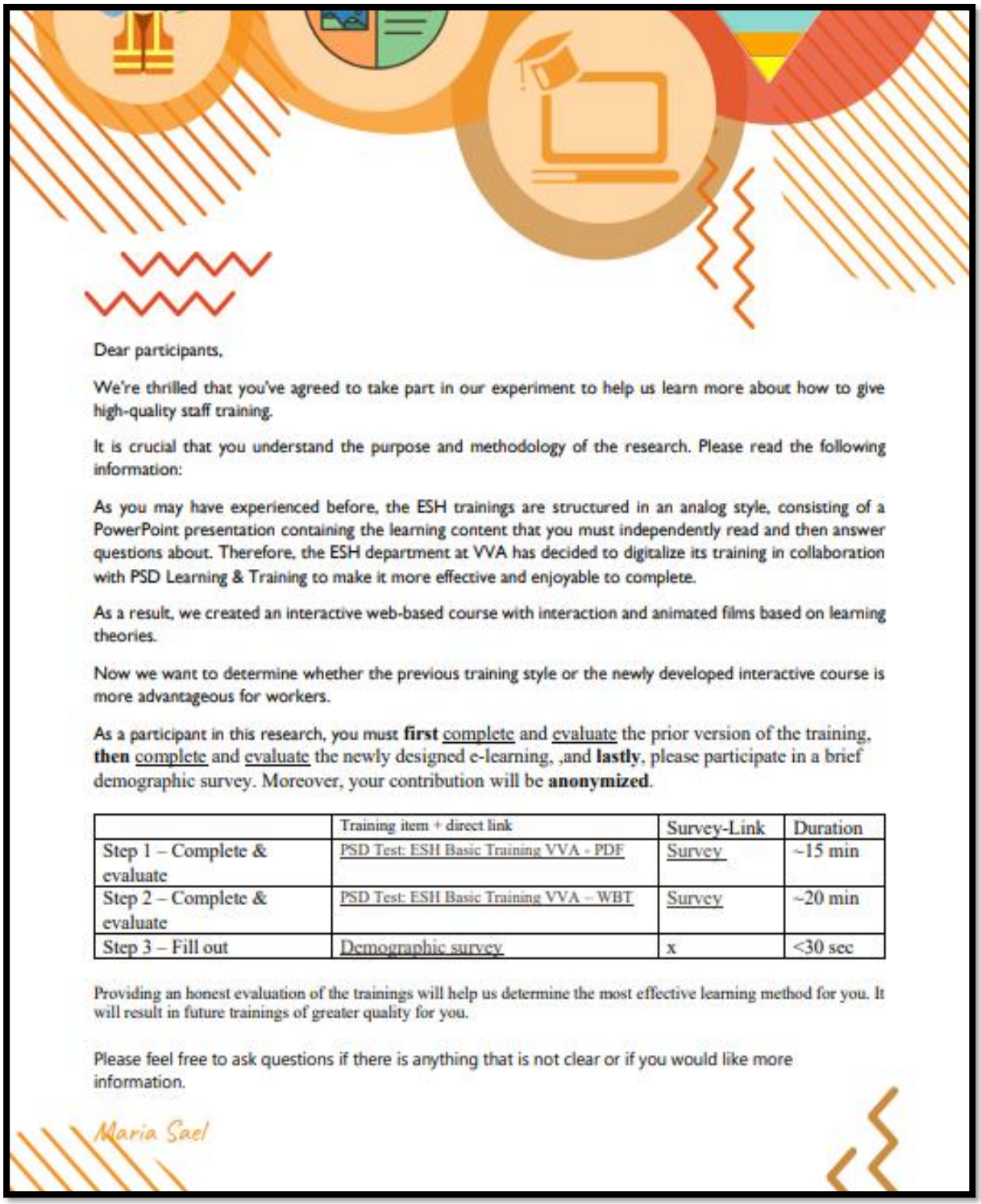
We would appreciate it if you could answer the questions truthfully, since we are only interested in capturing your thoughts and opinions regarding the quality of trainings at Continental AG. Your responses to the questions are Anonymous.

No monetary compensation is offered for participation in this study. However, your participation will be an essential addition to our study, and the findings may lead to the company giving interactive trainings of the best quality.

Many thanks and best regards

Maria Sael
Learning Designer
E-mail: maria.sael@conti.de

Appendix 2 Explanation of the experiment's purpose and methodology



Dear participants,

We're thrilled that you've agreed to take part in our experiment to help us learn more about how to give high-quality staff training.

It is crucial that you understand the purpose and methodology of the research. Please read the following information:

As you may have experienced before, the ESH trainings are structured in an analog style, consisting of a PowerPoint presentation containing the learning content that you must independently read and then answer questions about. Therefore, the ESH department at VVA has decided to digitalize its training in collaboration with PSD Learning & Training to make it more effective and enjoyable to complete.

As a result, we created an interactive web-based course with interaction and animated films based on learning theories.

Now we want to determine whether the previous training style or the newly developed interactive course is more advantageous for workers.

As a participant in this research, you must **first** complete and evaluate the prior version of the training, **then** complete and evaluate the newly designed e-learning, ,and **lastly**, please participate in a brief demographic survey. Moreover, your contribution will be **anonymized**.

	Training item + direct link	Survey-Link	Duration
Step 1 – Complete & evaluate	PSD Test: ESH Basic Training VVA - PDF	Survey	~15 min
Step 2 – Complete & evaluate	PSD Test: ESH Basic Training VVA – WBT	Survey	~20 min
Step 3 – Fill out	Demographic survey	x	<30 sec

Providing an honest evaluation of the trainings will help us determine the most effective learning method for you. It will result in future trainings of greater quality for you.

Please feel free to ask questions if there is anything that is not clear or if you would like more information.

Maria Sael

Appendix 3 Happy sheet used for evaluation

Training Evaluation

Last Name (optional)		Learning Item	
First Name (optional)		Location	
Division		Trainer	
Org. Unit		Date	

Participant's assessment after completion of the online learning item (such as e-learnings, videos, recorded virtual classroom training or any other online delivered formats of learning).

