The Future of E-Learning in Higher Education

Using the scenario planning method to develop four scenarios on the futures of technology-enhanced higher education

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"*The single biggest reason companies fail is they overinvest in what is, as opposed to what might be*".

– Gary Hamel

"*The best way to predict the future is to create it*".

– Abraham Lincoln

"*Science and technology have progressed to the point where what we build is only constrained by the limits of our own imaginations*".

– Justin Rattner, Intel's Chief Technology Officer

Overview of Contents

List of Abbreviations

AR	augmented reality
CMS	content management system
DE	distance education
HE	higher education
HEI	higher education institute
HR	human resources (also, people operations)
LMS	learning management system
MOOC	massive open online course
OCW	OpenCourseWare
OLI	Open Learning Initiative
VR	virtual reality

1. Introduction

Technology has increasingly permeated society. Over the past decennia, at all levels of education the role of technology has increased drastically. Various innovations have seeped through, influencing how we learn. This includes: 1) *devices*, such as smart phones, tablets, and laptops; 2) *communication technologies*, such as (wireless) internet connectivity; 3) *software*, such as WhatsApp, Facebook, Blackboard, Canvas, and various e-learning packages from for instance Google and Adobe; 4) *information sources*, such as Wikipedia, Google, YouTube; and 5) *online education*, such as Khan Academy, Coursera, Udacity, Udemy, and EdX. All these innovations have found a place within modern higher education. Some of these are general-purpose technologies, while others are specifically designed for education. Educational institutions increasingly integrate various technologies into everyday practice.

Social Relevance. Technological innovation is the engine of societal progress and growth of prosperity. Social change has a limited capacity to sustain economic growth. The innumerous education enhancing technologies seem thus greatly promising for the future of higher education and universities. However, technological innovation also introduced non-traditional providers into the education market. In the past two decennia, this includes numerous cheap or free educational apps, as well as various online providers of higher education courses and programs. Some of this online higher education is for a fee and some is free. Some of these award recognized higher education (HE) certificates or degrees. Until now, technology has not had a major impact on higher education practices. This is in part due to the highly conservative culture within universities. According to Harvard professor Clayton Christensen (ND), higher education has until now been safe from – what he coined is – disruptive innovation. Yet he sees recent technological changes as making the higher education market ripe for disruptive competition (Sutherland Institute, 2012b). Disruptive innovation "*describes a process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves up market, eventually displacing established competitors*". Examples of disruptive innovations provided by Christensen are personal computers to mainframe and mini computers, and cellular phones to fixed line telephony. Once new disruptive competitors emerge, it is exceedingly difficult for established providers to compete effectively, eventually being displacing by them. Therefore, it is crucial for universities to strategically plan and prepare for the future of technology-enhanced education.

Academic Relevance. A great many studies examine the effects of e-learning on educational outcomes. The relevance of these studies is often justified by stating highly optimistic expectations for the impact of technology on higher education. However, rarely is explained what these high expectations are based on, or through which mechanisms they take place. The commonly held assumption behind this seems to be that great technological innovations determine great social changes. This reductionist thinking is referred to as technological determinism. The few studies that do examine the future of technology-enhanced education focus only on either future technology, future instructional methods, or future policies. However, higher education is a complex adaptive system in which the aggregate understanding of individual parts does not result in an understanding of the whole. This means that a correct prediction of the technologies of the future does not lead to a correct prediction of the role of technology within higher education of the future. What is required is to take an integral approach that considers simultaneously all major domains of the higher education system.

Research Aim. This study's research aim is to develop scenarios describing potential futures of the role of technology in higher education. This examination of potential futures using an integral approach provides universities with a tool to strategically plan and prepare the future. To this aim, this study uses the scenario planning method to generate four scenarios. This method does not attempt to predict as accurately as possible what the future will be like. Instead, its purpose is to identify highly uncertain assumptions about the future that would affect the organization crucially if they happened. The method then uses these assumptions as a dimension on which two extreme and opposing positions are taken. Two of these dimensions combined result in four scenarios. The future is uncertain, which often makes predicting it impossible. Planning for multiple polarized potential futures is more feasible.

Research Questions. Our central question is: "*what does the future of e-learning in higher education look like*"? This study attempts to answer this question by providing four scenarios of potential futures. To answer this question, it is helpful to answer the following four sub-questions. Firstly, *what is e-learning*? Within the literature there are vastly differing definitions of e-learning, while it is commonly assumed everyone has the same understanding of the term. Chapter 2 explores the characteristics and definitions of e-learning, and provides the definition used in this study. It will also provide a list of e-learning characteristics that can be used to improve communication about and the development of e-learning. Secondly, *what is currently known about the effects of e-learning in higher education*? Chapter 3 provides an overview of the most important effects of e-learning found in the literature. These effects can be distinguished into six categories: pedagogical outcomes,

institutional outcomes, user outcomes, moderating effects, development and HR effects, and lastly, effects on policy of innovation leaders. Thirdly, *what e-learning implementations exist currently*? The analysis of implementations from within and outside of one's industry is an important step in the *blue ocean strategy* approach (Kim & Mauborgne, 2005, 2017). Implementations from within higher education demonstrate what the direct competitors are currently offering. Implementations from outside of higher education allow early detection of potential disruptive innovation, and provide inspiration for blue ocean shifts of strategy. Chapter 4 presents an elaborate overview of implementations from within and outside of higher education based on the literature, available information on products and services, and extensive personal experiences. Fourthly, *what are the main elements, domains and assumptions of e-learning affecting potential futures of e-learning within higher education*? Chapter 5 synthesizes the findings of the previous three chapters to find the main elements of relevance for e-learning. Through the methods presented in chapter 5 this results in 6 main domains of e-learning, and two dimensions that form the basis of the four scenarios.

Methodology Overview. The process of this entire thesis can be summarized through a brief overview of the methodology. The methodology is roughly divided into six steps that are graphically represented by six panels in Figure 1 below (For a larger image, see Appendix B, Figure 1). Chapters 2 through 4 present the most important findings on e-learning from the literature, describing the definition and characteristics, the numerous effects, and e-learning implementations respectively (see L1 in Figure 1).

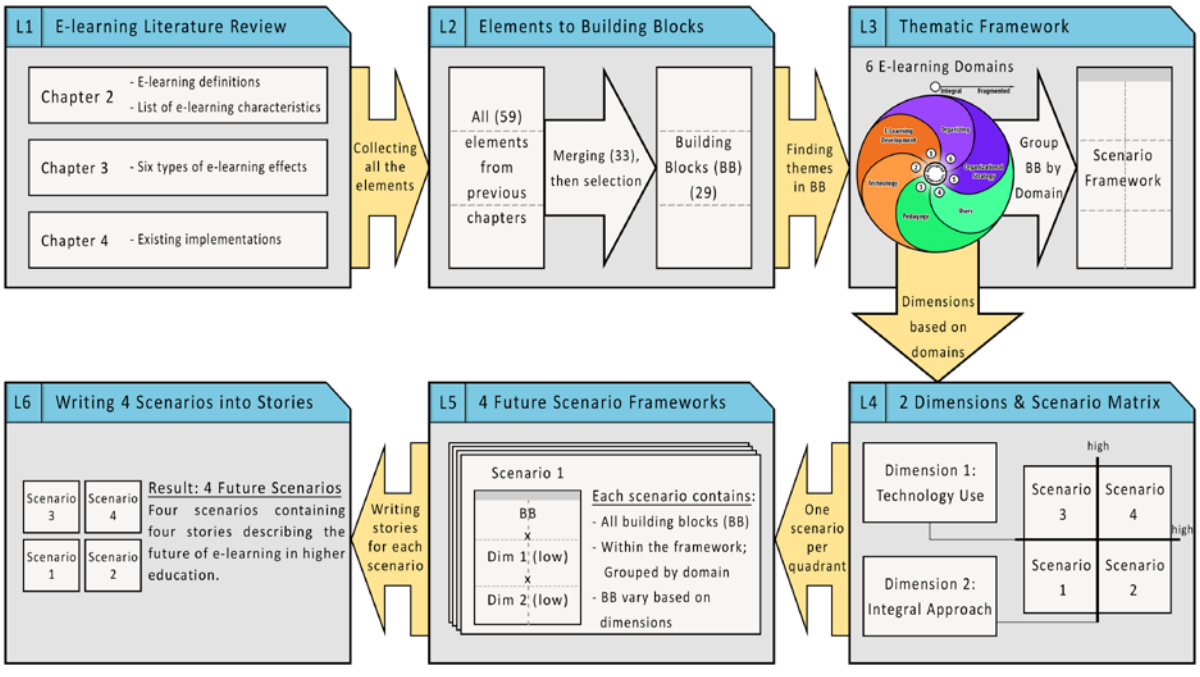

Figure 1 – Six Level Model summarizing this thesis' development of the scenarios.

Chapter 5 starts with collecting all the elements from these three previous chapters. This resulted in a collection of 59 elements, which were then merged into 33 clusters. Finally, based on defined inclusion and exclusion criteria, a selection of these clusters resulted in 29 'building blocks'. These aspects form the basis of the stories of the scenarios. An example of a building block is 'educational effects', which refers to e-learnings effects on the time required to study, exam scores, drop-out rate, attitude towards instruction, the education experience, and experienced engagement (see panel L2 in Figure 1).

Thirdly, the building blocks revealed six domains of e-learning that were highly relevant within the literature. These six domains form the basis of both the scenario framework and the dimensions of the scenario matrix. The scenario framework contains all the building blocks grouped together per domain. This provides the overall structure of each of the scenarios (see L3 in Figure 1). Fourthly, based on pre-defined criteria and the six domains, two dimensions are created. Combining these two dimensions leads to the *Scenario Matrix* that has four quadrants representing the four scenarios (see L4 in Figure 1).

Fifthly, the *Scenario Framework* – containing the building blocks grouped per domain – is placed in each of the four quadrants of the Scenario Matrix. The building blocks vary based on the two dimensions, resulting in four different scenarios (see L5 in Figure 1). In the last step these four scenarios are written into story form to describe the future of e-learning in higher education (see L6 in Figure 1).

2. E-learning Definitions and Characteristics

Throughout the e-learning literature numerous implicit and explicit definitions of e-learning have been used. This chapter provides a thorough examination of the concept as used in the scientific literature, and how e-learning relates to terms with which it is often used interchangeably. Lastly, this chapter presents a summary of all the characteristics of e-learning found in the scientific literature, either via explicit use in definitions or implicitly in the implementations used. This chapter results in two main products on which the rest of this thesis is built: definitions of e-learning, and a list of e-learning characteristics. As will be addressed in future chapters, within the e-learning literature there are numerous misconceptions based on fallacious reasoning, such as equivocation and illicit fallacy. The definitions and the list of e-learning characteristics help define the conceptual space of e-learning (Zenker & Gärdenfors, 2015), which can help prevent such fallacious reasoning.

2.1 Definitions of E-learning

Understanding what the term "e-learning" means is essential to meaningful research, effective implementation and unambiguous communication. It is a commonly held myth that people know what e-learning is, and that everyone has the same conception of the term.

According to Dublin (2003, p. 2) the "phrase was first popularized in 2000 [to refer to] computer-based training delivered over Intranets and the Internet". It replaced the term "Web-based training". The central idea is that its delivery is online; an aspect often found in e-learning definitions, and frequently the most defining characteristic. This is exemplified by Anderson's (2003, p. xi) definition of e-learning as "learning facilitated on-line through network technologies".

However, the 'online' element is not always present in definitions. For example, the in 2001 published report by ASTD used a broader definition of e-learning: "instructional content or learning experiences delivered or enabled by electronic technology … that is designed to increase workers' knowledge and skills so they can be more productive, find and keep high-quality jobs, advance in their careers, and have a positive impact on the success of their employees, their families and their communities" (Dublin, 2003, p. 3). It significantly differs in three ways. Firstly, it lacks any 'online' element. Secondly, it includes the much broader 'electronic technology'. Thirdly, it adds a purpose in the form of increased productivity, requiring a degree of effectiveness in order to qualify as e-learning.

More importantly, for many people e-learning is synonymous with distance education. This misconceived idea leads to the assumption that e-learning rules out face-to-face meetings among students and between students and teachers. Although a common assumption, rarely if ever is this part of e-learning definitions. While e-learning may be used online or from a distance, this is no

mandatory condition. E-learning could be exclusively offline. Similarly, it could stand alone, or be combined with traditional instructional methods.

In short, people assume everyone knows what is meant by e-learning. But as Dublin states "the truth is that the term e-Learning means different things to different people". Dublin (2003, p. 2) continues by giving a definition that according to him most would generally agree with: "The use of technologies to create, distribute and deliver valuable data, information, learning and knowledge to improve on-the-job and organizational performance, and individual development". However, this is so broad that it even includes books and paintings as part of e-learning. It is very common to find definitions that are far too narrow or too broad. It is clear that these authors of these definitions almost always have a very different concept in mind from what they explicitly defined. It is unclear however what they actually mean precisely.

All these differences in e-learning definitions gives rise to some problems. The main benefit of having a commonly used and understood term is that it allows to effectively and efficiently communicate ideas. It eliminates the need to every time use long descriptions. It is clear then why having such wildly differing definitions is problematic. Since e-learning does not have a clear and common denotation the benefit of using the term is largely lost. Even more, the use of the term 'e-learning' likely causes more problems than it solves. In discussions about e-learning it is very common that the initial response is less than positive. Usually the argument against it is that face-to-face and classroom contact between people is too important to lose. Even though e-learning does not say anything about excluding these types of contact. Just as the invention and mass production of books did not entail the end of lectures or face-to-face communication. It is important to be constantly aware that e-learning means different things to different people.

2.2 Related Terms

There are numerous terms describing some form of learning with technology. Many of these terms are synonymous or overlap in meaning. As with e-learning, many terms are defined in greatly differing ways (Oblinger & Hawkins, 2005). Below several of these terms are presented. This helps identify the characteristics of e-learning. These terms are sorted into six groups, based on how they relate to e-learning.

I. Antonymous terms. Numerous terms exist to contrast e-learning with, such as *Classroom Training*, *classroom-based training*, *classroom instruction*, and *instructor-led training*. These are used for control conditions in the literature referring generally to a physical classroom where teachers and students meet face-to-face.

II. Subset terms of e-learning. A plethora of terms are synonymous with e-learning, yet are defined more narrowly. Internet-based Training, Web-based Learning or Online Learning describe training taking place over the Internet. Many consider e-learning identical in meaning to these terms. Virtual Education means education in virtual classrooms via the internet. Distance Learning and Distributed Learning describe education in which there is distance between learners and instructors. These classes may either be Asynchronous or Synchronous, referring to whether students and teachers interact simultaneously or at different moments in time. Computer-based training is defined as using computers to learn. In practice it is used mostly to refer to the old drill-and-practice types of learning. Lastly, mLearning refers to the use of mobile devices for learning (O'Malley et al., 2003).

III. Hybrid forms of e-learning. Blended Learning and Hybrid Learning refer to the use of e-learning combined with traditional teaching methods. The following definition demonstrates the vision behind it: "Blended learning […] integrate[s] the innovative and technological advances offered by online learning with the interaction and participation offered in the best of traditional learning" (Thorne, 2003: p. 16). This is nothing new per se. Almost every definition of e-learning allows for a combination with traditional teaching methods. It seems a response to the excessive focus on the "e" in e-learning in the academic literature, as well as the automatic assumption of many people to think of e-learning as necessarily an online and distance type of learning. Too little focus is usually on what e-learning is all about: learning (Boezerooy & Gorissen, 2004).

IV. Beyond the scope of e-learning. Electronic *Learning* and *Technology-based Learning* refers to the use of any (electronic) technology used for learning, such as television, radio, and any other electrical devices. While often the "e" in e-learning is considered by many to mean "electronic", Dublin (2003) points out its meaning has been much debated.

V. Other terms. *Networked learning* is a method of supporting learning of people through a process of developing and maintaining connections with other people, organizations, and information. New information technologies play an important role in this, especially those that fall under the label of "web 2.0". Tools used for this are, for example, e-mail lists, blogs, wikis, RSS web feeds, Podcasting, tagging, and many others. OpenCourseWare (OCW) is defined as: "a free and open digital publication of high quality university-level teaching materials – including syllabi, lecture notes, assignments, and exams – organized as courses. OpenCourseWare (OCW) initiatives typically do not provide a degree, credit or certification, or access to instructors. The materials are made available under open licenses, for use and adaptation by educators and learners around the world" (MIT, 2009; OCW Consortium, 2009).

2.3 Defining Characteristics

2.3.1 Lists of Characteristics of E-Learning

This chapter presents the list of characteristics of e-learning, which is based on an extensive literature search of several hundred scientific articles and books on e-learning, as well as various Internet resources. All characteristics were sorted and grouped into a list. This list helps to create a definition of e-learning. It is essential for anyone involved in the development, adaptation or implementation of e-learning to have a good understanding of what e-learning is (Oblinger & Hawkins, 2005). Rather than merely presenting our own definition, this list allows individuals and teams to think and discuss about e-learning in a structured manner. Oblinger and Hawkins (2005) stress the necessity for any organization involved in e-learning to discuss how to define e-learning. All too often, the meaning of e-learning is mistakenly considered to be commonly understood (Dublin, 2003). Prior to any attempt at meaningful communication about e-learning it is important to ensure that everyone involved understands what one means. This list can furthermore help in the creation process of e-learning, by structuring discussions and serving as a source of ideas. This list can furthermore help in decision-making, as the characteristics of e-learning will influence many important outcomes (Abrami, d'Apollonia, & Lou, 2001).

2.3.2 The Defining Characteristics of E-Learning

Now we will turn to the list of defining characteristics of e-learning (Table 1 – Categories of Defining Characteristics of E-Learning). Which is sorted into eight groups: a) carrier/platform; b) degree of dependency on technology; c) distance and communication; d) social context; e) type of e-learning; f) flexibility, interaction, progress tracking and feedback; g) control; and h) design, presentation and media. There is one additional defining element for e-learning, namely that e-learning is about learning. This is so basic and self-evident, yet ironically, in most in e-learning implementation there is a lack of focus on the aspect of learning.

1. Carrier / Platform. This refers to the delivery method of the learning experience. This includes *simple electronic devices* (e.g. television, radio, the telephone, film), *computer devices* (e.g. PCs, laptops, tablets, smart phones, PDAs), *offline* or *online* (e.g. any type of network), *print* (e.g. books, articles), *live* or *in-person* (all forms in which people teach other people). This last element does not define e-learning by itself. However, when technology-enhanced learning is used in tandem with in-class discussions to complement each other, this component is part of the same e-learning experience.

2. Degree of Dependency on Technology. This describes the degree in which learning takes place via technological or traditional methods (Siragusa, Dixon, & Dixon, 2007). Pure applications either exclusively use technological or face-to-face methods of learning. While nowadays purely face-to-face is near non-existent, purely technology-enhanced learning is increasingly common. Most common are all sorts of combinations of technology and traditional forms.

3. Distance & Communication. All elements in this group relate to the distance between students and the instructor. *Independence from place* and *time* refer to learning that is not limited to a fixed location or time respectively. *Synchronous* educational methods depend on all participants to be simultaneously present to communicate. In contrast, *asynchronous* methods allow communication unrestricted to a fixed time. However, what matters more for pedagogical effectiveness of e-learning is the *availability of instructors*, the *availability of students*, and the *degree of meaningful contact (J. A. Kulik, Bangert, & Williams, 1983; Siragusa et al., 2007)*. Combined these describe the ease with which students communicate meaningfully with their instructors and peers.

4. Social Context. Some pedagogical approaches favour group-based learning (Abrami et al., 2001; Bernard et al., 2004; Dalsgaard, 2005). I*ndividual-group learning* refers to the degree to which students work individually or in a group. G*roup learning strategies* addresses whether strategies have been put in place that facilitate group learning (Siragusa et al., 2007). The *role of technology* points to the role of technology in group learning.

5. Type of E-Learning. C. C. Kulik and Kulik (1991) distinguish three different types of e-learning: Computer-Assisted Instruction, Computer-Mediated Instruction, and Computer-Enriched Instruction. In *Computer-Assisted Instruction* the computer instructs students. *Computer-Mediated Instruction* evaluates students, keeps track of the student's progress, and guides to appropriate instructional resources. *Computer-Enriched Instruction* refers to computers used as a tool to explore and discover. Means (1994) divides e-learning into four roles: (a) tutor; (b) exploratory environment; (c) tool; and (d) communication media. The tutor function instructs students. The *exploratory environment* provides opportunities to test ideas. *Tools* aid learning indirectly. *Communication media* facilitate communication among participants.

Reeves (1998) divided e-learning into two groups: (a) learning "from" technology; and (b) learning "with" technology. *Learning "from" technology* functions as a tutor or instructor. *Learning "with" technology* refers to technology used as a cognitive tool or exploratory environment. *Converted instructor-led courses* are recorded traditional classroom lectures made available online. Dublin (2003) seems to refer to "converted" courses in a derogatory manner. As many institutions regard e-learning as mere digitalised versions of what they are already doing. *Distributed learning* is synonymous with *distance education*. *Blended learning* stands for a mix of e-learning with learning in a traditional classroom setting.

6. Flexibility, Interaction, Progress Tracking and Feedback. This category of characteristics include the degree to which users can customize the learning experience (Oblinger & Hawkins, 2005). This includes personalised tutoring, flexible sequencing, adjusting to learning styles, tailoring to special learning needs, and the dynamic adjustment of instruction (Abrami et al., 2001; Aroyo & Dicheva, 2004; J. A. Kulik et al., 1983; Phipps, 2004; Siragusa et al., 2007). *Interchangeability* describes the exchangeability, reusability, shareability, and interoperability of e-learning (Aroyo & Dicheva, 2004). *Interactivity* can be implemented in very diverse ways (Bernard et al., 2004), such as via tests, exercises and quizzes. More advanced applications include games and simulations (Oblinger & Hawkins, 2005). *Progress tracking* allows the easy, inexpensive and automatic recording of students' progress (J. A. Kulik et al., 1983). This can be used in turn to provide *feedback*, which can affect learning outcomes significantly (Abrami et al., 2001). The outcomes depend on the type and method of feedback, including whether feedback is tailored to the user, instant and accurate, static or adaptive, and whether it reports only the correctness or also an explanation or underlying cause of the mistake (Abrami et al., 2001; Crook, 1991).

7. Control. Several aspects of control are important, such as whether the learner, medium, or instructor is in control (Siragusa et al., 2007). Control can be over when and how the lectures and breaks are taken (Abrami et al., 2001). *Type of control* describes whether the student can control the playback, the selection of content, and at what pace, time and place learning takes place (J. A. Kulik et al., 1983; Siragusa et al., 2007).

8. Design, Presentation and Media. E-learning can contain various *content*, such as lectures, games, notes, articles, documentaries, exams, quizzes, and exercises. Many implementations in the literature are merely *digitalised* copies of existing traditional educational materials, rather than *optimised* for the specific medium (D. A. Cook, 2005). Similarly, the implementations are rarely *pedagogically optimised* to maximise for learning effectiveness (Siragusa et al., 2007). Too often the learning is in the background of the technology (Bernard et al., 2004; D. A. Cook, 2005). While e-learning has “characteristics that are unique to the technology, which allows the exploration of new and richer pedagogical models” (Phipps, 2004, p. xii). *Room for creativity* describes whether the application allows for its use in new and unplanned ways (Abrami et al., 2001).

The ability to use *multimedia* is one of the advantages of learning with technology. Mayer researched extensively how multimedia can be used most effectively (Mayer, 2001). He does not advocate the use of multimedia because it is a current trend, as is often the case (Oblinger & Hawkins, 2005). Mayer's goal is to make learning more effective (Mayer, 2005).

0 Education & Learning Elements	
Learning	The claim that learning is the central focus of e-learning
1 Carrier / Platform	
Simple Electronic Devices	TV, radio, phone, film, etc.
Computer Devices	Computer, PC, laptop, tablet, mobile phone, PDA, etc.
Offline / Online	Availability via a network, such as the internet.
Printed	Books, articles, etc.
Live / in person	Such as lectures, meetings, etc.
2 Degree of Dependency on Technology	
Pure or Blended	How technology dependent is the education?
3 Distance & Communication	
Independence from Place	Distance learning. Ability to study not limited to a fixed location.
Independence from Time	No obligated fixed times at which to study.
Synchronous	Communication between individuals that takes place simultaneously.
Asynchronous	Communication at a time of each individual's choosing.
Availability of Instructors	The students' ease of access to communicate with the instructor.
Availability of Students	The students' ease of access to communicate with each other.
Degree of Meaningful Contact	The degree in which there is contact that is relevant to instruction
4 Social Context	
Individual - Group Learning	Degree to which students learn individually or in a group.
Group Learning Strategies	Are there strategies in place to facilitate group learning?
Role of Technology	What role does technology have in learning as a group?
5 Type of E-Learning	
Typology Kulik & Kulik (1991)	Assisted, Managed, and Enriched Computer Instruction
Typology Means (1994)	Tutor, Exploratory Environment, Tool, and Communication Media.
Categories of Reeves (1998)	Learning "from" technology, and learning "with" technology
Popular Types	Converted Instructor-led course; distributed and blended learning
6 Flexibility, Interaction, Progress Tracking, and Feedback	
Customisability to the user	Can learning be personalized or customized to the user?
Interchangeability	Exchangeability, reusability, shareability, and interoperability
Interactivity	Elements of interactivity. Such as exercises, tests, games, etc.
Progress Tracking	Whether student progress is tracked automatically
Feedback	Tailored, instant, and accurate? Static or adaptive? Underlying cause?
7 Control	
Learner or Instructor Controlled	Who is in control? Extent of control over learning experience.
Type of Control	Playback. Content selection. Pace, time and place of learning.
8 Design, Presentation & Media	
Content	Lectures, games, notes, articles, documentaries, exams, quizzes, etc.
Digitalised vs Optimised	Merely digitalized? Or offer unique features? Exploit the medium?
Pedagogical Optimisation	Use of educational science to maximize (e-)learning effectiveness?
Room for Creativity	Useable in innovative ways? In unintended ways?
Multimedia	What media are used? Text, (animated) images, audio, video?

