Metropolia

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Improving E-Learning through Feedback

An Approach to Listening to the Voice of the Customer

Abstract

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For several years, e-learning has been used increasingly as an electronic means of training and educating employees in business companies. Despite the cost-effective benefits of e-learning, and its use as a flexible method of self-study, there is a need for a customer oriented process for creating high quality e-learning. This thesis is about implementing customer orientated practices in a case organization, which uses e-learning to train its employees and customers.

The purpose of this thesis was to find out how to embed the voice of the customer in an improvement process of e-learning in the case organization, firstly, by creating a set of tools for gathering and analyzing qualitative feedback, and secondly, by implementing a procedure for connecting qualitative data into a continuous improvement process.

An action research design was used in the thesis in three research cycles. The first cycle was a current state analysis, which built a conceptual framework through the best available knowledge in literature and a survey of the employees of the case company. In the second cycle, theme interviews were conducted with the employees of the case organization and subsequently with the users of e-learning. In parallel with the first and second cycle, a user satisfaction model of e-learning was developed to create a theme interview model. In the third cycle, a quality improvement process was implemented by conducting a workshop to analyze qualitative feedback from the users.

The research resulted in a revised process of evaluating and improving e-learning by embedding the voice of the customer through the continuous improvement activity. The research also resulted in the creation of an interview template; a model of the user satisfaction of e-learning, which was found valid for the case organization; and best practice recommendations for e-learning developers of the case organization.

Keywords	e-learning, web-based training, customer orientation, evaluation, quality improvement, user satisfaction

Table of Contents

Appendices

Abbreviations and Acronyms

ADDIE   Analyze, Design, Develop, Implement, Evaluate

ELS   E-Learning Satisfaction

KPI   Key Performance Indicator

LMS   Learning Management System

QCF   Quality Control Framework

QFD   Quality Function Deployment

HoQ   House of Quality

TR   Technology Readiness

1 Introduction

> "Organizations learn only through individuals who learn.
> Individual learning does not guarantee organizational learning.
> But without it no organizational learning occurs." (Senge 2006)

One of the most groundbreaking changes in society in recent decades has been caused by the expansion of the Internet into all facets of modern life. The speed at which communication is able to take place is increasing rapidly. People are able to access information, converse about it, share it, and create it at an increasing pace. Wireless and mobile web access are making the Internet more and more a part of everyday life, and thriving communities are effortlessly being formed in social media. As Internet technologies are extending the global reach of information, they are also awaited to bring unprecedented advances in education.

For many years, electronic education via the means of computers and digital media has been proposed to radically change the way that people are able to learn. The concept of electronic education, usually taking place via the Internet, is also known as e-learning. Today, e-learning is becoming known in the educational sector through success stories such as the Khan Academy (TED 2011) and spokespersons such as Bill Gates (TechCrunch 2010). In businesses, e-learning has been recognized as a cost-effective method of training competent employees. The availability of web access, computers and software is encouraging companies to increasingly take advantage of e-learning as a method of training workforces globally. Based on a survey of U.S. companies and institutions by Training Magazine (2012), the majority of hours that employees of large companies spent in training involved some type of e-learning. Sixty-two percent of training consisted either partly or entirely of online or computer-based methods, webcasts, mobile methods, or a combination thereof (Training 2012).

E-learning is nowadays a de facto training method to support lifelong learning. Rapidly developing technologies, such as video and mobile technologies, create new challenges for training staff to deliver effective e-learning with high quality. On the other hand, business management expects training and e-learning expenditures to be used efficiently. Therefore, it is crucial for training developers to identify key issues which promote effective learning with correct tools and methods. The purpose of this Thesis

is to propose a process to listen to the users of e-learning in order to understand their needs and recognize improvement areas. Before approaching the subject in more depth, we present the case organization where the research took place.

1.1 Case Organization

The present thesis was done for ABB Oy, Finland. In 2012, ABB Group was one of the world's largest power and automation technology companies, which operates in around 100 countries (ABB Ltd. 2013a). Table 1 lists some key financial figures of the company.

Table 1. 2012 key financial data (ABB Ltd. 2013a)

Revenues	39,336 million USD
Earnings before interest and taxes (EBIT) as % of revenues	10.3%
Net income	2,704 million USD
Number of employees	146,100

The two main market areas of ABB are the automation market and the power market. The automation market is driven by the need to improve product quality, energy efficiency and productivity in industries and manufacturing, while the power market is driven by the need to transmit electricity to industries and consumers. ABB is organized into five divisions: Discrete Automation and Motion, Low Voltage Products, Process Automation, Power Products, and Power Systems. The divisions offer products and services for the generation, transmission and distribution of electricity, improving productivity, saving energy, and for the automation and electrification of industrial processes. (ABB Ltd. 2013a)

A priority in the strategy of ABB during the period from 2011 to 2015 is to drive competitiveness by profitably growing business according to market needs while increasing productivity and quality (ABB Ltd. 2013a). Adding value to customers and implementing improvements based on customer expectations and perceptions, and increasing the motivation and skills of employees through continual training and development is a policy within ABB (ABB Ltd. 2011).

The case organization of this thesis is a business unit within one division of ABB. During the course of this thesis, the term 'case organization' is used to refer to the business unit, and the term 'case company' is used when referring to other organizations within the company or to the company as a whole.

The case organization is oriented towards offering services to its customers. The customers consist of both end users and various partner companies, such as distributors and original equipment manufacturers. The operations of the case organization are managed via a set of service processes. The goal of the service processes is to create added value for customers and generate cash flow for the organization. Figure 1 illustrates the principle of the service processes in the case organization. Processes A, B and C represent the key processes of the case organization. For example, the organizational aim of Process C is to ensure the operational performance and the quality of service work and technical support. Process C consists of subprocesses, such as training services, which is a value-adding service in product after-sales. The training services subprocess is further segmented into classroom training and e-learning activities. The e-learning activity is the context of the present thesis.
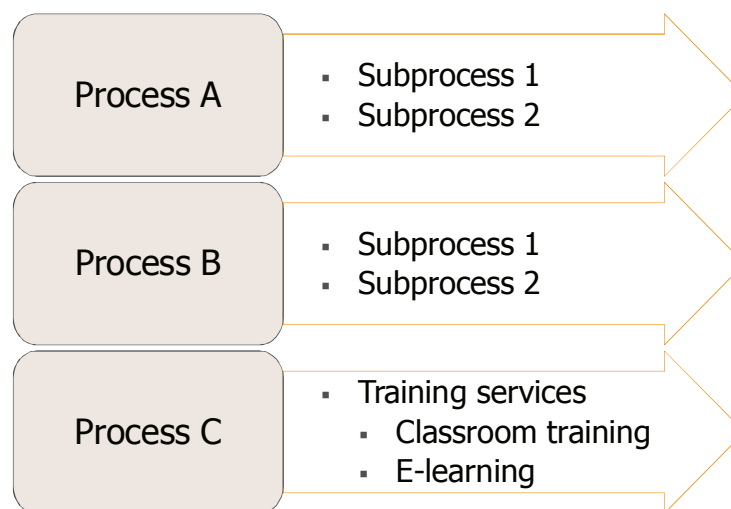

Figure 1. Processes within the case organization

The training services subprocess provides training for globally distributed employees and customers. The demand for training is influenced by company acquisitions which has increased the number of employees (ABB Ltd. 2013a), and the turnover of

employees (ABB Ltd. 2013b), as well as the need to provide training services for new and existing customers. The case organization uses e-learning to provide training for employees, partners and customers worldwide.

1.2 Research Question and Scope

Even though utilizing e-learning provides benefits for organizational training, there are obstacles to overcome. In the absence of an instructor to mediate the learning material, e-learning users lack social contact and physical practice. The quality of e-learning material relies on having a sound development process, which must be flexible in order to allow expedient production times, while maintaining a level of rigor to fulfill quality standards. In training literature, Kirkpatrick and Kirkpatrick (2005) evaluate the quality and effectiveness of training with classical methods bearing similarity to measuring customer satisfaction. The applicability of the classical methods to e-learning is a debated topic within training and human resources literature (Galloway 2005; Horton 2005). Regardless of the debate, striving to satisfy customers is a practice which indicates more successful outcomes in small and medium-sized enterprises (Appiah-Adu & Singh 1998). The present thesis takes a customer oriented view towards e-learning, where customer satisfaction is a key element. The purpose of the present thesis is to investigate methods to include the voice of the customer into the improvement process of e-learning. The aim is to cause a change in the e-learning activities in the case organization towards a customer oriented direction. The research question is as follows:

How can the voice of the customer be embedded in the improvement process of e-learning in the case organization?

The result of the present thesis is, firstly, to create a set of tools for gathering and analyzing qualitative feedback consisting of interviews and written comments, and secondly, a procedure for connecting the qualitative data into a continuous improvement process. The scope of the thesis is a case organization in Finland, operating within a global technology company. In the context of this thesis, the main functional roles of e-learning users were service and maintenance, sales, and engineering and design. Aspects of adult education and teaching methodologies are left out of the scope of the present thesis. The approach of this thesis was to search

for analogies of quality improvement from traditional product development methodologies. Several studies using quantitative methodologies for quality improvement in the context of e-learning, but few studies using qualitative approaches were found in literature. This thesis aims to complement the quantitative research by adopting a qualitative methodology, with theme interviews as the main data gathering method. Observational methods were scoped out of the research, as the primary e-learning users of the case organization were globally distributed.

Section 2 of the thesis presents the research design and data used in the research. In section 3, the theoretical background of the research is outlined. The fourth section describes a current state analysis. In section 5, the interviews conducted for the research are reported. Section 6 covers a quality improvement methodology. In section 7, the conclusions of the research are drawn, recommendations given, and the reliability and validity of the research process is evaluated.

2 Research Design

This section gives an overview of the research design and research process. The research design is based on action research. Action research is a participatory research methodology, where the researcher involves participants in the process of research (Lewin 1946). A key goal in action research is to help practitioners in proposing and effecting a change in their community. Action research is used when there is a need to find solutions to practical problems as they exist in everyday contexts instead of creating contrived experimental settings, and where the researched phenomenon is complex or the researcher lacks sufficient methodological knowledge to investigate it in a scientific manner (O'Brien 1998). Although action research originated from social sciences of the mid-twentieth century, it is currently used in several fields of study, such as organizational development (Coghlan & Brannick 2009), marketing (Perry & Gummesson 2004), healthcare, and information systems research (Champion et al. 2005).

Action research departs from the traditional scientific principles of objectivity by accepting that the researcher is an active and subjective participant in the research process. The active involvement of the researcher places specific demands on the

rigorousness of the research process in order to achieve scientific value and credibility. Action research consists of a systematic process of consecutive cyclic phases, which are documented rigorously (Coghlan & Brannick 2009). Riel (2010) uses the terms 'Study and Plan', 'Take Action', 'Collect and Analyze Evidence', and 'Reflect' for the phases of the action research process, which are illustrated in Figure 2.
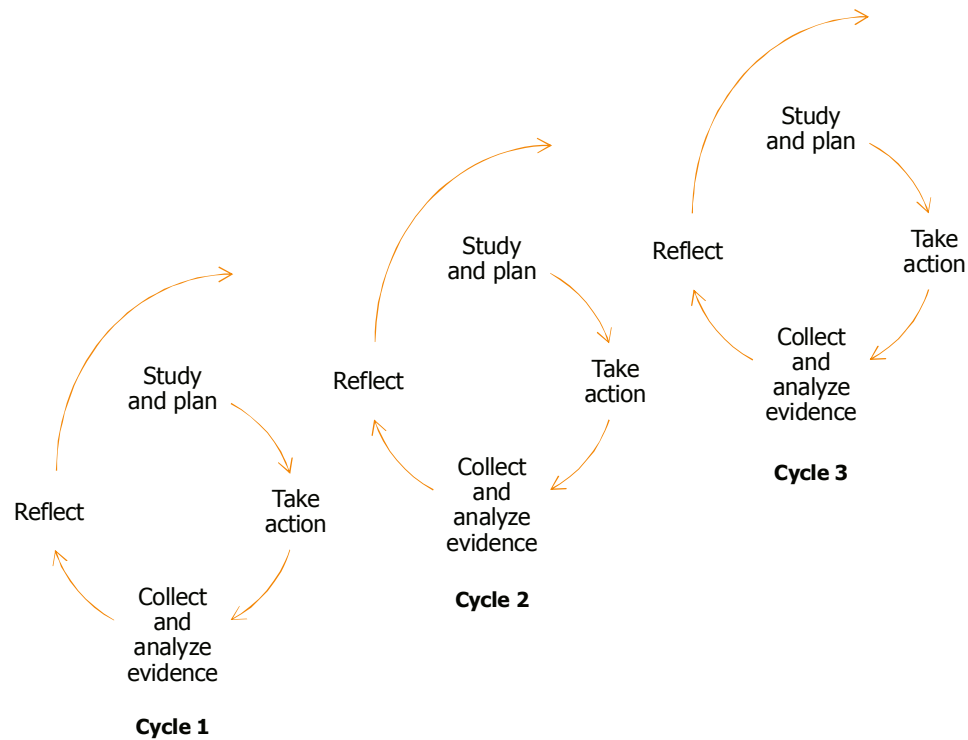
Figure 2. Action research process, adapted (Coghlan & Brannick 2009: 8–10; Riel 2010)

The 'Study and plan' phase is the delineation and documenting of the theoretical foundations of the action. In the next phase, the planned action is carried out. Then, the evidence from the action is collected and analyzed. Finally, the outcome of the action is reflected upon, to evaluate how the outcome corresponded with the initial assumption, how well the action was taken, and how the outcome will be used for the subsequent cycles in the process. After the entire action research process is complete, the overall learning from the research process should be reflected upon (Riel 2010).

The generic action research process in Figure 2 was applied to the present thesis in three cycles as follows: In the first cycle, a current state analysis was performed, which included a survey. In the second cycle, theme interviews were conducted. The

outcome of this cycle included recommendations for best practices and a final theme interview model. Finally, a quality improvement methodology was implemented. Figure 3 illustrates the action research process as it is applied in the present thesis.
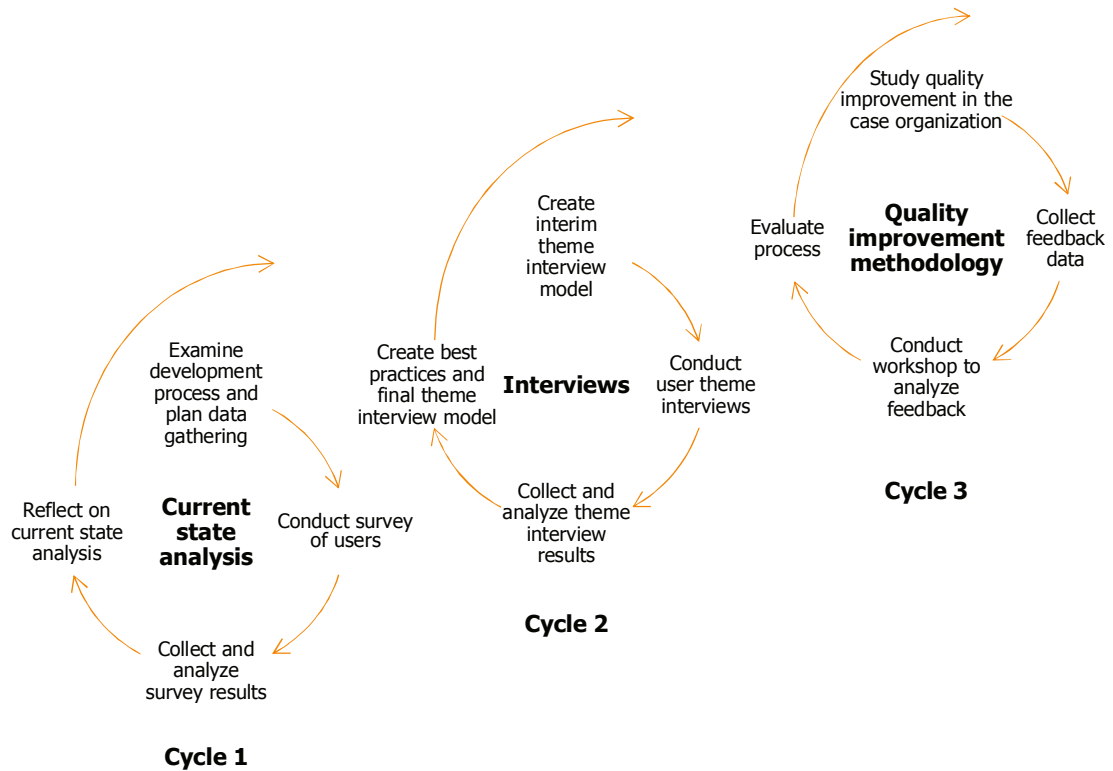
Figure 3. The application of the action research process into the present thesis

E-learning users of the case organization were globally distributed with different backgrounds and experience levels, from a wide range of target groups, and from both internal and external organizations. Furthermore, it was not known which issues the users found significant in terms of e-learning quality. The variables for measuring e-learning quality were difficult to define and measure. Therefore, quantitative data gathering was delineated out of the scope of the present thesis. Instead, it was seen beneficial to gain an understanding of what e-learning users were experiencing and what they saw as important issues. It was decided that qualitative theme interviews would provide useful data to understand users' expectations and actual experiences of using e-learning.

It was estimated that the range of topics related to the quality of e-learning was extensive. Therefore, it was a concern that the duration of the user theme interviews

became excessively long and unfocused. In order to keep the duration of the interviews short and at the same time acquiring meaningful data, a theme interview model was constructed which encompassed the most significant topics impacting users. Applicable qualitative theme interview models were not found in current literature. Therefore, it was necessary to construct a user satisfaction model which acted as a tool to scope the theme interviews. The user satisfaction model also enabled rigorous coding and analysis of the content of theme interviews. Figure 4 illustrates the development of the user satisfaction model.

In the first action research cycle, the research process began by planning to gather data via a survey of users. The survey results were analyzed through two structural e-learning models described in subsection 3.4. As the outcome of the first cycle, an initial theme interview model was formed. The theme interview model was developed further in the second action research cycle to create an interim theme interview model. The interim theme interview model was grounded on input from internal theme interviews with stakeholders from the case organization. The interim theme interview model was used to conduct user theme interviews. The outcome of the user theme interviews was a user satisfaction model of e-learning.
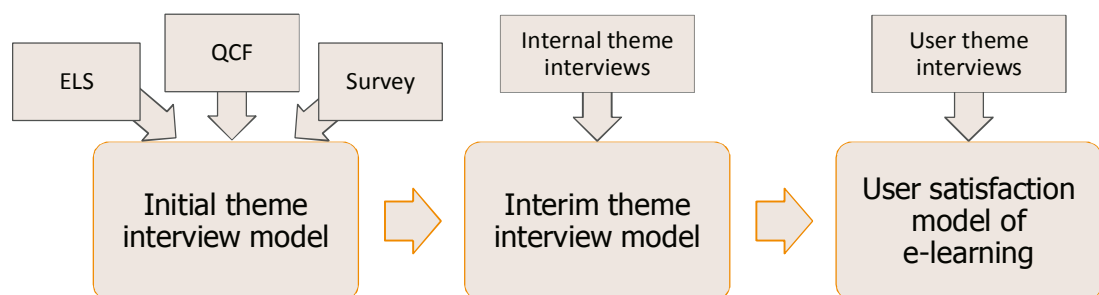
Figure 4. The development of the user satisfaction model of e-learning

The aim of the third cycle of the action research process was to create a change in the e-learning development process. Quality improvement methodologies of the case organization were studied and applied in the research process. The user satisfaction model of e-learning was used to prepare course feedback data for analysis. Finally, the implementation of the quality improvement process was evaluated.