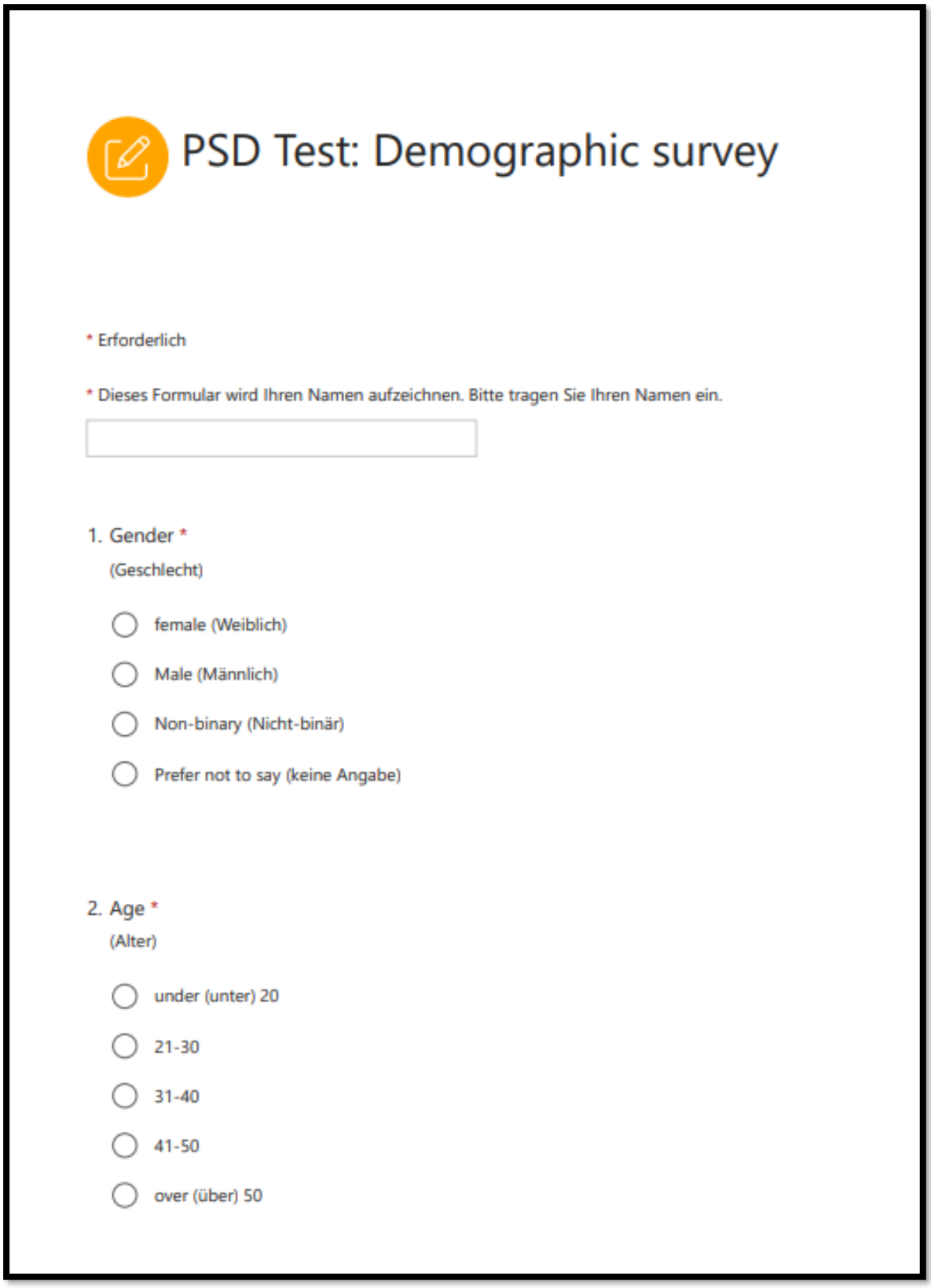
	--	-	0	+	++
Content					
1. The content was relevant and of current interest.					
2. The content was adapted to my previous knowledge.					
Facilitator					
3. The content was delivered understandably (intonation, pace).					
4. Questions and/or technical problems were answered/ resolved on time.					
Learning Application					
5. The knowledge/methods gained from this learning item will be useful on my job.					
6. The knowledge/methods that were taught in this learning item apply directly to the type of work that I do.					
Methods, Materials & Length					
7. The set-up as virtual/ online learning worked well for the topic and content covered.					
8. The interactivity level was satisfactory and appropriate for the content covered.					
9. The learning item's length was appropriate for the content covered.					
10. The amount of content covered was appropriate for the learning item.					
Overall					
11. My personal expectations and learning goals were met during the learning item.					
12. Overall, I was satisfied with this learning item.					
13. I would recommend this learning item to others.					
Organization					
14. The learning item was well organized and I have received all logistical information (time/date/location etc) on time.					

Learning item

15. What did you like best about this learning item?

16. What suggestions do you have to improve this learning item? / Other comments:

Appendix 4 Demographic survey Page 1



PSD Test: Demographic survey

* Erforderlich

* Dieses Formular wird Ihren Namen aufzeichnen. Bitte tragen Sie Ihren Namen ein.

1. Gender *
(Geschlecht)

- female (Weiblich)
- Male (Männlich)
- Non-binary (Nicht-binär)
- Prefer not to say (keine Angabe)

2. Age *
(Alter)

- under (unter) 20
- 21-30
- 31-40
- 41-50
- over (über) 50

Appendix 5 Dempgraphic Survay. Page 2

3. What is your highest degree? *

(Was ist Ihr höchster Abschluss?)