*Table 1 – Categories of **Defining Characteristics of E-Learning***

2.4 Defining e-learning

With the list of e-learning characteristics and based on the above discussion, we can create our own definition. The below definition simultaneously serves as a summary of this chapter. Our definition of e-learning is as follows:

E-learning is a blanket term with vastly differing meanings to different people. Its most defining aspect is the use of computer technology to facilitate learning. E-learning can take an enormous range of different forms, some of which may share virtually no similarities amongst each other. It has a large array of characteristics that may apply, and that contribute to the effects it has. It may support various organizational goals or settings, one of which is always to facilitate learning.

This definition includes the most important aspects of e-learning. It consists of four elements. The **first** describes the most essential component, without which something should not be considered e-learning. Both the use of computer technology and a focus on learning are essential to being considered e-learning. The **second** part addresses that e-learning is not singular, but rather can take many forms. This is the source of disagreement on definitions and confusion over what e-learning is. It acknowledges and leaves room for the many different interpretations of what it could mean. The **third** part gives a sense of how broad and varied e-learning is. It explicitly refers to the numerous characteristics that define particular e-learning implementations. The **last** part stresses the importance of a focus on learning, rather than technology. The effectiveness of learning depends greatly on the application of design, technological and pedagogical principles. For which ideally the characteristics of the medium are used to their fullest. The technology is a means and not an end of e-learning. Essential to e-learning is its ability to facilitate learning.

3. E-Learning Effects

The effects of e-learning have been extensively studied by researchers. There are numerous different effects of e-learning on various dimensions. Much of the e-learning literature focuses on what it often refers to as "educational effectiveness", or sometimes simply "effectiveness". This refers to various effects on pedagogical outcomes, such as the exam results of students, their attitudes towards various targets, and the time required for studying. This chapter looks at effects in a broader way. For a successful implementation of e-learning the support of all stakeholders is essential (Dublin, 2003). It focuses broadly on six groups of effects: 1) effects on pedagogical outcomes, 2) effects on institutional outcomes, 3) effects on students and faculty, 4) moderating effects, 5) indirect effects, and 6) effects on course and curriculum development.

3.1 Effects on Pedagogical Outcomes

3.1.1 Study Time. Based on three meta-analyses there is strong evidence that compared with traditional classroom-based instruction, students in the e-learning condition learned at approximately a 50% faster pace (C. C. Kulik & Kulik, 1991; J. A. Kulik et al., 1983; J. A. Kulik, Kulik, & Cohen, 1980).

3.1.2 Achievement. Early comparison studies concluded that e-learning raises student achievement scores (Visonhaler & Bass, 1972). Russell's review of 355 studies found relatively few studies with significant differences between distance education (DE) and traditional classroom instruction (Russell, 1999). These early studies had significant methodological flaws and biases (Bernard et al., 2004; J. A. Kulik et al., 1983). Other researchers undertook attempt to overcome these issues by using a quantitative approach with Glass' meta-analysis (Glass, McGaw, & Smith, 1981). Various meta-analyses have been performed. These generally found that the e-learning condition increased student achievement scores significantly and positively (Hartley, 1978; C. C. Kulik & Kulik, 1991; J. A. Kulik et al., 1983; J. A. Kulik et al., 1980). Students learning with e-learning have on average better exam results. For example, C. C. Kulik and Kulik (1991) found that 94 out of the 100 studies with statistically significant results favoured the e-learning condition, and the average student in the e-learning condition outperformed 62% of the students in the traditional classroom condition. The meta-analyses of Ungerleider and Burns (2003) and Machtmes and Asher (2000) found no difference in effect for achievement. The meta-analysis of Cavanaugh (2001) found a small, positive, but statistically insignificant overall effect favouring the distance education conditions. In agreement with the earlier meta-analyses, Shachar and Neumann (2003) found in their meta-analysis that the distance education setting outperformed the traditional classroom condition significantly and substantially. A few studies

in these meta-analyses found higher scores on follow-up examinations, with small positive effects of e-learning on exam scores and follow-up exam scores (C. C. Kulik & Kulik, 1991; J. A. Kulik et al., 1983).

These findings have stood the test of time. More recent meta-analyses confirm the above results. For example, Bernard, Borokhovski, Schmid, Tamim, and Abrami (2014) found an overall positive impact of e-learning and blended conditions compared with traditional teaching methods. Interestingly, the effect size was identical for the e-learning and blended conditions. Similar results were found for serious games compared with conventional instruction methods (Wouters, Van Nimwegen, Van Oostendorp, & Van Der Spek, 2013).

Overall, the general trend in the literature suggests that e-learning is at least as pedagogically effective as traditional classroom instruction. All meta-analytical studies found either small to moderate positive effects in favour of the distance learning condition, or no significant difference. However, average effect sizes tend to be rather small, with variability within the conditions relatively large. Thus, there are many studies in which the e-learning condition greatly outperforms the control condition, and vice versa. It is worth noting that many studies in the above meta-analyses developed their own e-learning implementations. These implementations were often not based on sound pedagogical design (Govindasamy, 2001). As such, the positive effects of e-learning on student achievement may be greater than the meta-analyses suggest.

3.1.3 Retention. Some studies looked into the link between e-learning use and retention or drop-out rates of students. Bichsel (2013) states that e-learning may increase student retention due to the greater flexibility it offers, which is particularly important to lifelong learners, and working and military learners. Yet, other studies have shown some conflicting results.

3.2 Effects on Institutional Outcomes

Several reports refer to the institutional effects of e-learning (Bichsel, 2013; Boezerooij, 2006; Boezerooij, Wende, & Huisman, 2007; Moore, 2012). This paragraph presents a consolidated list of effects on institutional outcomes. Boezerooij provides a list of ten objectives of ICT policy in higher education institutions (HEIs; Boezerooij, 2006; Boezerooij et al., 2007). Among these are two effects on students and eight on institutional outcomes. The former will be addressed in section 3.3. The latter will be addressed below together with the effects from other reports.

This section serves as a brief summary of the literature on institutional e-learning effects. While it is beyond the scope of this study to discuss these findings in-depth, for an objective interpretation of these findings it is important to take into account that the literature presents a view that seems both overly positive and simplistic. Due to the incredible flexibility of e-learning, it may

address nearly any educational issue. However, these findings do not support a simplistic view in which the implementation of e-learning solves any and all educational challenges. Firstly, these effects are not guaranteed, with results varying greatly. Secondly, e-learning development and implementation requires effort and investments. The greater and more numerous the desired positive effects, the greater the effort and investment. Thirdly, development and implementation requires making trade-offs. For example, using e-learning to improve the quality of education creates challenges to it being used simultaneously to reduce costs. Reflecting the literature, this summary focuses on the output side of e-learning. The reader should keep in mind the input side as well, such as the various required resources. Generally, greater outputs require greater inputs.

3.2.1 Increasing Access and Enrolment. One of the goals of HEIs is to widen access to their education (Moore, 2012). It is possible to distinguish two general routes to an increase, namely by enlarging the market share in existing markets, or by reaching new markets. Higher education institutes may attract more of their traditional students by offering e-learning which has perceived benefits to these students (Bichsel, 2013). Prospective students may be more willing to choose for a university that is seen as innovative, has flexible study possibilities, and offers state-of-the-art educational methods. Secondly, e-learning may open up new markets of non-traditional students. Over the past decades, societies increasingly shifted towards knowledge economies. This led to the need for lifelong learning. Traditional classroom-based education is often no option for working students due to conflicting schedules. Flexible education options that allow the students to study at their own pace, anytime and anywhere allows non-traditional students to enrol. Furthermore, students that live in remote areas may have few opportunities to attend HE unless e-learning options are available. The university may also be able to attract international students that are unable or unwilling to relocate to another country. Three of Boezerooij's objectives refer to this, namely 1) widening access to traditional students, 2) creating opportunities for life-long learning, and 3) creating opportunities for international students (Boezerooij, 2006; Boezerooij et al., 2007).

3.2.2 Reducing Costs and Increasing Revenue. E-learning can help in reducing costs and increasing income in several ways. It can increase institutional income by attracting more students and offering more courses more frequently to larger audiences. E-learning can reduce costs by limiting the reliance on expensive physical classroom space, and obtaining an economy of scale advantage by reducing the marginal costs of students attending courses (Moore, 2012). However, any cost reduction first requires investment in e-learning development. Furthermore, trade-offs between cost reduction and other desirable effects may lead HEIs to deliberately decide not to use e-learning to reduce costs. By broadening access, courses for which there would otherwise be insufficient interest may be offered

due to increased organizational revenue. Furthermore, institution may increase revenue by providing e-learning services to students of other universities via partnerships with other institutions (Bichsel, 2013). Three of Boezerooij's objectives refer to this effect: 1) increasing efficiency, 2) enhancing cost-effectiveness, and 3) generating institutional income (Boezerooij, 2006; Boezerooij et al., 2007).

3.2.3 Enhance Reputation. Studies found that e-learning initiatives have enhanced the reputation of HEIs at the local, national and international level. One reason for this is that students tend to perceive institutions with e-learning initiatives as more innovative (Bichsel, 2013). Another cause of this enhanced reputation is that the institutions' courses, programs and policies were models for other institutions. This enabled these institutions to form more partnerships with other institutions and corporations. Furthermore, better technological infrastructures and advanced technology are associated with higher status or better reputation (Collis & van der Wende, 2002). Boezerooij refers to this as enhancing status and reputation of the institutions (Boezerooij, 2006; Boezerooij et al., 2007).

3.2.4 Streamline Curricula. Bichsel (2013) notes in her report that e-learning initiatives can streamline course offerings. E-learning can help reduce offering duplicate courses across departments or institutions. It can furthermore accommodate for larger student enrolment numbers, reducing the faculty-to-student ratio. It can also help create greater coherence across disciplines and faculties by offering general science courses that have general applicability.

3.3 Effects on Students and Faculty

3.3.1 Attitude. The effects of computer-enhanced learning on attitudes of students towards the course and the subject has been often studied. Three meta-analyses found good evidence that computer-based learning has a more positive effect on attitudes of students toward the subject being taught compared with traditional classroom instruction (J. A. Kulik et al., 1983; J. A. Kulik et al., 1980). All of four studies examining attitudes towards instruction found higher positive effects for the e-learning condition, although none significant. A more recent meta-analysis (Ungerleider & Burns, 2003) with a small sample size of four studies found that classroom-based instruction affects student satisfaction positively and significantly. Interestingly, studies in which students achieved higher achievement scores tended to have lower student satisfaction scores. Lastly, a report from The Sloan Consortium considers both faculty and student satisfaction as important to e-learning (Moore, 2012).

3.3.2 Greater Study Achievements. As discussed in paragraph 3.1, e-learning has several positive pedagogical effects. These effects include small positive effects on attitudes towards the subject being taught and the results on exams and delayed exams. There were very large effects on the time required to study, as the study pace in the e-learning condition was on average approximately 50% higher. Furthermore, there is some evidence that suggests that the retention of students is higher with e-learning. Lastly, studying with e-learning led to students obtaining their degree in a shorter amount of time (Bichsel, 2013). Factors cited for this include the frequency with which courses are offered, and the number of students that can enrol per course. This is particularly helpful with prerequisite courses that need to be retaken. Bichsel (2013) further mentions that military and working students in particular benefit from the flexibility e-learning offers and experience reduced times to degree.

3.3.3 Enhanced Educational Experience. Often institutions start e-learning initiatives to improve the quality of education (Moore, 2012). Boezerooij found that enhancing quality was the objective of ICT policy that was rated as most important across all three strategy groups (Boezerooij, 2006; Boezerooij et al., 2007). Similarly, Bichsel (2013) states that e-learning improves the educational experience in many ways. She provides numerous ways in which this can take place, however, these are nearly all dependent entirely on the particular e-learning implementation that is being used. Examples are the ability to communicate with peers 24/7, students being required to participate in discussions online, study sessions held online, increased opportunities for collaboration, better and faster feedback due to LMSs' increased data collection, and the anytime and anywhere availability of course materials.

3.3.4 Engaging Teaching. According to Bichsel "e-learning initiatives nearly always involve course redesign" (2013, p. 10). Instructors get training to teach effectively with new media. This also exposes them to new pedagogical techniques and approaches, and encourages a renewed focus on thinking about and formulating learning objectives. Bichsel (2013) states that focus groups report that these new techniques transfer to the traditional classroom teaching, and that some instructors report feeling renewed passion for teaching.

3.3.5 Greater Flexibility. The increased flexibility of e-learning is what Bichsel (2013, p. 10) refers to as the "greatest benefit of e-learning [to] students". The flexibility includes more course offerings and greater access to course materials. It also is better able to fit to the circumstances of the students, such as the circumstances in the students' work and family life, as well as health issues or learning disabilities. Boezerooij (Boezerooij, 2006; Boezerooij et al., 2007) found that this one of the most important objectives of ICT-related policies. Flexibility may also mean increased user control over the learning experience. Such as the ability to pause and rewind lectures, and a greater choice over what to study and in what sequence.

3.4 Moderating Effects

3.4.1 Source of Effects. For several decades there has been a discussion on the source of the pedagogical effects of e-learning. Most findings are based on media comparison studies, comparing an e-learning with a traditional classroom condition, this approach has been criticized by several scholars (R. C. Clark & Mayer, 2008; R. E. Clark, 1983). The main argument is that the instructional method, the content of instruction and the medium are all intangibly tied together. The medium is merely a neutral carrier of the instructional method, which is the source of the pedagogical effects (R. E. Clark, 1983, 1994). This is supported by several reviews and meta-analyses (Tallent-Runnels et al., 2006). Predictions of revolutionary effects in society and education specifically is nothing new. Every new technological advance led to promises of total societal change (van Dijk, 2009). In education each new medium led to overly optimistic estimates of revolutionary improvements to education. Yet after decades there is little support for a media superiority view (R. C. Clark & Mayer, 2008, p. 19). Despite this, the frequency of media comparative studies actually increased (Bernard et al., 2004, p. 407).

Several scholars argue that media comparisons are still useful. Firstly, because this critique does not hold for new interactive media capable of providing instant and accurate feedback, competitive or cooperative games, user control and personalization, etc. (Kozma, 1994). Secondly, e-learning has unique characteristics which enable positive effects (R. C. Clark & Mayer, 2008; Phipps, 2004). E-learning is capable of everything traditional media are capable of and more. Large positive

effects require maximizing the use of the characteristics. Thirdly, It is a mistake to design new media to mirror the old (R. C. Clark & Mayer, 2008; Dublin, 2003). Regardless of the medium, if students experience the same, the result is the same. Fourthly, some scholars reject that media are neutral, transparent carriers of information. Cobb (1997) argues that e-learning can perform more of the cognitive work for the learner, lowering the cognitive load on the learner, allowing more of the learner's cognitive resources to be spend on effectively processing information (Bernard et al., 2004, p. 381; Cobb, 1997). Fifthly, e-learning may yet revolutionize education as it becomes more advanced and flexible, its capabilities are fully exploited, and teachers are willing and able to adopt it (Abrami et al., 2001; Crook, 1994; C.-L. C. Kulik & Kulik, 1986; Means, 1994).

Lastly, not all predicted effects have come to pass. Just as many not all effects that did happen were predicted. At the advent of new technology, it is easy to be tricked into overly optimistic predictions. On the other hand, when technology is fully adopted it tends to be invisible. Changes may feel more like an evolution than a revolution. Yet, past technological revolutions similarly took decades. Whether technology presents education with an evolution or revolution may be merely in the eye of the beholder. Yet, computers have undoubtedly already drastically changed education.

3.4.2 Social Context. The social context is important to e-learning effect. Firstly, some voiced concerns that e-learning may lead to social isolation, presumably based on the misconception that e-learning essentially equals solitary learning. Secondly, group e-learning exists and has been studied frequently. Reasons to have students study together include financial considerations and learning strategies. Abrami et al. (2001, p. 451) found in their meta-analysis small positive effects for learning in groups on individual achievement, and moderate positive effects on group task performance. Individually students accomplish tasks faster, but require more help from teachers. In groups, students have more social interaction and persevere more on tasks assigned.

Numerous factors influence how well students learn in groups, such as previous group work experience, cooperative learning strategies, teachers trained in learning methods, instructional materials adapted to group learning, group size, type of e-learning, topic being taught, ability of students, and group composition (Abrami et al., 2001, p. 477; Johnson & Johnson, 1989; Lou et al., 1996, p. 455; Slavin, 1989). Group learning is particular helpful in small groups solving difficult tasks, open to multiple perspectives and solutions, with minimal available feedback (Abrami et al., 2001, p. 454; Cohen, 1994). Group and individual performance differ, thus positive interdependence and individual accountability strategies are necessary (Johnson & Johnson, 1989; Lou et al., 1996; Slavin, 1989). Additionally, the computer may be take on the role of group member or instructor. Lou et al. (1996) found positive effect sizes for all small groups, regardless of ability level. Group learning was more effective for lower ability students. And the composition of low, medium and high ability students significantly affects learning outcomes.

3.4.3 Learner Characteristics. E-learning does not affect all students in the same way. The characteristics of the learner affect the outcomes of e-learning. A meta-analysis found no significant difference for students' gender on achievement outcomes, while the amount of experience learners' have with computers has an important impact (Abrami et al., 2001). However, nowadays all students have extensive experience with computers. Higher level and higher ability students benefit more from having control over their learning experience (Hartley, 1978; C. C. Kulik & Kulik, 1991; J. A. Kulik et al., 1983; J. A. Kulik et al., 1980; Sivin-Kachala & Bialo, 1994).

3.4.4 Type of E-learning. As learners are not all the same, neither is all e-learning. Different types of e-learning have different characteristics resulting in different effects. Bernard et al. (2004) conducted a meta-analysis examined the effects of distance education (DE). Only dropout was substantially lower for synchronous DE than for asynchronous. For exam scores, retention and attitudes the effects were small or insignificant, with significant heterogeneity. Reeves (1998) distinguished computer-based learning into two categories. Firstly, learning "from" technology tutors and instructors. It excels at motivating students, decreases instruction time, and increases equity of access to quality education. Secondly, learning "with" technology refers to cognitive or exploratory tools, which excel at engaging learners in real world tasks (Abrami et al., 2001, p. 453; Reeves, 1998). Drill-and-practice types of e-learning effectively raise achievement scores and are most effective when tasks are simple (Abrami et al., 2001). More pedagogically complex applications showed less conclusive results but were deemed promising (Coley, Cradler, & Engel, 2000). And after nearly two decades, a recent meta-analysis found promising effects on learning and retention (Wouters et al., 2013).

3.5 Effects on E-learning Development & HR

3.5.1 Increasing Complexity and Skill Requirements. With the rise of e-learning the development of courses and curricula has become increasingly complex. This is part of the general trend of convergence of media, meaning that various media increasingly merge together, blurring the lines between once-distinct technologies (Lawson-Borders, 2003). This leads to an increasing number of characteristics per medium (see Appendix A, Table 1 – Categories of Defining Characteristics of E-Learning), and increases its capabilities and number of potential implementations. This greater complexity results in the potential ability of e-learning to affect the learning environment to a greater extent than traditional methods (Zentel, Bett, Meister, Rinn, & Wedekind, 2004). All the while, of primary importance is the quality of course design (Bernard et al., 2004). Educational science is a field of its own. There are numerous considerations to be taken into account from this perspective alone. To give an idea several aspects will be shortly addressed.

Providing adaptive feedback on underlying causes has substantial positive effects (Abrami et al., 2001; Azevedo & Bernard, 1995; Sivin-Kachala & Bialo, 1994). Relevant mediated communication opportunities should be plenty, mediated or not (Bernard et al., 2004). Learning benefits substantially from active collaborative strategies, with appropriate activities, involving engaging and deep interaction that leads to understanding and deep processing (Bernard et al., 2004). Learning benefits from learner-control, learning embedded in cognitive strategies and design principles, and animations (Sivin-Kachala & Bialo, 1994). Innumerous other factors enhance learning, including video material and interactive media (Bernard et al., 2004) and creativity in instructional design to support learning and participation (Davie & Inskip, 1992).

As e-learning scales up the number of students it becomes increasingly more important to get the underlying pedagogy right. As many scholars noted, the e-learning literature is a chronical of e-learning implementations design by individual instructors that focus on the technical aspect of converting existing educational materials into a digital format, while the pedagogical foundations are severely lacking. These pedagogical considerations are just one aspect of e-learning. The simple process of digitalizing existing instructional materials and lectures testifies to lacking of needed multidisciplinary skills.

In comparison, scholars that publish a book get help via the publisher from people with various skills, such as typesetting, editors, desktop publishers, graphic designers, copyrights and law, etc. Yet much of e-learning research is based on individual instructors tackling a medium that is infinitely more complex than paper. The skills required include all the above and more, such as photography, video editing, animation, audio editing, programming, game design, social media, web 2.0, pedagogy, design of educational materials, (big) data analysis and many more. “It is the total package in DE that must ultimately come together to foster student learning and satisfaction” (Bernard et al., 2004, p. 413). While e-learning may revolutionize education if its capabilities are fully utilized, accomplishing this requires a large set of skills from different many fields.

3.5.2 Division of Labour & Teams: Less Generalist, More Specialist. Due to the above effect of e-learning, HEIs that desire high quality e-learning that fully uses the mediums capabilities, will need to move away from a generalist approach of e-learning development. The skills required to accomplish this are too numerous and complex for any single individual to master. Let alone individual instructors that tend to be evaluated on their research, rather than their teaching. The generalist instructor-designer will have to make room for multidisciplinary teams of professionals dedicated to e-learning design and development.

Proof of the merits of professionalization and specialization comes from findings from meta-analyses. E-learning studied in the literature have often been created by instructors from various fields.

Yet, the disciplines of education and psychology – those professionally studying e-learning – have unusually strong positive effects (C. C. Kulik & Kulik, 1991, p. 91).

Further evidence for the use of multidisciplinary teams of professionals dedicated to e-learning design and development is found in the Chapter 4's discussion of exemplary implementations. All of which were created by such teams. Such teams include programmers, designers, directors, producers, graphic artists, researchers, instructional designers, editors, technicians, teachers, educational scientists, security experts, communication scientists, lawyers, and economists (EdX, 2017d; Khan Academy, 2017; The Teaching Company; Wikimedia, 2017).

The role of the current instructors depends on the strategy opted for by the institution. Institutions with such teams may allocate more time for research to many currently instructing, those instructors with a passion for teaching may do more of the (mediated) teaching, and all will likely serve as content experts within the design and development teams.

3.5.3 Large-scale Collaborations & Licensed Teaching. Large-scale collaborations are an extension of the previous trend. E-learning scales exceptionally well. Initial production costs of high-quality e-learning are high, but marginal costs are very low. High-quality courses will, once produced, likely be used at institutes beyond the one creating them. Similarly, some institutions will either co-produce courses collaboratively or license existing ones (Bichsel, 2013). Salmon found “strong interest in networking and collaboration between institutions and many exchanges of experiences” (Salmon, 2005, p. 207). Yet, she found little evidence of testing and transferring of models and principles.

Again, this trend is evidenced by our findings from chapter 4's discussion of exemplary e-learning implementations. Almost all of which are based on substantial collaboration. Examples include MOOC providers, such as EdX and Coursera, which collaborate with numerous universities worldwide to offer courses via shared platforms. The Great Courses collaborate with renowned institutions, such as the Mayo Clinic, National Geographic, Smithsonian, The Culinary Institute of America, Craftsy and Woodworkers Guild of America (The Teaching Company, N.D.). Others created a platform internally and then collaborate on a massive scale with content creators, such as Wikipedia, TEdX, YouTube, Anki, Udemy and various MOOC platforms. Learning Management Systems (LMSs) witnesses a similar trend, with numerous mergers leading to only a few major systems with large user-bases. Open source projects also follow this trend and exists already in HE, examples are Wikipedia and Sagai. Increasing complexity requires large-scale collaborations to reduce costs while increasing functionality and quality.

3.5.4 Shifts and Growth in HR. The implementation of e-learning will affect the human resources management of HEIs. Scalability will reduce the lecturer-to-student ratio. However, additional teaching assistants and tech support staff may be needed to serve these larger classes (Bichsel, 2013). The development time per course will increase, while the time spend on teaching per instructor will go down. Where these gains in time will be reallocated depends on institutions. One option is that institutions reduce the teaching faculty. Another option is that instructors may spend more time on other activities, such as discussions, critical in-depth analyses, or have more time to do research. This may result in an increase in more meaningful contact between instructors and students. Thirdly, institutions may adopt entirely different strategic options. For example, they may offer mass scalable e-learning of high quality to the masses. While offering top students additional education with more meaningful, intensive, engaging and small-scale interaction with instructors. Motivated students get top quality education for hard work, while teachers get to engage with well-prepared and motivated students.

3.5.5 Strategy Differentiation: Trend Follower or Innovation Leader. The emergence of e-learning provides HEIs with additional methods of providing education. Not all HEIs respond to these new opportunities similarly. As such, one effect of e-learning is that it results in new venues of strategy diversification. Some HEIs will respond conservatively and reactively, while others will respond more progressively and pro-actively. E-learning innovation requires substantial effort and investments. This does not happen via decentralized coincidence within the conservative climate of HEIs (Salmon, 2005). Most innovations originate from non-traditional education providers or even non-providers of education. Despite universities being engines of societal innovation, universities are democratic and bottom-heavy institutions with an inherently conservative culture, which tends to inhibit their capability to take collective action (Enders, 2002). More specifically, universities have thus far largely been unable to innovate with e-learning (Salmon, 2005; Schneckenberg, 2009; Westera, 2004). E-learning enables universities the possibility to offer new forms and new delivery methods of education. The effect is that universities will differ in their approach to e-learning adoption. This can broadly be categorized into two groups: trend followers and innovation leaders.

Trend followers use core technologies that are already in mainstream use, which represent less uncertainty and risk due to experience in-context. Examples are LMSs, e-mail and MS Office. Trend followers follow what Westera (2004) refers to as a ‘substitutional’ approach, referring to making small changes to established practices. Almost all universities use LMSs (Garrett & Jokivirta, 2004). Thus by definition these are not innovative, yet, often institutions mistakenly expect large effects from minor changes (Salmon, 2005). In policy studies this focus on non-innovative technologies and policies aimed at 'coping with change', rather than 'promoting change' is also apparent (Boezerooij, 2006;

Waterhouse & Rogers, 2004). Salmon (2005) places trend followers in the first phase of development, in which institutions use a new medium to do essentially the same as before.

Innovation leaders use both core and peripheral technologies. The latter offer more innovative and strategic opportunities, as well as greater risks and rewards due to less experience and certainty (Salaman & Asch, 2003). Unlike followers, innovation leaders are in Salmon's (2005) second phase of development, using innovative technologies in innovative ways to offer new possibilities.