The data flow of the present thesis is illustrated in Figure 5. The voice of the internal users was included in the survey, internal theme interviews, user theme interviews and course feedback data. The voice of the external users was included in the user theme interviews and course feedback data.

Voice of internal customers	Survey	Cycle 1
Voice of internal and external customers	Internal theme interviews User theme interviews	Cycle 2
Voice of internal and external customers	Course feedback data Quality improvement methodology	Cycle 3
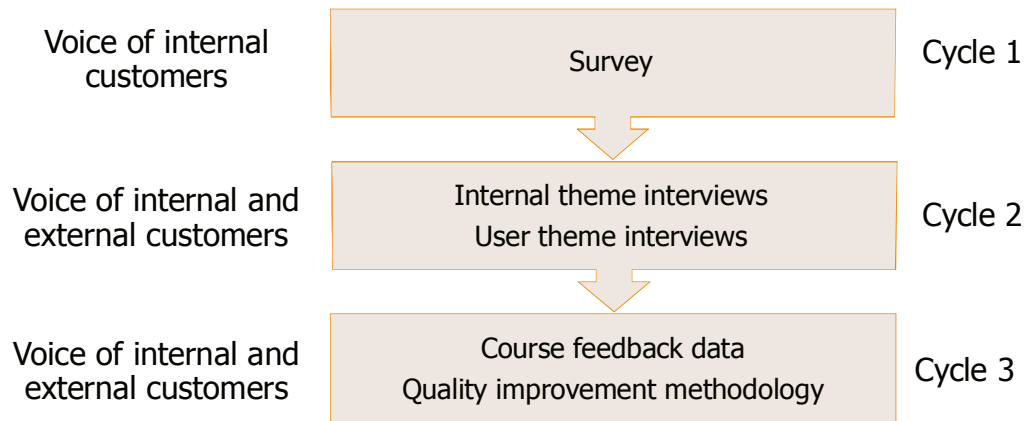
Figure 5. The flow of data in the present thesis

In summary, the planned outcome of the research process was to create a change in the development process of e-learning by implementing a quality improvement methodology where the data gathered from the interviews and course feedback data was used to improve e-learning user satisfaction. Additional outcomes were a user satisfaction model of e-learning and recommendations for best practices.

3 Best Practices

This section presents an overview of the best available knowledge in literature concerning the research problem. The review of literature spans the existing body of knowledge regarding e-learning and quality. At the end of this section, the conceptual framework of the thesis is presented.

3.1 E-Learning in a Corporate Environment

E-learning is an electronic method of education and training used in business and educational sectors. The primary medium for e-learning today is the Internet. The expansion of the Internet and development of high-speed connections has made it

possible to increase the use of audiovisual media to deliver training via the web. (Clark 2005)

In fast-paced and changing business environments, employees must be trained continuously in order for them to have the most up-to-date knowledge. In 2012, training expenditures of U.S. companies totaled 55.8 billion U.S. dollars (Training 2012). According to Ambient Insight (2013), the worldwide market for self-paced e-learning suppliers will reach approximately 51.5 billion U.S. dollars by 2016, with an estimated annual growth rate of 7.6%.

In addition to maintaining a competent workforce, the primary motivation for companies to invest in e-learning is to seek cost savings in training, such as in travel expenses, and reduce training time (Clark 2005). Investments in e-learning make use of existing investments in training staff and technology infrastructure, such as intranets and equipment (Driscoll 2010). Regulatory requirements mandate keeping training records, for which e-learning provides tools (Driscoll 2010). Also an advantage is the possibility of keeping online training material up to date (Driscoll 2010). E-learning enables worldwide access to corporate learning materials and continuous retraining of the workforce (Schweizer 2004), which is crucial for companies operating globally. E-learning technologies also enable capability to report training coverage and identify skill gaps (IBM Corporation 2010). E-learning provides employees flexibility of allowing one to choose when and where to learn, and support control of one's learning progress, opportunities to take self-tests and to review material, as well as to keep a record of one's learning history (IBM Corporation 2010).

Before explaining the details of e-learning, a common language and terminology is needed for the discourse. The term e-learning came into existence in the mid-1990s with the development of the World Wide Web (Garrison 2011). Clark (2005: 591) defines e-learning as "instruction delivered on a computer that is designed to achieve specific learning goals." As Driscoll (2010) states, the term 'web-based training' was previously used, but was commonly replaced with the term 'e-learning', which refers to all technologies using electronic media to designing, delivering and managing instruction using computers. The term e-learning is primarily used in the present thesis. In some cases the term web-based training is used interchangeably. Garrison (2011: 2) describes e-learning as "electronically mediated asynchronous and

synchronous communication for the purpose of constructing and confirming knowledge." The terms asynchronous and synchronous refer to the mode of communication, where asynchronous e-learning is designed to be taken individually as self-paced individual study, and synchronous e-learning is delivered to participants in remote locations simultaneously (Clark 2005). Certain types of usage combine synchronous and asynchronous e-learning. A live webinar can be recorded and the recording placed online for later viewing.

In practice, e-learning is the usage of audiovisual methods, such as voice-narrated presentations, animations, videos and simulations to deliver instructional information (Clark 2005). Narrated animations are used to explain complex visual content in order to expand working memory capacity (Low & Sweller 2005). Simulations can be used to practice specific procedural skills through a visual representation (Clark 2005), e.g. how to use a control panel of a device.

In corporate environments, e-learning is typically delivered via a learning management system (LMS). In 2012, 86% of large U.S. companies used an LMS for training delivery (Training 2012). An LMS is a system for the management and administration of training, as well as keeping and reporting of training records (Sappington & Nokes 2010) by training personnel. The LMS contains a database of records such as training enrolments, dates, completed courses, test responses, and training feedback. E-learning courses are provided to users via the LMS, which automates the tracking of learner progress and completion of courses.

The design of effective and efficient e-learning involves a multitude of best practices and instructional design challenges (Mayer 2005a). From the point of view of the users, the challenges range from technical problems to lack of face-to-face contact with an instructor to difficulties with the clarity and the ease of use of the learning material. From the point view of training personnel, the selection of software, tools and methods for creating the learning material are developing rapidly.

In addition to best practices of e-learning, user opinions of e-learning have been researched as well. While researching retail sales and service personnel's perceptions of e-learning, Gaither (2009) found that the perceptions of e-learning effectiveness did not differ significantly from those of traditional classroom training. However, it was

indicated that a blend of e-learning and traditional classroom training was required in technical areas (Gaither 2009). Blended learning is a training strategy which combines the usage of several learning methods, including e-learning and classroom training (Skillsoft 2010). For example, e-learning is used as a prerequisite course for participating in classroom training. In 2012, U.S. companies delivered 27% of training hours with blended learning techniques (Training 2012).

Critical views of e-learning have been taken, such as by Servage (2005), who calls for training personnel to understand e-learning users and appreciate the complexities of adult learning and cultural differences, instead of emphasizing the technological and economic aspects of e-learning. The difficulty from the training personnel's point of view arises from the fact that they may not meet their remote e-learning users in person. In the face of this conflict, training personnel should strive to gain insights into the experiences of the e-learning users. Involving stakeholders from various functions of an organization gives insight into the development and delivery process of e-learning from multiple perspectives.

In summary, e-learning provides business benefits through cost savings and competent personnel. Successful implementation of e-learning involves not only the cooperation of several stakeholders, and the application of a variety of best practices, but also an understanding of the users' experience. The next subsections focus on methodologies to achieve understanding the needs of the users of e-learning.

3.2 Customer Oriented Quality Methodologies

Understanding users is required in order to align the development of e-learning with successful outcomes. Customer orientation was introduced as a concept as early as the 1950s, and is the direction of all functions in an organization towards building customer loyalty and satisfaction (Drucker 1955). In the present thesis, the terms 'user' and 'customer' are used interchangeably, as it is commonly done by practitioners as well (Lee 2012; Reichelt 2012). Deshpandé et al. define customer orientation as

> the set of beliefs that puts the customer's interest first, while not excluding those of all other stakeholders such as owners, managers, and employees, in order to develop a long-term profitable enterprise (Deshpandé et al. 1993: 27).

Martin and Horne (1995) suggested that lack of customer orientation and customer input in the development of new services indicates dissatisfied customers. There are various levels at which users (i.e. customers) can be involved in the design process of any product or service. In co-creative design methods, the users are actively involved in the development and design of a product or service, e.g. in participative and lead user design methods (Kaulio 1998). In developer-centric design methods, the developers of a product or service are the key actors, with user needs informing the specification of a design, but user involvement is not actively supported by the design method (Kaulio 1998).

Although Pitta et al. (1996) recommend that customers should be involved in every phase of product development, a meta-analysis by He and King (2008) suggests that the participation of users too early in the development of information systems does not directly translate into successful outcomes. He and King (2008) recommend that involving users should be mediated by the goal of improving productivity outcomes. When increasing productivity is the goal of user participation, the outcome of the participation should be to inform the system developers of the domain knowledge required to fulfill users' needs (He & King 2008). Therefore, user participation in the present thesis is limited to gaining feedback from users in order to inform the development process of user requirements and improvement points.

A classical method which embeds user needs and requirements into the product development process is Quality Function Deployment (QFD). QFD was derived from the Total Quality Management product development philosophy (Akao & Mazur 2003). Total Quality Management is also known as Total Quality Control, and is a customer-focused management approach where quality is the guiding principle of all functions of an organization, and quality is measured by various indicators, such as customer satisfaction. As stated by Griffin and Hauser (1993), industry accepts that a goal of QFD is achieving satisfied customers, because they are seen as an asset to companies in the long run.

The first step in QFD is customer needs analysis (L.-K. Chan & Wu 2002). In QFD, the identification of customer needs is achieved by integrating the concept of 'voice of the customer' into the process (Griffin & Hauser 1993). The voice of the customer in the QFD process is articulated through a hierarchically constructed set of customer needs,

which are linked with the attributes of a product or service (Griffin & Hauser 1993). The QFD process is a means to understand the experiences and expectations of users, and to discover their conscious and latent needs.

The study of quality encompasses a broad field of research from product development and manufacturing to marketing and management. Quality has been defined in numerous ways over several decades. As stated by Juran and Godfrey, quality is the set of "product features which meet customer needs and thereby provide customer satisfaction" and "freedom from deficiencies" (Juran & Godfrey 1999: 2.1–2.2).

In traditional QFD approaches, customer needs are translated into product design attributes through a tool known as the House of Quality (HoQ). The HoQ is a matrix configuration, or 'deployment', aiming to give quantitative measurements for guiding the effective usage of development resources. There may be as many as four deployments of HoQ as part of a complete QFD project. (Griffin & Hauser 1993)

Several examples were found in literature where QFD was used in the development of training (Bier & Cornesky 2001; Boonyanuwat et al. 2007; C. Y. P. Chan et al. 2009; Desai & Thomassian 2008; Downing & Downing 2004; Franceschini & Terzago 1998; Ictenbas & Eryilmaz 2011; Lam & Zhao 1998). However, the process of constructing a HoQ requires significant time and effort (BusinessWire 2007). A HoQ matrix can consist of over a hundred rows and columns (Govers 1996). Alternative approaches which do not strictly require a HoQ have been developed to expedite QFD and overcome issues with limited time and resources. Blitz QFD (Jayaswal et al. 2007) is one such method, which is illustrated in Appendix 2. The Blitz QFD process begins by linking project goals to organizational strategy, and by focusing on the customer needs of the most important customer segments. Customer needs are gathered through observation, interviews, workshops and rigorous analysis processes. Only in complex projects, are tools such as HoQ, required to further analyze high-value customer needs (Jayaswal et al. 2007).

Once customer needs are identified, they can be used as input for quality improvement methodologies. One quality improvement method is the 4Q methodology, which consists of four stages shown in Figure 6: Measure, Analyze, Improve and Sustain. In the first stage, the improvement opportunity to be investigated is defined. This stage

includes scoping the problem, identifying baseline data and capturing the voice of the customer. In the second phase, the root causes of the problem are analyzed by using tools, such as the '5 Whys' method or Ishikawa diagrams. In the third phase, solutions to eliminate the root causes are developed and implemented. In the fourth phase, control methods are devised to monitor and sustain the implemented solutions. (Limacher 2011)
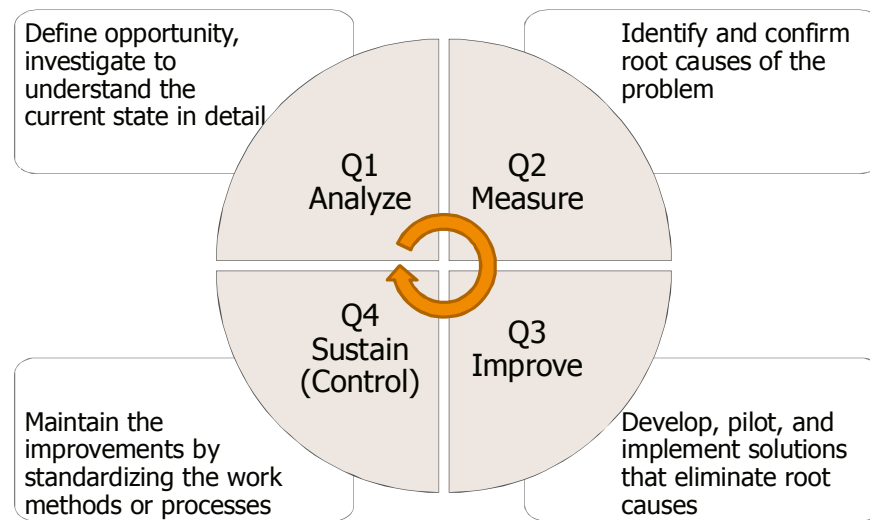
Figure 6. The stages of the 4Q quality improvement methodology

A subset of phases was selected from the Blitz QFD process in order to create an efficient method applicable to the case organization. The complete Blitz QFD process is shown in Appendix 2, and Figure 7 illustrates the subset of phases selected, which were: capturing the voice of the customer, interpreting it into customer needs, and constructing a structure of the customer needs.
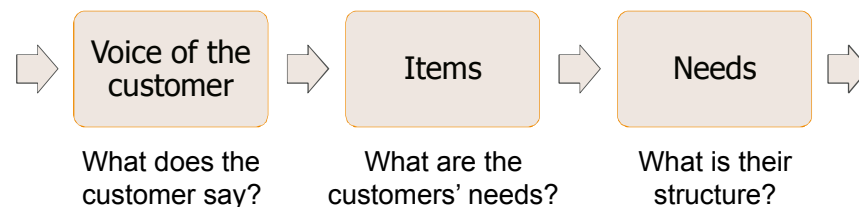
Figure 7. The scope of the thesis as part of the Blitz QFD process

This subsection presented an overview of the essential aspects of customer orientation and selected quality methodologies relating to the present thesis. In the following subsection, e-learning development models are discussed.

3.3   Training and E-Learning Development Models

A classical training development model known as ADDIE (Analyze, Design, Develop, Implement, Evaluate) was developed in the mid-twentieth century from U.S. military research. The ADDIE model consists of five consecutive phases which aim to provide effective and efficient training. A model revised in 2001, illustrated in Figure 8, places the process inside the sphere of quality improvement. In the five phases of the model, training requirements are analyzed, training objectives and tests are designed, instructional methods are developed, instructional activities are implemented, and evaluations are carried out in a cyclic process. (Allen 2006)
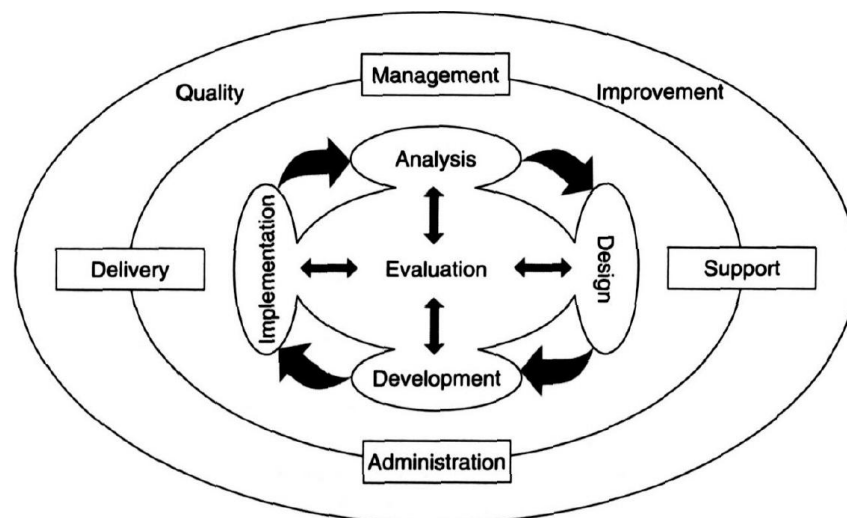
Figure 8. A revised ADDIE model (Allen 2006: 438)

The ADDIE model has been criticized for being slow for e-learning development and producing unsuccessful solutions (Gordon & Zemke 2000). Furthermore, as commented by Fabac (2006) and Karrer (2006), it should only be necessary to use a subset of the ADDIE model which fits the purpose of each e-learning development project. There have been adaptations of the ADDIE model for e-learning development, an example of which is illustrated in Figure 9 (Hutchins & Hutchison 2008). The proposed e-learning design model intends to embed usability guidelines and features

supporting online delivery within the design process. The model sets the learner at the centre of the design approach to match the end result with the user's mental models, needs and performance goals (Hutchins & Hutchison 2008).
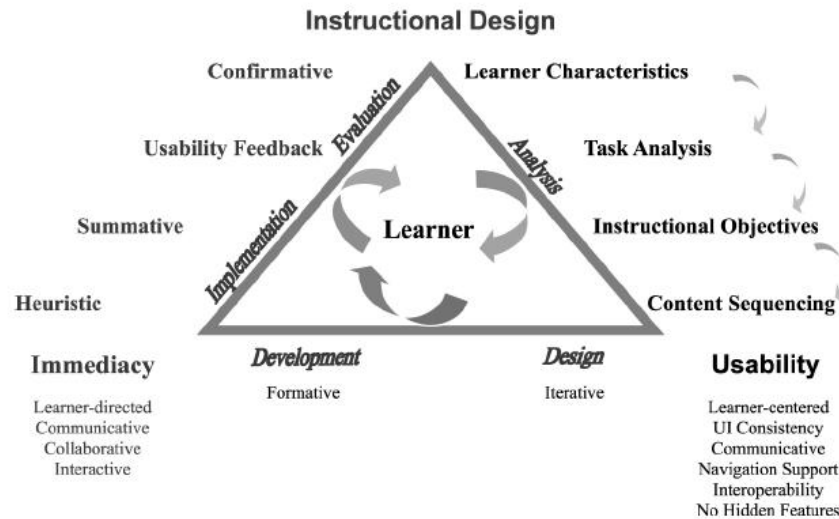
Figure 9. A proposed e-learning design model (Hutchins & Hutchison 2008)

The basic foundation of e-learning development rests on classical models, but external factors such as technological advancements and rapid changes in business environments predicate the development of new models. Abdous (2009) proposed a process-oriented lifecycle model to implement quality assurance and iterative design in e-learning. The phases of the model consisted of planning and analysis; design, prototyping, and production; as well as post-production and delivery. User feedback is collected at the end of the cycle and used for quality assurance.