- ◯ Lower-/Secondary School (Haupt-/Realschulabschluss)
- ◯ high-school diploma/Technical college (Abitur/Fachhochschulreife)
- ◯ Training (Ausbildung)
- ◯ Bachelor/Master (Bachelor/Master)
- ◯ PhD (Promoviert)
- ◯ Sonstiges

4. How long have you worked at the company *

(Wie lange arbeiten Sie schon im Unternehmen)

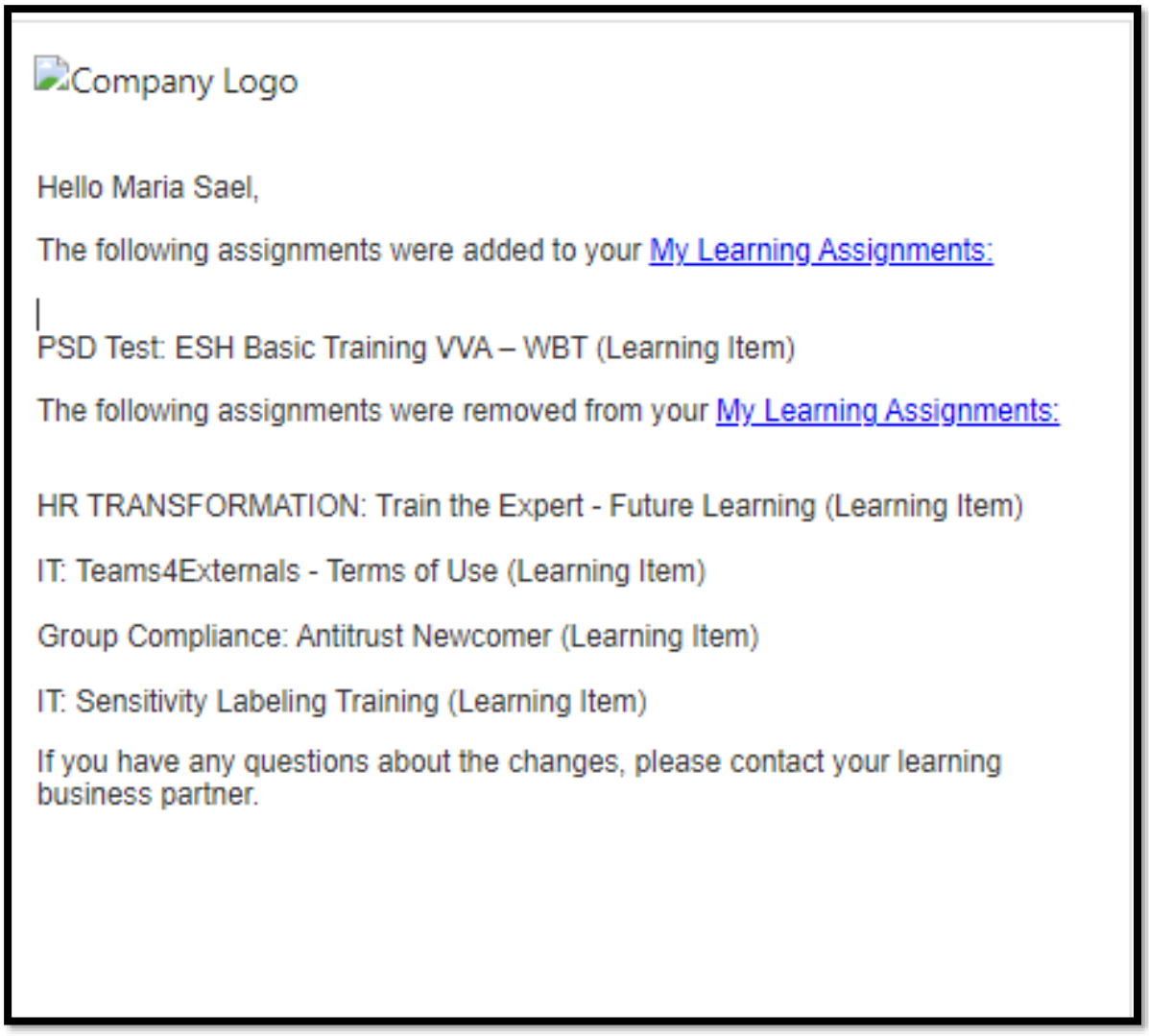
- ◯ Less than 1 year (weniger als 1 Jahr)
- ◯ 1-5 years (Jahre)
- ◯ More than 5 years (Mehr als 5 Jahre)

5. How motivated are you about using web-based learning for training and knowledge advancement? *

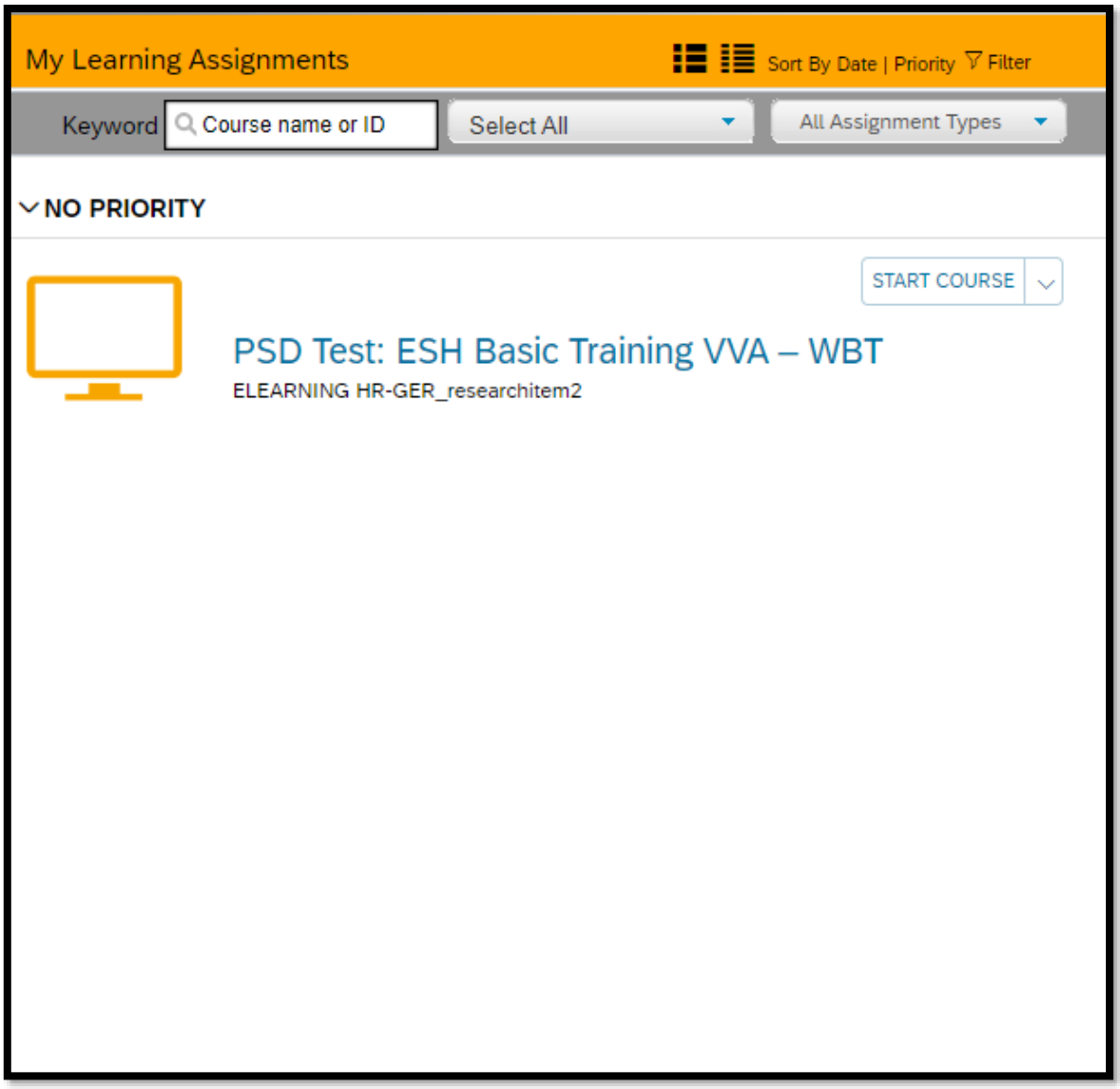
(Wie motiviert sind Sie, webbasiertes Lernen für Schulungen und Wissenserweiterung einzusetzen?)