Collis and van der Wende (2002) divide institution-wide ICT implementation into three stages. The first stage focuses on the technological infrastructure. This is where followers remain largely stuck. The second stage focuses on rich pedagogical applications and the third stage on the strategic use of e-learning. Current innovation leaders are primarily in phase three, with some pioneers making their first steps into phase two. I argue that a fourth stage needs adding, with a focus on an integral and comprehensive approach, in which technical, pedagogical and organizational considerations are taken into account as a whole throughout the organization. This is what the last effect focuses on.

3.6 Effects on the Policy of Innovation Leaders

As e-learning refers to many different types of computer-enhanced education, the effects depend entirely on the type of e-learning. For trend followers the effects will be small and easy to estimate. In contrast, innovation leaders can expect much larger effects that are much more difficult to predict. Only when the medium is fully utilized can full effects of revolutionary better education be expected. This is particularly of interest on the policies of innovators.

3.6.1 Integrative Policy Approach. The previous effects described how high quality e-learning with large positive effects can only be effected with large-scale initiatives with collaborations at the team, departmental, institutional and inter-institutional levels. This requires a pro-active, centralized approach, backed by substantial investments. Furthermore, it requires clear goals and organizational-wide commitment with policies on innovation and learning, incentives and motivation, and both technological and social change.

Innovation requires constant learning and adapting. The complex e-learning required to effect significant change cannot be accomplished in a single iteration. Systematic change and experimentation need to be encouraged (Calvert, 2005). The innovation efforts should be applied to institution-wide and broadly supported projects, rather than individual implementations. As, it is near impossible to generalize findings based on studies of individual implementations (Salmon, 2005).

Innovation requires appropriate incentives (Van Note Chism, 2006). The primary focus for many university instructors is research, although students are directly or indirectly the main source of income for universities (Collis & van der Wende, 2002). There are few innovative instructors and “internal investment, reward, recognition and approval systems do not encourage systematic change or experimentation” (Calvert, 2005). E-learning development is often merely a hobby or a side-effect of research. This contributes to there being few real developments (Salmon, 2005). Innovative institutions need to have staff development and support (Salmon, 2005), dedicated teams for e-learning development, and institution-wide or inter-institutional policies, and ownership structures benefiting developer-instructors (Salmon, 2005), as well as the institution (Gallagher, 2016).

Some innovation leaders will adopt a strategy to effect change through a modular and open source approach. This allows for thousands of developers inside and outside of the institution to simultaneously contribute to the development of e-learning. Each can focus on the area of their expertise, such as the user interface, graphical design or instructional design. Combined with big data and A/B testing this allows for large-scale experimentation, instant learning and rapid improvements to the e-learning environment, while simultaneously advance research on e-learning design and development. This approach is taken by the numerous institutions behind LMS Sagai.

Innovation leaders focus on technological change, as well as individual, social and organizational change (Zentel et al., 2004). Technological changes require social changes to have significant effects on society (van Dijk, 2009). Salmon's first phase of development, the technological integration often happens relatively quickly and effortlessly, in which social process are initially often unaffected and the effects on society negligible (Salmon, 2005). It is a common misconception that getting the technology right is the hard part. Yet, the true challenge lies in getting people to change their behaviours (Dublin, 2003; Oblinger & Hawkins, 2005). Innovation leaders align innovative policies with a culture of innovation that engages the whole community to "understanding the nature of the organization and its mission" (McNaught & Vogel, 2006, p. 382). Furthermore, e-learning not only requires social change, it can also be an instrument in realizing change. As Van Dijk points out, technology and society are in a continuous process of mutually affecting each other. It can be used as an opportunity to reflect on and discuss teaching practices. All of the above stress the need for integral, institution-wide and comprehensive policy.

3.6.2 A Big Picture Vision of Ends. E-learning innovation is only possible by seeing the big picture and having a vision based on ends, rather than means (Schneckenberg, 2009). As the previous effects discussed, to have e-learning that has strong positive effects it is necessary to make substantial investments, develop complex e-learning implications with large multidisciplinary teams supported throughout the organization and beyond. Such complex and integral policies and organizations require a view of the big picture. This peripheral view is necessary to identify relevant peripheral technologies, ideas, opportunities and threats.

Current scientific literature on e-learning policy has a narrow focus on primarily technical aspects. For example, Waterhouse and Rogers discuss privacy policies, e-mail and communication policies, discussion policies, assignment guidelines, technical support policies, code of conduct policies, and intellectual property rights policies (Waterhouse & Rogers, 2004). This entirely lacks in policies on e-learning design and development, on pedagogical optimization of e-learning, on incentivizing innovation, etc. Another example comes from the discussion of various implementations that are currently in use by Collis and van der Wende (2002). Their second phase of e-learning implementation is the use of rich pedagogical instruction, yet their examples are far from pedagogically rich. These studies are no exception. There is no education without learning. And yet, many e-learning policies focus on technology, rather than learning.

Universities tend to lack in capacity to affect the institution collectively or to exercise strong organizational leadership (Schneckenberg, 2009). Universities are the supposed drivers of change and innovation in society. Yet, ironically universities are so unable to innovate themselves. Salmon (2005) ascribes this to their conservative culture and democratic decision making. The result is that innovation is limited to individuals. Universities seem stuck in a complacency trap (Vogel & Bruch, 2011): an illusion that there is safety in doing what has always worked before. Yet, this unresponsiveness to a changing world leaves the universities open to disruptive change (Christensen, Baumann, Ruggles, & Sadtler, 2006), in which established organizations struggle to compete with new market entrants that use new business models based on technological innovation. Due to a lack an integral vision, organizations generally are not aware of these innovations. Similar to earlier observations specific to e-learning, Christensen states that it is not the technology itself that is intrinsically disruptive, but the business model enables disruption.

This stresses a focus on what really matters, the ends rather than the means, with innovating learning, rather than technology. Technology merely facilitates goal organizational attainment. Simon Sinek (2011) states that to be successful, organizations should focus on the why of their existence, not the what. The what is the technology. It is a mistake to compete by offering technical advantages, which does not provide a sustainable competitive advantage. E-learning is what facilitates high-quality education. Innovation leaders focus on their why: providing high-quality education.

Just as a student should have a clear understanding of what the instructor expects from them (Waterhouse & Rogers, 2004, p. 28), similarly instructors should have a clear understanding of what the institutions expect from them, as well as what they can expect from their institutions. Higher education institutes should have their goals clearly defined and communicated. Innovation leaders have clear, well-understood and shared goals broadly supported throughout the organization.

Salmon (2005, pp. 204-205) states that universities are rich in "resources in the form of intelligent keen individuals who are rarely appropriately directed to pedagogical innovation nor are self-motivated to radically transform their teaching". To affect change, Salmon says, instructors require a comprehensive understanding of the why, how and what. This is supported by McNaught et al. (2006) who state it is crucial to engage "the whole community in understanding the nature of the organization and its mission" (p. 382).

4. E-Learning Implementations

This chapter provides and overview of existing e-learning implementations available on the market, with the goal to provide insights into the possibilities of e-learning, to help the construction of scenarios in the next chapter. Secondly, the academic literature tends to study implementations created for the study, and often lack in complexity and innovativeness. As a result, often they merely mimic the old classroom instruction, without utilizing the unique capabilities of e-learning. For example, Collis and van der Wende (Collis & van der Wende, 2002) describe phase two of e-learning as focused on rich pedagogical implementations, yet the examples they provide are not rich but core technologies, such as e-mail, PowerPoint, and Webpages. These implementations are not considered innovative (Salmon, 2005).

Thirdly, this chapter grounds the discussion in reality, combining theory and practice. Not all problems are solved theoretically. Many actors outside of HE are involved in the advancement of e-learning theory and practice. While this chapter may seem to lack scientific rigor, scientific inquiry without a connection to reality risks solving theoretical puzzles rather than actual problems. Scenarios intentionally depart from current reality to explore possible future realities. Recent technological innovations - reading or transmitting thoughts digitally – could lead to wild fantastic scenarios, it is important to focus not solely on future technology, but also on social dimensions, such as the acceptance and application of already existing technology. As far as I am aware, there are no other studies with a comparable analysis.

I have gained extensive experience using nearly all implementations described in this chapter. At the minimum, I spent several hours with each e-learning implementation I tested. With most I spent far more time. In the process, I completed numerous courses and content on several platforms, including: The Teaching Company, Coursera, EdX, Kahn Academy, iTunes U, Class Central, OpenCulture, MIT OpenCourseWare, Open Yale Courses, Blackboard, Anki, AnkiDroid, Memrise, DuoLingo, Babbel, Rosetta Stone, Pimsleur, Michel Thomas, Lynda.com, Total Training, CreativeLive, and Udemy.

4.1 Video Lectures

4.1.1 The Great Courses

The Great Courses is a series of university-level audio and video courses created by The Teaching Company. It aims at lifelong learners and offers courses of very high quality, taught by some of the best professors in the world. The company depends strongly on its community of users in the creation process. It surveys its community on course concepts and creates audition lectures with each selected professor to select the most engaging professors as rated by the community. The Teaching Company employs top professors and experts from some of the top universities in the United States of America. The professors have often won awards for teaching excellence. The professors that have been selected and gone through the audition phase join a team of instructional designers, researchers, graphic artists, producers, directors, editors and technicians to produce the course (The Teaching Company). An avid fan of the series of courses, after his retirement from Microsoft, Bill Gates was so inspired by one of the courses that it led him to contact the professor of the "Big History" course to help introduce his course in high schools all across America (Sorkin, 2014).

The Teaching Company has produced over 575 series with more than 14000 lectures. The Teaching Company has partnered with The Culinary Institute of America, The National Geographic Society, The Smithsonian, and Mayo Clinic to produce specialized courses ("The Great Courses and Mayo Clinic Jointly Create Health and Wellness Courses," 2016, May 3).

The course consists of video or audio and a course guide. The courses are available on discs or via a digital download. As such, they can be viewed on a TV, laptop, table or mobile devices. This makes learning independent from place or time. The communication is asynchronous and only one-direction: from professor to learner. There is no contact between learners. This is a pure form of e-learning. There are no customizability options for the user. While the content could be exchangeable, shareable and reusable, this is restricted by copyrights. There are no elements of interactivity, such as exercises, tests, games, etc. There are also no exams and homework assignments. There are no prerequisites for following the course. There is no progress tracking or feedback. The user is able to control the playback and selection of content, as well as the pace, time and place of learning. The content consists of rich multimedia, containing video, pictures, and audio to accompany what the professor is talking about. The content is not merely a digitalized version of existing lectures. The content is well-designed and planned. While many features of the medium remain unused, The Great Courses do exploit the ability to put in a tremendous amount of time and resources to create very high quality content, since the marginal costs are extremely low. The lectures seem well-optimized for pedagogical effectiveness.

4.2 MOOCs

Another category of e-learning implementations is massive open online courses (MOOCs). According to a report in 2015 from Class Central, an online portal for MOOCs, the MOOC market doubled from 16-18 million in 2014 to over 35 million in 2015. Class Central has a database in which over 6000 MOOCs from various providers are listed. They have lists each month with newly added MOOCs. According to the Class Central the largest online course provider in the world is Coursera, which in 2015 was listed as having a user-base of 17 million students in total. For the first time in 2015 Coursera was no longer bigger than all other MOOC providers combined. The next biggest providers are EdX, FutureLearn and Udacity (Shah, 2015, December 21).

There are numerous other MOOC providers. These include individual universities, as well as large MOOC providers that offer content from multiple institutions. However, the goal of this implementations review is not to have an exhaustive overview of all implementations available. It serves rather as an exploration that supports the development of scenarios relevant for HE. For this reason, we examine a broad range of implementations, rather than an in-depth analysis of MOOCs. Coursera, EdX and Khan Academy will be discussed more thoroughly. The reason for this is that Coursera is the largest MOOC provider, EdX seems to have the highest quality learning experience, and Khan Academy does not try to be an alternative to traditional courses, but rather as a rich digital textbook. Udacity, FutureLearn, iTunes U, Class Central and OpenCulture.org will be briefly described. The justification for a shorter description is given at each respective discussion.

4.2.1 Coursera

Coursera offers universal access to courses of top universities and organizations. It was founded in 2012 by Daphne Koller and Andrew Ng, two computer science professors from Stanford, who put their courses online for anyone to follow. Coursera partners with 149 university partners offering over 2000 courses to 24 million learners worldwide (Coursera, 2017, April). Coursera offers courses, specializations and degrees. Three Master degree programs are offered in collaboration with the University of Illinois: a Master of Business Administration, Master of Computer Science in Data Science and a Master of Science in Accounting. Another Master's program offered is on Innovation and Entrepreneurship from HEC Paris (Coursera, 2017). These degree programs take from approximately 10 months to 36 months to complete with between 10 to 20 hours a week of study time per week. Upon successful completion, the student is awarded an accredited Master degree from these prestigious institutions.

Unlike for example Khan Academy, Coursera is a for-profit organization. It has secured $146,1 million in funding so far (Crunchbase, 2017, April). The courses can be taken for free. Although a proof of successful completion, in the form of a Course Certificate, often costs around $29 to $99. The prices of specializations generally range from around $200 to $500. The four degrees cost between $20000 and $30000.

Coursera offers courses via their app for iOS or Android, or via a web browser. This enables students to study independent of time and place. Communication with students can take place synchronously and asynchronously, however the learning experience generally seems to lack a strong social component. The contact with instructors is also one-directional. The content uses pedagogical strategies to create a pleasant learning experience. Social learning strategies are implemented; however, it seems far from comparable to group learning that traditional education can offer. The peer-based evaluations allow the courses to be taken by unlimited numbers of students, yet do not provide anywhere near the same standard as instructor-based evaluations. The learning experience can be customized in limited ways to the user. To get a certificate the student is expected to complete a predetermined curriculum of lessons and assignments. The content is organized into courses, which lowers the possibilities for exchangeability, reusability, and shareability. The interoperability is very good as studying takes place over browsers and apps. There are elements of interactivity, yet I found the expectations of students rather low. Nonetheless, even this basic testing of knowledge may be valuable to adopt in traditional forms of education. The quizzes help inform students and teachers if the lessons were clear and well-understood, or that further study or instruction is necessary. The content is of high production quality, with clearly a lot of effort and resources put into creating a high quality learning experience. Although it seems that to keep the learning experience accessible to a broad range of students the standards of what is expected of students is lowered.

4.2.2 EdX

The MOOC provider EdX was founded in 2012 by Harvard University and MIT, offering high-quality courses from top-tier universities. The mission of EdX is to “increase access to high quality education for everyone, everywhere. Enhance teaching and learning on campus and online. And to advance teaching and learning through research” (EdX, 2017a). This means that EdX does not only aim to offer education, but also to use the platform as a pedagogical research platform, to “conduct experiments, exploring how students learn and how faculty can best teach using a variety of novel tools and techniques”. This is done by examining big data generated from users, “from mouse clicks to time spent on tasks, to evaluating how students respond to various assessments” (EdX, 2017d). Several papers have been published based on research with EdX. Examples of this include a study exploring to

integrate the massive online open course content with traditional classroom instruction at a for-credit community college setting (Bebell & Petersen, 2015). In another study, the importance of social engagement of students for motivational support and overcoming difficulties while learning with an MOOC was examined. Synchronous collaboration was made possible within an EdX MOOC in the form of a Lobby program that matches students together to work collaboratively within a chat room. The findings suggest that this collaborative chat feature reduces the rate of attrition over time by a factor of two (Ferschke, Yang, Tomar, & Rosé, 2015).

Compared with Coursera, EdX mimics the traditional classroom instruction at universities more. For example, the Boston University's LeadershipX Ethical Leadership course incorporates reflection questions and asks students to keep a journal. The students are required to send in several assignments that will be graded. At the end of the online course, there is the following note: "we are offering the Ethical Leadership course for credit at Boston University in the fall of 2016. That course entails a more intense and deliberate process of developing and completing your final project. Through that course you will develop in further detail your Case Study and Final Project, and connect with others who are working within the same strategic vision and mission" (Fluker, 2017).

Besides individual courses, EdX also offers what they call MicroMasters. These programs consist of multiple courses and awards a certificate that is recognized by certain major employers, such as GE, IBM and Volvo (EdX, 2017c). It is unclear what this entails exactly, or what weight it carries in being hired by these companies. The MicroMasters also allow students to complete a Master's Degree at a university offering credit for the MicroMasters, reducing the time and money required to complete the Master's. An example is the Business Analytics MicroMasters from Columbia University. The time requirement for completion is indicated as 12 weeks of 8-10 hours a week per course. This particular MicroMasters consists of four courses and costs $1500 (EdX, 2017b).

The EdX courses can be followed via the EdX apps on Android and iOS or via a browser. On its own, the organization offers only 'pure' online learning. However, it can be used as blended learning within a traditional classroom setting (Bebell & Petersen, 2015). Studying takes place independent of time and place. The possibilities to communicate differ per course. Most courses offer options like a forum to have discussion with other students. Although these may be disabled after a course has ended. Some courses may also offer Google Hangout moments with the professor to answer any questions. Whether communication is synchronous or asynchronous, the availability of instructors and the degree of meaningful contact thus differ depending on the courses' availability of features. Group learning is encouraged, such as through the formation of Facebook groups or actual meetings around the world, although this is nearly entirely depending on the students' initiatives. There are not many possibilities for the user to customize the experience. However, the user is fully in control over what courses to follow, what and how much to complete as well as the pace, timing and place of learning.

The content consisting of a mix of text, assignments and video is of high production quality. There is only limited interactivity, such as tests, games and quizzes. The students' progress is tracked and accessible to the learner.

4.2.3 Khan Academy

The Khan Academy (www.khanacademy.org) is a non-profit educational organization that offers instructional videos online on a diverse range of subjects such as math, physics, chemistry, biology, computing, economics, and arts and humanities. The videos cannot truly be considered courses, but rather short explanations of concepts. Salman Kahn considers the content more as a rich textbook, rather than a course. The website also includes practice exercises and dashboard with progress tracking for educators. The organization finds its origins in 2004 when Salman Kahn started tutoring his cousin Nadia who was struggling with math. Soon after he was tutoring 15 of his cousins over the phone. To keep it manageable he started using a website and online tools for his cousins to practice problems. Two years later he started creating YouTube videos. By 2008 he reached tens of thousands of viewers every month. Now they reach over 10 million users globally, with over 5000 courses (Dreifus, 2014, January 27). The Khan Academy partnered with institutions like NASA, The Museum of Modern Art and MIT. All content is and will always be available for free (Khan Academy, 2017).

Khan Academy itself does not offer blended learning, however, videos are intended for use alongside traditional forms of education. The content can be used independent of time and place. The videos have been designed to be motivating to learn (Dreifus, 2014, January 27). Salmon Khan sees the Khan Academy as a "highly enriched, personalized textbook, a tool for you on your own or your teacher or tutor", rather than as a MOOC course (Dreifus, 2014, January 27). The learning experience adapts to the users' level of knowledge. The videos are also shared on YouTube, which allows for great exchangeability, reusability, shareability and interoperability. The Khan Academy offers interactive elements such as exercises, tests and games. The website also tracks progress of students. It is primarily the learner that is in control over the learning experiences, such as the playback of content, selection of content, as well as the pace, time and place of learning. The content is a variety of games, tests, problems and solutions and instructional videos with animation.

4.2.4 Others: FutureLearn, Udacity, iTunes U, Class Central, OpenCulture.com

There are numerous other providers of MOOCs that are worth addressing. The goal of these examinations is to inform the scenarios for the next chapter. For this reason, discussing similar educational experiences has little added value. The shorter discussion or exclusion of some MOOC providers does not signify a lower quality experience. Although not all MOOC providers can be mentioned and described here, there are a few that deserve at least a short discussion. These are: FutureLearn, Udacity, iTunes U, Class Central and OpenCulture.

FutureLearn is an MOOC provider which is very similar to Coursera. Which is the primary reason it is only discussed shortly. FutureLearn is a private company owned by the Open University, which offers free courses created in partnership with 121 other universities and institutions (FutureLearn, 2017a; The Open University, 2013). It offers certificates upon a minimum completion rate of a course of 90%, along with a 70% correct completion of test questions (FutureLearn, 2017b).

Udacity is an MOOC provider originating from a Stanford University experiment in which the "Introduction to Artificial Intelligence" course was offered online for free to anyone, in which over 160,000 students from more than 190 countries participated. It partnered with organizations such as Google, AT&T, Facebook, Salesforce and Cloudera. Their mission is "to change the future of education by bridging the gap between real world skills, relevant education, and employment" (Udacity). Udacity offers free courses and paid nanodegree programs. The nanodegree programs consist of several free courses, with the addition of coach support over Google Hangout, one-on-one appointments with coaches, access to moderated student forums, code reviews and career services, a certificate and a chance to be invited to the Google. This differs greatly from courses on Coursera, EdX and Khan Academy. The courses on Udacity focus on computer technology skills.

iTunes U, unlike the previous MOOC providers that all have websites with well-organized courses and programs, is mainly a repository of content from diverse organizations and creators. The content of interest for HE consists primarily of podcasts, interviews, and videos. While there is an abundance of incredible content, it is not very organized and easy to navigate. The experience is often closer to that of watching documentaries or listening to a news radio channel, rather than a university education. Even though there are also entire lectures online. The service is offered for free. There are over 1000 universities worldwide offering 350 000 lectures, which were downloaded 300 million times a year in 2011. Universities that offer content include Oxford, Stanford and Harvard. The UK's Open University set a record number of downloads on the iTunes U service, with 40 million downloads (Coughlan, 2011, October 3). This is the same organization that owns FutureLearn.

Class Central and OpenCulture are two websites that keep track of online course offerings from various e-learning providers. The website of OpenCulture is more basic in its design and user-friendliness, it offers links to audio books, online courses, MOOCs, textbooks, eBooks, language learning resources and free movies (see: http://www.openculture.com). The website of Class Central (https://www.class-central.com) is a lot more user-friendly and well-designed. It has various options to help search for courses, such as lists of what is currently trending, started recently or will start soon, courses that have been announced, and more. Furthermore, it categorized all courses into subjects with subdivisions. The website has an overview of courses that offer credentials. It also allows users of the website to rate and comment on the courses. Class Central also publishes reports on MOOCs.

4.3 Universities Online

4.3.1 Free online courses

Many HEIs offer many of their regular courses online, either partially or entirety. While some only publish course materials, others also publish the video or audio recordings on their website. The main differences with their regular educational offerings is twofold. Firstly, there is generally no institutional support, from instructors or otherwise. The course material is provided as is. Secondly, no proof of completions is awarded to students. Students cannot obtain degrees or certificates via this way. Below, some universities that offer their courses or course materials online for free are discussed briefly.

MIT OpenCourseWare is a Massachusetts Institute of Technology (MIT) initiative in which the institute makes all educational materials for its undergraduate and graduate programs available online for free and accessible to all. In 2001 MIT announced it would start a 10-year initiative to make public Web pages for almost all of its 2000 courses. Participation of professors' is voluntary (Goldberg, 2001, April). For many courses the syllabi, calendar, readings, and general course information are available. However, the majority of courses does not have video recordings of the lectures. MIT does not award certificates or degrees for taking the courses online. There is also no support from teachers. There is no synchronous or asynchronous communication between students or with the instructor. The learning is self-motivated and without any social elements. The courses are digitalized versions of the offline courses. As such, the online version is at best as good as the offline version. The OpenCourseWare does not utilize the full capabilities of the technology, such as interaction, games, and exams with feedback. Without all these features most of the courses published online seem interesting mostly for other educators and HEIs. The video lectures make it interesting for highly self-motivated students as well.

Open Yale Courses provides Yale courses online similar to MIT OpenCourseWare. Access to the courses is free and open to all. Yale does not provide course credits, certificates or degrees through the Open Yale Courses website, although it does offer for-credit courses online via Yale Summer Online. Unlike MIT OpenCourseWare, the Open Yale Courses does not attempt to make all of Yale's courses accessible online. However, it does have video, audio and text transcripts available for its courses. The website feels more accessible than MIT's and has made its video recordings of lectures available on YouTube and iTunes. The course pages include the syllabi, sessions, and an online survey to gather feedback on the course. The PowerPoint presentations can be downloaded from the course

webpages also, along with transcripts, and audio recordings of the lectures. Compared to MIT's offering, Yale presents a very polished website with a selection of courses, whereas MIT has little more than a repository of course materials online.

Carnegie Mellon Open Learning Initiative is the online HE platform of the Carnegie Mellon University. Their aim is to "create high-quality courses and contribute original research to improve learning and transform higher education" ("Learn More About OLI,"). The Open Learning Initiative (OLI) builds courses based on academic research, and in turn contributes to research as well. This is similar to what Harvard does via their EdX platform. The OLI courses were designed with the individual learner in mind, but are according to their website often used by other colleges and universities to support classroom instruction. Course designers analyse the data of students to assess courses and course materials. Low scores on a particular concept within a course leads the designers to review this aspect of the course to see if it can be improved upon. This sounds quite impressive. However, the courses that are available seem rather primitive in its design, with most being text-based learning. This does not match this generation's use of new media, which generally is fast-paced and represents a struggle for the user's attention. Unlike Yale and MIT's courses, these courses do include exercises. While this does utilize a capability of the online media that is unused in Yale and MIT's courses, it does little to engage the user.

None of the above free online platforms offer courses that are (well) optimized to utilize the full capabilities of the new online media on which the courses are offered. MIT OpenCourseWare is merely a repository of digitalized course material. Yale improves on this by have a well-designed website, with content adapted to the new medium by including transcripts with the audio and video files. Carnegie Mellon makes minor use of the capabilities of the new medium, by including simple tests. This is however merely a small step in the right direction, while the presentation of the course material takes a step back in the wrong direct, leading to courses which rely too much on text and are not engaging and motivating to the learner.

There are many other institutions that also offer free courses and course materials. Some of these include very different types of presentation, delivery or course information. Examples of these are University of Oxford Podcasts, which published lecture and workshop series on a variety of topics in podcast and video formats, for free on their website and iTunes U. Similarly, University of London has numerous podcasts and video recordings from various partner institutes.