This subsection described a brief selection of models aiming to define formal e-learning development processes, which emphasize the need for iterative design. Distinctive factors affecting the quality of e-learning arise from technological aspects, such as usability and interactivity. The next subsection presents structural models which characterize the quality factors in detail.

3.4   Structural Models of E-Learning Quality

Two structural models of assessing e-learning quality were found in literature, which were applicable to a corporate environment. Wang (2003) developed an E-Learning

Satisfaction (ELS) instrument for measuring student satisfaction with e-learning systems in Taiwan. The ELS consisted of four categories: learner interface, learning community, content and personalization. The four categories were further divided into 17 descriptive items as listed in Table 2.

Table 2. Description of the ELS (Wang 2003)

	Category	Code	Description
E-learner satisfaction	Learner interface	I1	The e-learning system is easy to use
		I2	The e-learning system is user-friendly
		I3	The content provided by the e-learning system is easy to understand
		I4	The operation of the e-learning system is stable
		I5	The e-learning system makes it easy for you to find the content you need
	Learning community	L1	The e-learning system makes it easy for you to discuss questions with other students
		L2	The e-learning system makes it easy for you to access the shared content from the learning community
		L3	The e-learning system makes it easy for you to discuss questions with your teachers
		L4	The e-learning system makes it easy for you to share what you learn with the learning community
	Content	C1	The e-learning system provides up-to-date content
		C2	The e-learning system provides content that exactly fits your needs
		C3	The e-learning system provides sufficient content
		C4	The e-learning system provides useful content
	Personalization	P1	The e-learning system enables you to learn the content you need
		P2	The e-learning system enables you to choose what you want to learn
		P3	The e-learning system enables you to control your learning progress
		P4	The e-learning system records your learning progress and performance

The ELS was empirically tested with a sample of 116 adult learners in five international organizations in Taiwan in the semiconductor business. The ELS was found to provide acceptable reliability, and it was also rigorously examined for validity. (Wang 2003)

A Quality Control Framework (QCF) for e-learning was outlined by Li (2009) to evaluate the quality of corporate e-learning systems from the perspective of their functional, pedagogical, usability and extensibility factors. The QCF was developed as a tool for management to evaluate and select a prospective e-learning solution, and for e-learning developers to assess the quality of their current e-learning solution (Li 2009). The structure and contents of the QCF is illustrated in Appendix 3. The QCF contains nine aspects: relevance, content design, instructional design, usability design, user interface, functionality, accessibility, services and support, as well as business impact (Li 2009).

The ELS and QCF provided valuable tools to evaluate the features and quality of an e-learning solution, but there were concerns about using the ELS and QCF exclusively in the evaluation of e-learning of the case organization. Firstly, the ELS was focused on asynchronous e-learning, whereas the case organization also utilized synchronous methods, such as webinars. Secondly, it was necessary to supplement the ELS and QCF with a structure to model a training service where users take part in a blended learning program. In order to construct a conceptual model of e-learning as part of a training service, the best available model found was a communications ecosystem drafted by Kilkki (2008) in a short article discussing quality terminology. A simplification of the draft model is illustrated in Figure 10.
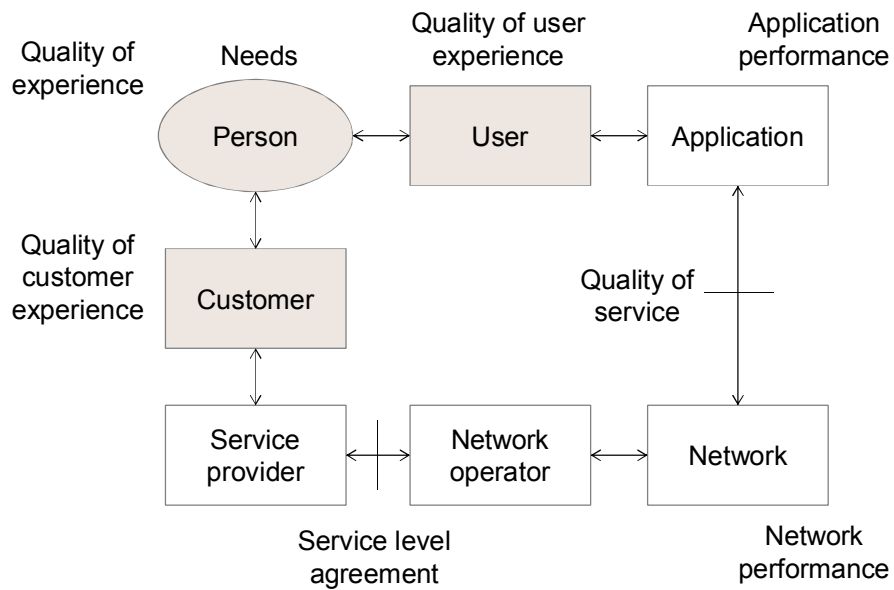
Figure 10. A draft model for analyzing a communications ecosystem, simplified (Kilkki 2008)

The draft model makes a distinction between the roles of user and customer. The combination of the experiences of two roles produce the person's perception of a concept termed as quality of experience. A non-normative definition for the quality of experience, provided by ITU-T (2008), is "the overall acceptability of an application or service, as perceived subjectively by the end-user." Customer experience was defined by Kilkki (2012: 315) as "the sum of all experiences a customer has with a supplier of products over the duration of their relationship with that supplier". Additionally, Meyer and Schwager (2007: 118) defined customer experience as "the internal and subjective response customers have to any direct or indirect interactions with a company." As an example, customer experience in the context of a blended learning program can be impacted by how communication with the customer is handled, how interactions and encounters are experienced by the customer, and how e-learning and traditional training complement each other.

User experience can be defined as "the perceived interactions that a person has with a product" (2012: 330) and "something we experience when we interact with a good or a service" (2012: 72). A definition for the quality of user experience was not found in literature. For the purposes of the present thesis, it can be interpreted as freedom from deficiencies and the acceptability of perceived interactions a user has with the e-learning application.

This subsection presented two structural models for evaluating e-learning quality applicable to a corporate environment, and terminology related to quality of experience. During the research process of the present thesis, the structural models were used as source models to adapt and develop a theme interview model. The development of the initial theme interview model is described in section 4. In the following subsection, the research methodology will be reported.

3.5   Conceptual Framework

The goal of the present thesis was to bring the voice of the customer into the development process of e-learning in order to guide quality improvement efforts. The overall conceptual framework used to analyze the voice of the customer is illustrated in Figure 11. The conceptual framework consisted of a user satisfaction model of e-learning which was developed during the research process, based on two models described in subsection 3.4, and the 4Q quality improvement methodology used in the case company. The voice of the customer is expressed by the subset of phases selected from the Blitz QFD process described in subsection 3.2.
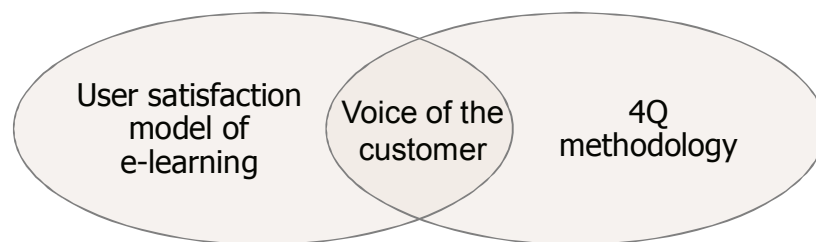
Figure 11.   The conceptual framework of the present thesis

The voice of the customer was the underlying theme in this research. Therefore, it was necessary to adapt the models from literature by applying the voice of the customers of the case organization.

4   Current State Analysis

In this section, an overview of the current state of e-learning in the case organization is presented. The development process of e-learning and the construction of an initial theme interview model are described.

E-learning in the case organization started in the late 1990s. After some years, the training offering of the case organization was standardized globally. In principle, training of new products was provided as a combination of e-learning and classroom training. Best practices of developing and delivering training with these methods were shared with other business units. The development process is illustrated in Figure 12.

Main activity

Training needs analysis → Course design → Courseware development → Course publishing

Support activity

Follow-up and reporting
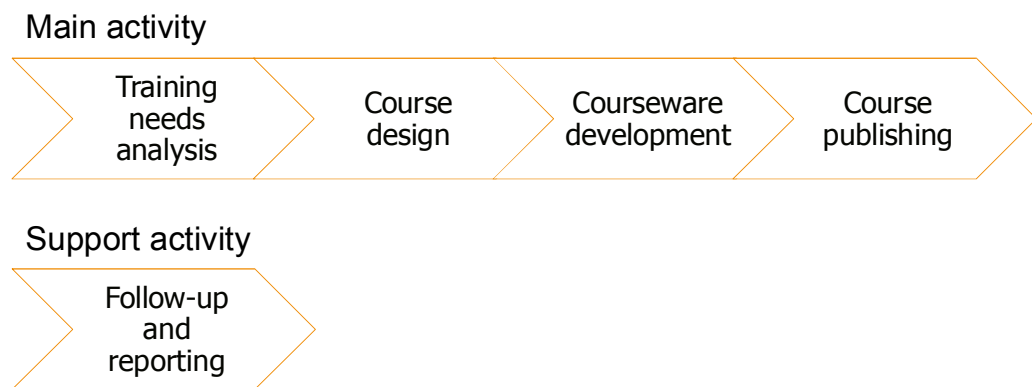
Figure 12.   The activities related to e-learning development and follow-up

The main stakeholders during the development of e-learning are, e.g. e-learning developers, trainers, product managers, sales training development and marketing personnel. The process begins with the analysis of training needs and specification of competence objectives achieved through the training. The training material is designed and developed accordingly. Finally, the training is published via the LMS of the case company. Support activities include follow-up, invoicing and reporting. Examples of reported key performance indicators (KPI) are described in Table 3. Example global figures from 2010 and 2011 are presented.

Table 3.   Examples of reporting items related to e-learning

KPI	Explanation	2010	2011
Completed enrolments	Number of completed e-learning courses by users	17,000	19,000
Study hours	Approximate hours spent studying e-learning	26,000	27,000

Based on professional experience of the researcher and discussions with colleagues, it was recognized that e-learning development needed to be customer oriented. There

was no systematic feedback process within the case organization to evaluate user satisfaction. Several topics of development were under consideration, such as involving users in the e-learning development process, and providing users with an opportunity to view e-learning with mobile devices, but there was no method of prioritizing the topics. Learner feedback was gathered in e-learning courses of the case organization, but the data was not analyzed regularly. Gathering feedback from e-learning and analyzing it was viewed as time consuming and difficult, and therefore its regular and systematic processing was overlooked. Feedback about e-learning was also received as part of classroom training events, if e-learning was used as pre-training before classroom training. Since there was no systematic feedback process, it was decided that surveying user opinions would indicate which issues were significant. Additionally, the survey was needed to select the prospective interviewees.

The survey was sent to a sample selected from a list of learners registered in the LMS. The selection criteria were as follows: the learners had an email address of the case company; the learners were located in one of the following countries: Australia, China, Finland, India, Singapore, South Africa, the United Kingdom, the United States; and finally, the learners had completed an e-learning course within the previous three years.

Before sending the survey, it was tested with a colleague for usability, and then piloted with 10 learners selected from Finland. The pilot survey confirmed that the survey was functionally correct. The survey questions are listed in Appendix 4. The survey was sent to the recipients on April 10, 2012 and the results were gathered on June 2, 2012.

A technology readiness (TR) questionnaire was included in the survey in order to find prospective interviewees. TR is a construct describing people's likeliness to have a positive disposition to using technology-based systems for accomplishing tasks (Parasuraman 2000). The TR questionnaire is listed in Appendix 5. TR consists of four dimensions: optimism, innovativeness, discomfort and insecurity. Matthing et al. (2006) found that Explorers and Pioneers adopted the use of home Internet quicker than other TR profiles. As reported by Parasuraman, the TR index has strong psychometric properties (Parasuraman 2000), which has been used to identify individuals who can provide innovative and creative ideas in service development (Matthing et al. 2004).

The survey resulted in 238 responses. The response rate was approximately 20.3%. The ratio of responses per country is illustrated in Figure 13. A third of the responses were from Finland, seventeen percent from India, sixteen percent from China, eleven percent from the United Kingdom, seven percent from Singapore, seven percent also from Australia, five percent from South Africa, three percent from the United States, and one percent from the United Arab Emirates.
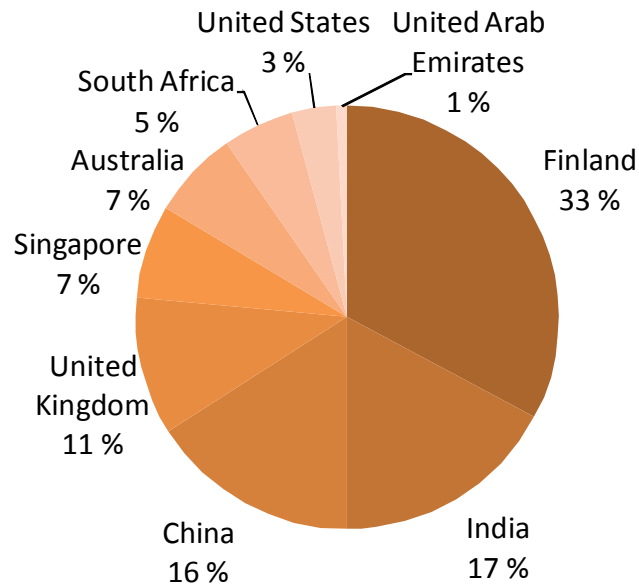
Figure 13.　　The survey responses per country

The TR data from the survey was sent for analysis to Rockbridge Associates Inc. as listed in Appendix 1. The results of the analysis classified the respondents into the five TR profiles (Parasuraman & Colby 2001: 72–86) shown in Figure 14, in decreasing order of technology-readiness: Explorer, Pioneer, Skeptic, Paranoid, and Laggard.
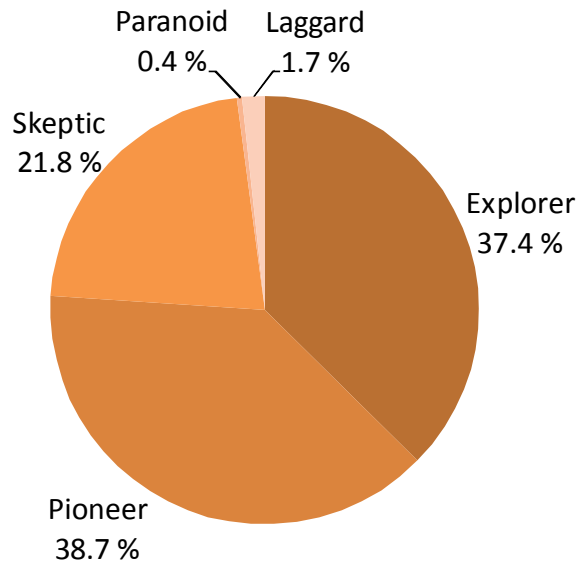
Figure 14.   The ratio of TR profiles of the survey respondents

Sixty respondents gave written comments which provided informative data to develop themes for the upcoming interviews. Examples of written comments are listed in Appendix 6. The written comments were analyzed and deconstructed into 135 subsentences which were categorized according to the themes in the ELS shown in Table 2 (subsection 3.4), and the QCF shown in Appendix 3. The analysis was done by using mindmapping software and Excel spreadsheets. Table 4 on the next page shows the themes and subthemes which emerged from the analysis, and a summary of the number of subsentences found from the written comments. The Source column indicates whether the theme emerged from the ELS, the QCF, the survey, literature, or a combination thereof. The codes with the prefix 'ELS' indicate the subtheme is based on the corresponding item code of the ELS, listed in Table 2 (subsection 3.4). The codes with the prefix 'QCF' indicate the subtheme is based on the corresponding item code of the QCF, listed in Appendix 3.

Table 4. Summary of themes, subthemes, relevant subsentences and source models

Theme	Subtheme	Subsentences	Source
Content	Up-to-date content	0	ELS-C1, QCF-2b
	Fit to needs	17	ELS-C2, QCF-1a
	Sufficient content	2	ELS-C3, QCF-2a
	Usefulness of content	19	ELS-C4, QCF-1a
Learner interface	Ease of use	1	ELS-I1, QCF-5
	User-friendliness	30	ELS-I2, QCF-4d,5
	Understandability	20	ELS-I3, QCF-2c,2e,3,4b,4c,4d
	Stability of the system	2	ELS-I4
	Ease of finding content	1	ELS-I5, QCF-6e
	Independence of time and place	12	Survey
	Structure and modularity	8	QCF-2c, 2e, 3b
Learner community	Ease of discussing learning with others	0	ELS-L1
	Ease of accessing shared content	0	ELS-L2, QCF-6a
	Ease of discussing questions with teachers	0	ELS-L3
	Easiness to share and discuss learning with others	1	ELS-L4, QCF-6a
Personalization	The e-learning system enables you to learn the content you need	0	ELS-P1
	Choose what you want to learn	1	ELS-P2
	Control of learning progress	0	ELS-P3
	Recording learning progress	0	ELS-P4
	Localized content	2	Survey
	Choose how you want to learn	1	Survey
Process	Process improvement	1	Survey
	Training and learning service	17	Survey
	Easiness of giving feedback	0	Literature
Total number of subsentences:		135	

Based on the review of the data, it was found that the written comments were more informative than expected for developing the theme interview model. As seen from Table 4, most comments were related to user-friendliness, understandability,

usefulness of content, fit to needs, training and learning service, convenience and independence of time and place. The Source column shows that the survey revealed themes which were not represented by the ELS or the QCF, such as the need for localized content. In the survey responses, there were 17 subsentences relating to the usage of e-learning as a complementary method to classroom and on-the-job training. Twelve subsentences concerned the convenience and independence of time and place as a positive or negative aspect, i.e. the flexibility to learn at one's own pace, but also challenges regarding usage in an office environment. There were 2 subsentences indicated the need to have content in one's own language. Personalization factors were less significantly represented in the survey results than the extent with which they were represented in the ELS. Only one comment concerned the opportunity of e-learning to offer a personalized learning experience through adaptation to a learner's reactions. Finally, one comment expressed a wish to expedite the e-learning process.

The results in Table 4 and a mindmapping technique led to the initial theme interview model shown in Table 5. The main themes remained the same as in Table 4: Content, Learner interface, Learner community, Personalization and Process. Subthemes which were not represented by any subsentences were merged into adjacent and logically similar subthemes. The labels of subthemes were revised, e.g. 'Independence of time and place' was rephrased as 'Location'.