- ◯ Very motivated (Sehr motiviert)
- ◯ Somewhat motivated (Etwas motiviert)
- ◯ Neither motivated nor unmotivated (Weder motiviert noch unmotiviert)
- ◯ Somewhat unmotivated (Etwas unmotiviert)
- ◯ Very unmotivated (Sehr unmotiviert)

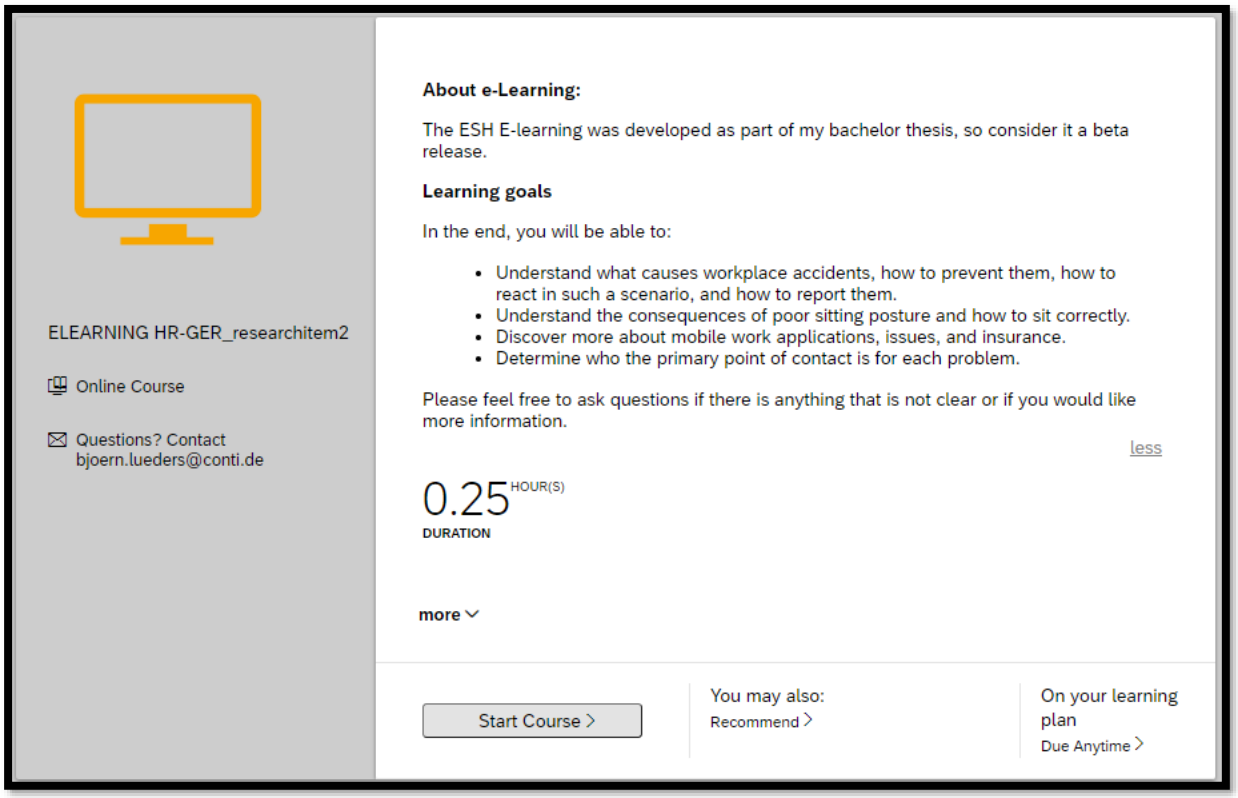
Appendix 6 Notification through email of Training assignment