4.3.2 Paid online courses

Stanford Online offers courses taught by Stanford faculty aimed at lifelong learners worldwide. Stanford offers both paid and free online courses. Stanford has a central office that works in collaboration with faculty and departments to create enriched learning experiences by offering support with instructional design, content production and delivery online. Stanford is engaged in online learning for two reasons: 1) to increase the depth and richness of the learning experiences Stanford offers, and 2) to broaden the range of learning experiences Stanford offers and broadening its audience around the world. The free courses are generally short lessons, which sometimes take only a few hours to complete. Some free courses are offered via other platforms, such as Coursera. Tuition fees differ somewhat per course, but seem to generally be around $1000. For example, the Decision Analysis course of Professor Ronald Howard costs $1295 for the online version and $3025 for the in-person course. The Stanford Online does not have a catalogue of courses that are easy to navigate. It does not use filters that allow filtering out free or paid courses. There are several lists of courses, yet the user has to navigate to several underlying pages to discover if enrolment is still open, or if the course is archived and will not even be offered anymore.

Harvard Extension offers close to 800 courses that award fully accredited Harvard credentials that includes becoming a member of the Harvard Alumni Association. It is possible to obtain graduate certificates, as well as undergraduate and graduate degrees. To complete a degree, several courses have to be taken online first, after which the student is required to take on campus courses. The degree awards a Bachelor or Master in extension studies with a specific mention of the field. For example, a master in Management will reward the Harvard University degree of *Master of Liberal Arts (ALM) in extension studies, field: Management*. The tuition fees of 4-credit courses range from $1400 to $2550. The cost of a graduate degree is approximately $30000.

UC Berkeley Extension offers online individual courses and certificate programs. Individual courses cost around $900 dollar, and certificate programs' estimated costs are approximately $5000. Some certificate programs do not have any admission requirements, although a bachelor and prior knowledge is highly recommended. Other professional certificate programs do require a bachelor in the field of study. There is no guarantee that completed courses will result in transfer credit when enrolling in another institution, including UC Berkeley. The institute offers an offline variant of the program as well.

Sophia Learning is an online learning platform that offers online courses for college credit. The website claims the courses are eligible for transfer to over 2000 colleges and universities, including partner institutions. On some of the course pages the guaranteed transfer mentioned refers to only a single university, this may be due to this course page being linked to this specific university, rather than the guarantee being limited only to this university. Some courses count towards an equivalent of a specific on-campus course, while others may count only as an elective course. The courses on Sophia Learning are graded on a pass/fail basis, no letter grade is issued. Before exams the user needs to pass an identity verification system, which uses questions from public databases as well as photo and sound verifications. The accuracy was not assessed. The costs per course are approximately $300.

4.3.3 Minerva

Minerva is a highly selective, non-profit university that depends entirely on e-learning for the delivery of its courses. Officially called Minerva Schools at KGI, the university is a joint project between the Minerva Project and Keck Graduate Institute. The start-up was founded in 2012 (Jackson, 2016, April). The founding class, that started in September 2014, had nearly 1800 applications of which 45 students were admitted. This results in an admission rate of 2,5%, which Minerva reports makes it "the most selective undergraduate program in U.S. history" (Vuynovic, 2014, March, p. 1). Minerva offers classes via their online platform. The classes are designed to be small-scale intensively participatory seminars. Students are asked their opinion, and the instructor can choose students to comment. The system tracks participation of students, and allows the teacher to replay the feedback and participation of students within the seminar. The students and teacher communicate with each other via their computers with webcams and headsets over the Internet. The university offers both undergraduate and graduate programs.

While Minerva aims to offer top quality of education, its model differs vastly from that of prestigious Ivy League universities. Firstly, students do not spend their entire four years of education in one location. Minerva has several locations in the world where students can live and study together, and they are planning to expand. These locations include San Francisco, Berlin, Buenos Aires, Seoul, Bangalore, and London. The students spend time in several of these locations during their studies. Minerva also offers offline activities, in which students discover the cities and countries, and learn from local organizations.

Minerva also boasts a large diversity in student population, with 78% of students coming from outside the USA. While Ivy League's subsidize international students that would not otherwise be able to afford tuition, these institutions only have around 10% to 15% international students (Jackson, 2016, April). Harvard estimates the costs for attendance for a student for tuition, fees, room and board for

the year 2017-2018 at $65,609. This is excluding travel costs and personal expenses such as books (Harvard). Minerva's estimates the same package of services for the same year at $24,450 (Minerva). However, this does not cover the world travel that is essential to the Minerva experience. The institution also does not finance anything that "does not directly contribute to your educational experience" (Minerva), this includes sports facilities, student centres or cafeterias or tenured staff.

Rather uniquely, Minerva stresses the learning experience for the students. While other universities discussed also mention the importance of good pedagogy, or the ability to research how students learn through their platform, none of the other institutions examined here focus on it as Minerva does. Active learning strategies are employed throughout the teaching and instruction.

Ben Nelson, founder of Minerva, criticizes top-tier universities that "sit on their brands that they've built over decades or centuries and deliver the same ineffective experience" (Edgecliffe-Johnson, 2016). Furthermore, Nelson states he is not at all threatened by MOOCs, as they tend to offer introductory classes, for which he thinks it is not acceptable to ask money. Minerva only has classes where the professors are closely interacting and tracking students with the help of advanced software, something MOOCs are incapable of offering for free. In addition, Nelson expresses contempt for traditional lectures, as they "are not proven to work" (Rivard, 2013, April). The instructors will have the liberty to teach their courses from anywhere in the world.

4.4 Online Educational Media

4.4.1 Wikipedia

Wikipedia is a free online encyclopaedia that allows anyone to create and edit articles. As of the moment of writing, Wikipedia is ranked as the seventh most popular websites on the internet (Alexa, 2017, March-a) and the largest and most popular general reference work on the internet (Tancer, 2007). Wikipedia enables users to find information of a vast array of topics almost instantly.

It is compatible with most digital information carriers, such as PCs, smart phones, and smart TVs. This allows users to retrieve information independent of time and place. Wikipedia users can communicate with other users both synchronously and asynchronously. Most communication will be the asynchronous retrieval of information. There is also synchronous communication, in which users communicate simultaneously about topics, such as through discussion pages. For most users, the degree of meaningful contact with other learners or experts will be low. The very nature of Wikipedia, in which everyone can contribute to articles via diverse mediums, makes it a platform that supports exchangeability, reusability, shareability and interoperability.

While Wikipedia is useful for the wealth of factual information, it does not provide a learning environment. Wikipedia is what Reeves (1998) refers to as learning “with” technology, as opposed to learning “from” technology. Wikipedia is used as a cognitive or exploratory tool, rather than as a tutor or instructor. It lacks build-in individual or group learning strategies. Wikipedia informs but does not instruct. It does not provide features of a learning environment such as note taking, and feedback to and progress tracking of students. The information is static and consists nearly exclusively of text and images, rather than the information being interactive and consisting of rich content. This means it is lacking in content such as games, tests, quizzes, videos, sounds, etc. As of such, it leaves much of the capabilities of the electronic media unutilized. Lacking a pedagogical foundation, Wikipedia is optimized for informing about factual information, rather than optimized for providing a learning experience.

Criticism. As also reported on Wikipedia itself, on its page about Wikipedia, the online encyclopaedia is often discouraged for citation in academic work and sometimes explicitly forbidden ("Wikipedia,"). An often heard argument is the lack of credibility of the often anonymous authors and their writings. Since anyone can edit the articles. Jemielniak and Aibar (2016) discuss how many academics have expressed strong criticism on Wikipedia. Some go as far as to reject the whole idea of being able to build knowledge and expertise by using crowds. However, they also mention that “the perception of Wikipedia’s quality has improved over time, particularly among academics” (Jemielniak & Aibar, 2016, p. 1774). This includes open and clear support from some scholars. Interestingly, Jemielniak and Aibar describe a large survey held among teaching staff at two Spanish universities. The overall quality of articles is viewed rather positively by the teaching staff, but they also think that Wikipedia is not well regarded by their peers. There is a negative feedback loop, in which the positive evaluations are kept private, and thus the perceptions of negative peer evaluations remain unchanged.

Accuracy. How accurate is the information found on Wikipedia? Nature has investigated this (Giles, 2005) by comparing Wikipedia’s accuracy to that of Encyclopaedia Britannica, which employs paid editors. Nature entries from both encyclopaedias were chosen from a broad range of scientific disciplines and sent for review to relevant experts. The 42 usable reviews found only eight serious errors, four in each encyclopaedia. On average Wikipedia articles had 4 factual errors, omissions or misleading statements, whereas Encyclopaedia Britannica had 3.

A recent study comparing the English and Spanish versions of Wikipedia with the general use encyclopaedia Mini Larousse for terminology regarding Food and Nutrition Science found that both Wikipedia language versions have a greater number of and more exact entries than the mini Larousse (Cabrera-Hernández, Wanden-Berghe, Curbero Castro, & Sanz Valero, 2015). Similar conclusions have

been noted in other studies. Such as that Wikipedia is accurate although often incomplete, but that it has a "remarkably high level of internal validity" (Devgan, Powe, Blakey, & Makary, 2007, p. S77).

The article in Nature (Giles, 2005) mentions efforts by Wikipedia to improve its accuracy. Founder Jimmy Wales is primarily interested in getting experts to be involved in writing articles, which he describes could have a "multiplier effect", whereby the efforts of the enthusiasts combined with an expert editor results in a multiplication of the quality of the article. Furthermore, Wales intends to introduce 'stable' versions of entries once they reach a certain quality threshold.

More recently, Wikimedia Foundation initiated "partnerships with universities, scientific societies, and cultural institutions across the world" with the aim of involving professors from various fields in the co-construction of articles (Jemielniak & Aibar, 2016). In addition, The American Sociological Association, the American Psychological Association and the Association for Psychological Science have issued calls to improve articles in their fields. This suggests that while in the early years Wikipedia received a lot of criticism, gradually there is growing support along with structural initiatives to improve the quality of articles. Seven years after the aforementioned Nature article, a study examined content on 10 mental health-related topics, comparing Encyclopedia Britannica, a psychiatry textbook and 14 frequently accessed websites (including Wikipedia) that provide information on depression and schizophrenia. Experts rated all articles on the following criteria: accuracy, up-to-dateness, breadth of coverage, referencing and readability. Across all topics, Wikipedia was the most highly rated for all criteria except readability.

Of special interest for this thesis is the finding that some professors use Wikipedia as a teaching tool, integrating article editing within the curriculum. This benefits students, instructors and society at large (Konieczny, 2012).

4.4.2 TED

TED is a four-day conference that is held yearly since 1990. The speakers present for a maximum of 18 minutes on an idea that the speakers think should be spread. TED is an acronym which stands for technology, entertainment and design, although the topics are now much broader than that. In 2012 TED Talks celebrated its one billionth video view (TED). TED Talks are viewed an average 17 times per second. There has been some criticism on TED, mostly because it oversimplifies complex topics and that it does not contribute much to society in terms of actual change. An example of this is the criticism of professor Benjamin Button, paradoxically given at a TEDx event and published as an opinion piece in the Guardian, depicting TED as the American Idol of science forming a "recipe for civilization disaster" (Button, 2013). In another opinion piece in the Guardian Chris Anderson, TED's current curator, gave a rebuttal stating that TED is one of many sources of information and that it aims

to create interest into learning more about a topic (C. Anderson, 2014).

TED Talks can be viewed all devices that can play video files. While it would be considered 'pure' e-learning, rather than a blended form, from our previous review on the literature it is not expected that there is any pedagogical difference between attending the talks in person or watching them on video. TED Talks can be viewed independent of time or place. While the videos are synchronous and one-directional communication only, the website offers the ability to interact synchronously and asynchronously with other users in the comments section underneath videos. While it can be argued that users that have discussions in the comments have meaningful interaction, there seems to be almost no interaction with the presenters of the talks themselves. TED Talks' pedagogical optimization is limited primarily by attempts to captivate the interest and attention of the audience. The user is unable to customize the content. The Talks can be reused and shared easily and freely. There is no interactivity in the form of tests or games. Nor is there progress tracking or feedback. It is entirely up to the user to decide if and what TED Talks to watch, as well as what parts to watch and what to skip. The user can decide the time, place and speed of playing the Talks, and decide which topics to explore. This explains also the aim of TED of creating interest to learn more, rather than give an exhaustive lecture on a topic. The audience is never guaranteed. Instead, the Talks have to be so interesting and engaging that in the first place it attracts viewers, and then manages to keep them watching.

Important to note that the above description is limited to TED and TEdX talks. TED-Ed does provide videos with rich multimedia content and interactive elements, such as quizzes. Of interest to this thesis is that the most popular video Talk to date is Ken Robinson's talk about the role of creativity in education (Robinson, 2006, February).

4.4.3 YouTube

YouTube is a video-sharing website that launched in May 2005 and sold to Google in November 2006. YouTube reports to have over a billion users who watch hundreds of millions of hours of videos daily (YouTube). Users of the website are able to create and share videos, and rate, share, and comment on them. Furthermore, there is a community in which users can subscribe to channels of other users and communicate with them publicly and privately. The website also allows users to add videos to playlists and report them to YouTube. A broad range of video content can be found on the website, ranging from music videos, to documentaries, from audio books to movie trailers, and from video blogs to educational videos. The videos are uploaded by individuals as well as profit and non-profit organizations. In March 2017 the website is ranked as the second most popular website on the internet (Alexa, 2017, March-b). YouTube generates revenue through various sources, including their

Google AdSense program.

YouTube contains numerous educational videos and channels of high quality. The Khan Academy started casually on YouTube (Dreifus, 2014, January 27) and has since then grown into what is by some referred to as “the largest school in the world, at 10 million students strong” (Noer, 2012, November 19). Other educational channels include: Veritasium, a channel of science and engineering; Vsauce, a channel which answers unusually strange questions in a very thought-provoking and scientific manner; and CrashCourse, a channel on philosophy, games and physics. These courses depend on engaging and captivating their audiences that they do so successfully that they reach millions of viewers each. These channels are operated by only a few individuals, yet manage to have subscription numbers comparable to the population of a small country. This is especially impressive considering the voluntary viewership.

YouTube videos can be watched on virtually all devices that are connected to the internet and are capable of playing videos. The videos themselves offer practically only asynchronous communication, although live streaming is possible in which synchronous communication is an option. Furthermore, the comment and chat sections allow also for synchronous communication. There is nearly endless content from some of the most renowned instructors and researchers. However, interaction is rarely possible. The content can be viewed independent from time or space. Many instructional videos seem to apply pedagogical strategies, such as in the video by Pierce Cook on whether e-learning will revolutionize education (P. Cook, 2017). It seems designed for individual learning and not for learning in a social environment, not considering the social media component of YouTube. YouTube offers very good exchangeability, reusability, shareability and interoperability. The user cannot customize the experience much, nor is there much interactivity. The website also does not provide any learning environment with features such as progress tracking or feedback. The user is in control over what is viewed as well as the viewing pace. In general, the videos have very rich content with high quality animations and recordings.

4.4.4 Search Engines: Google

In a discussion on technology used for learning purposes, search engines such as Google should not be absent. While we will not discuss these in the same depth as some other implementations, it is important to consider their role in education briefly. Search engines are a critical tool in connecting users with all the information available online, including educational content. In this regard, search engines could arguably be considered the largest educational collections in existence. Through a single interface, a wealth of information about nearly any topic can be found almost instantly.

It may seem strange to consider Google as e-learning, as it is a general purpose tool for finding

information, not specifically designed for educational purposes. Partly this seems justified. As discussed in the chapter on e-learning definitions and characteristics it became clear that it is impossible to draw clear lines between what can be considered e-learning and what not. In part this is due to differences in definitions. However, another reason is that there are many subtle variations on many different dimensions. This is similar to biological evolution: each generation of a species belongs to the same species as the generation that came before, however, over several generations differences become large enough to recognize it as a distinct species. Similarly, the search engine Google is clearly a 'species' of technology distinct from Coursera or university courses offered online. While it may not be considered 'pure' e-learning, it has an important function in education.

The case of Jack Andraka illustrates the educational potential of Google's search engine and Wikipedia, who developed as a teenager a test for pancreatic cancer that is "168 times faster, over 26000 times less expensive, and over 400 times more sensitive than our current standard for pancreatic cancer detection" (Andraka, 2013, February). He did his research using Google and Wikipedia. It is however important to note that several researchers have criticized the claims he made (Sharon et al., 2012). Regardless, it does shows the potential of these media for education.

4.5 Learning Management Software (LMS)

4.5.1 Blackboard and Canvas

Blackboard Learn and Canvas are two of the largest Learning Management Systems (LMS) commercially available, with Blackboard Learn being used by 33% of US based colleges and universities and over 7 million enrolments. Canvas is used by 19,8% of colleges and universities in the US and has over 4,5 million enrolments. Blackboard has had a noticeable drop since the last update from EduTechnica, whereas Instructure's Canvas has had an increase in institutions adopting its LMS (Kroner, 2017, March).

Learning Management Systems are software applications used for the administration, tracking, organizing and delivery of courses. They offer a means of delivering course information and materials to the learners, administer tests and assignments to them and helps to track the progress of them. They can be used to support classroom-based instruction, as the basis of fully online courses, and everything in-between. LMSs generally serve to connect various aspects of the learning experience together. In this respect, they have a very different function from many of the other implementations discussed here. They are tools or containers for the actual learning experience, which is the content. An LMS can deliver the learning experience to the learner by tying multiple components of that experience together, such as study materials, course information, syllabi, web casts, a calendar,

information about assignments and a submission system, an e-mail system, fora, chat boxes, and any other component of the learning experience.

Both Blackboard and Canvas have apps for Android and iOS. At the time of writing the Blackboard Mobile Learn app received a 1,6 out of 5 rating based on 2522 reviews. The Android app received a 3,1 out of 5 rating based on 54346 votes. The Canvas app for iOS and Android received scores of 4,7 based on 302 reviews and 4,4 based on 27913 votes respectively.

In 2015 the SURF cooperation started a public procurement for a new LMS for eight institutions. The SURF cooperation is an organization in which Dutch universities, colleges, medical centres, research institutes and community colleges collaborate on the innovation of ICT. In the final phase on the April 1st 2016 Canvas and Blackboard were two of four remaining suppliers of LMSs (Coöperatie SURF, 2017). In a news article from January 2017 it was announced that at the University of Twente Blackboard will be replaced by Canvas. Hans Oeloff, the director of the Centre for Educational Support, is cited as saying that based on several days of testing Canvas was by far the best LMS. This was mainly based on user-friendliness, intuitiveness, and the flexibility of the system. The article also gives two views of a student and teacher, which echo the reviews found of the two LMSs elsewhere online, that Blackboard is relatively less user-friendly and is often experienced more like a necessary hassle than a system supportive of education (Visschedijk, 2017).

4.6 Software

4.6.1 Anki

Anki is memorization software based on spaced repetition flashcards. The information that the learner wants to memorize is contained on flashcards. This is similar to the traditional paper or cardboard cards. Both sides of the card have information on them. The learner reads the front side and has to try to remember the associated information found on the back. This works well for memorizing associations, such as learning words from English to another language. It can be used to memorize also other information, such as historical dates, lists, and facts. Recall testing is not only effective for assessing memorization. A study that compared two groups of students memorizing prose passages, in which one group spend testing recall after learning, while the other group spend the same amount of time rehearsing the material, found that on delayed tests students that tested recall remembered more. This means that besides assessing memorization, recall testing also effectively contributes to long-term memory retention (Henry L. Roediger & Karpicke, 2006).

Anki is furthermore based on spaced repetition. This means that with each correct recall the time of retest is increased. On an incorrect recall the flashcard is rehearsed more frequently. This is based on Ebbinghaus' forgetting curve research, which shows the rate of decay of memories. Subsequent research demonstrated that increasing the time between repeated assessments helps memorization (Pavlik & Anderson, 2005). The same principle forms the basis in the Leitner system. Anki tracks the optimal time for repeats of rehearsals automatically for the user.

On the website of Anki, the user can download existing decks. These are collections of flashcards the user can memorize. The users can also create their own collections of flashcards. The cards can contain HTML code, images, sounds and text. The software is easy to use, yet offers a large array of features and options. The software is available for PC, Mac, Linux/BSD, Android, and iOS. For iOS the app requires a purchase. The software is available for free on all other systems. It is furthermore possible to use the online web-based version for free. Anki can synchronize between devices.

4.6.2 Language Learning Software

There are numerous software applications facilitating language learning. Some of the most well-known of these are: Anki, Memrise, DuoLingo, Babbel, Rosetta Stone and Pimsleur. Since Anki can be used for memorization in general, not only specifically to language learning, it was addressed more in-depth before. The discussion of these applications here is limited to what is of interest for educational technology within HE in general, and for the development of scenarios in particular.

Memrise is a language-learning platform accessible via their website, and iOS and Android apps. Memrise gamifies language learning, combining memorization techniques with motivational elements. It is free to use and free of advertisements. There is a paid Memrise Pro subscription available, which offers additional features. Memrise gives points to learners as they progress, and tracks these scores on leader boards, adding social and competitive elements. Grand memory champion and co-founder Ed Cooke says that what distinguishes Memrise is that it makes learning fun and the learner proud of accomplishments. It is designed to engage the learner (Bjoran, 2011).

He explains Memrise is based on three principles: vivid encoding, systematic reminders and adaptive testing. The vivid encoding principle refers to connecting otherwise arbitrary words to images, creating more and stronger connections in the brain to the word, allowing faster and more accurate recall. The second principle refers to a systematic way of reminder users to rehearse and retest their knowledge. The algorithm used is developed by co-founder and Princeton neuroscientist Greg Detre. The third principle, adaptive testing, refers to testing the right memories at the right time

by varying question difficulty based on the user's performance (Bjoran, 2011).

There is almost no published research on Memrise. The study that was available suggests that Memrise outperforms students' otherwise self-selected methods. Memrise was found to be more enjoyable, convenient and effective (Walker, 2016). Memrise collaborates with scientists on their scientific advisory board (Memrise).

DuoLingo and Babbel take similar approaches to Memrise. Each of these language learning platform has some differences, but are comparable in terms of our analysis interest. DuoLingo offers free language courses, with some additional features that require payment.

Rosetta Stone is a software that uses images, text and sound to teach users one over 30 languages. There are substantial differences with Memrise, DuoLingo, Babbel and other competitors. It provides a learning experience similar to how babies and young children learn their native language. Is shows photos of people, objects and activities and shows associated phrases in the target language via text and recorded audio. The user has to actively engage with the content to extract the meaning of what is read and heard. This includes the meaning of words, activities, as well as the underlying grammar of phrases. There is no explanation of any kind, including grammar. This may at times be frustrating, especially when it concerns irregular grammar. It also requires learners to be actively engaged with content to make sense of what they hear and see. This active processing tends to improve learning. Language courses are split into levels. An individual level of a single language costs $99 on their website, while all five levels of a language costs $199. There are also subscription plans available in which the user has unlimited access to all levels of a language starting from $64 per three months to $199 for two years. These costs are relatively very high compared to its competitors. However, the product is of a higher complexity and greater production value. There are also discounts available for students and military personnel.

Pimsleur and Michel Thomas offer similar type of language courses, although with different pedagogical approaches. Both are audio courses in which the learner is taught a new language by listening to a recording. Pimsleur slowly builds up the fundamentals of a language, and gives explanations about pronunciation and grammar. Michel Thomas generally grows the language more quickly via certain tricks. Many of the European languages have large parts of their vocabulary in common. Michel Thomas teaches students how to identify which words are common based on, for example, the word endings. Pimsleur uses highly scripted language lessons, in which everything the learner hears is planned. Michel Thomas has a structured build-up but uses inexperienced students to simulate a real-life teaching situation. The interactions between Michel Thomas and the students

provide a more traditional classroom experience.

4.6.3 University Apps

Many universities have apps for Android and iOS. The University of Twente as the “Campus - University of Twente” app, which keeps tracks of events and appointments, has maps of the campus, a route planner, and offers a community message board. Other Dutch Universities also offer their own apps, such as the Radboud University Intls app for the University Nijmegen, which offers features such as admission and application information, and information to find accommodation and visa requirements. It also has a map of the campus and social media features. The Erasmus University offers the OSIRIS Erasmus University app, which primarily focuses on rosters for lectures, an overview of grades, and announcements.

A short investigation on the Android and iOS app stores shows that many universities offer apps, and most offer similar kind of features. These features are mainly focused on four broad categories of information: 1) navigating campus, 2) course information, 3) study progress and 4) finding services on campus. For our analysis it is noteworthy that very little is geared specifically to the actual educational experience. The apps provide facilitative information, not actual educational experiences.

The Learning Management Systems (LMSs), Blackboard and Canvas, each have apps as well. The Blackboard Mobile Learn app provides access to its LMS environment via the app on mobile devices. The features and design are very simple yet functional. Some integration is lacking, such as with course information on Osiris, as it loads a webpage rather than in-app information. Canvas has a much more polished looking app. Furthermore, where Blackboard is very functional with minimum features, Canvas seems to create a mobile learning experience. The student can watch videos, take quizzes, and listen to podcasts. Similar to findings on Blackboard and Canvas in general, the apps for Canvas have a much more user-friendly appearance. Furthermore, where Blackboard seems to be technologically driven, Canvas seems to have a more pedagogical-centred approach. This places the user-experience central and seems more innovative. While especially the Canvas app seems to create more of a mobile educational experience, the apps still seem to be little more than supporting the existing educational experience, rather than redesign education for a mobile platform.

4.6.4 Solo Learn: Python, SQL, C++, PHP, CSS, Java

Solo Learn offers several apps that teach the user how to code in various coding languages, such as Python, PHP, Java, JavaScript, and many others. It provides instruction, quizzes, and in-app practice exercises. The app lets the user write and run code from within the app. There is a competitive

and social element in the form of challenges, where the user competes with other users on exercises. The app gamifies learning to code. The app is free of use and shows no advertisements.

4.6.5 Other apps

TED has created the TED Talks app, which is available for Android and iOS through which users can see TED and TEdX talks. It has a sleek and intuitive interface. It enables users to find the newest, trending, and most viewed talks. It has curated playlists based on themes. It also lets users pick a theme and the amount of time they have available; after which it comes with suggested TED Talks. Users can register an account to create playlists, keep track of talks they liked, download talks to their mobile devices and view a history of talks they watched or listened to. Furthermore, it has podcasts and community features.

NASA released an app that lets users explore the galaxy virtually via over 15000 images, videos information on missions, feature stories, streaming TV broadcasts of NASA and tweets, launch information and countdown clocks. It furthermore has ISS and Earth orbiting satellite trackers.