Table 5.   Initial theme interview model

Theme	Subtheme
Content	Fit to needs
	Usefulness
Learner interface	User-friendliness
	Understandability
	Stability of the system
	Location
	Structure and modularity
Learner community	Easiness to share and discuss learning with others
Personalization	Enables learning the content you need
Process	Process improvement
	Training and learning service
	Easiness of giving feedback

In reflection of the current state analysis, e-learning development has a history of over a decade in the case organization, and it is integrated into organizational processes. However, a systematic feedback process was lacking from the development process of e-learning. In order to begin the development of an improved feedback process, the survey produced more qualitative information than was expected, which was useful in developing the initial theme interview model. Additionally, the discovery of the TR construct was an advantageous method for finding prospective interviewees for the next action research cycle. In the next section, the internal and user theme interviews are reported and the development of the theme interview model to analyze the interview results.

5 Theme Interviews

This section describes the second action research cycle, in which the internal theme interviews were conducted with employees of the case organization, and user theme interviews were conducted with users of e-learning. The planning of the interviews and detailed actions taken are reported. Finally, the outcome of the theme interviews and the final model of user satisfaction of e-learning is presented.

The purpose of the internal theme interviews was to gain insights about e-learning within the case organization, and include the voice of internal customers into the theme interview model. The aim was to make the subsequent user theme interviews short and focused.

The interviewees for the internal theme interviews were selected from the survey, which described in the previous section. The selection of the interviewees was done based on a purposeful sampling strategy, which according to Patton (2002: 40) is appropriate in order to gain information rich and illuminative insights into a case or phenomenon. According to Parasuraman and Colby (2001), users belonging to the highest TR profiles of Pioneer and Explorer are optimistic and comfortable with technology, and recognize the benefits of technology. Matthing et al. (2004) suggest that these users are likely to provide innovative and creative ideas. Therefore, it was decided to select interviewees among persons from the two highest TR profiles.

Firstly, the survey respondents were classified according to their TR profile, organization and location, according to the criteria listed in Table 6. The respondents were included in the selection process if they belonged to the TR profiles of Pioneer or Explorer, and worked in the case organization in Helsinki. Secondly, six interviewees were chosen from the selection, based on different job functions, such as sales, marketing, service, design, and product management. Thirdly, it was relevant that interviewees represented varying experience levels, ranging from at least one year to over ten years of employment within the case company. The creation of the themes of the internal interviews was presented in the previous section. The questions for the themes are listed in Appendix 7, and they were formulated through a mindmapping process.

Table 6.   Selection criteria to choose respondents for the internal theme interviews

Classification	Selection criteria
TR profile	Pioneer or Explorer
Organization	Case organization
Location	Helsinki
Job function	Sales, marketing, service, design, and product management
Years of employment	One year to over ten years

Six internal theme interviews were performed on dates listed in Appendix 1. The interviewees were first explained the purpose of the interview, which was to gather opinions about e-learning. The interviewees were asked for consent to be interviewed and to the recording of the session. Due to privacy and confidentiality, the transcripts were made available only to the thesis instructor. The interview sessions were approximately 1 to 2 hours in length. After the first interview, minor adjustments were made to phrase questions in an open-ended manner, and overlapping questions were combined. The interview themes remained the same throughout the interviews.

Firstly, the recorded interviews were transcribed and coded using the NVivo software for qualitative research, according to the initial theme interview model shown in Table 5 (section 4). The hierarchy of the codings is listed in the first column of the table shown in Appendix 8. Secondly, transcribed statements were coded according to

five items: importance, satisfaction, dissatisfaction, usefulness and unusefulness. This was done in order to limit and focus the questions of subsequent user theme interviews. In total, 165 statements were coded, as tabulated in Appendix 8. Thirdly, the coded statements were formulated into example statements, which are exemplified in the second column of Table 7. The example statements were reviewed with a training manager in order to prioritize and cluster the statements and eliminate redundancy. The review was done on the date listed in Appendix 1. Based on the review, the statements were formulated into revised questions, examples of which are shown in the third column of Table 7.

Table 7.   Selected examples of questions formulated from interview statements

Theme	Example statements	Revised questions
Content	E-learning is useful for me when I need to get a basic overview of something in a short period of time.	In which ways did the e-learning address your particular needs?
Learner interface	I found [the system] hard to use -- enrolling to a course and starting it [...] I was not that delighted with the system.	What opinions do you have about the e-learning experience as a whole?
Process	E-learning helps avoid time-consuming questions in face-to-face training, saving time to focus on in-depth topics. It is useful to use e-learning as prerequisite for hands-on training so that everyone has a common starting level.	How well did the e-learning give you enough background information for this classroom training?
Learner community	I do not see the need to discuss the content with others. I might ask something [in a discussion forum]... but it's hard to say if I would use it.	What would you think of the possibility to discuss the topics with your fellow learners via a discussion forum in the training system?
Personalization	Seeing other people's comments about an e-learning would help me choose courses that might be useful for me. It would be useful for me if the system would recommend me courses that relate to a course I have taken.	What would you think about the possibility of seeing what other people have said about the e-learning? What would you think about the possibility of the system recommending other courses for you based on what other people have taken in addition to this e-learning?

The initial theme interview model was modified with the NVivo software, based on the clustering of the statements. The result was an interim theme interview model which is illustrated in Appendix 9, on the right-hand side of the diagram. The left-hand side of the diagram displays the theme structure of the initial theme interview model, and the lines between the two sides show how the nodes correspond between the two structures. The interim theme interview model on the right-hand side was applied in the user theme interviews.

5.1   User Theme Interviews

This subsection reports the conduction of the user theme interviews. The process of planning the user theme interviews is introduced, followed by a description of the actions taken and a detailed report of the results. Finally, a synthesis of the user satisfaction model of e-learning based on the user theme interviews is presented.

The participants for the user theme interview were selected based on a purposeful sampling strategy, which Patton (2002) refers to as criterion sampling. Criterion sampling is suitable for finding sources of rich qualitative information in order to reveal potential targets for system improvement (Patton 2002: 238). In order to gain access to interviewees, the first criterion was that the participants were persons attending a product training class in Helsinki. The second criterion was that the participants had completed e-learning courses as a pre-requirement for attending the training class. The third criterion was to select the participants from different countries. The fourth criterion was that the selected sample would represent both case company employees as well as external users of e-learning, since user statistics indicated that approximately fifty percent of users were external to the case company.

Nine user theme interviews were conducted during two months at the end of the year 2012, as listed in Appendix 1. A summary of the interviewees is listed in Table 8. There interviews were conducted with one interviewee at a time, and the interviewees were from eight European countries. Six interviewees were employees of the case company, and three interviewees were external to the case company. Five of the interviewees were working in the area of service and maintenance, two interviewees represented engineering and design, and the two interviewees were employees within sales. The interviewee IDs are used in subsection 5.2 to identify responses.

Table 8.   Information about interviewees in the user theme interviews

Country	Interviewee ID	Internal / External	Role
Finland	C and G	Internal	Service and maintenance
Italy	A	Internal	Service and maintenance
Norway	I	External	Engineering and design
Poland	B	Internal	Sales
Romania	F	External	Service and maintenance
Sweden	H	Internal	Service and maintenance
Switzerland	D	Internal	Sales
Ukraine	E	External	Engineering and design

The interviews were arranged by asking the groups attending face-to-face training to fill in a form to indicate their willingness to be interviewed. The interview participants were selected from three separate training events, each lasting at least two days. In each training event, the first interview was held after the first day of training.

In the interviews, the interviewees were first explained the purpose of the interview, which was to gather opinions from e-learning users. The interviewees were asked for consent to be interviewed, and to make an audio recording of the session. All interviews were recorded with permission from the interviewee, with the exception of one interview. The interviewees were also told that responding to any question was voluntary, and that they had the possibility to interrupt the interview. Due to privacy and confidentiality, the transcripts were made available only to the thesis instructor.

The interview sessions were approximately 20 to 40 minutes in length. The goal was to keep the length under 30 minutes. The interviews were designed to obtain opinions and feedback about each theme in the user satisfaction model of e-learning. Table 9 lists one example question from each theme in the user satisfaction model of e-learning. All interview questions are listed in Appendix 10.

Table 9.   Example questions in user theme interviews

Theme/subtheme	Example question
Fit to needs	In which ways did the e-learning address your particular needs and why?
Location	What would you think about the possibility of taking e-learning with a tablet device?
Personalization	What would you think about the possibility that the system would automatically recommend courses for you, based on what you have previously taken?
Process	What did you think about how you were informed about the prerequisite e-learning courses?
Engagement	What was your opinion of the interactivity of the e-learning?
User-friendliness	What opinions do you have about the e-learning experience as a whole?

The user interviews were transcribed and coded by the researcher with NVivo software for qualitative research. The coding scheme used was according to the initial theme interview model. Codings were also classified with one of three significance ratings: low, medium or high; similarly as suggested by Patton (2002: 472). The transcribing and coding work was started immediately after the first interview. After the first three interviews, the interview length had to be shortened and certain interview questions needed to be revised, as listed in Appendix 10. Questions 10, 16, 18 and 26 were revised. Questions 1, 25 and 27 were added. Sixteen questions listed in Appendix 11 were removed based on the codings indicating a low significance. Moreover, the final thematic model was beginning to emerge from the analysis of the codings. In Table 10, the first column lists the themes of the interim model, which was the starting point for the user theme interviews. The second column lists the themes which were revised after the first three user theme interviews. The third column lists the themes of the final model constructed after all the interview data was analyzed.

Table 10. Development of the user satisfaction model of e-learning

Interim model	Revised model	Final model
User-friendliness	User experience	Quality of user experience
Fit to needs	Fit to needs	Fit to needs
Usage patterns		
Usefulness		
Topic-specific		
Structure and modularity	Structure and modularity	Understandability
Engagement	Interactivity	
Test questions		Interactivity
Community		
Location	Ubiquitousness	Mobility
Process	Customer experience	Quality of customer experience
Personalization	Personalization	Personalization

The following is a description of the changes between the interim model and the revised model. The theme labeled 'User-friendliness' was redefined as 'User experience' in order to represent a concept broader than the user-friendliness or usability of a product or service. Here, 'User experience' represents the total user experience where an appealing, pleasurable and satisfying user experience is composed not only as the sum of functional attributes, such as usability or utility, but also of highly subjective elements, such as hedonic and emotional attributes coupled with the context of the experience (Hassenzahl 2005; Hassenzahl et al. 2001).

The themes 'Usage patterns', 'Usefulness', and 'Topic-specific' were merged with the theme 'Fit to needs', which represents how the attributes of the e-learning responded to the needs and expectations of the user. The themes 'Engagement', 'Test questions' and 'Community' were merged together to form a theme entitled 'Interactivity'. The 'Interactivity' theme encompasses several modes of interaction in online contexts, such as interaction between an online learner and online content, between an online learner and other learners, and between an online learner and an instructor (Anderson & Kuskis 2007). Examples of such interactivity are online discussion forums and webinars.

The theme 'Location' was tentatively relabeled as 'Ubiquitousness', to emphasize the need to enable usage in not only while travelling, but also in everyday situations. The term 'Process' was rephrased as 'Customer experience' in order to emphasize the role of the user as a customer. A user and a customer are in most cases the same person, but the distinction emphasizes the separate set of behaviors to be modeled.

The following is a summary of the changes between the revised model and the final model. The terminology used in the themes of the revised model was changed in order to align it with the model proposed by Kilkki (2008) for analyzing a communications ecosystem (Figure 10 in subsection 3.4). The term 'User experience' was changed to 'Quality of user experience' to indicate the quality perceived by a user when interacting with an application. The theme 'Customer experience' was relabeled as 'Quality of customer experience' to describe the measure of quality that a person perceives when being in interaction with a service provider. The usage of the terminology is explained by the illustration in Figure 15, which shows the application of e-learning as part of a blended learning program. When taking part in a blended learning program, the person interacts with a training service provider in the role of a customer. The training service provider enrolls the person into a blended learning program via an LMS. As part of the blended learning program, the person is required to complete an e-learning before attending classroom training. When interacting with the e-learning application, the person acts as a user. The e-learning application communicates with the LMS, which records the person's progress. In this model, depending on the role of the person as a customer or user, he or she perceives the quality of customer experience or the quality of user experience, respectively. The theme 'Structure and modularity' was renamed to 'Understandability', which was also extended to include 'Engagement'. Thus, understandability describes the attribute of making information clearly and compactly structured, as well as engaging through the application of illustrative case examples and audiovisual means of presentation. The theme 'Ubiquitousness' was relabeled as 'Mobility' in order to avoid conceptual ambiguousness, and to highlight practical usage during travelling and the need for offline access, such as in industrial environments where wireless networks are not available. Devices applicable to these situations include mobile devices, such as smartphones and tablet computers. This concludes the changes leading from the interim model to the final model.
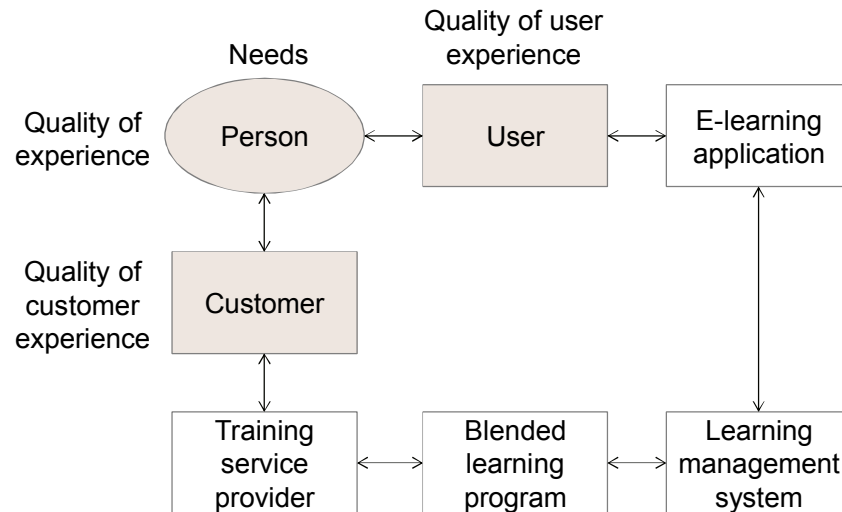
Figure 15.   A proposed model for analyzing a blended learning program

Table 11 illustrates the coded statements and the number of codings with high significance. The total number of coded statements was 261. There were 148 statements with high significance. The themes with the largest number of codings were 'Fit to needs' and 'Understandability'.

Table 11. Number of coded statements according to coding theme and significance

Coding theme	Total codings	High significance
Quality of user experience	7	4
Fit to needs	142	70
Understandability	42	33
Interactivity	25	12
Mobility	16	10
Personalization	14	12
Quality of customer experience	15	7
Total	**261**	**148**

The final emergent model is illustrated in Figure 16. To summarize the elements in the model, the top level element is the quality of experience of a person which represents a person's overall subjective perception of the acceptability of a training service. Quality of experience is divided into the elements of quality of user experience and

quality of customer experience, which depend on the person's contextual role as either a user interacting with the e-learning application, or as a customer interacting with the training service provider, respectively.

Quality of user experience is subdivided into five elements which relate to the attributes of the e-learning courses with which a user interacts as part of a blended learning program. Each element and the main factors affecting them are explained as follows. Fit to needs represents the applicability and relevance of the content to the user. Well-defined course descriptions inform the user of the objectives and the expected outcomes of the e-learning courses, and their relationship to the blended learning program. The topics covered in the course are selected according to best practices of e-learning in order to provide an adequate learning experience to fulfill the objectives set for the course. The informational depth of e-learning is balanced between sufficient technical detail and while avoiding superficial coverage of information. The information in the courses is factually correct and up to date. The e-learning is perceived as useful for the work activities and interests of the user.
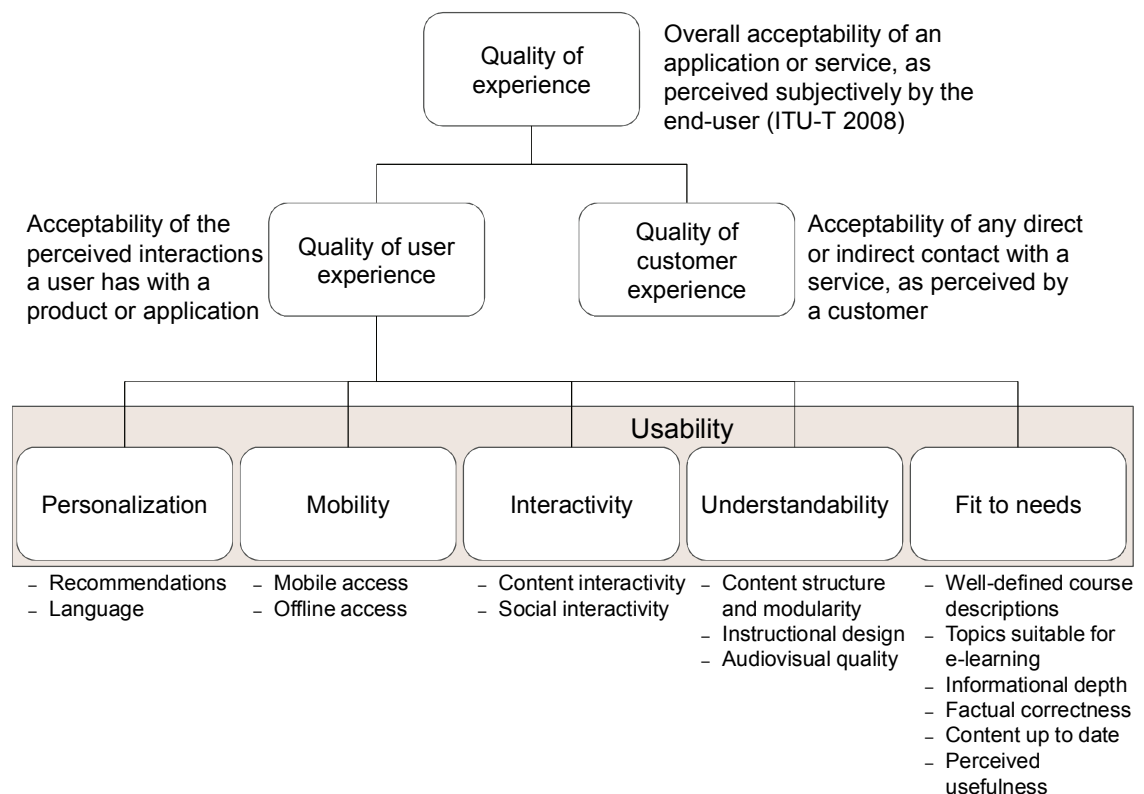

Figure 16.   The emergent model of user satisfaction of e-learning

Understandability of e-learning represents the capability of e-learning to provide learning transfer which, as described by Mayer (2005b), enables learners to apply information to solve new problems. Understandability is enhanced by structuring content as small modular units which can be completed in a brief amount of time, and which allow for flexible learning at the workplace. The modular units build up a logical collection of independent, inter-related and unrepetitive content. The content is designed according to instructional multimedia design principles (Mayer 2005a) which facilitate integration of knowledge, skills and attitudes (van Merriënboer & Kester 2005), and use multimedia such as audio, imagery, and animations to complement and increase learning (Fletcher & Tobias 2005; Low & Sweller 2005). Audio material, such as voice narrations, is used with consistent quality and speakers are used to free the users' cognitive capacity for active learning (Mayer 2005c).