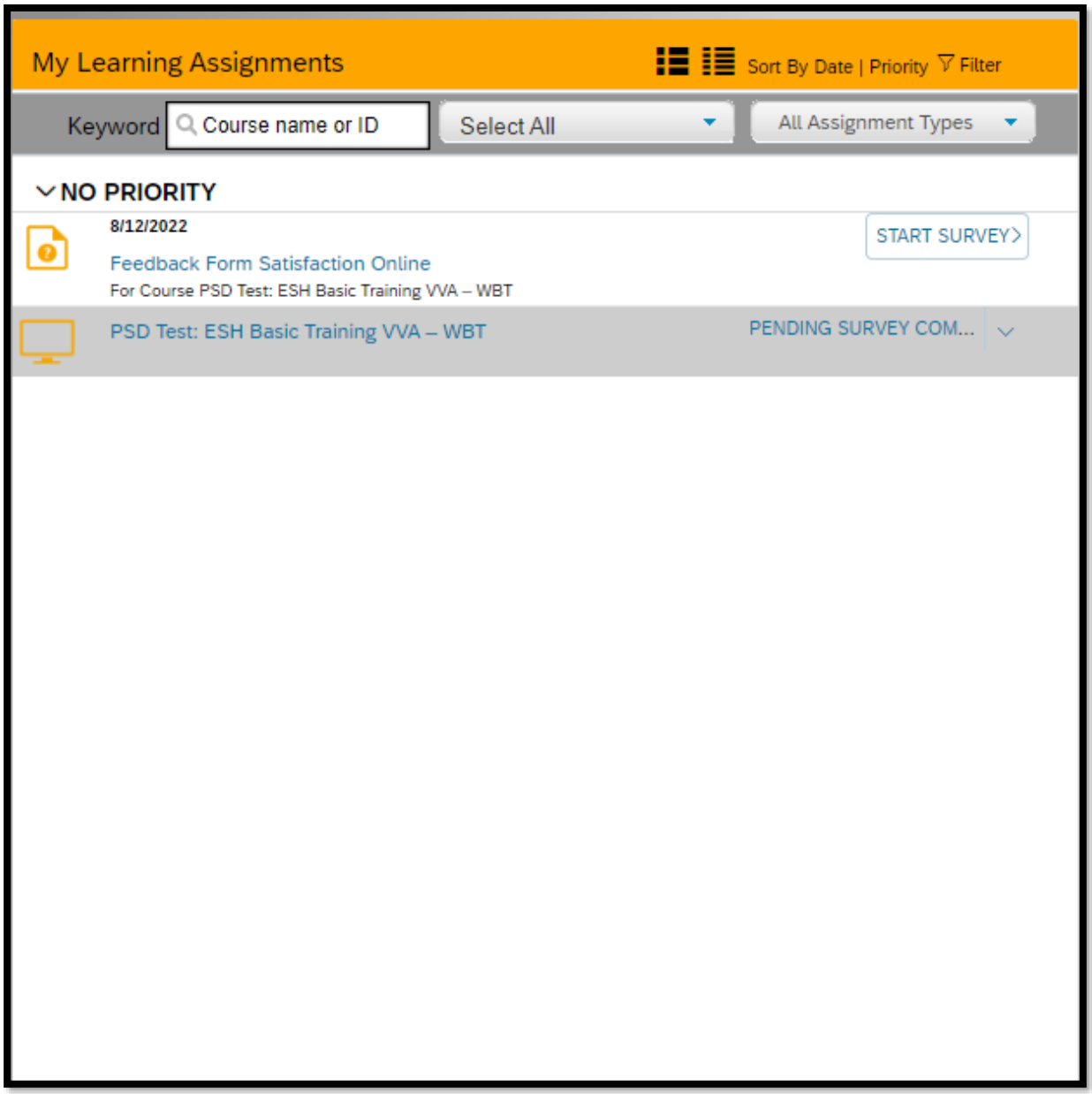
Appendix 7 The list of Learning Assignments on MySuccess