Blinkist provides summaries of some of the most popular nonfiction books. It currently has summaries of over 1500 books. These are available in text and audio format. It distils the best business books into the main ideas and stories. The user can download the audio or text so it is available for offline use. It furthermore offers features to store favourites, create playlists, and expert-curated reading lists.

4.7 Tutorials

4.7.1 Lynda.com

Lynda.com is an online education platform that offers video courses on numerous software, programming, creative and business skills. The website currently operates on a subscription basis with a fixed monthly fee, for which the user can watch any videos from any of the available courses.

The company was acquired by LinkedIn in 2015, which is part of the Economic Graph vision of LinkedIn. This is an ambition of LinkedIn to every member in the global workforce, as well as every company, organization, and institutions of education on their network. LinkedIn wants to connect all this with the skills necessary to perform all jobs in the world, and provide a graphical representation of the global workforce. Lynda.com is part of this vision since LinkedIn beliefs it can significantly contribute to the learning and development of new skills that enables professionals worldwide to accelerate their careers. Part of the vision is to integrate Lynda.com courses into the LinkedIn network, in which users of the network site are directly shown courses that allows them to attain the skills

needed for the jobs in which they are interested (Roslansky, 2015, April). Only a year later, in 2016, Microsoft acquired LinkedIn (Greene, 2016, June). Founder Lynda Weinman said schools "initially felt very threatened" by Lynda.com, but that many now license access to the site for their students and faculty members (Wingfield, 2013, March).

4.7.2 CreativeLive

CreativeLive is an online education platform broadcasting live courses by world renowned experts for free. The site uses a freemium pricing model which allows users to watch for free while it the classes are streamed live. This promotes access to top-notch education which is not found elsewhere. However, to be able to save and later watch the videos again at anytime, anywhere a purchase is required. On average 20000 to 60000 people watch the live broadcasts, while the highest viewed course had 150000 viewers. The instructors reportedly earn six-figure payments for multiday courses (Wingfield, 2013, March). During recordings, there is a small studio audience that, together with the much larger online audience, provides input for the classes and thus adding an interactive element. Particularly telling for our analysis is the vision of co-founder and CEO Chase Jarvis:

"Overall the education industry is the world's largest industry that has yet to see real disruption and meaningful innovation. It is ripe for change and what we are seeing (and doing at CreativeLive and elsewhere on the web) is just the beginning. The future of education is not about 4 year degrees from brick buildings covered in ivy. It is more about what you know and what you can do, than where you picked up that knowledge. And it's less about pieces of paper that verify your knowledge and more about demonstrated application of that knowledge" (Schawbel, 2014, Jan).

4.7.3 Udemy

Udemy is an online education platform that offers courses that build professional skills, and teach academic disciplines. Udemy offers courses on topics such as computer programming, business, design, marketing, software applications, music, languages, and health and fitness. While other platforms curate instructors and courses, on Udemy anyone can become an instructor and release courses. This leads to an enormous catalogue of courses that varies greatly in quality. Udemy prioritizes the presentation of courses that are rated highly, yet ultimately it is up to the user to evaluate the quality of courses before making a purchase. There are free courses available, although often these are merely used for upselling, in which the user has to pay for additional content. Some courses are taught by instructors with extensive work and teaching experience, among them are also university professors. Upon completion, Udemy offers certificates which can be shared on social media.

5. Methodology: Designing Scenarios

5.1 Scenario Thinking

5.1.1 About Scenario Thinking

The scenarios designed in this chapter are based on a method called scenarios thinking. It is a strategic planning tool that imagines several potential futures which are captured in stories. It engages the peripheral view by considering potential changes in the future. It is relatively easy to predict and plan for events that follow long-term continuing trends. In contrast, low probabilistic events are often surprising. They are possible to imagine, but are usually not taken into account or planned for. This is where scenario thinking is helpful.

Scenario thinking can promote collaborative thinking by surfacing a diversity of views, assumptions and knowledge dispersed throughout an organization. Collected in a systematic manner, this can help detect shifts in the environment at an early stage. It furthermore helps shape a shared understanding of the environment and the organization in it, which can help create a strategic planning and shared vision as well as foster alignment for them. Vivid scenarios can help create a sense of urgency and thereby facilitate organizational change (For more information, see: Ertel, Fulton, & Scearce, 2007; Hindle, 2012; Holman, Devane, & Cady, 2007; Roxburgh, 2009).

5.1.2 Five Fundamental Principles of Scenario Thinking

Scenario thinking provides the greatest benefits when following some fundamental principles. Firstly, it is crucial to understand that the scenarios – though plausible – are **not accurate predictions**. The future is uncertain. The only constant is change. The scenarios are exaggerations of different directions in which the future may be heading. While the future may be impossible to predict, it is possible to plan and prepare for multiple potential futures. As such, the goal is not to have one scenario as close as possible to the actual future. The goal is to develop a better understanding of the various ways in which our environment may change, and how this could affect us. Multiple stories based on one or more dimensions help with this.

Secondly, scenarios focus on those aspects of the future that are **most uncertain and most impactful**. Scenario thinking has no advantage if what the scenarios describe are already well-considered and planned for. The added-value of scenarios is to bring the periphery to the centre of attention, and to scan the organization for early signs of unexpected change. Similarly, the greater these changes impact the organization the higher the priority to include them in the scenarios.

Thirdly, the **inclusion of diverse groups of stakeholders** is important in the process of developing and analysing the scenarios. A diversity of perspectives, assumptions, worries and hopes helps expand the vision of the organization to the periphery. It increases the likelihood of including the main drivers of unexpected change, and makes for more believable stories.

Fourthly, scenario thinking requires **outside-in thinking**: a focus on how environmental changes impact the organization. Most individuals and organizations tend to think inside-out and focus on what is most familiar to them: their own work, their own way of doing things, and the current context (Ertel et al., 2007). The previous chapter's inclusion of e-learning implementations beyond those from HE contribute to this.

Fifthly, it is imperative to take a **long view**: to look beyond the immediate demands of everyday (Ertel et al., 2007). It requires looking further into the future. In e-learning this means looking beyond current practices of teaching, beyond existing e-learning implementations and its current track record. It requires imagining what the technology, pedagogy and organization of education may develop into.

Lastly, the scenarios should be **vivid and provocative stories**. They should provoke thoughts, emotions and reactions. It helps to imagine polar opposite futures on one or more dimensions. The stories are not to be conservative estimates of potential futures, nor the most likely futures. Scenarios are not meant to describe the future, but to help shape it.

5.1.3 Process of Developing the Scenarios

The process of developing the scenarios consists broadly of four parts: 1) the development of two dimensions, 2) identifying the main areas of e-learning, 3) the development of the 'building blocks', and 4) the development of the scenarios matrix. While the development of these parts are discussed sequentially, in reality these were developed alternatingly through several iterations to ensure coherence within and between these parts.

5.2 The Dimensions of the Scenarios

The previous chapters provided a broad integrative view of the literature and existing e-learning implementations, resulting in a comprehensive overview of the main elements of e-learning. The scenarios developed in this thesis are based on two dimensions that our analysis identified as the probably main drivers of change in e-learning in higher education. While using dimensions is not strictly necessary in scenario thinking, they provide a contrast helpful to understanding the impact of particular changes. As previously discussed, past predictions of the future have rarely been accurate. Considering two opposite futures helps prevent planning towards a future that will never happen.

5.2.1 Five Criteria for the Dimensions

The two dimensions have been developed based on **five criteria**. Firstly, the dimensions should have a high **degree of independence** from another. Since all domains interact, it is hard to imagine any dimensions without some overlap. However, this correlation between the dimensions should not be too big. Secondly, the two dimensions should **incorporate most of the building blocks** in a coherent manner. Thirdly, the dimensions should **meaningfully interact** with these building blocks. This means that the dimensions should lead to variation on the building blocks, resulting in different stories of the future. Fourthly, scenario thinking requires a substantial degree of **uncertainty** about future change on the dimensions (Ertel et al., 2007). Lastly, there should be an important focus on the **organizational aspect**, as there is currently a lack of focus on this within the literature and e-learning practice.

5.2.2 Brief Overview of the Two Dimensions

Dimension 1: Use of Technology. Technologies and knowledge can only positively impact society when used. One of the main purposes of research is to drive innovation within society. And, even though the literature has addressed the first five domains much more extensively than the sixth, as the literature review previously indicated, within HE there is very little innovation of technology-enhanced education. E-learning research is only in its infancy. Yet, much of what is known or already available is unutilized. As the literature review indicated, e-learning innovation has great potential to have substantial positive impacts, depending on the use of technology. One of the greatest uncertainties is how the use of technology to enhance education will develop in the future. There is an extensive literature on the acceptance and use of technology which relates strongly to all six domains. This makes the use of technology highly suitable as a dimension for scenario thinking.

Dimension 2: Approach to Organizing. Compared to the sixth domain, the first five domains (see Figure 3) have in common that relatively much has been written about them. Since the process of organizing has gotten almost no attention in the literature there is a high degree of uncertainty for the future. Furthermore, change within this domain could have a substantial impact on HE. As such, this domain satisfies two of the most important criteria for the scenario dimensions. The domain by itself is not yet a dimension. A common theme across the building blocks within this domain is the approach to organizing that HEIs employ: **fragmented** or **integral** (see Table 6 in Appendix A). This refers to the breadth of consideration given to all the various aspects of e-learning. This dimension ties all the six domains together in an integrative manner. In addition, it places the process of organizing in a central position that influences and moderates the effects of all other domains.

5.5 Dimension 1: Acceptance and Use of Technology

The first of two scenario dimensions is the acceptance and use of technology. The innovation of technology-enhanced HE is lacking. Currently available technology and knowledge are already capable of supporting the development and implementation of high-quality e-learning applications containing pedagogically-optimized rich multimedia content. Even the currently most innovative HE e-learning implementations tend to depend on several decades old technology. While, contemporary technology allows for computer-enhanced education far more advanced than exists today.

5.5.1 Defining 'Use of Technology'.

This dimension is grounded on six of the most relevant and popular theories of technology acceptance, as identified by Van Dijk, De Graaf, and Allouch (Forthcoming). The acceptance of technology literature is complex and multifaceted. The technology acceptance theories have been reduced to a single dimension. What 'use of technology' refers to may not be self-evident. Use of e-learning consists of more than the intended use by students. The dimension 'use of technology' is meant to refer to: 1) understanding, 2) decision, 3) use, 4) appropriation, and 5) development. These are not a static one-time events or phases (Van Dijk et al., Forthcoming), but rather continuously and simultaneously occurring processes. For the purpose of this study, all these meanings are simplified by referring to all these concepts as the use of technology.

Understanding is the process of becoming familiar with the technology, and gaining knowledge about and an understanding of the technology (Rogers, 2003). Within an organizational setting this refers to the degree of knowledge sharing about relevant learning-enhancing technologies, and enabling organizational members to try out educational innovations. **Decision**-making is the process by which the technology is accepted or rejected, intentions towards the technology emerge, and decisions are made on the adoption or non-adoption. This can be both conscious and unconscious (Rosengren, Wenner, & Palmgren, 1985). **Use** refers to the actual use of the technology. This includes the intended as well as the actual use of the technology (Venkatesh, Morris, Davis, & Davis, 2003). This meaning is the most straightforward. The use and development of technology depend on the skills and knowledge of both the users and developers and adequate planning thereof (Ajzen, 1991). **Appropriation** describes the process of mutual adaptation of the technology and daily life. In this process, the technology may be changed to fit the situation, or people adjust their habits and activities to the technology. The technology may also be used in unintended ways (Silverstone & Haddon, 1996; Silverstone & Hirsch, 2005). **Development** is the creation and continued development of the technology. According to Domestication Theory people are not merely passive users of technology;

they may also actively contribute to its creation or find unintended uses (Silverstone & Haddon, 1996; Silverstone & Hirsch, 2005).

5.5.2 Creating a Scale

A dimension allows for variance in two directions of its scale. A dimension is a matter of degree. This dimension ranges from low to high use of technology. It is important that it is clear what this means. Firstly, the previous paragraph defined what 'use of technology' means. In addition, there are three kinds of degrees that contribute to the position on this dimension: 1) frequency, 2) extensiveness of use, 3) the specific relevancy to learning, and 4) multitude of uses.

Firstly, high use of technology means **frequent use** of e-learning. As with the other kinds of degree, this applies to all previously defined meanings of 'use of technology'. Secondly, high use of technology entails more **extensive use** of computer technology to enhance education. A greater number of e-learning characteristics utilized means a higher use of technology (see Appendix A, Table 1). Technology is not a single thing, and not all technologies count equally. As such, old non-innovative implementations of common technologies are low on the scale. Thirdly, the position on the dimension is also determined by the degree to which the computer technology is **specifically relevant for learning**. This relates to what is referred to in the technology acceptance literature as the relative advantage of the technology (Rogers, 2003) or perceived usefulness (Davis, 1989; Venkatesh et al., 2003). As chapter 2 discussed, the mere use of technology within an educational setting is insufficient to bring about positive effects. Technology only matters if it has a meaningful role to education. Regardless of the involvement of technology, similar experiences lead to similar learning outcomes. The same applies to replacing low technology with high technology. The literature distinguishes between perceived and actual usefulness. Actual usefulness of e-learning may lead to better results on desired learning outcomes, yet this depends on the perceived usefulness for e-learning to be used (Rosengren et al., 1985). Fourthly, the use of a **multitude of meanings** of 'use of technology' leads to a higher position. The previous paragraph describes five different meanings of 'use of technology'. In particular, the use, appropriation and development types contribute to higher scores on this dimension. Thus universities that are only passive users of e-learning score low, while those that use and develop it score high.

5.6 Dimension 2: Approach to Organizing

Findings from the literature make it clear that effective acceptance and use of technology is multifaceted and highly complex. Any chance of fulfilling the revolutionizing promises of e-learning requires equally sophisticated implementations. It is unrealistic to have revolutionary expectations from small changes. This limits what any one individual or team can accomplish. Unlocking the potential of e-learning requires substantial coordination. The second dimension is based solely on the sixth e-learning domain of organizing, which is nearly entirely absent in the e-learning literature despite the technology acceptance theories demonstrating how crucial organizational processes are to the long-term acceptance of innovation. This second dimension describes the degree in which coordination is fragmented or integral.

The importance of an integral approach can not only be based on the e-learning and technology acceptance literatures, but also on the management literature. A recent McKinsey article (Khan, Lunawat, & Rahul, 2017, October) describes that a fragmented approach can lead to confusion among stakeholders and create a split in employee identification with either new or old ways of working. In contrast, an integrated model reportedly leads to greater process efficiencies, reduce redundancies, faster product delivery, facilitate standardization, and ensure system stability and interoperability. ***Blue ocean strategy*** (Kim & Mauborgne, 2005, 2017) describes two contrasting strategies: a blue and a red ocean strategy. The red ocean symbolizes a market crowded with head-to-head competition. The authors state that most organizations choose a red ocean strategy, by seeking sustainable profitable growth by doing the same thing everyone else is doing, and competing on who does it best. Organizations should try moving to a blue ocean, represents an uncontested market space, and look for growth opportunities in untapped new markets by doing things differently. There are many other similarities between the blue ocean strategy and the approach taken in this thesis, and of the organizing dimension specifically. Firstly, both take a big picture focus. Secondly, the blue ocean strategy expands beyond existing demands to widen access to new markets. Thirdly, it also advocates imagining new configurations of characteristics of innovations. Fourthly, it prescribes examining the organization's own industry as well as alternative industries, as is found in chapter 4's examination of e-learning implementations. Fifthly, blue ocean strategy has a focus on both the user and the product, similar to the focus of four of six e-learning domains. Lastly, similar to scenario thinking it also focuses on the future (Kim & Mauborgne, 2005, 2017).

5.6.1 Creating a Scale

What is meant by an integral approach to organizing? Each of the building blocks in the organizing category (see Appendix A, Table 6) helps define this concept. Based on this, there are five elements of an organizational approach that determine its position on this dimension: 1) transdisciplinary and whole systems, 2) synergy, 3) pro-active coordination, 4) imagination and vision and 5) strategy. Pro-active coordination is about taking action in anticipation of a future, with desirable outcomes in mind. Such anticipating of a future requires imagination and vision. While actions taken with intent rely on strategy. Doing so integrally is about creating synergy through a broad approach.

Firstly, a **transdisciplinary and whole systems** approach is needed. The e-learning and technology acceptance literatures show that high-quality e-learning development and implementation requires a large diversity of knowledge and skills from numerous people from different disciplines. No single individual can possess all necessary skills and knowledge. An integral approach entails merging the knowledge and skills from multiple disciplines in the creation of a common product. This should not take either a unidisciplinary or multidisciplinary approach. Instead, an integral coordination means taking a transdisciplinary approach, which has a multiplying rather than additive effect. This means integrating the sciences within the context, and transcending boundaries (Choi & Pak, 2006). This requires collaboration at an individual and organizational level, involving divisions of labour. It furthermore entails a holistic view of technology, education and organizations. Integral furthermore means incorporating a broad view of the organization, inclusive of the plurality of visions, goals, strategies and stakeholders.

Secondly, the integral approach is about creating **synergy**. Synergy describes situations in which the whole is greater than the sum of its parts. This occurs via multiplicative effects of the transdisciplinary approach and whole-systems thinking. Synergy is about multiple features jointly creating an effect larger than the effects of the individual features alone. The number of opportunities for synergy logically increases exponentially with each increase in options, such as the number of disciplines or e-learning features that could be used in an integral manner. As such, the complexity of e-learning offers opportunities for synergy. It requires more than individual changes to any of the characteristics of e-learning. This requires a broad view. It requires considering how all elements could fit and work together in unison. This requires more than the involvement of multiple disciplines. It requires multiple disciplines to be integrated and transcended. Synergy is about complex interaction effects. Synergy is about moving past either-or thinking. It is about creating win-win situations. This is what Riel and Martin (2017) refer to as integrative thinking. At its heart is an integral view of all relevant aspects and integration of all available information to come up with new and better solutions.

Thirdly, it requires **imagination and vision**. It is about integrating both what is and what could be. In an integral approach this visioning is done holistically. It is not about ignoring the current reality. Reality does not exist only at this moment in time. It exists in the past, present and future. As Peter Drucker said: “the best way to predict the future is to create it”. And to create something that is real, requires imagining something that is not. The process of imagining the future of e-learning should start with why, rather than what (Sinek, 2011). This means to focus on the purpose. An organization with a clear purpose is capable of exploring alternative processes of accomplishing it. This temporarily unchains the thinker from reality as it is. In e-learning this involves considering alternatives to existing and easily developed implementations.

Fourthly, **pro-active coordination** is needed to turn the imagined synergy of an integral vision into reality. The previous three aspects do not lead to change by themselves. To effect change they have to be acted upon. Various structural characteristics of universities makes universities relatively conservative and resistant to change (Salmon, 2005). This makes centralized organizational change challenging (see the discussion and conclusion). The complexity inherent to high-quality e-learning development and implementation necessitate a transdisciplinary approach. This involves shifts in human resources, new and different divisions of labour, and new collaborations on all levels. All these processes necessitate pro-active and centralized coordination. Coordination is about communication. Through communication people gain awareness and knowledge of e-learning (Rogers, 2003; Van Dijk et al., Forthcoming), form attitudes, beliefs and expectations about the technology (Ajzen, 1991; Davis, 1989; Karapanos, Zimmerman, Forlizzi, & Martens, 2009; Sung, Christensen, & Grinter, 2009), and influence each other (Venkatesh et al., 2003), which may depend on implicit assumptions (Ajzen, 1991). Currently, HEIs underutilize and undermanaged communication about e-learning, hampering knowledge sharing and sustaining misconceptions about e-learning. Centralized coordination does not mean top-down decision making, but about ensuring all organization parts are connected efficiently and effectively (Carmichael, Rigby, & Sutherland, 2016).

Finally, moving from vision to reality requires action informed by **strategy**. An organization's vision does not intend to predict the future, but to create a desirable and envisioned future. Strategy is the plan on how to reach this goal. A university without strategy cannot act pro-actively. Online learning places universities at risk of disruptive innovation (Christensen et al., 2006).

5.3 The Six E-learning Domains

The previous chapters show three broad recurring themes of investigation: technology, pedagogy and the organization. The technological and pedagogical aspects in particular are often referred to in the e-learning literature, while the organizational aspect is still largely absent. Reordering the building blocks (see section 5.4) shows it is helpful to further specify these themes. With each broad theme divided into two sub-themes, there are a total of six e-learning domains used to describe the scenarios.

5.3.1 Three Main Themes of E-learning

Earlier chapters revealed two important themes within e-learning: the technological and learning aspects. Early e-learning initiatives were often overly focussed on the technology, which is still frequently the case. The temptation to focus on what is novel is understandable. Such a technology-centric view is oft criticized. This focus is depicted by the left-most drawing in Figure 2.

There is good evidence suggesting the focus should be on both technology and learning. The initial shift towards a more pedagogical view still had the tendency to focus primarily on the technology, by examining the direct effects of the medium. Our literature review revealed that technology by itself has overall little effect on learning outcomes. This represents a technology-centred perspective viewed through a pedagogical lens. More recent research has become more balanced, by reimagining learning enhanced by technology. Such as, how technology can be utilized to maximize desired learning outcomes. Figure 2 depicts this inclusion of learning in the middle drawing.

However, an important third element is still largely missing: the organization. In contrast to the technology and pedagogy, almost nothing is written about organizational aspects of e-learning. Numerous studies address the organizational aspect very narrowly, such as by referring to organizational goals or non-innovative ICT policies. However, the organizational context in which e-learning in HE takes place seems largely taken for granted, and assumed to be mostly unchanging. Yet, the chapters on e-learning effects and implementations (chapters 3 and 4) clearly demonstrate, the context of the HE organizations is crucial to achieving positive learning or organizational outcomes. This includes aspects such as processes, structures, culture, policies, leadership and management. It is important to distinguish learning from education. Learning may take place anytime and anywhere, both inside and outside of organizations. However, education generally refers to organized learning, taking place within an organization. This distinction is important as evidenced by e-learning innovation coming largely from outside traditional HEIs. Universities – the institutions that are supposed to drive societal innovation – with their conservative culture have ironically been largely unable to innovate

their education with technology. The e-learning literature acknowledges the tendency to overly focus on technology. In response, the literature has become more balanced between technology and learning, now another shift is needed to include the organizational aspect. This shift is depicted by the right-most drawing in Figure 2.

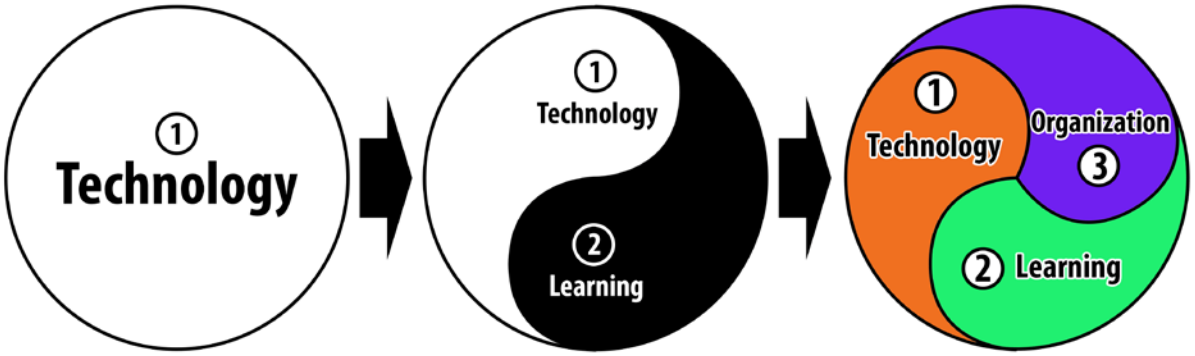

Figure 1 – Shifts of focus on the domains of e-learning. From an excessive focus on technology, to a more balanced focus via the inclusion of educational sciences, to finally an integrated focus on technology, pedagogy and the organizational context.

5.3.2 The Six E-learning Domains

The three broad themes can be meaningfully split into a total of six e-learning domains. The reordering of the building blocks (section 5.4) revealed that a further division helps to better describe the various aspects of e-learning and its future. The six e-learning domains are: 1) technology, 2) e-learning development, 3) learning, 4) user-centred learning experience, 5) organizational goals and strategy, and 6) the process of organizing (see Appendix A, Table 6). This distinction is helpful and reflects distinct literatures or issues addressed within the literature. Furthermore, this division reveals similarities between the otherwise seemingly three distinct themes of technology, learning and organization. An alternative three-part division could be process (development and organizing), means (technology and learning), ends (user-centred, and organizational goals and strategy). The division into six domains makes the scenarios more coherent by discussing technical and organizational e-learning development together. Below each of the six domains are briefly described.

Firstly, the domain of **technology** refers to 'the product' of e-learning. It describes the innovation in terms of hardware and software. This is what most defines e-learning. While there is virtually no agreement on a definition of e-learning (see chapter 2), all definitions include at a minimum the use of computers. This domain describes the type of technology used in the learning experience, and the degree in which that experience dependents on technology for its delivery.

Secondly, e-learning **development** refers to the practical creation aspects of e-learning. This includes the technical work such as programming and scripting the software applications, as well as the design work such as user experience design, graphics design, photography and video editing.

Thirdly, **learning** refers to the educational aspect of e-learning. It is about the application of pedagogical principles to optimize the effects of e-learning on learning outcomes. It includes instructional design and devising instructional strategies. This theme also encompasses the use of interactivity, progress tracking and feedback.

Fourthly, **user-centred learning experience** refers to the experience of various groups of users with the e-learning implementations. This relates to the educational effects of e-learning on users, such as the effect on exam scores, the attitudes of the users towards the subject and the course, the time required to study, etc. This domain is about the (dis)advantages of e-learning for the user, such as flexibility and customizability. The user includes both students and instructors.

Fifthly, **organizational goals and strategy** relates to the organizational goals of HEIs. These goals include increasing access and enrolment, reducing costs and increasing revenue, streamlining curricula, and improving the reputation. It is the organizational counterpart of the user-centred domain. The e-learning literature limits its discussion on organizational aspects of e-learning mostly to this domain. As such, this thesis' critique of a lack of attention for organizational aspects of e-learning does not apply to the aspects of this domain. However, this domain represents only a very small fraction of the organizational aspects of e-learning.