Interactivity refers to the capability of e-learning to provide learning transfer through activities of the learner. Interactivity can be provided through predetermined learning activities in the content, such as self-test questions and simulations, or it can arise through social interactions. Social interactions can take place online as learner-to-learner or learner-to-instructor activities. Learners can discuss and share information with each other, or they can participate in online collaboration through joint activities, as Jonassen et al. (2005) discuss.

Mobility signifies the accessibility of the e-learning environment via mobile devices, such as tablet computers or smartphones. In cases where networks are unavailable, offline access can be provided. Personalization is the capability of the e-learning environment to provide features and content adapted to the users' personal preferences, such as provision of content in the users' own language, or automated recommendations of related training, which enhances finding relevant training content. The concept of usability, shown in grey in Figure 16, underlies the five elements described above. Usability refers to the general attributes defined by Nielsen (1994) for the quality of user interaction, and it is a common attribute of the five elements.

The quality of customer experience describes the response customers have when interacting with the training service provider. As discussed by Meyer and Schwager (2007), the interactions may be direct "touch points" between a customer and service provider, or indirect contact, such as advertising or word-of-mouth. Practical instances

of interactions related to the training service include activities such as email communications regarding the blended learning program, customer care and technical support, as well as general marketing activities, such as provision of training catalogs and newsletters.

To proceed with the analysis of the user interviews, the significant statements from the interviews were examined in detail through the themes of the user satisfaction model of e-learning. Verbatim quotes were selected from the statements identified as highly significant in Table 11. The next subsection presents the analysis of the verbatim statements from the user theme interviews.

5.2   Results of the User Theme Interviews

As recommended by Patton (2002: 28), qualitative research should report direct quotations of interviewees in order to reveal the verbatim words of the interviewees. Some quotations were edited due to the fact that all interviewees spoke English as a second language, and two interviews were carried out in Finnish. This was indicated with square brackets. If quotations were translated, this was indicated at the end of the quote. Some edits were also done to remove information specific to the case organization. The interviewees are identified with the letters A though I according to Table 8 (subsection 5.1).

In general, e-learning courses were viewed as a useful method of obtaining basic knowledge on a topic area. As commented by one interviewee, e-learning was beneficial for new employees for their induction into their area of work:

> For one technician who is the first time [being introduced to the products], [the informational level] is good. (interviewee A)

E-learning was also viewed as important for employees who wished to gain knowledge, for instance, about new products. In the context of the following quote, e-learning courses were a requirement before participating in the face-to-face training of a new product:

> I think the e-learning is important, because normally you go in a course, but you know nothing about the new product. With this method you can take your time to show how is the new product with the new options, new program, software, everything is new. (interviewee A)

An experienced interviewee (interviewee A) suggested that e-learning should be designed to take into account their existing level of knowledge and experience. The interviewee told that he saw best to skip certain subjects he was familiar with, in order to be able to focus his attention on essential topics. Nevertheless, repetition was useful in emphasizing certain important topics, such as safety.

> It's very important [to know about the safety precautions]. But every time, you know that you don't put the hand [inside the device] before [certain safety precautions]. So, this part is better jump. Is not good, but is better jump. […] The people must take care of their work. But [at] the same time, you know that your concentration must be one or two hour… […] So, dividing the course could be also good, that more than one big [course]. (interviewee A)

Several interviewees (A, C, G, I) indicated that e-learning should focus on topics related to specific tasks. The motivation was that they are able to obtain the essential information to conduct their work activities correctly.

> The operation of the device and using the software were the most important things for me, since those are the things which I will use most myself. (interviewee C, translation)

Some interviewees criticized that it was difficult to remember tasks which would require physical practice or if the concepts were not easily understandable through e-learning:

> It's hard to show on the picture how to install things, it's not so easy to do, I think so… But I work in sales, so maybe it's not so important for me, for my daily basis. (interviewee B)

> On a practical level, it was easier to comprehend the names of certain components and the usage of certain software if you can touch or operate them physically. It was hard to remember them just by going through an e-learning course. (interviewee G, translation)

Conversely, another interviewee found it useful to practice working with a technical device through a simulated exercise:

> It's very good, you can use the [device] and it's like you have [it] in your hand. (interviewee A)

Another criticism was that the e-learning content was not sufficiently focused on technical topics. For example, interviewee D mentioned some content had "too much marketing" and "needed more technical details."

Some interviewees (B, D) emphasized the importance of face-to-face training subsequent to e-learning. The face-to-face training was viewed as a necessary part of a "successful education." However, they conceded that e-learning was adequate as a preparatory step for the face-to-face training, and enables starting practical exercises promptly. Two interviewees (G, F) commented that doing relevant e-learning prior to face-to-face training allowed them to make efficient use of the training event:

> It's better to have e-learning before coming [to the face-to-face training], because if you're not familiar with the product, you learn something – you don't come here blind, knowing nothing and you can put pieces together more easily. (interviewee F)

As mentioned by a salesperson (B), certain topics were out of the scope of his work activities, but e-learning gave him an opportunity to see, e.g. how a product was built and installed, which allowed him to appropriately respond to customer inquiries:

> Yes indeed, I think, because in normal work, we have not so many occasions to see how it really is built, how it's… how to install it and so on. And because we are the first contact for the client, there [are] many situations when we are asked about how to install, where can we find the information how to install, and so on. And also our job is to know, to be a partner for our clients. So I think yes, it is also very useful thing. (interviewee B)

On the other hand, two interviewees expressed a need to be able to focus on content which was directly relevant to their own work activities:

> In my case, [installation as a topic] is not important […], because [I] normally go [to a repair site] when [the installation] is finished. (interviewee A)

> [Regarding shorter, separate courses,] I think that it could be better, because you could go straight to the course you really need, and if you for example know that you will never use [a certain feature of a product], you cannot be so focused when you are taking the course. (interviewee B)

The following quote supports the concept that e-learning should be brief and modular to allow users to select the appropriate courses to save time.

> If you have [to] make many e-learning [courses], sometimes you see the same thing about safety, or… [Certain topics] are the same for every [device]. So, you can lose your concentration, because you think, "I know this, this is not new for me." I think it could be a good thing to have a common part… that you [don't] lose time for the same information. (interviewee A)

Additionally, an experienced person expressed the need to skip over familiar topics and focus on the most interesting topics:

> If I start directly with [a topic about software], my concentration is one-hundred percent. If I start with installation, [then] safety, [then finally] when arrive [to the topic about software], I'm not so concentrated. (interviewee A)

Two interviewees (A, C) commented that due to time constraints in their work, e-learning courses should be short in length. This enables completing e-learning in a short uninterrupted period of time.

> [A short course] is better than one large course, definitely. Where we work, I am not able to reserve an hour or two to take an e-learning course. I get calls from customers, get interrupted and have to continue, so it is better to take courses in short bites. (interviewee C, translation)

One interviewee (D) also commented that brief e-learning allows achieving "more experiences of success." Another interviewee (A) valued the ability to review content, interrupt and resume courses, as well as retake tests. The interviewee also suggested that retaking tests could be used as refresh training:

> You can take your time to stop and restart, come back. It's good for this possibility to go back and forward and [answer a] question [again]. It's very important. [… And then] in another time [I can check] if I pass the e-learning. (interviewee A)

Another interviewee pointed out that although there were limitations in learning practical activities from e-learning, multimedia features, such as simulations provided learning opportunities:

> I said it's not so easy task to do to learn from e-learning how to use, but that simulation [of the technical device] was OK, and also the [demonstration] for the [software] was also OK. You can see how it looks like, you can push some buttons like in the real program, so I think that it was a useful part. (interviewee B)

Additionally, another interviewee commented that he did not need to refer to a paper binder since the material was in electronic format:

> It's [a] good experience, very good for new technician[s]. Because when I start 15 years ago, it don't exist, e-learning, so you must take your binder and every time check. But [now] you can see [a] film or picture or something else, or use the program like [the software] or other like this. (interviewee A)

Concerning self-test questions, one interviewee (E) viewed that test questions added interactivity, whereas another interviewee (F) saw them as a useful opportunity for reflection. One interviewee suggested that it would be useful for his work activities if the questions contained topics related to practical tasks:

> Maybe some questions [regarding mechanical and operational details for technicians] could be included in the tests, if it is possible to do them in a functional way. They would be useful if I think about my own work. (interviewee G, translation)

One interviewee commented that if answering a question required memorizing topics or mastering additional reading material, it should be supported within the test by providing information where to find the answer:

> It would have been better if there were not so many links, but [be] more specific: "Look at chapter this and that and find this list here…" More specific [instructions], it will be more helpful to… Because when you get links with lots of documents and there are hundreds of pages, you don't know where to start, and you know you are supposed to finish this within one day. (interviewee I)

Interviewee I argued that if test questions do not provide sufficient support, learners were led to a situation where they answered based on trial and error, which did not properly support the learner reflecting on the topic. This was affirmed by the following two quotes:

> The quiz was sometimes OK, and sometimes it was a shock, because the session didn't mention about some things, because it was written in the manual and I hadn't read all the things. [The quiz should have indicated] what should I have read first to be able to answer. (interviewee I)

> Since you understand that I haven't read all of the manuals, I have to make some chances sometimes during the quiz. And then [the quiz] says, uh-oh, now you [chose] wrong - choose again. And, then I could alter one item which I was a little bit unsecure of, and then get correct answer on the quiz. And I did the correct answer even though that I didn't know… I didn't have the knowledge to answer the question actually. (interviewee H)

Interviewee I also noted that some additional reading material was not available due to access restrictions outside the case organization. He pointed out that the additional reading material should be made accessible if mastering it was required.

One interviewee (D) proposed that self-test questions should be designed to encourage "combining pieces of information together." Interviewee H gave criticism about questions that were too trivial. One interviewee (E) expressed dissatisfaction with a question that had a factual error. Furthermore, the interviewee (E) also commented that self-test questions should take into account learners' time constraints:

> Lot of information, so not all the time you concentrate on something which [will be] asked later. Because it's my work, I want to complete fast, so I read, read. (interviewee E)

Two interviewees (F, H) suggested that case examples would be useful as an illustrative method:

> [A case example] gives you ideas. Because if you learn from the manuals, you never know what will happen in a real situation. And when you see case notes […], they are good to know. (interviewee F)

> Yes, that would be very useful in troubleshooting [and other topics]. If someone had made wrong setup or wrong environment or something. […] It's commissioned [incorrectly] and it behaved like this. (interviewee H)

One interviewee (G) commented that it would be useful to simulate situations that help prepare for repair and maintenance work, because it often requires quick decisions and execution to minimize delays in production:

> Practical experiences are the most valuable, of course, but it can be a difficult situation if you are alone at a client where production is halted due to a breakdown. The more you can prepare for such events, the better. (interviewee G, translation)

Another interviewee (A) affirmed this view by suggesting that videos or photographs should be used to demonstrate, e.g. repair procedures. Interviewees A, B and F indicated that case examples help distribute tacit knowledge and illustrating concepts as they are applied in real situations. However, one of the interviewees pointed out a challenge in illustrating case examples that would be generally applicable, due to varying practices in different geographical areas:

> I think that [case examples] could be interesting, but I think that maybe it will be hard to do, because in different countries the experiences can be a little different, but I think it could be useful and interesting. (interviewee B)

When asked about using storytelling methods to illustrate case examples, two interviewees (C, D) suggested that such methods should be used with care. If a storytelling method was used, the method should provide additional value and be grounded in real life situations to avoid being perceived as a naive narrative.

> Example situations would be good I suppose, because it would be… Now some might think that the situations would be made up… But an example from real life would be effective. I wouldn't see that as a bad thing. (interviewee C, translation)

Two interviewees (A, C) commented that it would be preferable to have courses in learners' own language when English is not the person's native language. However, the possibility to review lessons mitigated language issues:

> With better English skills the training would have been more beneficial for me. I think some presentations were spoken too quickly. But the good thing is that you can review them. (interviewee C, translation)

Interviewee A also suggested that if the e-learning material were translated into learner's native language, it could be offered to end-customers inquiring about training.

> In many places the language is important. Some customer ask to make [the training in the local language]. […] We have the [manuals in the local language], but the course is in English, that's a little problem. (interviewee A)

Regarding audiovisual aspects of e-learning, interviewee A stated that important concepts should be illustrated with video and imagery as they were more memorable than text:

> [It] could be very interesting to have a film when someone repairs the [device]. […] because people remember the figure, the pictures, so when you see one [device] explode, you pay attention. […] If you read "pay attention because it explode", it's not the same. The image is very important. (interviewee A)

However, another interviewee (D) remarked that although video sequences are illustrative, they should not be excessively long because videos lack interactivity. One interviewee (E) pointed out that narrated audio tracks should be recorded with human

voice instead of a synthesized computer voice. He also recommended that narrations should be done with homogeneous quality and with the same voice throughout a single e-learning course:

> [The] voice... One part is girl's... I think is computer voice... Sometimes is voice of man, real recorded, and recorded with one microphone. [I] hear noise a little bit, and next part is the same voice, but record is not the same, is better. Sometimes it's... Maybe is better to [have] one [person], or voice of all parts of one course, maybe must be the same. (interviewee E)

On the other hand, one interviewee had the opinion that synthetic computer voice was acceptable because the quality had improved from previous courses.

> I think nowadays they are better, because the voice which reads the slides, it's now more like human voice, not like computer voice. (interviewee B)

Regarding usage of e-learning as a prerequisite for face-to-face training, one interviewee (H) indicated that he was not aware of the requirement to complete the e-learning prior to the face-to-face training. He proposed that the prerequisite condition should be emphasized in correspondence with the training service provider:

> I didn't understand from the moment from the start that it was a precondition to have made the e-learning first before [the face-to-face training]. I saw that quite late in the mail I [received] from the enrolment. So, maybe that information could be some highlighted or maybe I was in a hurry that I didn't read it, but... "Please observe: This is a precondition." (interviewee H)

The feature to automatically recommend further training was viewed as desirable. As explained by one interviewee, he had insufficient time to continually search for new information about training:

> If something closer to this course, it's useful. Because not every time you know about something new, because of time and lot of work. It will be very useful to have some information. (interviewee E)

Automated recommendations would also aid in finding training about related products:

> That's important, because we know [our devices], but [other devices are] a black box sometimes. (interviewee A)

Another interviewee also stated that as long as the automated recommendations are relevant, they would be beneficial:

> It depends on the work activities of the person, which tasks are important and concrete. But if recommendations were given, it would make it easier to consider what is relevant to you, and be informed about what training is available. (interviewee G, translation)

Interviewee C pointed out that employees were encouraged to search for training opportunities independently. Automated recommendations would make professional development opportunities more accessible:

> For years, it has been made known to us that we should find out on our own what training is available and apply for them. Nowadays it is also a question of being certified in order to be able to do certain actions. (interviewee C, translation)

> As I'm new in my position, I prefer to get as much training as possible at the beginning, so getting recommendations would help. (interviewee G, translation)

Interviewee H pointed out that recommending relevant training would be a challenge if the training needs are varying and unspecified. He had doubts that the recommendations would offer the expected benefits in such cases where the range of training needs is very wide.

> Yes, it could be useful, but I think, let's say if there is, for systems and automation, could it be … thirty different kind of trainings. It's quite [overwhelming] to sit and choose, "Ah, this one." So, the usage, it's not very much. (interviewee H)

Users had varying and conflicting attitudes towards mobile learning. None of the interviewees had actual experience of mobile learning solutions. Many interviewees (A, B, C, F, G, and I) responded that they did not personally use a tablet device. Nevertheless, some interviewees (A, D and I) saw mobile learning as a worthwhile opportunity to make learning accessible, e.g. while travelling or commuting.

> [An opportunity] could be to increase for me, the possibility to have the [content as a] file, to see, not in office, but […] at home, or in the hotel in the evening. If you don't have the connection, you could check this file. (interviewee A)

One interviewee (I) had reservations about using a mobile device due to smaller screen size. He indicated that issues regarding documentation must be solved, for instance, since he was accustomed to have multiple displays to simultaneously view manuals and training content. He saw mobile content as a positive factor if it was easy to use and navigate:

> I don't have a tablet device myself, but it is coming more and more, I know that. And it is more and more used in the business also. Tablets is very commonly used for -- for private use. Not so much in our business at least, but I know it is coming more and more, of course. But it is another way to work [compared] to clicking… I'm used to [having] more than one screen on my computer so I can put things here and put the manuals on that screen. I have three screens [on my desk…] I think I have a little bit [of a] problem to go into a tablet[…] But it depends how it is made. If it is made correctly, it is probably very nice. If you put [the current e-learning] as it is into a tablet, I think it will be difficult. (interviewee I)

Two interviewees (C, H) commented that rather than mobile devices offering a definitive improvement, the challenge was more about personal prioritization and the need to find time to focus on the learning activity:

> One should be able to make time for oneself to sit down in front of his or her desk to complete an e-learning course instead of having to do it on a train or bus. (interviewee C, translation)

> It's more accessible, but however, to make the e-learning, looking to myself, it's better to sit down, quiet place, focus on the e-learning, instead of doing it everywhere […] lack of focus. (interviewee H)

This concludes the results of the user theme interviews, which are reported here as a representation of the voice of the customer. The results presented here provided several opportunities for improvement as well as practical suggestions for developers. The researcher suggests that many of the findings are candidates for best practice guidelines for e-learning development. The results are therefore summarized in Appendix 12, formulated as guidelines for best practices and development suggestions.

5.3   Reflection on the Interview Cycle

This subsection reflects upon the second action research cycle. The lessons learned from the internal and user theme interviews are recollected, and the user satisfaction model of e-learning is evaluated.

The internal interviews gave insights into the significant issues which users expressed. Using a purposeful sample strategy to select interviewees for the internal theme interviews resulted in a set of quality factors affecting e-learning. The internal interviews emphasized the importance of obtaining feedback from users also outside of the case company. The internal interviews were a useful phase of becoming accustomed with the interview process.

The following is a review of the findings from the user theme interviews. First, it should be noted that the context of the user theme interviews was specific to the e-learning courses which were prerequisite for attending the face-to-face training events. In the user theme interviews, e-learning was viewed as beneficial for new employees for their induction into their area of work. E-learning was also viewed as important for employees who wished to gain knowledge, for instance, about new products. E-learning should be designed to take into account their existing level of knowledge and experience. Repetition was seen as redundant, but in emphasizing especially important topics it was seen as acceptable and useful. E-learning should focus on topics related to specific tasks. It was difficult to remember tasks which would require physical practice or if the concepts were not easily understandable through e-learning. Practicing the usage of a technical device through a simulated exercise was seen as useful. E-learning content was viewed as not sufficiently focused on technical topics. E-learning was seen as a useful preparatory step for the face-to-face training. Subsequent face-to-face training was seen as a necessary element in the complete training process.