Appendix 8 WBT Overview on LMS

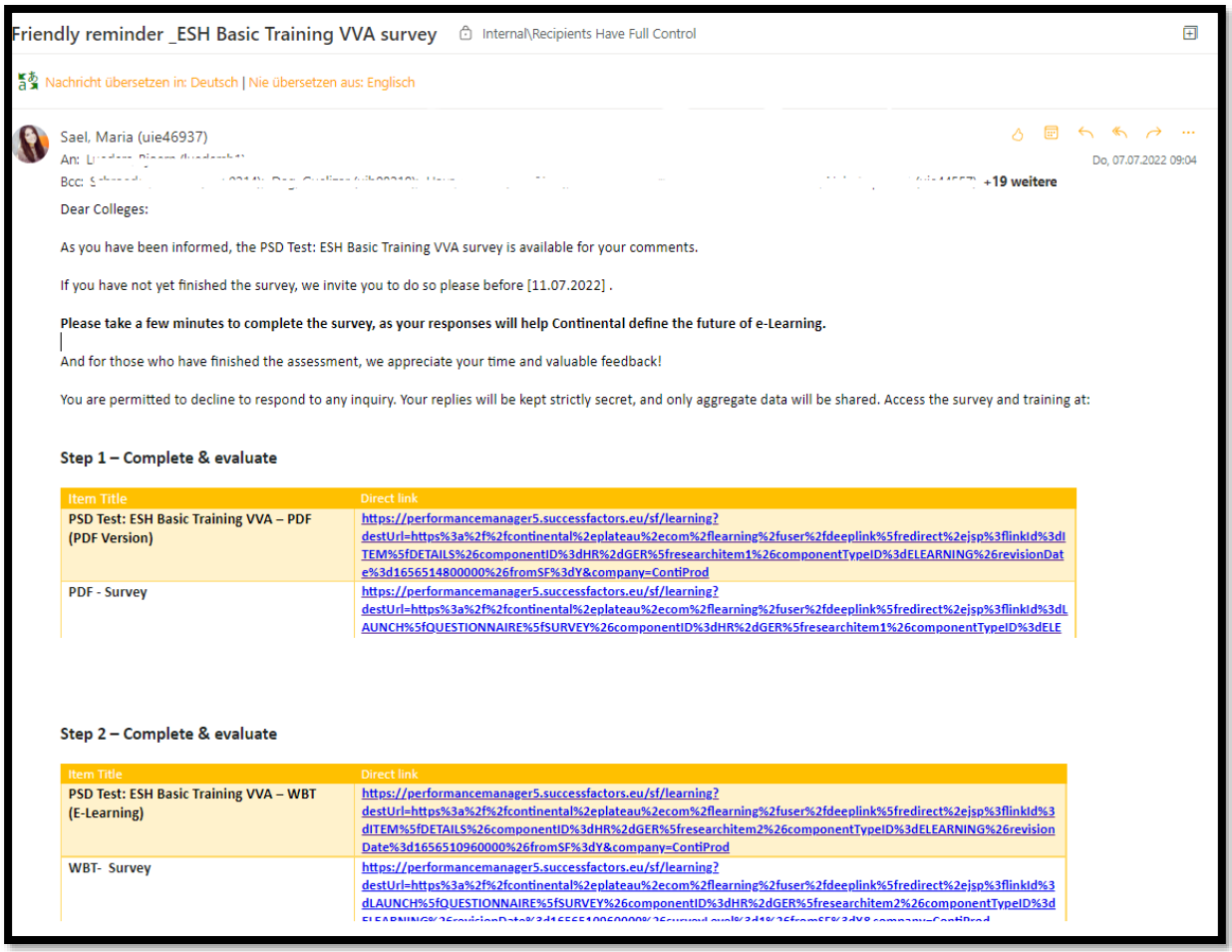


Appendix 9 Evaluation Assignment



Appendix 10 Happysheet questionaire on LMS

Appendix 11 Friendly reminder to complete survey



Friendly reminder _ESH Basic Training VVA survey Internal\Recipients Have Full Control

Nachricht übersetzen in: Deutsch | Nie übersetzen aus: Englisch

Sael, Maria (uie46937)
An:
Bcc: +19 weitere
Do, 07.07.2022 09:04

Dear Colleges:

As you have been informed, the PSD Test: ESH Basic Training VVA survey is available for your comments.

If you have not yet finished the survey, we invite you to do so please before [11.07.2022] .

Please take a few minutes to complete the survey, as your responses will help Continental define the future of e-Learning.

And for those who have finished the assessment, we appreciate your time and valuable feedback!

You are permitted to decline to respond to any inquiry. Your replies will be kept strictly secret, and only aggregate data will be shared. Access the survey and training at:

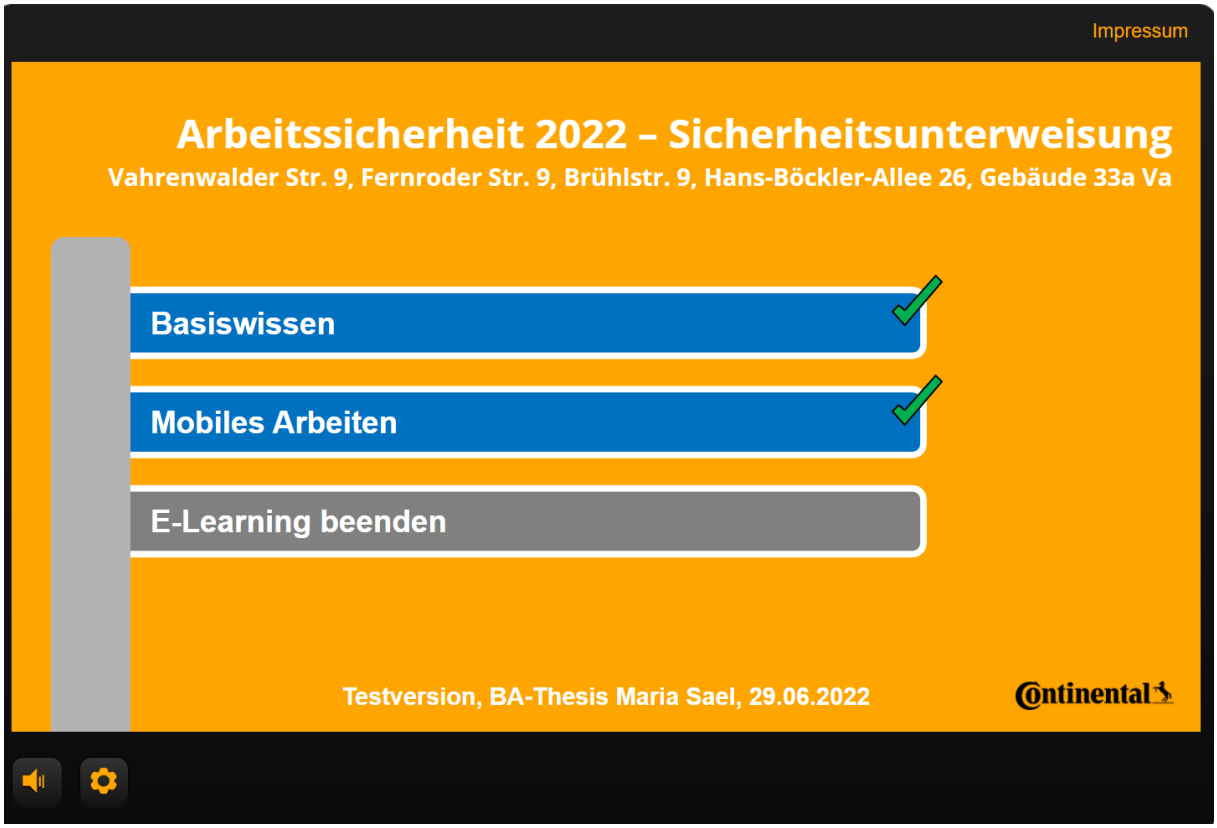
Step 1 – Complete & evaluate

Item Title	Direct link
PSD Test: ESH Basic Training VVA – PDF (PDF Version)	https://performancemanager5.successfactors.eu/sf/learning?destUrl=https%3a%2f%2fcontinental%2eplateau%2ecom%2flearning%2fuser%2fdeeplink%5fredirect%2ejsp%3flinkId%3dITEM%5fDETAILS%26componentID%3dHR%2dGER%5fresearchitem1%26componentTypeID%3dELEARNING%26revisionDate%3d1656514800000%26fromSF%3dY&company=ContiProd
PDF - Survey	https://performancemanager5.successfactors.eu/sf/learning?destUrl=https%3a%2f%2fcontinental%2eplateau%2ecom%2flearning%2fuser%2fdeeplink%5fredirect%2ejsp%3flinkId%3dLAUNCH%5fQUESTIONNAIRE%5fSURVEY%26componentID%3dHR%2dGER%5fresearchitem1%26componentTypeID%3dELE