Sixthly and lastly, the **process of organizing** refers to all the other organizational aspects of HE, such as organizational identity, vision, leadership and management, implementation, organizational culture, human resources, training, policymaking, setting incentives, stakeholder management, etc. As the chapters on e-learning effects and implementations show, this is crucial to fully exploiting the potential of e-learning. This domain is referred to interchangeably within this thesis as the 'process of organizing' and 'organizing'. This reflects the contrast with the fifth domain by emphasizing that organizations are constituted through processes of organizing (McPhee & Zaug, 2009).

Figure 3 depicts the proposed refocus of e-learning research, development and implementation based on the above six domains. All of these six domains are to be addressed to be able to utilize the full potential of e-learning. These six domains serve as the basis for the **framework of the scenarios**, which consists of the building blocks grouped by each of the six domains (see Appendix A, Table 6 for the Scenario Framework).

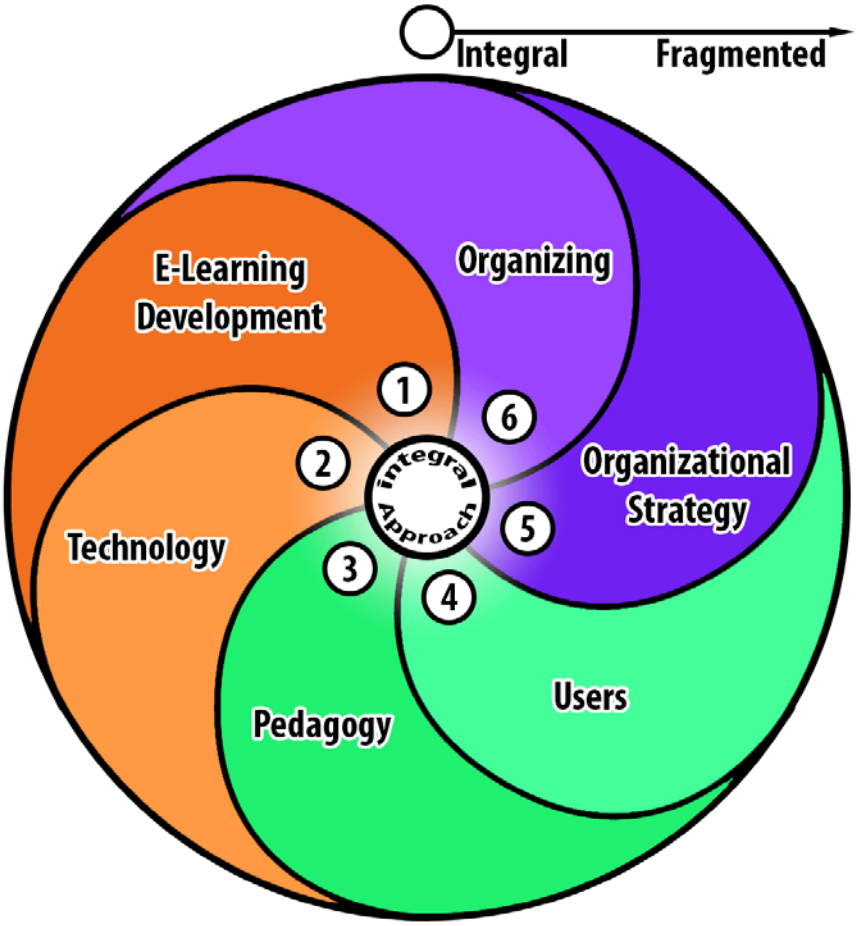

Figure 2 – The six main domains of e-learning in HE, formed out of the three overarching areas: technology, learning and the organization. The simultaneous whole-systems integration of all six areas is crucial to the successful development and implementation of high quality e-learning. This is represented by the centre of the figure where all areas connect. Conversely, the outside of the circle, with large single colour areas, represents the fragmented approach.

5.4 The Building Blocks

The scenarios are four stories about what the future of e-learning in HE could look like. The scenarios are positioned along two dimensions and are constructed based on the building blocks. The building blocks help describe each scenario in a structured and systematic way.

Collecting all elements. The first phase in the process of constructing the building blocks is the collection of all relevant elements from the previous three chapter (chapter 2-4). The result is the tables of elements (see Appendix A, Table 2 and 3). In total, the three chapters resulted in 59 elements.

Merging elements into clusters. In the second phase, the elements go through three steps to merge and filter them. The first step is the merging of elements, based on the degree of relevance and meaningfulness of the elements relative to the dimensions. Some elements are very relevant and meaningful as a group, but not by themselves, and as such have been merged together into a cluster. There were three merging criteria: 1) similarity, 2) broad applicability, and 3) redundancy. Elements fit the similarity criterion if there is strong similarity with other elements relative to the dimensions of the scenarios. Elements fit the broad applicability criterion if they do not warrant discussion in each scenario. Lastly, elements that fit the redundancy criterion have been discussed sufficiently in previous chapters, and do not warrant sufficiently extra attention within the scenarios. After merging, the 59 elements from the three chapters were grouped into 33 clusters (see Appendix A, Table 4 and 5).

Exclusion and inclusion criteria. Next, inclusion and exclusion criteria filter the clusters. The result is three groups of clusters: 1) those that will be discussed in the scenarios, 2) those not discussed, and 3) those discussed but only briefly. This last group of clusters pertain to aspects of e-learning about which there are widespread misconceptions exist within society and the academic literature, or are so essential that they cannot be left out. An example is the medium. While the medium itself has no effect by itself on learning outcomes, it is the most fundamental aspect of the definition of e-learning. Of the 33 clusters a total of 23 clusters will be discussed relatively more elaborately (group 1), 4 clusters were excluded entirely (group 2), and 6 clusters will be discussed briefly (group 3). This results in 29 clusters that will be used as building blocks for the scenarios.

5.7 Scenario Matrix

The result of using the two dimensions within a matrix is four quadrants that represent the four scenarios. Each scenario represents a potential future with differing positions on the dimensions. The first dimension represents a future in which the focal university is characterized by a fragmented organizing approach, with a low use of technology. Scenario two represents a fragmented organizing approach, but high in use of technology. Scenario three represents universities using an integral approach, with low use of technology. Finally, scenario four represents an environment high in technology use with an integral organizing approach.

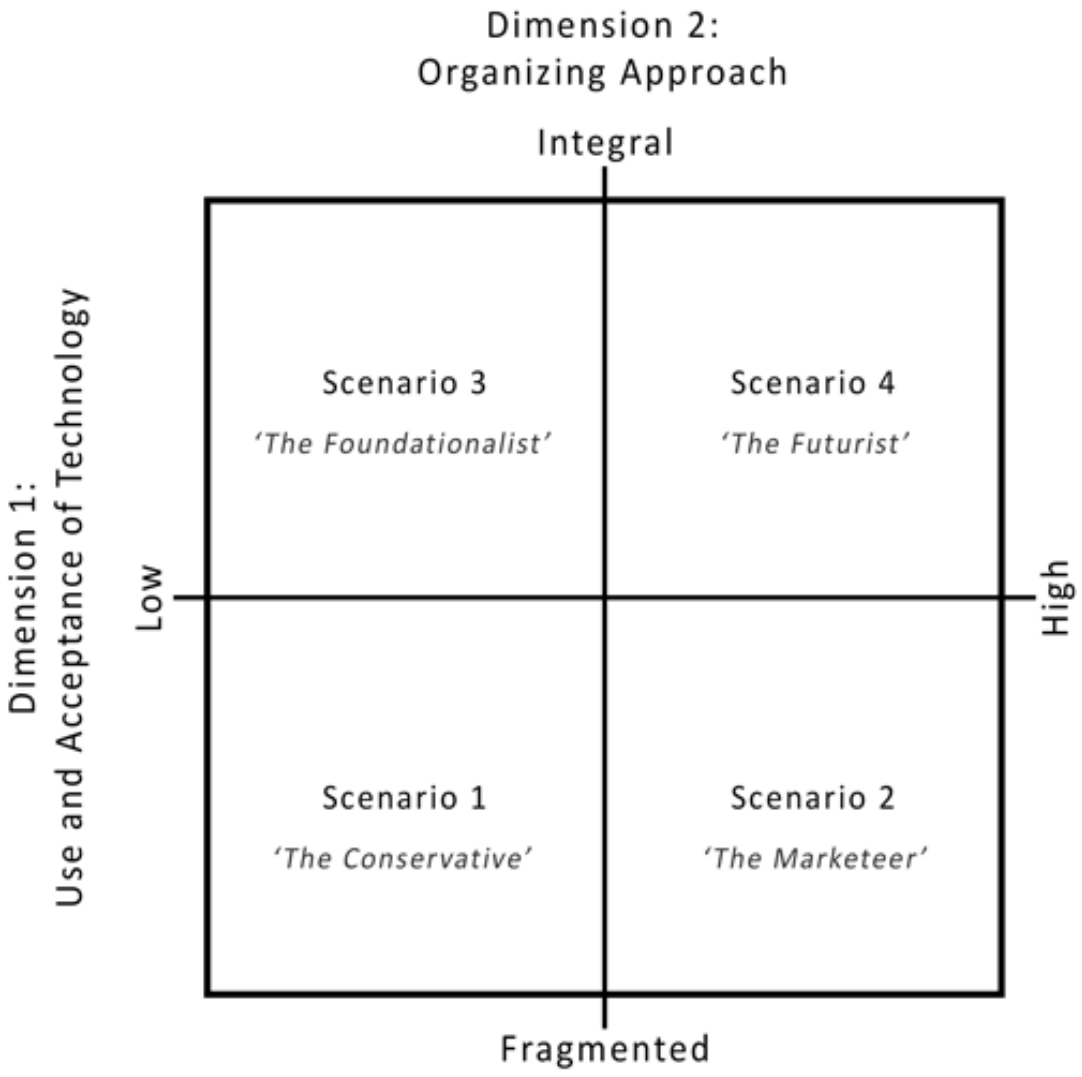

Figure 3 – Scenario matrix formed by the two dimensions with resulting four scenario. The blue lines represent the multiplying effect of the dimensions (see text below).

The building blocks and two dimensions interact with each other resulting in multiplicative effects. This means that the scenario stories are not simply an addition of outcomes on the two dimensions. For example, the story of scenario 1 is not a description of each building block where the use of technology is low **plus** a description of each building block where the organizing approach is fragmented. The story describes the building blocks **given** that the use of technology is low and the organizing approach is fragmented. In short, each scenario is the sum of descriptions of each building block given the positions on both dimensions.

Similarly, the dimensions interact with one another. While the two dimensions are conceptually highly independent, there is also substantial interplay between them. The degree to which universities are capable of using technology depends in part on how integral their coordination of e-learning is. As previously noted, for universities to be able to fully utilize learning-enhancing technologies they will have to adopt an integral approach. Similarly, universities that are high on technology use may reach greater levels of integrality on the organizing dimension.

It is important to note that the integral approach within this thesis is restricted to e-learning. It is not claimed that it is impossible for organizations to be highly integral in their approach without e-learning. However, it is impossible for organizations to use a highly integral approach with respect to e-learning without a high level of technology use. Nonetheless, considering technology is an important aspect in organizations, without addressing the technology component organizations by definition adopt a less integral approach.

In other words, high on use of technology differs in meaning for organizations depending on their position on the organizing approach dimension. The dimensions have multiplying effects on each other, higher positions on one dimension raises the maximum (or 'ceiling') of the other dimension. Similarly, the position is relative to other providers of HE and society in general. Low on either dimension does not mean a total absence. For example, low on use of technology does not mean that almost no technology is used, rather that it is used relatively little.

5.8 The Scenario Framework

The four scenario stories presented in this chapter follow a common framework. This scenario framework contains all elements that are described within all scenarios. The building blocks developed in the previous chapters are the foundation for the stories. The building blocks are the elements that describe how the potential futures differ depending on change on the two dimensions. The order of the stories is based on the six e-learning domains. All the building blocks are grouped in one of the six domains. The building blocks vary depending on the two dimensions.

There are slight variations in the order and grouping, depending on the position on the two dimensions. Since the change on the dimensions is multiplicative and not additive (see chapter 5), the model and framework are dynamic. As such, the building blocks not only change value, but sometimes also the domain they best fit. An example is the aspect of individual and organizational collaborations. Within the first scenario (low on both dimensions) this best fits the development domain, as it refers only to the development of e-learning by individuals working alone or in a small group. Within the fourth scenario (high on both dimensions) this aspect fits best in the organizing domain, as additional organizational processes shift its 'centre of gravity' towards the organizational domain.

Lastly, the building blocks interact with the two dimensions. Thus, the stories the building blocks form are enriched with the aspects of both the acceptance of technology theories and the integrality of organizing approach. The building blocks and the dimensions all interact with each other in a multiplicative manner. As a result, the form the building blocks take in each scenario can differ radically in some cases. The framework of the scenarios is graphically represented in Figure 5 below.

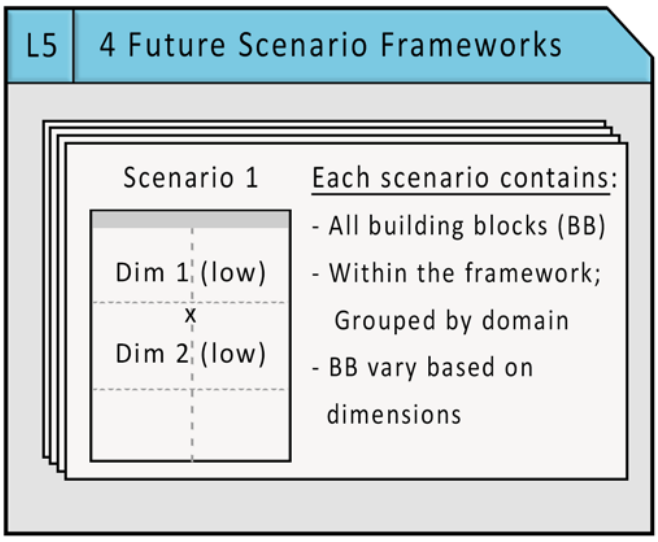

Figure 4. L5 – Graphical representation of the framework of the four scenarios.

Order within the Framework. The previous chapter grouped the six domains in three overarching groups: technology, education and organization. These three are the most recognizable distinct groups of disciplines or fields of study within the building blocks. A second way of grouping results in the same six domains, but with three different overarching groups based on the causality of relationships between these six domains. This way of grouping provides a better flow for the scenario stories. Coincidentally, both groupings result in all six domains to be in the same relative position in Figure 3. Each domain in Figure 3 has two direct neighbours. What changes is which neighbouring domain it groups with. The first group or theme refers to the experience and consists of the learning and technology domains. The second theme refers to the process of realization of this experience and consists of the development and organizing domains. The third theme refers to the outcomes on goals of individuals and users and consists of the users and organizational goals domains. This same order is used for the stories of the scenarios.

The order of the domains has the scenarios first give a glimpse into the future experience of HE. Then the scenarios describe the required development and organizing processes to make this future possible. Lastly, the scenarios describe the outcomes of these future learning experiences for various users and the HE organizations.

5.9 Overview of the Scenarios

The scenarios describe the potential future of universities and e-learning. The scenarios do not describe the change of a focal organization, but rather that of universities in general. The stories of the scenarios are meant to lead to action. The change will not happen by itself. Instead, it helps organizational members to imagine the changing universities and the role of e-learning within it, as well as the impact of change on their organization and themselves.

Timeframe. The Scenarios are set in the year 2030. This is approximately as far into the future, as the start of the MIT OpenCourseWare project is back in the past, which is one of the first major e-learning initiatives. This shows how young e-learning is, and how much has changed in such a short period. Envisioning e-learning in 2030 provides it with roughly twice the time to mature. It is far away enough into the future that it allows imagining a substantially different future. Yet, it is not so far away that the stories become unrealistically futuristic. Furthermore, looking forward just over a decade helps planning. It is far enough in the future that universities have time to plan for it, yet close enough to create a sense of urgency to start planning for these futures.

6. Scenarios

6.1 Scenario 1: The Conservative

Low Use and Acceptance of Technology (dimension 1)

Fragmented Approach of Organizing (dimension 2)

Learning. By 2030 the e-learning hype has passed. Universities still use technology to facilitate education, but these are non-innovative implementations that facilitate education rather than educate students directly. Decades of experimentation resulted in mostly comparable effects, generally at higher costs than 'traditional' higher education. E-learning is merely the latest addition to the list of technologies that were said to revolutionize education, but ultimately changed little. There has been a backlash to the pervasiveness of connected technology in society, which resulted in the banning of mobile phones in most classrooms. Technology still has a key role in universities, but not specifically to education. Integrative thinking is rarely applied to e-learning development or organizational processes in general. Compared to research, teaching remains an undervalued function of the university. Online courses are frequently digitalisations of traditional instruction and usually consists of recorded lectures, digital articles, example exam questions, assignments and general course information. Media are limited mainly to text, static images, and videos. E-learning innovation remains largely absent, and most capabilities of computers remain unused. Learning with e-learning remains a solitary activity with little meaningful interaction with instructors or other students. Interactivity is limited to simple exams. Tracking of progress and feedback is limited mainly to assignments handed in. Similarly, feedback students receive is restricted to assignments. There is no automated feedback, personalization or customization.

Technology. The forms of e-learning remain fairly simple and mainly technologically-oriented. It is common for universities to have a number of videos of lectures online. A broad range of technologies have always found their way into universities. However, use of technology is limited to its narrow definition. While the core technologies are actively and frequently used, more advanced technologies are used infrequently and only limitedly. Their use is mostly about experimentation with the technology – to sate the curiosity for innovation inherent within universities – rather than to enhance education. New technologies are used for teaching by digitalising century-old educational content and methods.

Core technologies that are frequently used include video streaming, video lectures, digitalized books and articles, existing software packages, learning management systems, content management

systems, quizzes, online forums, progress tracking and simple feedback. Peripheral technologies such as Virtual Reality, Augmented Reality, and Hologram Instruction, are rarely used and only to learn about rather than from the technology. Since the universities use technologies commonly used within society, without much adaption to the HE environment the perceived and real education-specific advantage of technology is relatively low.

Development. E-learning implementations stem predominantly from isolated and one-time initiatives. The development of online courses consists mainly of recording traditional classroom-based instruction. Development is small-scale, mostly involving just one or two instructors, possibly assisted by support staff tasked with the recording and uploading of videos of the lectures or other content. The most innovative universities develop e-learning limited to digitalized copies of their traditional lectures, providing a near-identical learning experience to online and offline students. Most other e-learning implementations are developed either to stay competitive by offering courses via existing MOOC providers, or as a basis for research for educational sciences. Only a very small percentage of e-learning is developed specifically to benefit from the capabilities of computers. Examples of this are the MOOC provider EdX and the university Minerva. These implementations too have remained fairly simple.

Organizing. The main driver of e-learning innovation is the societal acceptance of technology. This means that innovation in education is limited to innovation that affects society in general. As such, the main drive for universities to innovate technology-enhanced education comes not from competing universities, but rather from the outside in the form of general technology acceptance within society. Universities adopt new technology to not lag behind society. The drive of universities to stay technologically-relevant leads to a focus on the technology, rather than the learning. The focus is on what rather than why. The reputation of the institution is one reason some universities try to stay ahead technologically compared to other universities, but this is technological innovation, not educational innovation. Universities by and large do not distinguish themselves by using e-learning to offer higher quality learning experiences. Due to the technological focus, lack of instructional method, and experimental use on small scales this approach can best be described as 'technological tinkering'.

The leadership and management of HE e-learning is typified by a laissez-faire style and non-coordination. Universities rarely have a vision, mission and strategy specifically for e-learning. The leadership of universities focuses on the current reality of learning technologies, rather than on probable or possible future. There is little to no facilitating and directing to promote e-learning use Similarly, the perceptions of learning technologies are unmanaged. Universities tend to have either no e-learning strategy or a red ocean strategy in which they compete with other universities reactively.

ICT policies tend to be basic and reactive, prescribing for example the rules, regulation and conditions for the use of ICT facilities, such as access to the internet, the use of e-mail and the library services, etc. These are reactive in that these policies are formulated at or after the adoption of new technologies. These policies rarely aim to innovate or increase the use of e-learning. Policy has a narrow focus on the continuation of existing activities.

Experimentation with e-learning takes place primarily within educational sciences and technology departments. This is initiated primarily by individuals who have an pedagogical research interest. From a human resource (HR) perspective the knowledge and skills exist coincidentally, with barely any organizational involvement. Staff is recruited and trained for what they need now rather than based on a vision of what will be needed in the future. As such, training is based on an incompetence-reduction rather than a competence-increasing strategy. This means that staff needs to become noticeably incompetent in their use of current technologies before HR offers training. Due to the high autonomy of the teaching staff, staying up-to-date on technological skills and know-how is on voluntary basis. This holds particularly true for senior and tenured instructors with relatively high autonomy and usually the most dated instructional methods and techniques. Job evaluations and career advancements of instructors are primarily based on research performance. There is a strong pressure stemming from a publish-or-perish culture. Overall, each individual organizational member tends to focus primarily on their own daily activities, within their own discipline, and limited to core technology.

Users. By 2030 many new technologies will have been adopted in HE, but with little real effects for users. New technologies like Virtual Reality, Augmented Reality and holograms are promising. Yet, as nearly half a century of educational research demonstrated, the learning outcomes are not a direct effect of the technology. This myth of technological determinism is still commonly held. Overall the effects of e-learning on learning outcomes is comparable with traditional instruction. When students use e-learning they do learn significantly faster. The effects on learning outcomes have increased over the years but insufficiently to keep e-learning innovation alive. Since e-learning is limited mostly to simple recordings of traditional classroom-instruction, there are few distinct advantages beyond the flexibility e-learning offers instructors and learners, being able to teach and learn from anywhere and at any time. The effects on learning outcomes are limited mainly due to a focus on technology, the initiatives being small and one-time only, little to no structural organizational support, little or no integration or streamlining with other initiatives, the absence of e-learning in the vision and mission of HEIs, and the limited scale of development involving few individuals limited almost entirely educational scientists.

Organizational goals. Universities benefit from new technologies. However, the benefits are limited mostly to those experienced throughout society. New technologies widen access to education somewhat, although few alternatives to traditional instruction are available. The widening of access primarily offers additional learning opportunities to the already highly educated autodidactic learners. Technologies do in some instances offer costs reductions as fewer physical locations are needed for classes that are offered online. The simple, technology-oriented, and fragmented approach results in low costs technological solutions. While the costs are moderate, so are the benefits. Technological innovation is crucial for universities to build and maintain their reputation. However, universities do not significantly extent these technologies in meaningful ways to HE.

6.2 Scenario 2: The Marketeer

High Use and Acceptance of Technology (dimension 1)

Fragmented Approach of Organizing (dimension 2)

Learning. By 2030 the e-learning hype has increased tremendously in popularity. Technology is taking an ever increasing role within education to the point of being all pervasive. Almost every aspect of higher education involves technology. However, the focus is mainly on the technology, rather than the learning. While it is undisputed that tremendous technological innovation took place within universities, there has been markedly little educational innovation. Little attention is given to pedagogical aspects of education. This is in part due to the perception that by the time learners reach adulthood they should have acquired the skills to learn effectively, and do not benefit much from educational sciences. Mere exposure to the latest knowledge is deemed sufficient. E-learning consists often of digitalized courses. Virtually every university uses MOOCs for at least the introductory courses. These MOOCs are digitalized lectures providing students with learning experiences in many ways similar to traditional classroom-instruction. It is rare for students to go to classrooms, since technology is capable of offering at least comparable technology-enhanced learning experiences. Technology controls many aspects of the students' education. Most peer-interaction occurs via forums, video chat, serious games, simulations, etc. Computer algorithms score students on participation and performance. Among educational scientists there is an unresolved and heated debate on whether an e-learning revolution has taken place. While there has undoubtedly been a technological revolution within higher education, with pedagogical aspects mostly unaffected there are few that would consider it a learning revolution. The technology mostly substitutes the medium of the learning experiences.

Technology. In 2030, the latest technologies are used within HE. There is a trend of racing to implement the latest technologies within e-learning. Compared with the first scenario, technology has a much more prominent role, yet similarly, it did not change educational practices much. E-learning courses often implement marketable innovative features. An example of this is the use of VR glasses that allow students to experience sitting in the classroom, providing a virtually identical experience to traditional classroom instruction. Students can see themselves following a lecture with other students sitting around them. Some educational scientists criticise this for being a distraction that adds no educational value. Both core and peripheral technologies are used frequently and extensively.

Development. The newest technological innovations within society are experimented with at universities. It is common for classes to use the latest technologies, and to experiment with, and continue development of them. This experimentation and development takes place throughout the university, without any central management or directing. Instructors and students are inherently curious about technologies. Importantly however, not all technologies count as e-learning. While there is a strong interest for technologies, this does not translate into advanced e-learning implementations. Courses are digitalized replications of traditional education, utilizing the latest technologies, yet the lecture format remains at the basis. Universities generally have ICT support to record lectures and publish them online.

Organizing. The main driver of e-learning innovation is the institute's reputation as a technological innovator. The reputation of institutes is closely associated with the level of technological innovation and integration within education, in particular for technical universities. It is a trend for universities to closely associate them with the latest technological innovations, such as nanotechnology and artificial intelligence. Universities compete to have the most advanced labs, the latest technological equipment, and studies dedicated to these popular new fields. Often without realizing it, universities lack a *why*. Universities are in a paradoxical competition of who is the most innovative, by trying to be the best at *what* every other university is doing. Moreover, universities are no longer the main innovators in society. When it comes to technological innovation, large tech companies take the lead. Similarly to the first scenario, leadership and management of HE e-learning is typified by a laissez-faire style and non-coordination. Universities rarely have a vision, mission and strategy for e-learning. Their focus is on the current reality, rather than what might be. Universities have shifted their focus more onto technology than before, yet this represents a new red ocean in which they compete. The ICT policies and HR are nearly identical to that of scenario one.

Users. Although universities in 2030 extensively use the latest technologies, their educational practices do not change substantially. As half a century of educational research demonstrates, technology does not directly affect learning outcomes. When it comes to education, the universities in 2030 achieve approximately the same results as via traditional instruction. The advances in e-learning slightly improve achievement and retention scores. In addition, students do learn significantly faster with MOOCs that are now common place in HE. This also gives them great flexibility to study any time, any place, although universities usually limit this via organizational practices.