E-learning gave users an opportunity to see topics that were out of the scope of typical work activities. Users also had a need to focus on content which was directly relevant to their own work activities. E-learning courses should be designed to be modular to enable users to pass directly to the topics relevant to them. E-learning courses should be designed to be short in length to enable completing the courses uninterrupted. The ability to review content, interrupt and resume courses, as well as retake tests was seen as useful. Retaking tests was suggested as a possibility to do refresh training. The electronic format reduced the need to refer to paper material.

Test questions provided added interactivity and an opportunity for reflection to the users. The usefulness of test questions would increase if they focused on topics related to practical tasks. If answering a question required memorizing topics or mastering additional reading material, it should be supported within the test by providing information where to find the answer. Test questions that lead to answering based on trial and error does not support proper reflection on the topic. If any additional reading material is required, it should be ensured that the material is accessible. Test questions should be designed to encourage "combining pieces of information together." The

quality of test questions was seen as important: questions should be non-trivial and factually correct. The frequency of test questions should be designed to take into account the time constraints of workplace learners.

Case examples were seen as a helpful method to illustrate concepts as they are applied to real situations. It would be useful to simulate situations that help in preparing for repair and maintenance work in the field. Videos or photographs should be used to demonstrate, e.g. repair procedures. Storytelling methods should be used with care to avoid being perceived as naive.

It would be preferable to have courses in learners' own language, but it was recognized that being able to review the content mitigated the problem for people speaking English as a second language. However, if an appropriate language was not offered, it was seen as a barrier for end-customers.

Important concepts should be illustrated with video and imagery. Video sequences should not be made excessively long because they lack interactivity. Narrated audio tracks should be done with human voice instead of a synthesized computer voice. The narration should have homogeneous quality and there should not be too much variation in the voices used in a single e-learning course. On the other hand, rgw synthesized computer voice was viewed as acceptable due to its improved quality.

When using e-learning as a prerequisite for face-to-face training, the requirement to complete the e-learning beforehand should be emphasized in correspondence to the users. According to the interviews, if participants were reminded to fulfill the requirements of the classroom training, they were better prepared, and hands-on exercise performance was improved.

Automatic recommendations of further training were viewed as a potential method to save time in searching for new information about training, and thus making training more accessible. However, the value of the automatic recommendations was dependent on the specificity of individual training needs.

There were varying opinions about using mobile devices for e-learning. The small screen size of a mobile device was a concern. Mobile devices were seen as a method to make learning accessible while travelling or commuting.

The user satisfaction model of e-learning was reviewed in two separate discussions with training experts from two European countries, as listed in Appendix 1. Both evaluators were experts in the field and had several years of experience in developing e-learning programs. The reviewers stated that an element representing usability should be visualized in the model. Usability was not included as a theme *per se*, because it was viewed by the researcher to be related to multiple themes. Therefore, 'Usability' was added as an underlying element of the quality of user experience, as shown in Figure 17. Minor adjustments were made to the explanations under the themes 'Fit to needs', 'Personalization' and 'Quality of customer experience'. It was also suggested that the themes would be clarified by adding interrogative statements in the figure. Based on the responses of the evaluators and the minor adjustments they suggested, it was found that the user satisfaction model of e-learning had sound face validity. The final model is presented in Figure 17.
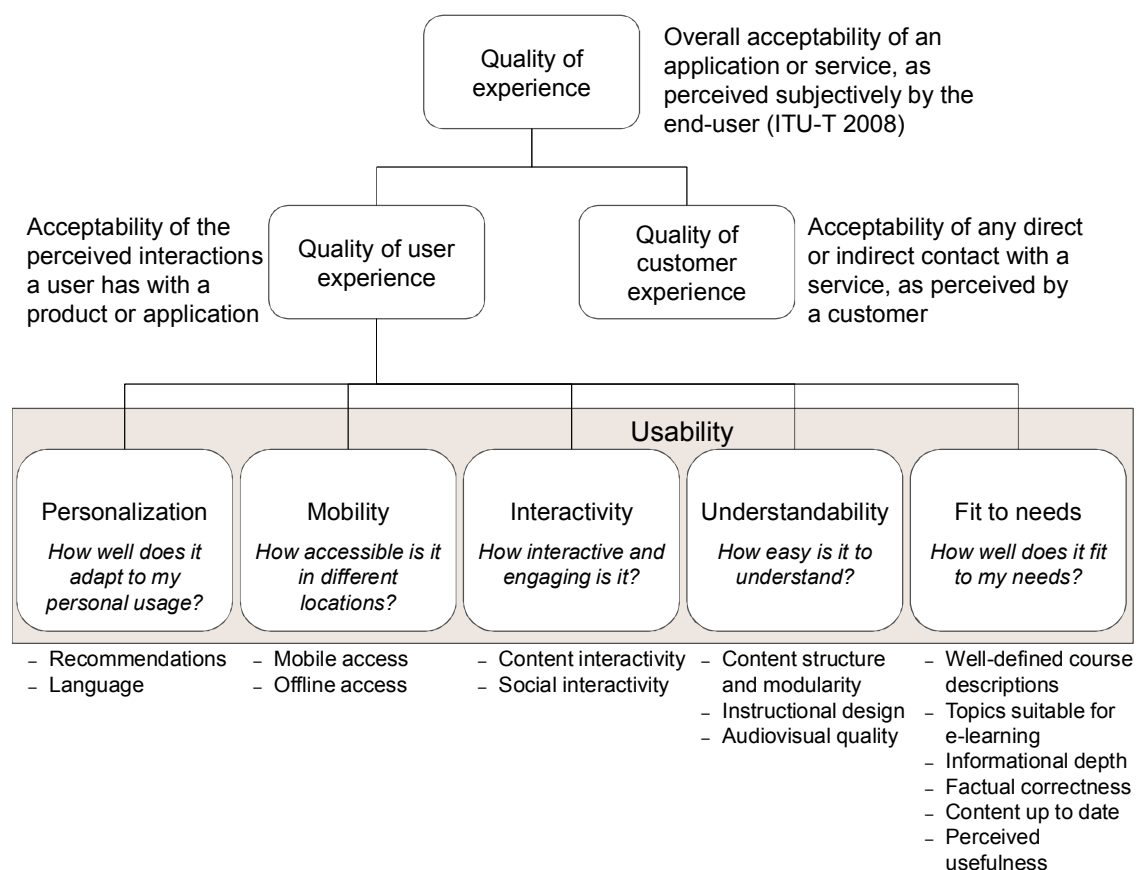
Figure 17.   The final user satisfaction model of e-learning

In summary, the user satisfaction model of e-learning presented in Figure 17 emerged by combining the ELS and QCF with the results of a survey, and by developing it further through six internal theme interviews and nine user theme interviews. During the development of the user satisfaction model, certain themes became prominent while others diminished. Thus, the model contains themes which apply to the context of the case organization. In the next section, the user satisfaction model is applied to a quality improvement methodology in the case organization.

6   Implementation of the Quality Improvement Methodology

The goal of action research is to create change in the community where it is practised. Therefore, the understandings from the user theme interviews needed to be translated into actionable objectives which lead to change. The information from the interviews drew a broad image of the context in which users found themselves. The interviews captured information which was inquired from relatively few individuals in different contexts. The individuals participated in different training courses, the interviews were done in a limited timeframe, and the results were subjectively interpreted by the researcher. Therefore, the experiences should be viewed as a partial but descriptive picture of the critical factors that contribute to quality in e-learning in the case organization. From the point of view of quality improvement, it is a requirement to understand which factors contribute most to quality outcomes. The responses did not convey a specific enough sense of priority to be usable in an improvement process. Therefore, the interview data needed to be supplemented with other data in order to approach quality improvement systematically.

In the case organization, process improvement was implemented through a 4Q methodology, which includes the phases Measure, Analyze, Improve and Sustain as described in subsection 3.2. The 4Q methodology enables solving problems rigorously by first seeking to understand the current state in detail, then identifying problems and their root causes, developing solutions to address the problems, and finally, maintaining improvements by standardizing them in work practices and follow-up procedures.

During the research, a continuous improvement workgroup was formed independently of the research activity. The researcher identified the continuous improvement workgroup as an opportunity to achieve change in the e-learning development process. The researcher was invited to the workgroup, and the workgroup accepted the research as part of the continuous improvement activities. The continuous improvement workgroup included employees from the training department of the case organization, such as the training manager, trainers, and administrators.

Written course feedback from the LMS of the case company was selected as the source data for the quality improvement methodology. The case organization used evaluation forms in all e-learning courses. The evaluation form asked for feedback about the course, which was recorded in the database as text. The evaluation form also asked for numerical course feedback, but the processing of quantitative rating data was scoped out of the present thesis. The feedback gathered in the database provided a larger set of data than the limited number of user theme interviews.

The continuous improvement workgroup followed the 4Q methodology to identify problem situations. The workgroup started by evaluating the training services subprocess described in subsection 1.1, and by identifying potential weaknesses in the subprocess. The workgroup evaluated the e-learning activity in the subprocess by using a '5 Whys' instrument. Based on the results of the evaluation, it was identified that a problem within the training delivery process is that some participants do not complete e-learning courses on time or at all. Based on discussions in the workgroup, it was suggested that a source of dissatisfaction for users was that e-learning did not fulfill their need for specific information. It was commented that e-learning provided an overview, but not enough technical details. The user theme interviews suggested similar results. However, it was necessary to find information supporting the anecdotal evidence. To verify that the lack of technical detail indeed was a major contributor to negative feedback, the evaluations given by users themselves in the database needed to be analyzed. Therefore, the user evaluation comments were gathered from the database of the learning management system.

6.1   Results of the Quality Improvement Methodology

The comments were gathered from eight e-learning courses of one product family, from users who had filled in the evaluation form at the end of the courses within the previous year. This resulted in 462 comments from 50 countries. The comments were first classified into four groups based on their impact: Error, Improvement, Informative, and Irrelevant. The categorization logic is described in Table 12. The categorization was reviewed by a trainer to check for mistakes.

Table 12. Evaluation of the impact of comments

Impact	Description	Example
Error	The comment points out a deviation in quality calling for specific corrective action.	"The order on the picture does not match the order in the text."
Improvement	The comment indicates an opportunity for enhancement but does not specify a detailed action to be taken.	"Some more detailed descriptions would be nice to have."
Informative	The comment provides information about which elements are found valuable.	"I liked the video and the presentation also gave a pretty good overview about different features."
Irrelevant	The comment does not provide information.	"No comments"

Four percent of comments were categorized as Errors. Sixteen percent of comments were categorized as Improvement, as illustrated by Figure 18.
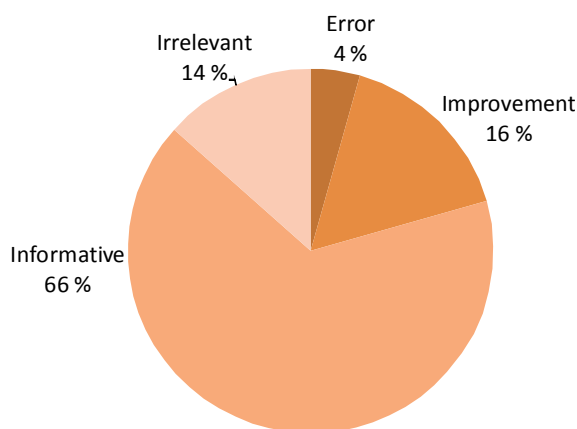
Figure 18.   The classification of the impact of comments

As explained in subsection 3.2, quality can be defined as freedom from deficiencies. Therefore, in order to find the comments where action should be taken to reduce defects, the comments in categories 'Error' and 'Improvement' were analyzed in more detail. The analysis was carried out based on the themes identified by the user satisfaction of e-learning model. The comments were first allocated one or more of the themes to which they were related. The comments were then placed into one or more problem categories, as illustrated in Table 13.

Table 13. Examples of the categorization of problems

Example comment	Themes	Problem categories
No mentioning of any need for special tools to carry out some of the jobs.	Fit to needs	More details, explanations or examples needed
This course need to be detailed more	Fit to needs	More details, explanations or examples needed
The voice of the trainer could be better.	Understandability	Audiovisual issue
Hope can see more picture in course	Understandability	Audiovisual issue
Minus points for missing quiz and voice. Otherwise good package.	Understandability; Interactivity	Audiovisual issue; Issue regarding test questions
The presentation was confusing. You could not focus on listening because too crowded slides. It should be synched.	Understandability	Audiovisual issue
There is error in the exam.	Understandability	Errors in test questions

The categorization resulted in the following problem categories and frequencies as illustrated by Figure 19: More details, explanations or examples needed (21); Issues regarding audio & visual (18); Miscellaneous issues regarding test questions (11); Errors in test questions (9); Starting problems, playback errors (8); Content does not fit expectations (6); Requests for new topics (6); Errors in content (5); Other issues (5); System tracking error (4); Need to download content, offline content (2).
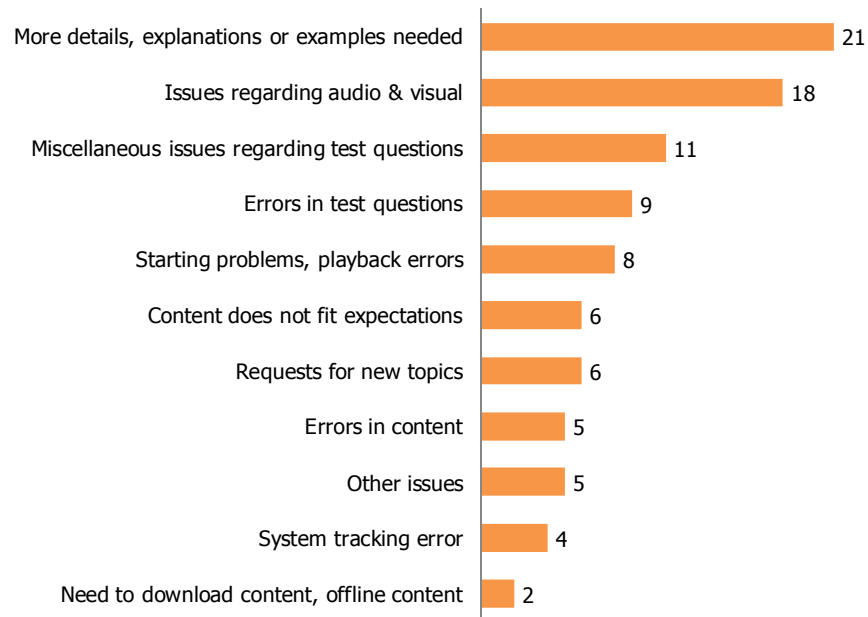
Figure 19.   The problem categories and frequencies

After the problem categorization, a continuous improvement workshop was organized to process the comments according to the procedure outlined in the 4Q quality methodology. The workshop included a multi-functional team representing users, product management, training management, training administration, and training development. The workgroup processed the two most frequent problem categories with the '5 Whys' instrument to find the root causes of the problems. The results of the process are listed in Table 14. The problems were formulated into specific questions and processed according to the '5 Whys' instrument. The root cause for the first problem category of missing details was identified to be caused by unclearly defined learning objectives and the lack of communicating the objectives to the users. The root cause for the problem regarding audiovisual issues was identified to be caused by improper or missing instructions and guidelines for persons creating e-learning material.

Table 14. Results of processing problems with the '5 Whys' instrument

Problem category	Question	Root cause
More details, explanations and examples are needed	Why are more details needed in course X?	The training development process must define clear objectives that have to be communicated to the users.
Issues regarding audio and visual	Why are slides too crowded and not easy to view and listen?	There is no process existing where persons creating slides are sent proper instructions and guidelines.

In summary, the collection and categorization of written comments resulted in a list of problem types, which were analyzed in a multi-functional workshop, and which produced root causes for the problems. Since the workshop was the first in the context of e-learning development in the case organization, the process was also evaluated, which is discussed in the following subsection.

6.2 Evaluation of the Implementation

This subsection presents an evaluation of the third action research cycle, which included the usage of the 4Q quality improvement methodology in a continuous improvement workgroup, and a workshop to find root causes of quality deficiencies. The researcher gained knowledge of the quality processes of the case organization, and continuous improvement practices. The implementation of the quality improvement in the e-learning development resulted in the creation of a systematic method of analyzing written feedback and a practice of using a workshop for finding the root causes of significant deficiencies.

Based on subsequent discussions, the workshop was perceived as a useful event for discussion and sharing insights between different departments of the case organization. There were varying opinions about the usage of quality improvement tools, such as the '5 Whys'. Firstly, it was viewed that the usage of quality improvement tools should be adequately briefed beforehand. Secondly, it was stated that the '5 Whys' should be used selectively when the issue under discussion is complicated. On the other hand, it was noted that using a quality improvement tool was a guiding method to find root causes.

7   Conclusions

This section summarizes the overall research process, presents the key recommendations based on the results, considers the reliability and validity of the results, and provides suggestions for further studies. The contribution of the three action research cycles to addressing the research question is also summarized.

7.1   Summary

The purpose of the present thesis was to investigate methods of embedding the voice of the customer into the improvement process of e-learning in the case organization. The planned outcome was a revised quality improvement process and a set of tools to gather and analyze qualitative user feedback.

A current state analysis was conducted in order to gain an understanding of the existing processes within the case organization relating to e-learning, and which quality improvement methodologies were adopted in the case organization. An e-learning development process existed in the case organization, but there was no systematic method of gathering feedback. The intent of the research was to improve this process. The research design was based on action research, which involved three cycles. Due to the interdependent nature of the cycles of the research process, it was considered that there were several possible outcomes from the research. The benefit of using a cyclic process in the present thesis was the flexibility if offered in proceeding towards goals which emerged while exploring the field of subjects relevant to answering the research question. For example, in the beginning of the research, one potential outcome was to involve users at an early stage of the e-learning development process. This, however was scoped out from the research during the current state analysis and the interviews. It was also unclear in the beginning of the research, how the quality improvement process would be implemented in practice. A precondition for this process was that it had to be compatible with the existing processes and easily applicable within the resources of the case organization. Each cycle in the action research process produced a contribution towards the outcome of the present thesis. The contributions are described in Table 15.

Table 15. The contribution of the cycles of action research to the present thesis

Cycle	Contribution
Current state analysis	Gaining an overall understanding of the current processes within the case organization, and the applicability of quality improvement processes from literature. Conducting a survey with internal employees to construct an initial theme interview model grounded on the best available knowledge from literature.
Internal theme interviews	Gaining a perspective into the key elements of user satisfaction of e-learning from the point of view of the case organization.
User theme interviews	The user interviews give insights into the experiences of the customers which leads to the emergent user satisfaction model of e-learning.
Quality improvement methodology	Testing a quality improvement methodology within the current processes of the case organization.

In the current state analysis, the best available knowledge from literature was researched to find quality evaluation methods relating specifically to e-learning in a corporate environment, and to seek a general overview of quality improvement methodologies. Two structural models for e-learning quality, i.e. the ELS and QCF, were applicable to evaluating the voice of the customer in a corporate environment. The models were adapted through a survey and theme interviews. Quality improvement methodologies were reviewed to find analogies from product development to e-learning development. A subset of a QFD methodology was selected, which was feasible within the e-learning development process of the case organization.