Step 2 – Complete & evaluate

Item Title	Direct link
PSD Test: ESH Basic Training VVA – WBT (E-Learning)	https://performancemanager5.successfactors.eu/sf/learning?destUrl=https%3a%2f%2fcontinental%2eplateau%2ecom%2flearning%2fuser%2fdeeplink%5fredirect%2ejsp%3flinkId%3dITEM%5fDETAILS%26componentID%3dHR%2dGER%5fresearchitem2%26componentTypeID%3dELEARNING%26revisionDate%3d1656510960000%26fromSF%3dY&company=ContiProd
WBT- Survey	https://performancemanager5.successfactors.eu/sf/learning?destUrl=https%3a%2f%2fcontinental%2eplateau%2ecom%2flearning%2fuser%2fdeeplink%5fredirect%2ejsp%3flinkId%3dLAUNCH%5fQUESTIONNAIRE%5fSURVEY%26componentID%3dHR%2dGER%5fresearchitem2%26componentTypeID%3d

Appendix 12 Testversion fort the experiment



Appendix 13 PDF-Happy sheet responses

	Question	*Average*	*N/A*	*5 -*	*4 -*	*3 -*	*2 -*	*1 -*	*Overall Average*
Facilitator	The content was delivered understandably (intonation, pace).	**3,231**	6	3	2	5	1	2	**3,4**
	Questions and/or technical problems were answered/ resolved on time.	**3,600**	9	2	2	6	0	0	
Content	The content was relevant and of current interest.	**4,105**	0	7	8	3	1	0	**3,9**
	The content was adapted to my previous knowledge.	**3,684**	0	4	10	1	3	1	
Methods, Materials & Length	The amount of content covered was appropriate for the learning item.	**3,632**	0	4	7	6	1	1	**3,3**
	The set-up as virtual/ online learning worked well for the topic and content covered.	**3,412**	2	4	6	3	1	3	
	The interactivity level was satisfactory and appropriate for the content covered.	**2,500**	3	1	3	3	5	4	
	The learning item's length was appropriate for the content covered.	**3,667**	1	3	7	7	1	0	
Learning Application	The knowledge/methods that were taught in this learning item apply directly to the type of work that I do.	**3,368**	0	3	5	8	2	1	**3,6**
	The knowledge/methods gained from this learning item will be useful on my job.	**3,895**	0	5	8	5	1	0	
Organization	The learning item was well organized, and I have received all logistical information (time/date/location etc) on time.	**3,867**	4	2	9	4	0	0	**3,9**
Overall	My personal expectations and learning goals were met during the learning item.	**3,053**	0	1	6	7	3	2	**3**
	Overall, I was satisfied with this learning item.	**3,053**	0	2	4	7	5	1	
	I would recommend this learning item to others.	**2,895**	0	2	3	6	7	1	

Open Questions

	Question 1: *What did you like best about this learning item?*	Question 2: *What suggestions do you have to improve this learning item? / Other comments:*
Answers:	-	-
	- die virtuelle Darstellung	- Videos teilweise zu lange
	.	Eine Möglichkeit, die Redegeschwindigkeit anzupassen wäre super. Die Geschwindigkeit war sehr langsam.
	the visual design, the tests and the interaction	good work, no suggestions
	Die anklickbaren Sachen haben Spaß gemacht und die Videos waren sehr schön! :-)	Eigentlich nichts.
	Moderne Gestaltung der Präsentation, Erläuterungen auf der Tonspur zusätzlich zu Inhalten auf der Folie	Statusanzeige aufnehmen (z.B. in Prozent - wie weit ist man bereits?); die Erläuterungen auf der Folie und zeitgleich die Erklärungen waren sehr hilfreich. Die Abschnitte, wo es grafische Darstellungen gab (z.B. Mobiles Arbeiten - Versicherungsschutz) und die anschließende Zusammenfassung hat mir nicht so gut gefallen, da die Inhalte dann doppelt vorgetragen wurden. Dies war nicht der Fall wenn die Erläuterungen bereits schriftlich auf der Folie festgehalten wurden und zeitgleich die Erklärung stattfand.
	Virtuelles Format, wichtigste Aussagen zusammengefasst	Mehr Interaktion (z.B. Quizes), um Wissen zu festigen
	interactive	would be nice if the speed of the voice could be variated (sometimes little bit slow...) would be nice to see a progress bar (like slide 10/25) within the sections
	Die bildliche Darstellung und die kurzweiligen Erklärungen.	.
	na	na
	Die interaktive Gestaltung	nothing
	-	-
	Video Based, better to follow and understand because of visuals	Found the voice a bit technical - might be better to speak the text? Time period fpr ArbschG was a bit too long, might be a point to shorten the video
	Digitalisierung besser als Powerpoint -> lebendiger, interessanter. Inhaltlich bleibt am Ende mehr daran als bei der Powerpoint Präsi	Skript noch teilweise sichtbar, obwohl sollte nicht zu sehen sein Computer Stimme wirkt oft unnatürlich (immer die gleiche Melodie in den Sätze, Keine Pause um Luft zu holen) -> wirkt sehr digital
	Interaktionen Verbildlichung der Inhalte Das einem die Inhalte vorgetragen wurden	noch mehr Tests/interaktionen einbauen
	Visuelle Darstellung anhand von Videoclips	Übergänge zwischen den Frequenzen (manchmal zu langsam und manchmal zu schnell) Bei dem Quiz nicht nur richtige Antworten benutzen Nach einer Frequenz die Zusammenfassung eventuell in einem anderen Wortlaut wiedergeben (war viel Wiederholung) Sehr monotone Stimmlage. Aufmerksamkeit viel manchmal schwer