Organizational goals. Universities that are highly technologically advanced benefit from higher reputations. Technological innovations lead to almost no changes in reputations however, as this provides no sustainable competitive advantage, since all universities compete over this. The increased use of MOOCs widens access to HE, resulting in global competition. Furthermore, while e-learning reduces some costs, this is largely offset by development costs increase. The e-learning costs and benefits are modest. The focus on technological innovation benefits mostly research, due to the increased availability of educational big data, as well as the academic staff saving time on education which can be used for research.

6.3 Scenario 3: The Foundationalist

Low Use and Acceptance of Technology (dimension 1)

Integral Approach of Organizing (dimension 2)

Learning. By 2030 e-learning gradually increases in prominence in HE. Most HEIs offer at least a form of computer-enhanced education and have some experience with MOOCs. However, most crucial to education is learning, not technology. Technology is merely one of many aspects to consider in higher education. Higher education needs to meet societal, market and user demands. As technologies evolves, HE evolves with it. New technologies have always had a place in universities, and this remains true. HE teaches about the newest technologies, and provides students first-hand experience with them. Yet, technologies alone do not have a transformative effect on education, and education does not change fundamentally by technology itself.

Technology. The flourishing universities in 2030 realize that excellent education does not depend on wildly futuristic technologies. The future is not only found in the silicon valleys. Technology often enables changes, but rarely is the cause of them. The universities that garnered the strongest reputations for e-learning innovation are those that realized that technology has advanced for centuries, while education has remained unchanging, and that it is merely an excuse to postpone educational innovation until more advanced technologies are available. These universities have integrated technology within every aspect of education. However, these universities have primarily optimized existing technologies to make the most of what already exists. Institutionalized e-learning depends mainly on core technologies, which have gone through numerous iterations of continuous development, implementation and appropriation. At the same time, peripheral technologies are frequently experimented with for educational purposes. Some AR and holograms are used within teaching, although these technologies are not commonplace. In HE, big data and data analytics boosts educational research and practice. MOOCs and learning platforms provide valuable data that educational scientists can study. More is known about core technologies, which benefits the compatibility of systems. Compared to scenario two, the technologies less innovative and are adopted slower, yet implementations result in educational innovations with a greater impact on desirable learning and organizational outcomes.

Development. The development of e-learning is planned centrally for core technologies, while peripheral technologies depend on relatively isolated initiatives. The core technologies allow for learning experiences that differ significantly from traditional classroom-based instruction. Among the first universities taking this approach was Minerva, which utilized simple and already available technologies to optimize learning experiences. Data analytics and big data offer information on how to improve the learning environment and courses. Through A/B-testing, continuous and rapid improvements to existing systems are made, allowing for small but fast-paced improvements.

Organizing. The 'why' of flourishing universities in 2030 is great education. For this, these universities depend not on technology, but on organizing HE differently. The main driver of educational innovation are these universities themselves. Technological innovation does take place, and it does affect educational practices. However, substantial HE innovation is already possible with established technologies. To universities that flourish in 2030, the "latest technologies" are an excuse not to innovate education. Overly focusing on technology sets too high expectations for technology and risks losing sight of crucial non-technological aspects. It shifts too much of the responsibility away from educators and towards technology. Integral coordination at universities helps integrate the latest technological advances faster in case they have direct and meaningful applications to education. However, an integral approach entails taking the many non-technological aspects into consideration. This means technological innovation has to compete for resources with other investment needs, such as pedagogical innovation. Technologies are generally only adopted when expectations of the technology are aligned with organizational goals, vision and strategy.

The vision of most universities communicates "make the best with what you have". The vision is not about greatly outperforming the current best. There is no aspiration to march too far in front of the troops. Technological innovation is incorporated in, but does not necessarily emanate from within higher education. Most of technologies used are not innovated *for* higher education, but – once innovations emerge – are implemented in higher education.

The leadership and management of HE is more centralized than in the previous scenarios. Yet technology does not play an important role within the vision, mission and strategy. The strategy may include early detection of core and peripheral technologies suitable for direct implementation into HE. Universities do focus on future trends. The management of universities also facilitates the development and use of e-learning, although this is limited to core technologies. Without the enabling potential of technology, the chances of any disruptive innovation or blue ocean strategy are slim.

Universities increasingly turn popular courses into MOOCs, such as introductory courses followed by all students in a program. These MOOC courses receive additional planning and design compared to traditional courses. Frequently these MOOCs are largely digitalisations of the classroom

instruction course. These tend to function as modern textbooks, frequently replacing course materials and traditional lectures with digital ones. Most universities use blended forms of learning, and combine online lectures in the form of MOOCs with interactive on-campus classes.

Universities engage in various collaborations with other HEIs and non-HEIs. Some early innovating universities made strategic alliances with other organizations, either because these organizations have great reputations in HE, are engaged in educational research, or have expertise and experience in developing e-learning. Also, numerous collaborations with non-HEIs are initiated by universities. Some of these collaborations with organization that develop the software or products for HE. Yet other collaborations are made between universities and companies to offer lifelong learning, on-the-job training, and optimize the transition from university to work for the students and companies. This gives graduates better chances on the labour market, while the companies hire students better prepared for the demands of their careers.

As a result, hiring at universities slightly changes. More technical support staff is hired to help develop and maintain the e-learning courses and systems. The number of instructors required remains the same. These instructors do need additional training to prepare them for their work in the digital era. It also changes their role from lecturers into various other more interactive roles.

Users. Universities in 2030 innovate HE mainly by organizing education different, while using existing technologies moderately. This results in improved educational outcomes: students have on average higher achievement scores, a slightly more positive attitude towards their instruction, receive more engaging teaching, and learn at nearly double the pace. For instructors their classes are also more engaging, since they are not required to spend hours repeatedly giving the same lectures. Students come to class better prepared, and can engage and challenge both each other and the instructor. E-learning enables more flexibly studying, making it easier to combine with a career. While the use of technologies is modest, the benefits of integrally planned implementations are significant.

Organizational goals. Higher education institutes benefit from new methods of organizing education with e-learning. Their staff and students are more engaged and satisfied. The innovation of organizing has a relatively low cost. There are no required large investments in technology. Moreover, investments lead to substantial cost reductions in requirements for physical classrooms. Innovative universities gain large increases in reputations, through association with top universities in educational sciences and similarly innovative universities. The increased flexibility widens access to HE, opening new markets of learners, such as lifelong learners. Furthermore, MOOC-developing universities can diversify their offerings at virtually no extra costs, by offering the same MOOCs used in blended form, to offer distance education to students from around the world.

6.4 Scenario 4: The Futurist

High Use and Acceptance of Technology (dimension 1)

Integral Approach of Organizing (dimension 2)

Learning. By 2030 technology revolutionized HE, with the newest technologies omnipresent. Yet, technologies by themselves are not what makes education great. Initially e-learning was centred nearly exclusively on technology, which was a necessary precondition of the learning revolution. Yet, technology only enabled change. Gradually focus shifted to include pedagogy. Eventually, through integrative organizational processes both perspectives intertwined leading to the learning revolution. Now, students globally study in technology-enhanced and pedagogically-optimized courses full of rich content. All aspects of education are meticulously developed involving transdisciplinary teams of the world's top subject experts, developers, and industry leaders, ensuring academic and professional relevancy. This together with integrative thinking result in great improvements in streamlining.

Courses offer frequent and meaningful communication – between students and with the instructor – enhanced by technology to overcome the interactional limitations of traditional education. It promotes participation from all students, rather than just the most vocal ones. It facilitates group formation and discussions based on students' input. Progress and participation is automatically tracked, providing a wealth of information to students and instructors. This also enables adaptive, tailored, accurate and instant feedback. This data is also available for educational research, to help improve the e-learning environment and to study human learning. This offers unprecedented capabilities for machine learning with big data to automate the experimentation and instant improvement to the quality of education.

E-learning does not only innovate learning; it transforms the whole institutions of higher education. Higher education is dominated by a few of the world's leading universities. There are several major shifts in educational philosophies and practices of these universities. Firstly, selection at the gate is nearly entirely abandoned. Near limitless scalability of technology undermines justifications for selection procedures, based on the limited capacity of universities. As a result, rejecting students on other grounds than their capability is morally reprehensible. Secondly, there is a disentanglement of functions. This refers to a widening separation of the three primary tasks of universities: education, research, and knowledge valorisation. High-quality e-learning necessitates intensive and transdisciplinary team-based development that demands highly-specialised hiring leading to division of labour and the separation of teaching and researching into separate jobs. Similarly, HE rankings and evaluations in response evaluate these tasks separately. Thirdly, the divergence of education from other tasks, brings it in focus and leads to a steadily increasing importance of pedagogical excellence.

Fourthly, in response to the abandonment of selection at the gate, universities are evaluated on their transformative effect. This contrasts with measuring only the quality of a university's graduates, which depends strongly on the quality of students at enrolment. Instead, educational quality evaluations now examine the magnitude of improvement of students relative to the amount of received education. Fifthly, the tremendous flexibility and accessibility of high-quality education will increase its attractiveness to professional life-long learners, who are particularly interested in on-the-job training providing them with directly applicable knowledge. Sixthly, these learners are less focussed on the short-term goal of passing tests, and are intrinsically motivated towards long-term acquisition of skills and knowledge. This shifts the underlying educational philosophy towards continuous reinforcement of learning, and away from the '*learn once, test once*' philosophy. Before, students would forget the majority of what they learned within mere months of testing. As such, a passed test was only indicative of one's past ability to reproduce specific knowledge. Education's real value is to be sought in long-term mastery. Currently, everything students learn is reinforced over the course of their studies, based on the Ebbinghaus forgetting curve. Lastly, modular education has become the norm due to a globalized competitive market of HEIs offering highly flexible and accessible education. This has led to an explosive growth in diversity in educations products. Students can combine courses, study materials, examinations, instructors, and mentors from various providers all over the world to create their own personalized education program.

Technology.

Leading universities in e-learning make daily, extensively use a plethora of technologies. These include core technologies, such as video streams, recorded video, interactive articles and books, animations, advanced LMSs, quizzes and email. As well as the newest technologies, such as serious games, simulations, active learning forum, dynamic breakout groups, adaptive feedback, deep customization, in-class polls, group interaction, virtual reality, augmented reality, holographic projections, big data, AI mentoring and tutoring, 4D printing, brain-to-computer technology, and brain-to-brain communication. The universities use their full capabilities to optimize pedagogically, to create a highly interactively learning experience that provides direct and adaptive feedback, and is scalable and easy to use. An integral development approach results in cross-compatibility of the technologies, which benefits the sharing and exchange of technologies and components. This development approach further ensures the technological innovations have high relevancy to learning. Texts about theories are replaced with VR and AR that offers rich contextualized first-person point-of-view learning experiences. This provides virtual hands-on experiences through lifelike simulations, bridging theory and practice. It also offers lifelong learners modular just-in-case on-the-job education.

Development. Top universities facilitate, coordinate and plan for high-quality e-learning design, development and implementation. The universities do not leave excellence and innovation to chance by depending on individual instructors and initiatives. E-learning excellence is not accomplished within a single development iteration. E-learning development is highly complex and demanding, requiring substantial coordination and planned continuous development. Intended use often differs from actual use. Innovations lead to domestication effects that require mutual adaptation of technological and societal aspect. This requires frequent and continuous iterative development cycles, and time. Universities apply various design strategies, such as from design thinking, UX, and A/B-testing. Furthermore, an open architecture enables high customizability, adaptability, compatibility, exchangeability and allows for modification and further development by third parties.

The innovative e-learning universities are not passive users of the technology; they are also actively engaged in its development for learning purposes. Students and instructors are involved in all phases of development. Innovation leaders in e-learning promote a culture of experimentation and knowledge management structures. Rather than isolated one-time experimentation with technology, the integral and collaborative approach of universities leads to systematic innovation and to institutional learning. These universities deliberately and pro-actively innovate their technology, education and organization.

Organizing. Universities flourishing in 2030 have a clear sense of purpose. They understand with great clarity why they innovate computer-enhanced HE. In 2030 the educational philosophy of universities is drastically changed. Based on a reinterpretation of the Principle of Utility – previously advocated by moral philosophers such as David Hume, Jeremy Bentham and John Stuart Mill –equating the morality and legitimacy of a university with the utility it provides. A thing's morality depends on the degree to which that leads to a measure of well-being. In the educational context, a university derives its legitimacy from the extent in which it succeeds in providing its greatest quantity of education, at the highest quality, to the greatest number of students. With the emergence of technology-enabled limitless scaling of education, rejecting students is morally reprehensible. While the number of rejected student applications was once considered a boastworthy statistic demonstrating status, it became an indicator of moral failure. The main driver of educational innovation comes from universities themselves.

The global and competitive e-learning market resulted in a few early innovative universities innovated disruptively. While early e-learning was flawed and regarded as inferior. Early innovative universities rapidly gained experience and were able to build an extensive infrastructure. Consequently, e-learning competed initially in the lower market, while continuously pushing traditional providers further up-market, as its quality improved. Most universities neglected this

innovation due to its initial lower quality and profitability. Now in 2030 the entire HE market is controlled by only a select few universities, all top-tier universities with the strongest brands and most valued degrees. These few top higher education providers have access to unprecedented levels of resources magnifying their competitive lead.

The leadership and management of universities is pro-active and highly centralizing. This does not mean an entirely top-down decision-making structure. Leadership is less about directing and more about coordinating and facilitating. It is centralizing, rather than centralized. This means that universities restructured their organizations in such a manner as to facilitate leadership distributed throughout the organization, with organizational structures facilitating and coordinating the bottom-up flow of information and influence. This is in part accomplished through the adoption of participatory decision-making processes. At the same time there is a top-down approach, through which the leadership and management of universities bring about collective action and actively manage perceptions and expectations of technology throughout the organization. Due to this, universities are able to maintain much of their democratic culture with individual autonomy, but are able to overcome the traditionally inherent conservative culture, increasing the capacity to take collective action. Technology and pedagogy both have an important position within the vision, mission and strategy of universities. The distributed leadership structures facilitate the institutional detection of and responsiveness to peripheral developments. With an increase in capacity for collective action, universities increasingly take responsibility as an organization for the quality of the learning experiences it offers, rather than delegate that responsibility to its individual members.

Collaborations on all levels have become the norm. The development of top quality e-learning is an incredibly complex undertaking, which requires team-based and transdisciplinary collaborations. Collaborations transcend the borders of the university. The enormous investments required developing infrastructures and systems with a solid technological and pedagogical basis necessitates collaborations between multiple universities. This allows for the pooling of resources.

The limitless scalability of e-learning combined with the global market on which online education is offered leads to a professionalization and division of labour along the primary tasks of the university. Development of e-learning takes place in transdisciplinary teams. As a result, the hiring at universities changes drastically, with a strong increase in the hiring of a more diverse staff with more specialized skills. This specialization and professionalization furthermore also put greater emphasis on skill and knowledge development of academic staff. HR policies drastically changed the reward structure and career advancement possibilities to encourage staff to value teaching more. There have furthermore been major changes in the growths and declines of jobs. With lecturer being a phenomenon of the past, the instructor-to-student ratio decreases. However, numerous instructors are still needed for more interactive teaching activities, such as leading online class discussions and

feedback. This has not compensated for the lower demand for instructors, since technology is increasingly capable of facilitating most educational activities. However, universities also created new roles that previously did not exist, such as that of the mentor. These mentors are not necessarily the traditional mentors, but may include professionals with extensive practical experience, career coaches or researchers.

Users. All the above trends lead to large improvements in learning experiences and outcomes. The integral approach to organizing e-learning allows for the full learning potential of technology-enhanced HE to be unleashed. On average students study at 150-200% of the pace of students two decades prior. At the same time, achievement scores improve significantly. Learners have greater control over their education, due to modular education and unparalleled customization and personalization capabilities. It can adapt to learning preferences, learning styles, previous knowledge and skills, preferred learning pace, amongst other options. Learners can control what, when and how they want to learn. Courses are designed to allow advanced students to skip content, without missing the essentials. Similarly, students that have difficulties mastering the materials are offered and referred to extra content. Higher education is also increasing flexibility, enabling a greater study-life balance. Universities also cater increasingly to life-long learners, by providing on-the-job and just-in-time training. This means that employees perform their jobs, and receive training exactly when it benefits their work. Particularly interesting for this are VR and AR that offer video instruction transposed on top of what they are seeing.

Organizational goals. E-learning has become a necessary instrument to attaining organizational goals. Not all HEIs prioritize the same goals. The few universities that innovated early, have secured a dominant position within HE. The adoption of e-learning furthermore increases the access to education, which enables universities to target new markets. The innovative universities have on average tremendously increased their revenue, while their costs increased simultaneously. The integral approach combined with a high use of technology involves highly complex processes, the professionalization that followed has greatly helped streamline curricula. The few early innovative universities have very strong reputations. While critics may argue that almost all of these early innovators already had strong brands, it is worth pointing out that many other top-tier universities with strong brands have become side-lined after reacting too slowly to the innovation of e-learning.

Discussion and Conclusion

This thesis started in chapter 2 with an in-depth exploration of what e-learning is. This resulted in a definition of e-learning along with an understanding of the nuances in meaning, and how it relates to other terms. An important product of this chapter was also the list of defining characteristics. This list was useful for more than formulating definitions of e-learning. While most people assume everyone knows what e-learning means, this is far from the truth. The list of defining characteristics is a helpful tool to explore common assumptions. It furthermore served as the basis for the building blocks used to write the stories for the scenarios. Chapter 3 examined six categories of effects of e-learning. The e-learning literature generally limits itself to either pedagogical effects, technological aspects or the institutional goals. This chapter contributes to a much more integral view of e-learning and broadens the organizational aspect beyond only the rather limited discussion of policy goals of institutions. Chapter 4 provides an extensive overview of e-learning implementations. While at first glance this chapter may seem an odd addition that lacks the usual rigor of academic analyses, it is essential in overcoming the bias present within the scholarly e-learning literature. Much of the literature is based on e-learning implementations developed within academia for the purpose of research. As argued throughout this thesis, e-learning development and implementation is a complex process that requires specialized skills from multiple disciplines. E-learning is furthermore in its infancy, and most initiatives including EdX are only several years old. An analysis of e-learning that intends to take a holistic approach cannot limit itself only to e-learning created within universities designed for research purposes. This is especially true considering the most innovative e-learning implementations are largely found outside of the universities.

The scenarios developed in this thesis may serve as a starting point for a discussion about the future of e-learning within education. Scenarios are helpful instruments in exploring uncertainty about future impactful outcomes. The developed scenarios describe in situations substantially different from the current e-learning situation. As noted several times within previous chapters, the innovation of education within universities is not without challenges given some of its institutional characteristics that make it resistant to change. Since the notion of a changing university is central to the scenarios, it seems appropriate to end with a reflection of this resistance to change that is inherent within universities.

The Innovative Capacity of Universities

Enders (2002) states that the European higher education market has recently changed from a protected institutional environment to a more competitive market that pressures universities into restructuring to become more responsive to market demands. Public universities are facing increasing competition from other public universities and from corporate providers of education, while public funding of higher education is continuously reduced (Schneckenberg, 2009). In response universities have had to innovate strategically. It also resulted in the emergence of entrepreneurial universities that have both greater autonomy and responsibility in defining and reaching their goals. Amongst many aspects, e-learning is thought of as a means for universities to differentiate and compete (Schneckenberg, 2009). Universities have thus far been largely unable to innovate higher education using e-learning (Salmon, 2005; Schneckenberg, 2009; Westera, 2004). According to Salmon (2005, p. 204), HEIs have "an aspirational rather than realistic approach" and that "real development […] has so far been modest" (p. 205). Similarly, Schneckenberg (2009, p. 413) states that "the integration of e-learning in universities has been so far disappointing both at the macro-level of their strategic options and at the micro-level of their educational work processes", and that "universities are stalled in the traditional pedagogical model of knowledge transmission" (p. 411).

Since these publications a lot has happened in the higher education e-learning landscape. The emergence of MOOCs stems largely from after these publications. It is important to recognize the important advances made since. Nonetheless, much of the critique remains valid. There is still a strong emphasis on technology, which "is easily mistaken for educational innovation" (Westera, 2004, p. 3). Westera and Salmon (Salmon, 2005; Westera, 2004) argue that the substitutional approach of merely adopting technology to support education cannot be considered educational innovation. Westera argues that for something to be educational innovation it should influence the three dimensions identical to the three domains of e-learning found in this study: technology, pedagogy and organization. Chapter 4 on e-learning implementations showed that such three dimensional innovations is still rare.

There are various explanations for this lack of e-learning innovation. For one, Westera (2004) argues that traditional classroom-based instruction is so common due to its normalcy to an academic staff that has been educated itself in this way. Classroom-based instruction – with its implicit pedagogical paradigm based on a teacher-controlled transfer of existing knowledge, skills and attitudes – has furthermore become resilient to change due to its efficiency (Westera, 2004).

Academic staff has a crucial role in the lack of e-learning innovation within universities (Schneckenberg, 2009). Kerres, Euler, Seufert, Hasanbegovic, and Voss (2005) argue that academic staff is involved in nearly all aspects of teaching, from the design of curricula and individual courses to

the actual teaching in and outside of the classroom. As such, organizational change depends largely on the universities' ability to mobilize their professoriate (Schneckenberg, 2009). However, numerous scholars conclude that university instructors lack the competences required for e-learning innovation (Schneckenberg, 2009). Furthermore, instructors are unlikely to change their teaching without a thorough understanding of the benefits, while they are rarely self-motivated or institutionally encouraged to innovate their teaching practices (Salmon, 2005).

The lack of e-learning innovation within HEIs can furthermore be attributed to various institutional characteristics. Schneckenberg (2009) states this can be best understood through Weick's (1976) characterization of educational institutions as 'loosely coupled systems'. Weick uses this term to describe the weak connectedness between distinct parts of an organization. Schneckenberg (2009) argues that the different faculties within universities have a high degree of autonomy that leads to an "organizational anarchy" in which the "boundaries between universities as organizations and their wider environment … difficult to define" (p. 416). For academic staff, this furthermore means a lower commitment to and identification with their university relative to their discipline. The "academic careers are not in first place determined by institutional criteria of universities, but by quality assessment standards, which are defined within science disciplines" (p. 420). HEIs have reward structures favouring research over teaching, and classroom teaching over online teaching (Whitworth, 2005). Because of this, HEIs have a limited capacity to direct their academic staff. As Schneckenberg concludes, this risks institutional attempts at collective innovation to be reduced to being merely symbolic. In addition, innovation has to take place within the historical, cultural, institutional and political contexts of the university, in which multiple stakeholders are involved (Becher & Trowler, 2001; Whitworth, 2005). This helps explain the universities' intrinsic conservatism (Salmon, 2005; Schneckenberg, 2009; Westera, 2004), lack of organizational autonomy, and low capacity for collective action (Enders, 2002).

All these factors contribute to understanding why universities are resistive to change initiatives in general. Educational innovation through e-learning within universities is particularly challenging, considering it involves large investments and great complexity, involving changes on technological, pedagogical, and organizational dimensions (Schneckenberg, 2009; Westera, 2004). In sum, for e-learning innovation most universities depend nearly entirely on individual instructors to innovate their teaching, who are unwilling to do so without a deep understanding of the benefits, within a context that offers almost no reward for doing so, while a deep understanding involves a complex combination of technological, pedagogical, and organizational dimensions in addition to expertise in their own respective fields.

It is therefore not surprising that Brown (2002) concludes that the re-engineering of existing universities that e-learning innovation requires is highly unlikely. HEIs are not unique in this innovation

dilemma. Westera (2004) states that any system as large as a university intrinsically exhibits inertia. Harvard Business School professor Clayton Christensen, who coined the immensely popular term 'disruptive innovation', has written extensively on disruptive innovation in higher education (Christensen et al., 2006; Christensen, Horn, & Johnson, 2010). Christensen (Sutherland Institute, 2012a) addressed Utah's Higher Education Appropriations Subcommittee on disruptive innovation in higher education, where he argues that universities have in the past been successful without a need to change substantially. Christensen warns HEIs that in other markets "the only instances in which the [market] leader caught the next wave of disruption, was when they set up a completely independent business unit and gave this new business unit a charge to kill the parent" (39:10 - 39:50). According to Christensen, historically higher education has not faced any disruptive innovation, as there was no technology allowing competitors to gradually move up-market. However, "online learning changes the potential for disruption" (49:00 – 49:35). The chapter on e-learning implementations shows that almost all educational innovation seems to originate from outside the established universities. The most innovative universities have either created new organizational units within their organization (e.g. Harvard Extension school), are newly established universities (e.g. Minerva, and University of Phoenix), or do so via external platforms (e.g. EdX, Coursera). This emphasizes once more the need to address e-learning innovation holistically, taking into account the technological, pedagogical and organizational dimensions.

An understanding of the futures of e-learning in higher education requires to have some understanding of the inherent resistance to change within universities. The e-learning literature is primarily dedicated to technological and educational aspects. The literature lacks the level of attention that organizational aspects deserve. Probably the most important conclusion within this study, is that the true promise of e-learning innovation requires an integral understanding inclusive of technology, education and the organization.

On Using Scenarios

This study shows e-learning poses great risks and opportunities to the future of universities in higher education. There is much uncertainty about the future direction of technology-enhanced higher education. The futures within the scenarios describe unprecedented opportunities and risks for universities. Future studies teaches that the future is plural and can be influenced. This is where scenario thinking is most helpful: high stakes situations with great uncertainty about future outcomes. The scenarios developed in this study can help overcome either/or thinking, provide a common language to systematically discuss and plan for potential futures, and help transform higher education towards more favourable futures by promoting a holistic view of e-learning innovation.