The internal theme interviews were done as in-depth interviews with a broad scope of questions. The internal theme interviews guided the design of the user theme interviews by delineating the key elements, and focusing on significant factors of user satisfaction of e-learning from the point of view of the case organization. The user theme interviews gave insights into the actual experiences of the users and their opinions about user satisfaction. The user theme interviews led to the creation of a

user satisfaction model of e-learning. The user satisfaction model of e-learning, illustrated in Figure 16 (subsection 5.1), was used to analyze the qualitative feedback.

As the research progressed, the outcome of the research formed into augmenting the existing development process with an evaluation and improvement phase. This was implemented through a continuous improvement workgroup which adopted a 4Q quality improvement methodology, which was used in the case company. Qualitative feedback from e-learning users was collected and evaluated in a workshop. This was found to be a feasible method which was compatible with the existing processes of the case organization.

In summary, the planned outcome of the research process was to create a change in the development process of e-learning by implementing a quality improvement methodology, where the data gathered from interviews and course feedback was used to improve e-learning user satisfaction. Additional outcomes were a user satisfaction model of e-learning and recommendations for best practices. The present thesis has been an exploration for the researcher into the professional practices and theoretical backgrounds of e-learning, and has provided the researcher a deep dive into the realm of his work.

7.2   Recommendations

Firstly, it is recommended to include an 'Evaluation and Improvement' phase into the existing courseware development process of the case organization. The revised courseware development process is illustrated in Figure 20. The evaluation and improvement of courseware can be done according to the 4Q quality improvement methodology in situations where root causes of complex problems need to be identified. Gathering of qualitative data can be done with the interview templates provided in Appendix 10, and analyzed with the user satisfaction model shown in Figure 17 (subsection 5.3).
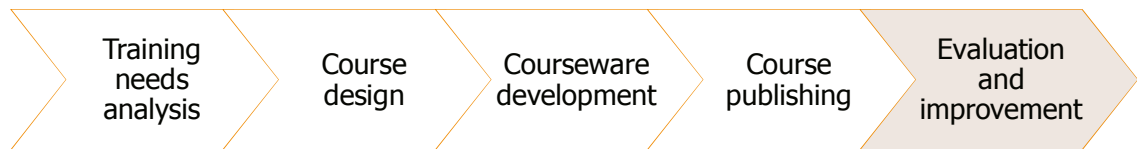
Figure 20.   The proposed revision of the courseware development process

Secondly, it is recommended to create guidelines and instructions for e-learning developers to create content through best practices in order to increase user satisfaction. A list of recommendations for best practices is presented in Appendix 12, which is based on the findings from the user theme interviews described in subsection 5.1 and the continuous improvement workshop documented in section 6.

7.3   Reliability and Validity

In the context of qualitative research, it is necessary to evaluate the credibility of a study. An assessment of the reliability and validity of a study is based on the rigor of reporting the actions taken and the openness of describing the reasons for conclusions. The present thesis builds a practical understanding and knowledge of the best practices in the field of e-learning. The triangulation of the data was done by including three perspectives. Firstly, literature was reviewed for the best available knowledge and applicable models. Secondly, a theme interview model was developed iteratively based on models from literature and data from a survey and interviews. Thirdly, the implementation of the process was done by following a known quality improvement methodology. The implementation was evaluated by the participants of a continuous improvement workgroup. The aforementioned considerations provide the theoretical foundations for the credibility of the present thesis.

The user satisfaction model of e-learning was developed based on two existing models in literature: the ELS (Wang 2003) and the QCF (Li 2009). The former was tested rigorously using a sample in Taiwan. The generalizability of the ELS to other cultural surroundings requires a confirmatory analysis. In order to provide validity in the context of the case organization, the ELS was adapted through a survey. The QCF was based on a case study. Elements from the QCF were included in the theme interview model, and this was done rigorously through comparing the structure with the ELS and the user feedback gathered through the survey. The models were merged to form an

initial theme interview model as described in section 4. The development of the intermediate versions of the model was documented, and was reviewed after the user interviews. The user satisfaction model captured aspects that emerged from listening to the voice of the customer, which may exclude factors such as learner motivation and learning environment. The user satisfaction model contains themes which apply to the context of the case organization. Therefore, if applied in other situations or contexts, the applicability of the model should be reviewed for validity.

The internal theme interviewees were selected from a purposive sample of the survey respondents. A selection criterion for the interviewees was that the respondents had a high TR profile, as described in section 4. A potential weakness regarding the validity of the theme interview model is that individuals who have a high TR profile are motivated to use technology-based systems, and thus may not perceive the same issues as individuals who are resistant to using technology-based systems. Also, Matthing (2006: 294) concludes by stating that generalizations about high TR profiles and creativity should be confirmed by further studies.

The internal theme interviews were transcribed and coded solely by the researcher, but it was done systematically. The interview questions resulting from the internal theme interviews were reviewed by a training manager from the case company in order to avoid bias. The user theme interviews were transcribed and coded solely by the researcher as well. In order to avoid bias, the resulting user satisfaction model of e-learning was reviewed for face validity by two experts in training functions in the case company.

The interviews were made as open and forthcoming as possible in order to solicit candid responses. Nevertheless, the interviewees may have perceived the researcher as a formal representative of the case company, thereby acquiescing in their responses. In order to avoid the interviewees providing answers that they think the researcher wished to hear, they were informed about the voluntary nature of the interview, and the absence of any right or wrong answers. The aforementioned precautions notwithstanding, the interviews and their coding could have benefited from being conducted by an external interviewer.

The application of the quality improvement methodology was based on best practices in literature. The continuous improvement workshop which processed written user evaluation comments included representatives of several stakeholders. From the point of view of sample size, 462 written user evaluation comments from 50 countries provided reliability for the conclusions of the workshop. The applicability of the improvement process into the case organization was based on one workshop, and therefore its generalizability into other organizations should be considered case by case.

7.4   Further Prospects

The findings of the present thesis provided a recommendation of a process to evaluate the quality of e-learning and a set of tools to guide subsequent improvement actions. This subsection provides suggestions for further research.

The recommended process of utilizing the 4Q methodology should be a continuous activity within the case organization. Using the 4Q methodology to solve emergent quality problems could be initiated based on a measurable indicator. The development of a measurable indicator is a potential topic for future study. Quantitative measures for the quality factors in e-learning should also be developed. The user satisfaction model of the present thesis could also be extended through other models, e.g. by considering satisfying and dissatisfying quality factors (Chyung & Vachon 2005), or by studying quality of customer experience, e.g. through the service concept suggested by Moisio and Smeds (2004). Further research should also be done to evaluate the possibility to include user oriented methods in earlier stages of the e-learning development process.

E-learning is a field constantly in a state of flux, with new paradigms being invented. Imaginative prospects are researched in the realm of mobile learning, ubiquitousness, virtual reality and augmented reality. It is encouraged for future researchers to adapt and use the results of the present thesis to study new horizons which broaden the range of learning contexts.

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Personal Communications

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October 22, 2012. Internal theme interview with interviewee 3.

October 23, 2012. Internal theme interview with interviewee 4.

October 26, 2012. Internal theme interview with interviewee 5.

November 5, 2012. Internal theme interview with interviewee 6.

November 14, 2012. Review of internal theme interview statements, K.N., Germany.

November 19, 2012. User theme interview with interviewee A.

November 20, 2012. User theme interview with interviewees B, C and D.

December 5, 2012. User theme interview with interviewees E and F.

December 11, 2012. User theme interview with interviewee G.

December 12, 2012. User theme interview with interviewee H.

December 13, 2012. User theme interview with interviewee I.

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February 13, 2013. User satisfaction model of e-learning review with K.N., Germany.

March 5, 2013. User satisfaction model of e-learning review with A.S., Finland.

The Blitz QFD Process
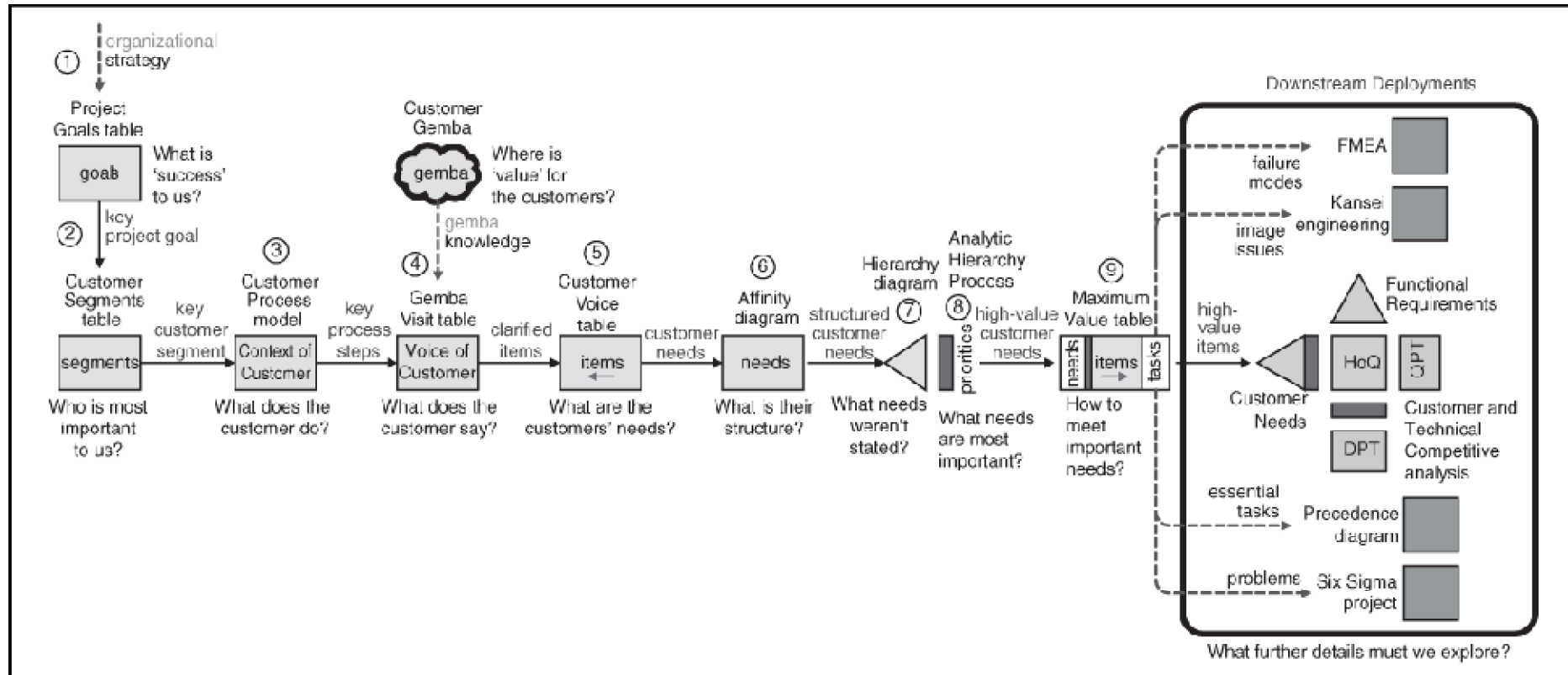
The Blitz QFD process (Jayaswal et al. 2007)

E-Learning Quality Control Framework Codings

E-learning QCF (Li 2009: 62) with analysis codings	
QCF-1. Relevance	QCF-1a. Relevant courseware
	QCF-1b. Suitable e-learning provider
QCF-2. Content design	QCF-2a. Breadth and depth
	QCF-2b. Accuracy and currency
	QCF-2c. Organization
	QCF-2d. Standardization
	QCF-2e. Granularity
	QCF-2f. Inclusivity
QCF-3. Instructional design	QCF-3a. Course objectives
	QCF-3b. Structure and sequence
	QCF-3c. Pedagogies
	QCF-3d. Tutor assistance
	QCF-3e. Practice
	QCF-3f. Assessment
QCF-4. Usability design	QCF-4a. LCD instead of UCD
	QCF-4b. Learnability
	QCF-4c. Memorability
	QCF-4d. Interactivity
	QCF-4e. Technology (rich multi-media, virtual reality, etc.)
QCF-5. User interface	QCF-5a. Simplicity
	QCF-5b. Affordance
	QCF-5c. Consistency
	QCF-5d. Flexibility
	QCF-5e. Tolerance
	QCF-5f. Feedback and undo
QCF-6. Functionality	QCF-6a. Upload/download
	QCF-6b. Bookmark
	QCF-6c. Print course materials/notes
	QCF-6d. Tracking learner's progress
	QCF-6e. Search and learn
	QCF-6f. Publish and subscribe
QCF-7. Accessibility	QCF-7a. Increase the reach of people
	QCF-7b. Include people with disability
QCF-8. Services and support	QCF-8a. Consulting services
	QCF-8b. 24x7 system technical support
	QCF-8c. Commitment to ongoing system maintenance
QCF-9. Business impact	QCF-9a. Cost of the training course
	QCF-9b. On time delivery of the course

E-Learning Quality Control Framework Codings

Survey Questions

This survey is intended to research various user groups' perceptions on web-based training of product group X. The aim is to improve the design of future web-based training. The survey should not take more than 5 minutes. All fields are mandatory, unless indicated as optional.
Last name
First name
E-mail
Division
Country

Which of the following best describe your current job role? Select all that apply.
Job role: □ Service □ Technical support □ Sales □ Other
If you entered 'Other', please specify: (optional)

How many years of experience do you have in the following areas:

	None	<1 year	1-2 years	3-5 years	6-9 years	10 years or more
Service						
Technical support						
Sales						
Other						

In your own opinion, please indicate your current work experience with product Y:

	None	Low	Average	Good	Excellent
Service					
Technical support					
Sales					

Have you received training in product X? □ Yes □ No

As best you know, will you be involved with product Y in the following:

	Definitely not	Probably not	Probably	Definitely
Service				
Technical support				
Sales				

Do you have field experience of product X? □ Yes □ No
As best you can remember, in how many web-based training courses about product group Y have you participated? □ None □ 1 o 9 □ 10 to 19 □ 20 or more
Which of the below have been reasons for you to take web-based training about product group Y? Select all that apply: □ You had to familiarize yourself with a task □ The training was a certification requirement □ Self-improvement □ I have not participated in web-based training □ Other reason

If you entered 'Other reason', please specify: (optional)
Which of the following training methods do you prefer? □ Classroom training □ Web-based training □ A combination of both
Would you recommend web-based training to a colleague? □ Definitely not □ Probably not □ Probably □ Definitely
Have you ever participated in web-based training provided by an external company? □ Yes □ No
Technology Readiness questionnaire, see Appendix 5
Please write below if you have any comments about web-based training - either regarding product X or in general. (optional)

Technology Readiness Index Questions

The following are 10 statements about your beliefs about technology at your work.

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	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
You find new technologies to be mentally stimulating.					
If you provide information to a machine or over the Internet, you can never be sure it really gets to the right place.					
You like computer programs that allow you to tailor things to fit your own needs.					
You do not consider it safe to do any kind of financial business online.					
Other people come to you for advice on new technologies.					
You worry that information you send over the Internet will be seen by other people.					
You can usually figure out new high-tech products and services without help from others.					
When you get technical support from a provider of a high-tech product or service, you sometimes feel as if you are being taken advantage of by someone who knows more than you do.					
In general, you are among the first in your circle of friends to acquire new technology when it appears.					
It is embarrassing when you have trouble with a high-tech gadget while people are watching.					

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Examples of Survey Comments

Comment	Theme	Subtheme
Web based training can be somewhat generic, customisation on a particular subject can be rather challenging.	Content	Fit to needs
Web based training is very good, but some technical information is always missing at the crucial point of learning.	Content	Fit to needs
In [the case organization's] training, somehow it is mandatory to go through the entire training course. But of course, everybody has different interests. It would be good [if it were] possible to skip the parts which are not needed in [my] work.	Content	Fit to needs
I wish we had more web-based training for all the equipment we offer.	Content	Sufficient content
More exercises required to enhance learning	Content	Usefulness of content (More exercises)
Learning is not underpinned with examples and knowledge is not suitably tested.	Learner interface	Understandability - More examples
Some sections do not update after completing	Learner interface	Stability of the system
Time-independent training method	Learner interface	Convenience
I have noticed that suitable courses are a bit difficult to find from the system.	Learner interface	Ease of finding content
Web based training could be short information for some targeted subjects available just on time for user	Learner interface	Granularity of content
I would prefer [that content is] downloadable in pdf for our later reference.	Learner interface	User-friendliness (Reviewable material)
The interface of the web training modules is somewhat clumsy and should be more flexible.	Learner interface	Ease of use
Web based training is good to a certain extent, classroom training is for interaction and practical knowledge, and sharing the knowledge with others.	Learner community	Ease of sharing learning with others
Web based training is good to a certain extent, classroom training is for interaction and practical knowledge, and sharing the knowledge with others.	Learner community	Ease of sharing learning with others
[...] It would be good [if it were] possible to skip the parts which are not needed in [my] work.	Personalization	The system enables you to choose what you want to learn

Comment	Theme	Subtheme
For people to use e-learning they should be in the language of the user.	Personalization	Localized content
[For] any training to be effective [it] should be personalised, computer-aided training has this opportunity by built in psychological tests and adaptability based on the student reaction. Otherwise it is an electronic page turner.	Personalization	The system enables you to choose how you want to learn
Current web based training is good, but if the process could be made quicker I think it would be a big improvement	Process	Process improvement
Web based training is good when used along side hands on training	Process	Service infrastructure (Supportive function)

Internal Theme Interview Questions

Date: _____

Time: _____ - _____

Interview ID: _____

Checklist:

- ☐ Approval for recording
- ☐ The purpose is to interview e-learning users to gather comments and opinions about the system's usefulness, user-friendliness and other similar topics. The context of the interviews are the prerequisite e-learning that you took for this training.
- ☐ The interview is voluntary and will be handled anonymously. The interviewee can choose not to answer and can interrupt the interview.
- ☐ The respondent consents to all the above and has no questions.

Theme	ID	Question	Comment
Content	C2-02	Have you been able to find courses you need in the e-learning system?	
Content	C2-03	Have there been situations where you have not found the training you have needed?	
Content	C2-01	Do web courses provide a suitable level of informational depth?	
Content	ELS-C2	What is your opinion of the content fitting your needs?	
Content	C2-04	What aspects of web-based training have not fulfilled your exact needs?	
Content	C2-05	Have you found that crucial technical information has been missing from the content?	
Content	C2-05a	As best you can remember, what such missing information were you expecting but did not receive?	
Content	C2-06	Has there been mandatory content in web-based courses that you have not needed in your work?	
Content	C2-06a	What mandatory content has there been that you would not need in your work?	
Content	C2-07	Have you interrupted a course due to the content not being what you expect?	
Content	C2-08	Are the course descriptions sufficient to know a course is what you need?	
Content	ELS-C4	What do you think of the usefulness of the content?	