Appendix 15 WBT-Happy sheet responses

	Question	*Average*	*N/A*	*5 -*	*4 -*	*3 -*	*2 -*	*1 -*	*Overall Average*
Facilitator	The content was delivered understandably (intonation, pace).	**4,105**	0	7	9	1	2	0	**4,2**
	Questions and/or technical problems were answered/ resolved on time.	**4,273**	8	5	4	2	0	0	
Content	The content was relevant and of current interest.	**4,368**	0	8	10	1	0	0	**4,3**
	The content was adapted to my previous knowledge.	**4,263**	0	7	11	0	1	0	
Methods, Materials & Length	The amount of content covered was appropriate for the learning item.	**4,316**	0	8	9	2	0	0	**4,2**
	The set-up as virtual/ online learning worked well for the topic and content covered.	**4,632**	0	13	5	1	0	0	
	The interactivity level was satisfactory and appropriate for the content covered.	**4,105**	0	9	5	3	2	0	
	The learning item's length was appropriate for the content covered.	**4,000**	0	7	7	3	2	0	
Learning Application	The knowledge/methods that were taught in this learning item apply directly to the type of work that I do.	**4,000**	2	5	7	5	0	0	**4,2**
	The knowledge/methods gained from this learning item will be useful on my job.	**4,333**	1	6	12	0	0	0	
Organization	The learning item was well organized, and I have received all logistical information (time/date/location etc) on time.	**4,267**	4	6	7	2	0	0	**4,3**
Overall	My personal expectations and learning goals were met during the learning item.	**4,316**	0	9	7	3	0	0	**4,3**
	Overall, I was satisfied with this learning item.	**4,105**	0	8	8	3	0	0	
	I would recommend this learning item to others.	**4,273**	0	8	7	4	0	0	

Open Questions

	Question 1: *What did you like best about this learning item?*	Question 2: *What suggestions do you have to improve this learning item? / Other comments:*
Answers:	-	-
	- die virtuelle Darstellung	- Videos teilweise zu lange
	.	Eine Möglichkeit, die Redegeschwindigkeit anzupassen wäre super. Die Geschwindigkeit war sehr langsam.
	the visual design, the tests and the interaction	good work, no suggestions
	Die anklickbaren Sachen haben Spaß gemacht und die Videos waren sehr schön! :-)	Eigentlich nichts.
	Moderne Gestaltung der Präsentation, Erläuterungen auf der Tonspur zusätzlich zu Inhalten auf der Folie	Statusanzeige aufnehmen (z.B. in Prozent - wie weit ist man bereits?); die Erläuterungen auf der Folie und zeitgleich die Erklärungen waren sehr hilfreich. Die Abschnitte, wo es grafische Darstellungen gab (z.B. Mobiles Arbeiten - Versicherungsschutz) und die anschließende Zusammenfassung hat mir nicht so gut gefallen, da die Inhalte dann doppelt vorgetragen wurden. Dies war nicht der Fall wenn die Erläuterungen bereits schriftlich auf der Folie festgehalten wurden und zeitgleich die Erklärung stattfand.
	Virtuelles Format, wichtigste Aussagen zusammengefasst	Mehr Interaktion (z.B. Quizes), um Wissen zu festigen
	interactive	would be nice if the speed of the voice could be variated (sometimes little bit slow...) would be nice to see a progress bar (like slide 10/25) within the sections
	Die bildliche Darstellung und die kurzweiligen Erklärungen.	.
	na	na
	Die interaktive Gestaltung	nothing
	-	-
	Video Based, better to follow and understand because of visuals	Found the voice a bit technical - might be better to speak the text? Time period fpr ArbschG was a bit too long, might be a point to shorten the video
	Digitalisierung besser als Powerpoint -> lebendiger, interessanter. Inhaltlich bleibt am Ende mehr daran als bei der Powerpoint Präsi	Skript noch teilweise sichtbar, obwohl sollte nicht zu sehen sein Computer Stimme wirkt oft unnatürlich (immer die gleiche Melodie in den Sätze, Keine Pause um Luft zu holen) -> wirkt sehr digital
	Interaktionen Verbildlichung der Inhalte Das einem die Inhalte vorgetragen wurden	noch mehr Tests/interaktionen einbauen
	Visuelle Darstellung anhand von Videoclips	Übergänge zwischen den Frequenzen (manchmal zu langsam und manchmal zu schnell) Bei dem Quiz nicht nur richtige Antworten benutzen Nach einer Frequenz die Zusammenfassung eventuell in einem anderen Wortlaut wiedergeben (war viel Wiederholung) Sehr monotone Stimmlage. Aufmerksamkeit viel manchmal schwer
	x	x
	Anschauliche Beispiele, gut dargestellt, alle Informationen kompakt in einem WBT	Handout mit den wichtigsten Informationen, Nummern etc.

Question ID	Question	5	4	3	2	1	Mittelwert	Stdaw	
F1	*The content was delivered understandably (intonation, pace).*	3	2	5	1	2	3,2	1,3099528	0,6549764
F2	*Questions and/or technical problems were answered/ resolved on time.*	2	2	6	0	0	3,6	0,8	0,4
C1	*The content was relevant and of current interest.*	7	8	3	1	0	4,1	0,8519165	0,4259583
C2	*The content was adapted to my previous knowledge.*	4	10	1	3	1	3,7	1,126365	0,5631825
M1	*The amount of content covered was appropriate for the learning item.*	4	7	6	1	1	3,6	1,0367219	0,5183609
M2	*The set-up as virtual/ online learning worked well for the topic and content covered.*	4	6	3	1	3	3,4	1,3745084	0,6872542
M3	*The interactivity level was satisfactory and appropriate for the content covered.*	1	3	3	5	4	2,5	1,2247449	0,6123724
M4	*The learning item's length was appropriate for the content covered.*	3	7	7	1	0	3,7	0,8164966	0,4082483
A1	*The knowledge/methods that were taught in this learning item apply directly to the type of work that I do.*	3	5	8	2	1	3,4	1,0367219	0,5183609
A2	*The knowledge/methods gained from this learning item will be useful on my job.*	5	8	5	1	0	3,9	0,8519165	0,4259583
O1	*The learning item was well organized and I have received all logistical information (time/date/location etc) on time.*	2	9	4	0	0	3,9	0,6182412	0,3091206
S1	*My personal expectations and learning goals were met during the learning item.*	1	6	7	3	2	3,1	1,0499967	0,5249984
S2	*Overall, I was satisfied with this learning item.*	2	4	7	5	1	3,1	1,0499967	0,5249984
S3	*I would recommend this learning item to others.*	2	3	6	7	1	2,9	1,0708942	0,5354471