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Appendix A – Tables

0 Education & Learning Elements	
Learning	The claim that learning is the central focus of e-learning
1 Carrier / Platform	
Simple Electronic Devices	TV, radio, phone, film, etc.
Computer Devices	Computer, PC, laptop, tablet, mobile phone, PDA, etc.
Offline / Online	Availability via a network, such as the internet.
Printed	Books, articles, etc.
Live / in person	Such as lectures, meetings, etc.
2 Degree of Dependency on Technology	
Pure or Blended	How technology dependent is the education?
3 Distance & Communication	
Independence from Place	Distance learning. Ability to study not limited to a fixed location.
Independence from Time	No obligated fixed times at which to study.
Synchronous	Communication between individuals that takes place simultaneously.
Asynchronous	Communication at a time of each individual's choosing.
Availability of Instructors	The students' ease of access to communicate with the instructor.
Availability of Students	The students' ease of access to communicate with each other.
Degree of Meaningful Contact	The degree in which there is contact that is relevant to instruction
4 Social Context	
Individual - Group Learning	Degree to which students learn individually or in a group.
Group Learning Strategies	Are there strategies in place to facilitate group learning?
Role of Technology	What role does technology have in learning as a group?
5 Type of E-Learning	
Typology Kulik & Kulik (1991)	Assisted, Managed, and Enriched Computer Instruction
Typology Means (1994)	Tutor, Exploratory Environment, Tool, and Communication Media.
Categories of Reeves (1998)	Learning "from" technology, and learning "with" technology
Popular Types	Converted Instructor-led course; distributed and blended learning
6 Flexibility, Interaction, Progress Tracking, and Feedback	
Customisability to the user	Can learning be personalized or customized to the user?
Interchangeability	Exchangeability, reusability, shareability, and interoperability
Interactivity	Elements of interactivity. Such as exercises, tests, games, etc.
Progress Tracking	Whether student progress is tracked automatically
Feedback	Tailored, instant, and accurate? Static or adaptive? Underlying cause?
7 Control	
Learner or Instructor Controlled	Who is in control? Extent of control over learning experience.
Type of Control	Playback. Content selection. Pace, time and place of learning.
8 Design, Presentation & Media	
Content	Lectures, games, notes, articles, documentaries, exams, quizzes, etc.
Digitalised vs Optimised	Merely digitalized? Or offer unique features? Exploit the medium?
Pedagogical Optimisation	Use of educational science to maximize (e-)learning effectiveness?
Room for Creativity	Useable in innovative ways? In unintended ways?
Multimedia	What media are used? Text, (animated) images, audio, video?

Table1 – Categories of ***Defining Characteristics of E-Learning***

Chapter	#	Element	Description	Category
2. Definitions and Characteristics	1	Learning	The claim that learning is the central focus of e-learning	Education & Learning Elements
	2	Simple Electronic Devices	TV, radio, phone, film, etc.	Carrier / Platform
	3	Computer Devices	Computer, PC, laptop, tablet, mobile phone, PDA, etc.	
	4	Offline / Online	Availability via a network, such as the internet.	
	5	Printed	Books, articles, etc.	
	6	Live / in person	Such as lectures, meetings, etc.	
	7	Pure or Blended	How technology dependent is the education?	Degree of Technology Use
	8	Independence from Place	Distance learning. Ability to study not limited to a fixed location.	Distance & Communication
	9	Independence from Time	No obligated fixed times at which to study.	
	10	Synchronous	Communication between individuals that takes place simultaneously.	
	11	Asynchronous	Communication at a time of each individual's choosing.	
	12	Availability of Instructors	The students' ease of access to communicate with the instructor.	
	13	Availability of Students	The students' ease of access to communicate with each other.	
	14	Degree of Meaningful Contact	The degree in which there is contact that is relevant to instruction	
	15	Individual - Group Learning	Degree to which students learn individually or in a group.	Social Context
	16	Group Learning Strategies	Are there strategies in place to facilitate group learning?	
	17	Role of Technology	What role does technology have in learning as a group?	
	18	Typology Kulik & Kulik (1991)	Assisted, Managed, and Enriched Computer Instruction	Type of E-Learning
	19	Typology Means (1994)	Tutor, Exploratory Environment, Tool, and Communication Media.	
	20	Categories of Reeves (1998)	Learning "from" technology, and learning "with" technology	
	21	Popular Types	Converted Instructor-led course; distributed and blended learning	
	22	Interchangeability	Exchangeability, reusability, shareability, and interoperability	Flexibility, Interaction, Progress Tracking, and Feedback
	23	Interactivity	Elements of interactivity. Such as exercises, tests, games, etc.	
	24	Progress Tracking	Whether student progress is tracked automatically	
	25	Feedback	Tailored, instant, and accurate? Static or adaptive? Underlying cause?	
	26	Customisability to the user	Can learning be personalized or customized to the user?	
	27	Learner or Instructor Controlled	Who is in control? Extent of control over learning experience.	Control
	28	Type of Control	Playback. Content selection. Pace, time and place of learning.	
	29	Content	Lectures, games, notes, articles, documentaries, exams, quizzes, etc.	Design, Presentation & Media
	30	Digitalised vs Optimised	Merely digitalized? Or offer unique features? Exploit the medium?	
	31	Pedagogical Optimisation	Use of educational science to maximize (e-)learning effectiveness?	
	32	Room for Creativity	Useable in innovative ways? In unintended ways?	
	33	Multimedia	What media are used? Text, (animated) images, audio, video?	

*Table 1 – **All e-learning elements** discussed in Chapter 2.*

Chapter	#	Element	Description	Category
3. E-learning Effects	34	Study Time	Time required to study	Pedagogical Effects
	35	Achievement	Effect on exam and delayed exam scores of students	
	36	Retention	Drop-out rate and retention rate	
	37	Attitude	Attitude towards the subject or course	Effects on Students and Faculty
	38	Enhanced Experience	Improved quality of the educational experience	
	39	Engaging Teaching	Renewed passion for teaching, course design and pedagogy	
	40	Flexibility	More opportunities to study that fit the learner's circumstances	
	41	Access and Enrolment	Widen access to education via new and existing markets	Institutional Effects
	42	Costs and Revenue	Reducing costs and increasing revenue	
	43	Reputation	Status, identity and reputation of the institution	
	44	Streamline Curricula	Reducing faculty-to-student ratio and increasing coherence	
	45	Source of Effects	The aspect of e-learning that leads to any of the effects	Moderating Effects
	46	Learner characteristics	The characteristics of learners that moderate effects	
	47	Complexity and Skill Requirements	E-learning increases complexity of development, and skill requirements	Effects on Development and HR
	48	Division of Labour & Teams	Professionalization and specialization of e-learning develop in teams	
	49	Collaborations and Licensing	Various types of collaborations at multiple levels to benefit from scaling	
	50	Shifts and Growth in HR	Changes in personnel needs of institutions	
	51	Strategy Differentiation	The strategy institutions follow: trend follower or innovation leader	Effects on Policy of Innovators
	52	Integrative Policy Approach	Pro-active and centralized policy driving e-learning innovation	
	53	Big Picture Vision	Organizational awareness extended to peripheral technologies and ideas	
	54	Focus on Ends, Not Means	Focus on the ends (e.g. learning), rather than means (e.g. technology)	
4. E-Learning Implementations	55	Existing or Futuristic Technology	Technology available, or requires further technological innovation	Creation
	56	Professionalization	Resources dedicated to innovation of learning technology (incl. HR)	
	57	Stand-alone or Part of System	Isolated and standalone, or integrated part of an e-learning system.	E-learning Environment
	58	Type of Education Provider	Universities, new online universities, non-traditional providers, etc.	Providers of higher education
	59	Awards Degree	Whether the education offers the possibility to attain a degree	Degree

*Table 3 – **All e-learning elements** discussed in Chapter 3 and 4.*

Chapter	#	Element	#	Step 1: Merge elements into clusters	Step 2: Inclusion	Step 3: Exclusion	Group # 1	2	3
2. Definitions and Characteristics	1	Learning		>> Merged with: Focus On Ends, Not Means					
	2	Simple Electronic Devices	1	Medium	F, M	R, IU, E		1	
	3	Computer Devices							
	4	Offline / Online							
	5	Printed							
	6	Live / in person							
	7	Pure or Blended	2	Degree of Technology Use	F, M				1
	8	Independence from Place	3	Independence from Time and Place	F	E		2	
	9	Independence from Time							
	10	Synchronous	4	Synchronicity	-	x	1		
	11	Asynchronous							
	12	Availability of Instructors	5	Availability & Degree of Meaningful Contact	F, M				2
	13	Availability of Students							
	14	Degree of Meaningful Contact							
	15	Individual - Group Learning	6	Social Context	F, M				3
	16	Group Learning Strategies							
	17	Role of Technology							
	18	Typology Kulik & Kulik (1991)	7	Types of E-learning	-	x	2		
	19	Typology Means (1994)							
	20	Categories of Reeves (1998)							
	21	Popular Types							
	22	Interchangeability	8	Interchangeability	-	x	3		
	23	Interactivity	9	Interactivity	F				4
	24	Progress Tracking	10	Progress Tracking	F				5
	25	Feedback	11	Feedback	F, M				6
	26	Customisability to the user	12	Customisability to the user	F				7
	27	Learner or Instructor Controlled	13	Control over Experience	F	E		3	
	28	Type of Control							
	29	Content	14	Rich pedagogically-optimized e-learning	F				8
	30	Digitalised vs Optimised							
	31	Pedagogical Optimisation							
	32	Room for Creativity							
	33	Multimedia							

*Table 4 – This table shows the **process of reducing the number of elements** (in this table only for chapter 2) into a lesser number of clusters, and finally into building blocks. This process included the merging of elements based on similarity, filtering based on inclusion and exclusion criteria, and priorization. Selection for building blocks: merging, inclusion and exclusion (red = excluded; green = major building block; orange = minor building block)*

Chapter	#	Element	#	Step 1: Merge elements into clusters	Step 2: Inclusion	Step 3: Exclusion	Group # 1	2	3
3. E-learning Effects	34	Study Time	15	Educational Effects	F, M				9
	35	Achievement							
	36	Retention							
	37	Attitude							
	38	Enhanced Experience							
	39	Engaging Teaching							
	40	Flexibility	16	Flexibility	F				10
	41	Access and Enrolment	17	Access and Enrolment	F				11
	42	Costs and Revenue	18	Costs and Revenue	F				12
	43	Reputation	19	Reputation	F, M				13
	44	Streamline Curricula	20	Streamline Curricula	F	E, P		4	
	45	Source of Effects	21	Moderating Effects	-	x	4		
	46	Learner characteristics							
	47	Complexity & Skill Requirements	22	Complexity and Skill Requirements	F, M				14
	48	Division of Labour & Teams	23	Division of Labour & Teams	F, M				15
	49	Collaborations and Licensing	24	Collaborations and Licensing	F, M				16
	50	Shifts and Growth in HR	25	Shifts and Growth in HR	F				17
	51	Strategy Differentiation	26	Strategy Differentiation	F				18
	52	Integrative Policy Approach	27	Integrative Policy Approach	F				19
	53	Big Picture Vision	28	Big Picture Vision	F				20
	54	Focus on Ends, Not Means	29	Focus on Learning and Ends, Not Means	F				21
4. E-Learning Implementations	55	Old or Future Technology	30	Old, Existing or Future Technology	F				22
	56	Professionalization		>> Merged with: Division of Labour & Teams					
	57	Stand-alone or Part of System	31	Isolated or Integrated Implementation	F				23
	58	Type of Education Provider	32	Type of Education Provider	F	P		5	
	59	Awards Degree	33	Awards Degree	F	P		6	

*Table 5 – This table shows the **process of reducing the number of elements** (in this table only for chapter 3 and 4) into a lesser number of clusters, and finally into building blocks. This process included the merging of elements based on similarity, filtering based on inclusion and exclusion criteria, and priorization. Selection for building blocks: merging, inclusion and exclusion (red = excluded; green = major building block; orange = minor building block)*

Chapter	Building Block Name	Description	Domain	Scenario Dimension
Ch. 4	Type of Education Provider	Traditional versus non-traditional providers of education	General	
Ch. 4	Awards Degree	Whether the education awards degrees upon completion		
Ch. 2	Medium	Medium over which learning takes place	Technology	Use and Acceptance of Technology
Ch. 4	Old, Existing or Future Technology	The use of established versus innovative technology		
Ch. 2	Degree of Technology Use	How dependent learning is on technology		
Ch. 3	Focus on Learning and Ends, Not Means	Focus on ends (e.g. learning), rather than means (e.g. tech)	Learning	
Ch. 2	Rich pedagogically-optimized e-learning	Rich content based on pedagogical principles		
Ch. 2	Social Context	The role of social interactions		
Ch. 2	Availability & Degree of Meaningful Contact	Amount and nature of contact among all involved		
Ch. 2	Interactivity	Interactivity: games, tests, quizzes, etc.		
Ch. 2	Progress Tracking	Automatic tracking of students' progress		
Ch. 2	Feedback	Type and timing of feedback		
Ch. 3	Educational Effects	Effects on learners and learning outcomes	User-Centred Learning Experience	
Ch. 2	Independence from Time and Place	Ability to study any time, any place		
Ch. 3	Flexibility	Learning adjusted to the learner's circumstances		
Ch. 2	Customizability to the user	Personalization and customization of experience		
Ch. 2	Control over Experience	User, medium or instructor in control of learning		
Ch. 3	Access and Enrolment	Increased enrolment via new and existing markets	Organizational Goals & Strategy	
Ch. 3	Costs and Revenue	Reducing costs and increasing revenue		
Ch. 3	Streamline Curricula	Increasing coherence, reducing faculty required		
Ch. 3	Reputation	Status and reputation of the institution		
Ch. 3	Strategy Differentiation	Trend follower versus innovation leader	Organizing	Approach: Fragmented versus Integral
Ch. 3	Integrative Policy Approach	Pro-active and centralized policy driving e-learning innovation		
Ch. 3	Big Picture Vision	Organizational awareness extended to peripheral tech and ideas		
Ch. 3	Collaborations and Licensing	Various types of collaboration at multiple levels		
Ch. 3	Division of Labour & Teams	Professionalization and specialization of development in teams		
Ch. 3	Shifts and Growth in HR	Changes in personnel needs of institutions		
Ch. 4	Isolated or Integrated Implementation	An implementation's level of integration with others systems		
Ch. 3	Complexity and Skill Requirements	Complexity of development and skills required		

*Table 6 – **Scenario framework**. In the final framework, the order in which the domains are discussed in the scenarios is as follows: organizing, development, technology, learning, user-centred experience, and organizational goals and strategy. Domains are overarching aspects identified by the literature review and analysis. The dimensions to which the building blocks and domains are most strongly related are indicated in the right-most column. The development domain is not shown here, but included in the final framework. This consists of the final three building blocks, and constructs from technology acceptance theories and organizational behaviour literature.*

Group	Construct	Model/Theory	Applicable Domain(s) 1	2	3	4	5	6
Redesign	Redesign of technology	DT	**x**					x
	Continuous use	DT	**x**					x
Technology	Perceived characteristics of innovation	DOI		**x**	**x**	**x**	**x**	**x**
	Design of technology (supply)	DT		**x**				
Pedagogy								
Needs of Users and Organizations	Perceived characteristics of innovation	DOI		**x**	**x**	**x**	**x**	**x**
	Perceived usefulness	TAM, UTAUT; DOI		x	**x**	**x**	**x**	
	Basic needs	UGT			**x**	**x**	**x**	
	Gratification (sought vs obtained)	UGT			**x**	**x**	**x**	
Needs of Users	Perceived ease of use	TAM, UTAUT	**x**			**x**		
User Characteristics	User characteristics; Receiver Variables; Individual characteristics	UTAUT; DOI; UGT				**x**		**x**
	User characteristics	DT				**x**		**x**
	Perceived behavioural control (internal)	TPB				**x**		**x**
	Affections					**x**		x
	Attitudes	TPB, TAM				**x**		x
	Beliefs	TAM				**x**		x
	Expectations				x	**x**		x
	Rationalizations					**x**		x

*Table 7 – **Constructs from six of the most popular technology acceptance theories**. The constructs from different theories are grouped based on similarity. The right side of the table indicates if the constructs relate to the six domains of e-learning identified earlier. The acceptance of technology theories are: Diffusion of Innovation Theory (DOI; Rogers, 2003), Domestication Theory (DT; Silverstone & Haddon, 1996; Silverstone & Hirsch, 2005), Technology Acceptance Model (TAM; Davis, 1989), Theory of Planned Behaviour (TBP; Ajzen, 1991), Uses and Gratifications Theory (UGT; Rosengren et al., 1985), and Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003). The numbers of the domains are identical to those in Figure 3 (see Appendix B).*

Group	Construct	Model/Theory	Applicable Domain(s)					
			1	2	3	4	5	6
Long-term view	Phases of technology acceptance	No theory, article		x				**x**
			x					**x**
HR	Perceived behavioural control (internal)	TPB				**x**		**x**
	Perceived characteristics of innovation	DOI	**x**	x	**x**	**x**	**x**	**x**
Communication	Knowledge about the technology, and communication sources	DOI						**x**
								x
Social Influence	Social system variables	DOI						**x**
	Subjective norm, Opinions of others, Social influence	TPB, UTAUT						**x**
	Social and spatial influence of local environment	DT						**x**
Context	Society and media structure	UGT						**x**
	Perceived external behavioural control; Facilitating Conditions	TPB; UTAUT						**x**
	System characteristics	DT						**x**
Acceptance, Use, and Appropriation	Use behaviour	UTAUT				**x**		x
	Persuasion, decision, and confirmation	DOI				x		**x**
	Intentions	TPB, TAM, UTAUT				**x**		x

*Table 8 – **Constructs from six of the most popular technology acceptance theories**. The constructs from different theories are grouped based on similarity. The right side of the table indicates if the constructs relate to the six domains of e-learning identified earlier. The acceptance of technology theories are: Diffusion of Innovation Theory (DOI; Rogers, 2003), Domestication Theory (DT; Silverstone & Haddon, 1996; Silverstone & Hirsch, 2005), Technology Acceptance Model (TAM; Davis, 1989), Theory of Planned Behaviour (TPB; Ajzen, 1991), Uses and Gratifications Theory (UGT; Rosengren et al., 1985), and Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003). The numbers of the domains are identical to those in Figure 3 (see Appendix B).*

Appendix B – Figures

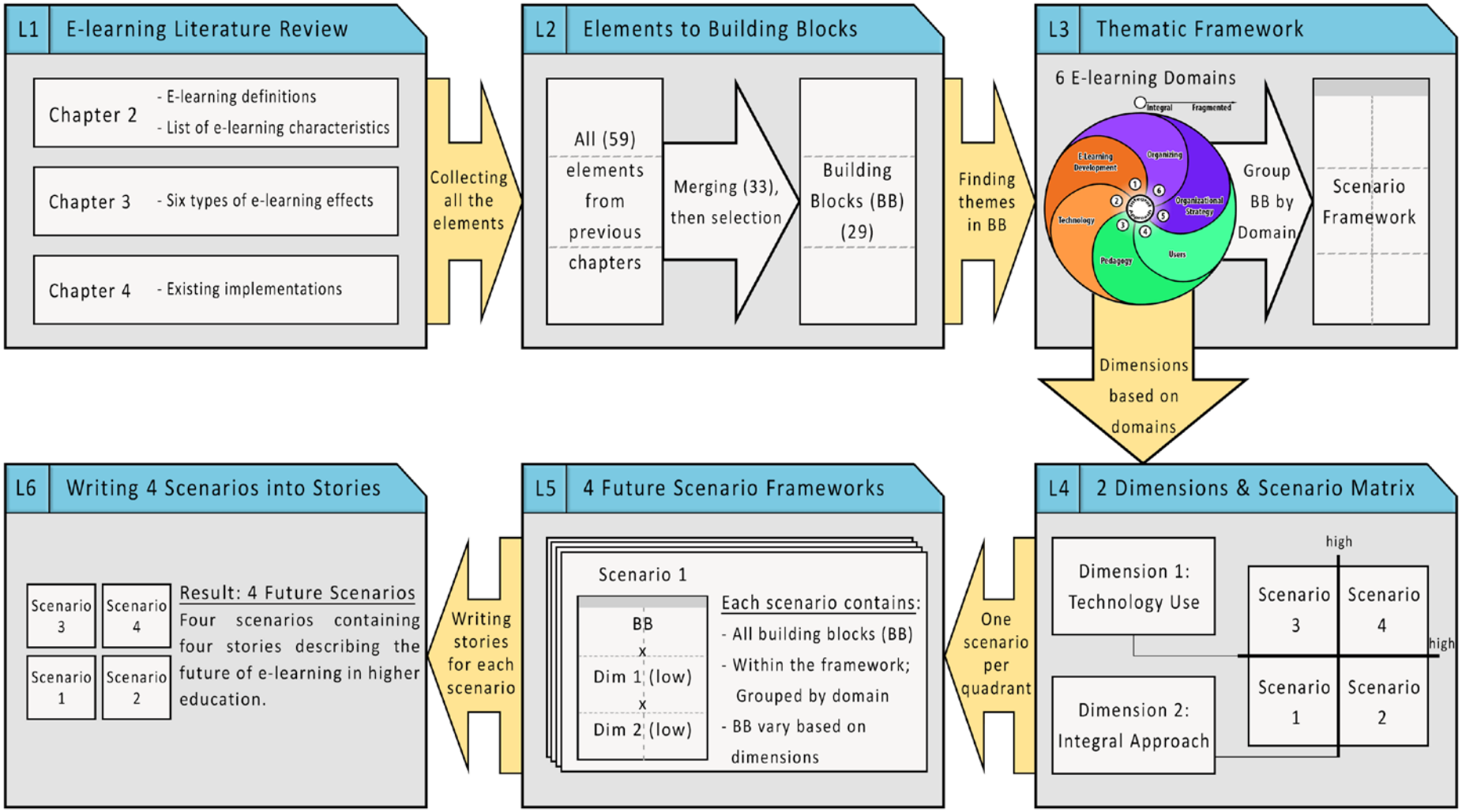

Figure 1 – 6 Level Model summarizing this thesis' development of the Scenarios. Level 1 (L1) describes the review of the literature and the implementations of e-learning found in chapter 2, 3 and 4. In level 2 (L2) all elements (59) from these three chapters are collected, and subsequently merged and filtered into building blocks (29). In level 3 (L3) common themes from the building blocks result in the 6 domains of e-learning which form the basis for the Scenario Framework. Level 4 (L4) describes the construction of the dimensions based on the 6 e-learning domains, resulting in the scenario matrix. Level 5 (L5) combines all previous steps into the four scenarios. Level 6 (L6) writes out all elements within the framework into stories.

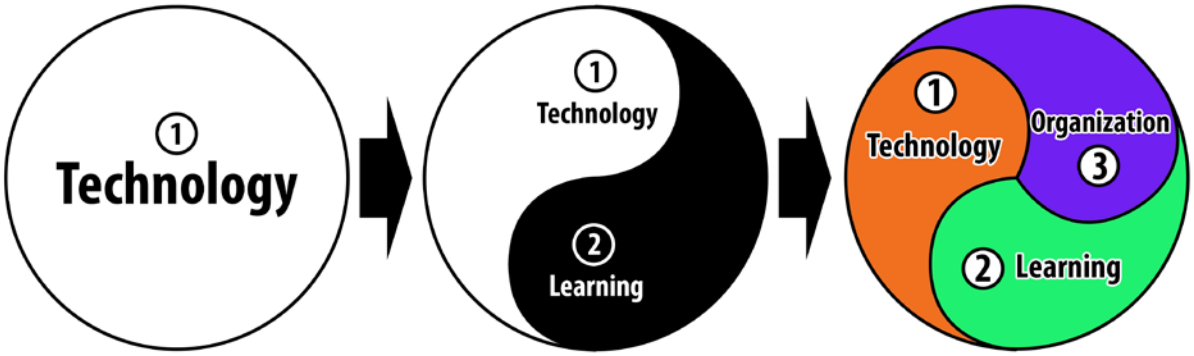

Figure 2 – Shifts of focus on the domains of e-learning. From an excessive focus on technology, to a more balanced focus via the inclusion of educational sciences, to finally an integrated focus on technology, pedagogy and the organizational context.

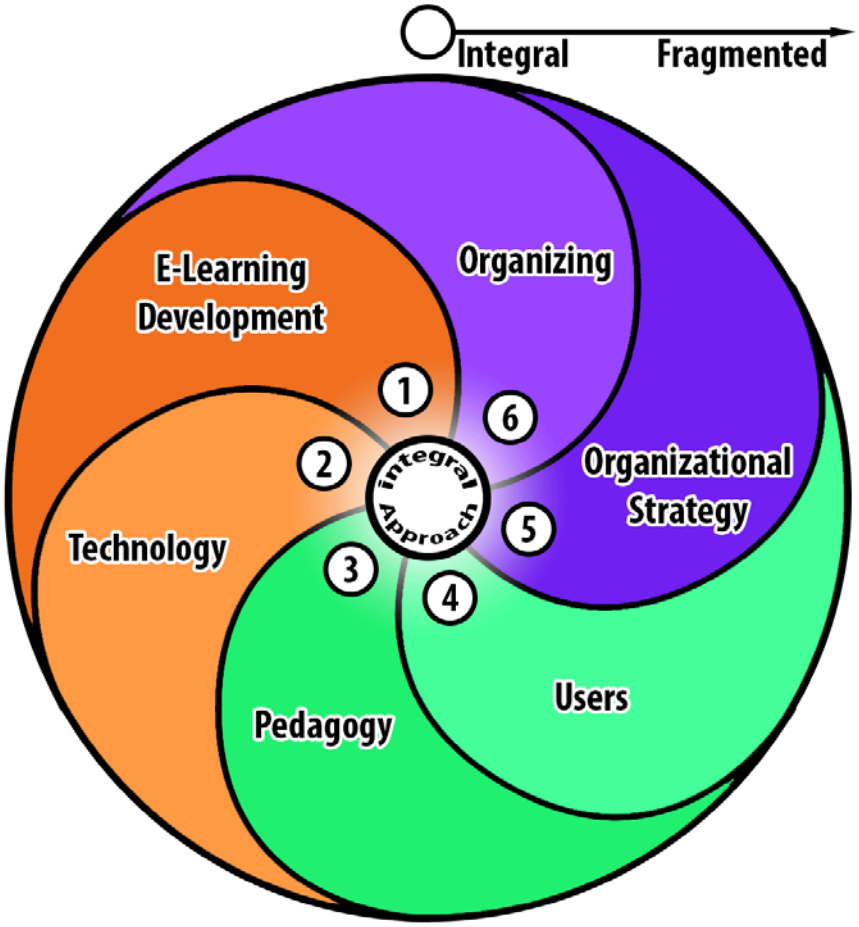

Figure 3 – The six main domains of e-learning in HE, formed out of the three overarching areas: technology, learning and the organization. The simultaneous whole-systems integration of all six areas is crucial to the successful development and implementation of high quality e-learning. This is represented by the centre of the figure where all areas connect. Conversely, the outside of the circle, with large single colour areas, represents the fragmented approach