Theme	ID	Question	Comment
Content	C4-09	In your best estimate, what ratio of web-based training has been useful to your job?	
Content	C4-10	In your opinion, are the current web-based training courses more useful for learning theory instead of practical tasks?	
Content	C4-10b	Would web courses be enough for product updates and extensions?	
Content	C4-11	In your opinion, is web-based training sufficiently useful to you if the informational level is kept on the basics?	
Content	C4-12	Is it useful to repeat detailed technical information from manuals, technical catalogues or other reference material?	
Content	C4-14	Is it useful to have links to additional material, such as manuals, technical catalogues or other reference material?	
Content	C2-13	How critical is it for content to be up to date?	
Content	C2-13a	What is your opinion of the usefulness of knowing when the content has previously been updated?	
Content	C2-13b	What is your opinion of the usefulness of being informed that past training material has been updated?	
Learner interface	ELS-I2	What is your opinion of the user-friendliness of the e-learning system?	
Learner interface	I2-01	Do you consider the presentations user-friendly?	
Learner interface	I2-02	While taking a course, is it easy to browse the content backwards and forwards?	
Learner interface	I2-03	After taking a course, have you returned to a course later to review the material?	
Learner interface	I2-04	How important is it to get downloadable material?	
Learner interface	ELS-I3	What do you think of the understandability of the content?	
Learner interface	I3-05	Is web-based training content presented in a way that is easy to understand?	
Learner interface	I3-06	In your opinion, which of the following presentation methods could make the content easier to understand: webinars, simulators, demo videos, 3D visualizations?	
Learner interface	I3-07	Which of the following is sufficiently easy for you to understand: content presented with a human-read voice, content read with a machine voice, or content without any voice?	Removed

Theme	ID	Question	Comment
Learner interface	I3-07.1	What do you think about the machine voice?	
Learner interface	I3-07.2	Has the machine voice been sufficiently easy to understand?	
Learner interface	I3-07.3	What do you think of content that has not been narrated?	
Learner interface	I3-07.4	What do you think about content spoken with a real person?	
Learner interface	I3-07.5	Has the currently used machine voice prevented you from understanding content?	
Learner interface	I3-08	Has the machine voice prevented you from understanding the content?	
Learner interface	I3-09	In your opinion, how important is interactivity for making content easy to understand?	
Learner interface	I3-10	Have the test questions made the content easier to understand?	
Learner interface	I2-11	What is your opinion of the user-friendliness of the test questions?	
Learner interface	I2-12	Have you interrupted a course due to dissatisfaction in user-friendliness?	
Learner interface	I2-13	Have you interrupted a course due to uninteresting presentation style?	
Learner interface	ELS-I3	Has something been too detailed or complicated to be covered through web-based training?	
Learner interface	ELS-I3a	What do you think about going through a step-by-step commissioning procedure in web-based training?	
Learner interface	ELS-I3b	What is your opinion of presenting technical specifications from product catalogs in web-based training?	
Learner interface	ELS-I3c	What do you think of going through an installation procedure in web-based training?	
Learner interface	QCF-I7	What is your opinion of the structure of the courses?	
Learner interface	I7-14	Has the content in the courses been structured appropriately for you?	removed
Learner interface	I7-15	In your opinion, what is a suitable duration for a web-based training session?	
Learner interface	I7-15.1	Length of a single presentation?	
Learner interface	I7-15.2	Total course length?	

Theme	ID	Question	Comment
Learner interface	I6	What do you think of the e-learning system's ability to let you choose when and where you take web-based training?	
Learner interface	I6-16	Does the e-learning system offer enough freedom of time and place?	Removed
Learner interface	I6-17	Is the system convenient to use in an open office environment?	
Learner interface	I6-18	How probably would you use the e-learning system via a mobile device?	
Learner interface	ELS-I4	What do you think of the stability of the e-learning system?	
Learner interface	I4-19	In your opinion, have you been able to rely on the e-learning system being stable while taking web-based training?	
Learner interface	I4-20	Have you experienced loss of data or loss of access?	
Learner interface	I4-21	Have you received enough technical support?	
Process	PR1-01	In your opinion, have the web-based courses been designed for your needs?	
Process	PR1-06	In your opinion, would the quality significantly increase if requirements gathering was improved?	
Process	PR3-02	What is your opinion of the support that web-based training provides hands-on training?	
Process	ELS-PR3a	What is your opinion of prerequisite training before hands-on training?	
Process	ELS-PR3b	How long would you need to take prerequisite training?	
Process	ELS-PR3c	What do you think about using web-based training after hands-on training to reinforce learning?	
Process	ELS-PR3d	Have you thought that some topics would be best covered in hands-on training instead of web-based training?	
Process	ELS-PR3e	Regarding openness of information or access limitations, have you found any issues in current web-based training?	
Process	PR5-03	Have you given evaluation at the end of web courses?	
Process	PR5	What do you think of the capability of providing feedback via the e-learning system?	
Process	PR5-04	Have you been able to give the feedback you have wanted (or why have you not given feedback)?	

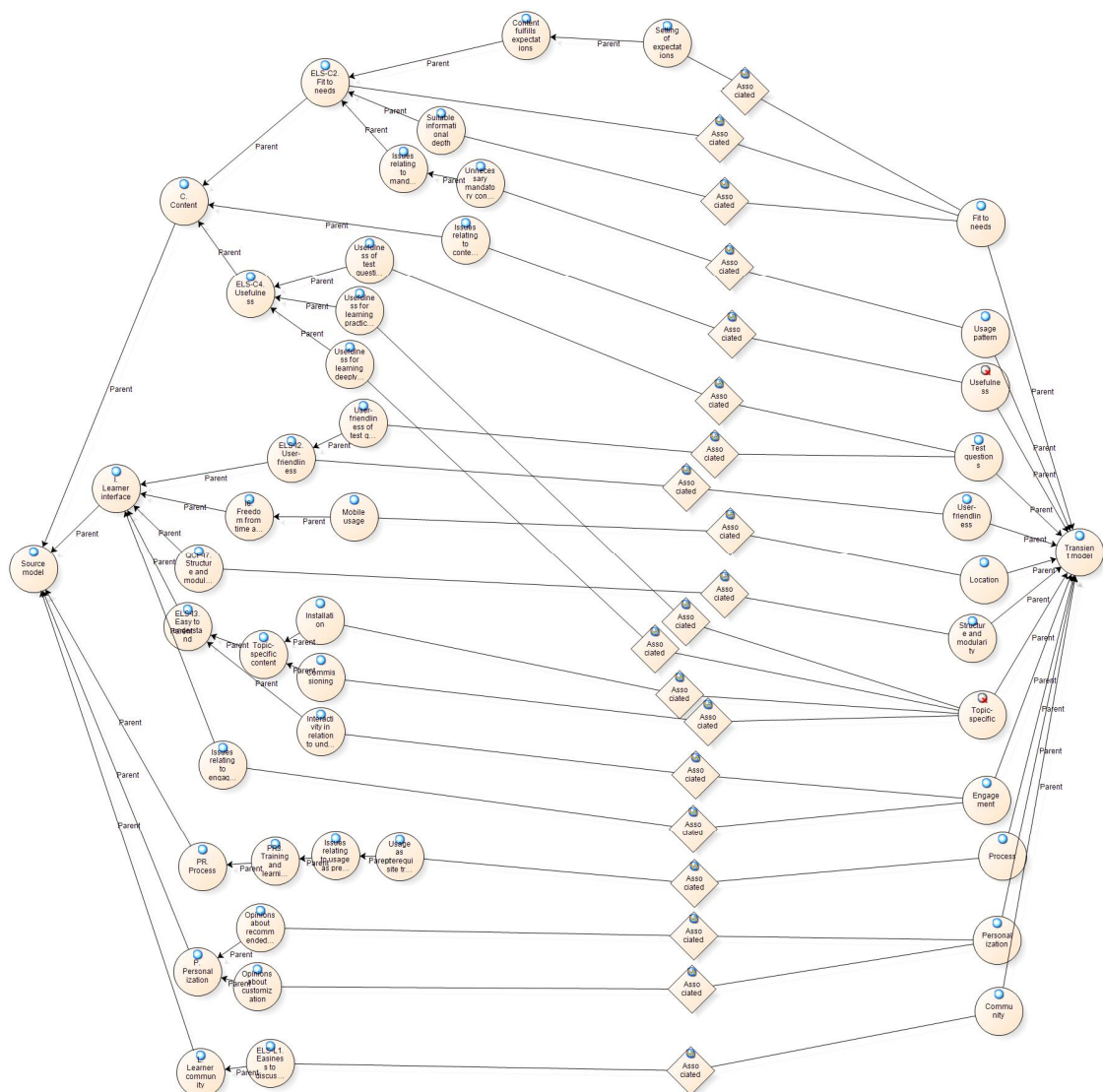| Theme	ID	Question	Comment
Process	PR5-05	Have technical reasons prevented you from giving feedback?	
Learner community	L1-01	What is your opinion of being able to discuss course topics with other learners?	
Learner community	L1-02	What is your opinion of being able to belong to a community of practice that can share advice or get answers to questions?	
Personalization	P1-01	What do you think about being able to take courses in a suitable language?	
Personalization	P1-02	What is you opinion of being able to customize content to your personal needs?	
Personalization	P1-02a	What do you think of optional content?	removed
Personalization	P1-02b	What is your opinion of being able to choose viewing practical content before theoretical content?	
Personalization	P1-03	What do you think about getting suggestions of other training based on what you or others have taken?	
		Do you have anything you would care to add?	

Summary of Coded Statements in Internal Theme Interviews

	A : State-ments of dissatisfac-tion	B : State-ments of impor-tance	C : State-ments of satisfac-tion	D : State-ments of unuseful-ness	E : State-ments of useful-ness
Content					
Fit to needs	0	0	1	1	2
Content fulfills expectations	2	0	1	0	0
Setting of expectations	2	1	1	0	1
Crucial information missing	2	0	0	1	0
Issues relating to compulsoriness of courses	1	0	0	1	0
Inability to select relevant content	1	1	0	0	0
Needed courses easy to find	2	0	0	0	0
Suitable informational depth	1	0	0	0	0
Usefulness	0	2	0	0	4
Clearly set objectives	0	0	0	0	0
Content too technical	1	1	0	2	0
Importance of content being up to date	0	3	0	0	1
Issues relating to memory	0	0	1	0	0
Content difficult to remember later	0	0	0	1	0
Issues relating to rote learning	0	0	0	0	0
Anecdote about a useful course	0	0	1	0	2
Usefulness for learning in-depth technical topics	0	1	0	1	1
Usefulness for learning informational topics	0	0	0	0	1
Usefulness for learning practical tasks	0	0	0	1	0
Usefulness of informational level	0	0	0	0	0
Usefulness of technical information	0	0	0	1	1
Usefulness of test questions	0	1	2	0	1
Issues relating to inutility of test questions	0	0	0	0	0
Issues relating to content quality	2	0	0	0	0
Excessive amount of information	0	0	0	0	0
Pedagogical aspects	0	0	0	0	0
Referring to topics in a clear and consistent manner	0	0	0	0	0
New usage ideas	0	0	0	0	0
Personal learning goals	0	0	0	0	0
Content usage patterns	0	0	0	0	0
Learning outside own job role scope	0	0	0	0	1
Treatment of uninteresting topics	2	0	0	0	0
Usage in context	0	0	0	0	0
Learner interface					
User-friendliness	2	0	0	0	0
Dissatisfaction in user-friendliness	1	0	0	0	0
Downloadable material	0	3	0	0	0
User-friendliness of presentations	2	0	0	0	0
User-friendliness of test questions	0	0	2	0	0
Easy to understand	0	0	0	0	0
Interactivity in relation to understandability	0	1	0	0	0
Issues of defining topics for each target group	0	0	0	0	0
Issues relating to voice	3	0	1	0	0
Preferred presentation methods	2	1	2	0	1
Issues relating to specific topic areas	0	0	0	0	0
Applications	0	2	0	0	2
Commissioning	0	2	0	0	1
Installation	0	3	0	0	3
Technical specifications	0	1	0	2	0

	A : Statements of dissatisfaction	B : Statements of importance	C : Statements of satisfaction	D : Statements of unusefulness	E : Statements of usefulness
Technology	0	2	0	0	2
Stability	1	0	0	0	0
Availability of technical support	0	0	0	0	0
Freedom of time and place	0	0	2	0	0
Mobile usage	0	2	0	0	2
Suitability for open office	2	0	0	0	0
Well structured content	0	0	0	0	0
Suitable duration	0	0	0	0	0
Interface usage patterns	0	0	0	0	0
Issues relating to engagement	1	0	0	0	0
Usage of storytelling methods	0	0	0	0	0
Monotonous presentation	1	1	0	0	0
New ideas relating to interface	1	1	0	0	0
Learner community					
Easiness to discuss and share	0	0	0	1	0
Opinions about communities of practice	0	0	0	8	5
Personalization					
Availability of suitable languages	0	2	0	0	1
Enabling users to learn the content they need	0	0	0	0	0
Opinions about customization	0	0	0	0	3
Opinions about recommended trainings	0	3	0	0	3
Process					
Courses are designed for users' needs	1	1	1	0	2
User requirements gathering	0	3	0	0	1
Training and learning service infrastructure	0	3	0	0	1
Access and openness	0	0	0	0	0
Issues relating to usage as prerequisite training	0	0	0	0	0
Insufficient time to complete prerequisite training	0	0	0	0	0
Usage as prerequisite training	1	3	1	1	4
Appropriate division between web and hands-on training	0	0	0	0	0
Usage as post-training	0	0	0	0	0
Easiness to give feedback	0	0	0	0	0
Opinions about giving feedback	1	0	0	0	3
Total	**35**	**44**	**16**	**21**	**49**

Development from the Interim Model to the Revised Model

The development of the interim model into the revised model

User Theme Interview Questions

Date: _____

Time: _____ - _____

Interview ID: _____

Checklist:

☐ Approval for recording
☐ The purpose is to interview e-learning users to gather comments and opinions about the system's usefulness, user-friendliness and other similar topics. The context of the interviews are the prerequisite e-learning that you took for this training.
☐ The interview is voluntary and will be handled anonymously. The interviewee can choose not to answer and can interrupt the interview.
☐ The respondent consents to all the above and has no questions.

#	Theme	Question
1	Fit to needs	How does this product relate to your job?
2	Fit to needs	In which ways did the e-learning address your particular needs and why?
4	Fit to needs	What did you think about the informational level of the e-learning?
6	Fit to needs	Was there something in the e-learning that was not interesting to you, and if so, what was the reason?
8	Fit to needs	What things in the e-learning do you think were useful for you from a practical point of view?
9	User experience	What opinions do you have about the e-learning experience as a whole?
10	Understandability	What did you think about the structure and length of the e-learning?
12	Interactivity	What did you think about the usefulness of the test questions?
16	Interactivity	What was your opinion of the interactivity of the e-learning?
18	Understandability	What would you think of e-learning that was based on real case examples?
25	Fit to needs	What was the most relevant topic in the e-learning for you and what did you think of that content?
26	Fit to needs	What general comments would you give about the content of the e-learning you took for this training?
27	Customer experience	What did you think about how you were informed about the prerequisite e-learning courses?

#	Theme	Question
28	Customer experience	How well did the e-learning give you enough background information for this classroom training?
29	Customer experience	Would the classroom training need an introductory presentation, and if so, what should it include?
31	Personalization	What would you think about the possibility that the system would automatically recommend courses for you, based on what you have previously taken?
32	Mobility	What would you think about the possibility of taking e-learning with a tablet device?

Removed User Theme Interview Questions

#	Theme	Question
3	Fit to needs	In which ways was did the e-learning not fit your needs and why?
5	Fit to needs	Was there something that was too technical or trivial, and if so, what was it?
7	Usage patterns	What did you do in that situation?
11	Structure and modularity	What did you think about the length of the e-learning?
13	Test questions	What did you think about the user-friendliness of the test questions?
14	Test questions	Did the test questions help clarify any topics?
15	Test questions	Were there trivial test questions?
17	Engagement	Did the videos and simulators make the e-learning more practical?
19	Topic-specific	What was your opinion of how the e-learning presented what the hardware features of the product were?
20	Topic-specific	What was your opinion of the e-learning overview of the installation procedure?
21	Topic-specific	Was the level of information sufficient from a practical point of view in the installation presentation?
22	Topic-specific	What was your opinion of the e-learning that illustrated the commissioning procedure?
23	Topic-specific	How do you think the control panel videos illustrated the commissioning in practice?
24	Topic-specific	What did you think about the e-learning describing the maintenance procedures?
30	Personalization	Would you have needed to skip some parts in the e-learning, and if so, which ones?
33	Community	What would you have thought about the possibility to discuss the e-learning topics with your fellow classmates before the hands-on training via a discussion forum in the training system?

Best Practices and Development Suggestions for E-Learning

Fit to needs and understandability
Users should be able to focus on content which is directly relevant to their work activities, i.e. by making e-learning modular to enable users to select appropriate content.
Best practices regarding interactivity
Simulated exercises should be used to enable practicing actual work tasks, e.g. as preparation for repair and maintenance work
Case examples may be used to add an illustrative element. However, varying practices in different geographical areas should be taken into account.
A storytelling method may be used to add engagement, but on the condition that it provides additional value and is grounded in real life situations.
Videos and photographs should be used to demonstrate physical activities, e.g. repair procedures. However, video sequences should not be excessively long because they lack interactivity.
It is recommended to narrate with human voice when possible, although synthetic computer voice quality is acceptable due to its improved quality.
Narrations should be done with homogeneous quality and with the same voice throughout a single e-learning course.
E-learning should be designed to be brief, to enable completing courses in a short uninterrupted period due to workplace time constraints.
The existing level of knowledge and experience of users should be taken into account when designing e-learning, e.g. new employees versus experienced employees.
If possible, courses should be provided in the learners' own language.
If e-learning is used as a prerequisite for face-to-face training, the prerequisite condition should be emphasized in communications with the learner.
E-learning gives an opportunity to learn topics outside the scope of one's work activities. Therefore, unnecessary obstacles to participating in e-learning courses should be removed.
Best practices regarding self test questions
Retaking a test for refresh or self-check purposes should be made easy and user-friendly.
Test questions should be designed in e-learning to provide opportunity for reflection and increase interactivity.
If answering a question requires mastering additional reading material or memorization, guidance where to find the answer should be provided in order to support information retrieval.
If answering a question requires reference material, it must be ensured that all users have access to the material.
Test questions that are unrelated to the learner's work activities, too trivial, too detailed or deceptive should be avoided.
Test questions should be designed to encourage "combining pieces of information together."
When possible, design test questions related to practical work activities.

Development suggestions
Automatic recommendations of training based on what the learner and other learners have taken. The benefits include reduced time spent on searching for new information, support for finding training about related products, and opportunities for professional self-development. A requirement for successful implementation is that in order to be beneficial, the recommendations must have high relevance for a user. A challenge is that if the user's training needs are varying and unspecified, a wide range of training is possible to be recommended.
Mobile learning via tablet device or smartphone. The benefits include making learning accessible while travelling or commuting, or while not having an online connection. Challenges vary from technological to physical to psychological, e.g. user base of tablets and smartphones, small screen size, personal usage habits, and users' perception of mobile technology as a learning tool. Some requirements for successful implementation include easy usage and navigation, and usability and availability of necessary documentation.