

LONG LIVE LEARNING!

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About Learning,
Technology
and the Future

Dhoya Snijders

STT Netherlands
Study Centre for
Technology Trends



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FOREWORD

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We all learn, all the time and everywhere. And yet, learning is especially associated with education. And that quickly brings us to learning in school, when we are young. We start going to school when we're about 4 and, depending on the educational path we take, we finish our education around 20 to 24 years old. After that, we continue learning, often informally, from life, on the work floor, from our friends and through the knowledge and information we acquire, while our formal learning is above all done by taking courses for work or out of interest. Some people spend a lot of time learning, others hardly any time at all. You learn because you have to or want to, or both.

In essence, this pattern has only emerged in recent decades. Before that, people spent a lot less time being educated and there were few opportunities to enter higher education. People did learn: on the work floor, in a master-apprentice relationship. Education has adapted to the larger groups of pupils and students taking part in education. Forms of education and courses have adjusted to those groups, as well as to the continuous and ever faster changing need of society. That is not an automatic process and it is understandable that the focus, in practice, development and research, is on educating, learning and training for the labor market. But that labor market changes and will continue to change very quickly.

The last decade, technology has led to a lot of changes. We live in an information society, where knowledge and technology are becoming increasingly important and where traditional jobs are subject to constant change. That affects education and learning, both in the initial phase and in later phases in life. As a result, today's education will have to adjust and anticipate. And it has to make optimal use of the technology that is available. To answer the question how that has to be done requires research: what changes and how? How can we use state-of-the-art technology in education and how can we make clear what technology we need for that?

What about people's focus on structural learning once they have entered the labor market? Obviously companies train their employees and there are numerous organizations that educate and provide courses at different levels and for many orientations. However, the question is whether that is enough in a fast-changing society in which we are continually faced with new jobs demanding new competencies and skills, making old ones obsolete. And that will only increase. The question is if the current system of educating and learning in the time we are also working, is enough to meet the growing demand for new knowledge and skills. I don't think it is. Now is the time to thoroughly review the way in which we learn after completing our initial education. After all, we are talking about 50 years of our lives!

We need to refocus on learning and educating throughout our lives. There are various aspects that are important in that regard. First of all, continuous education has to become normal, both formally and informally. That sounds self-evident, but it isn't. Learning, in particular formal education, in addition to a job, family and social life, requires serious commitment. At the moment, it is an individual choice, often inspired by ambition, sometimes required by employers or professional organizations. Sometimes, there is financial compensation, but more often there is not. So there are lots of failure factors.

In our fast-changing society, educational programs need to be continuously adapted to meet society's changing needs. Even people who have graduated need additional education and retraining to learn the necessary new knowledge and skills. Can we place that burden primarily on the individual, who has numerous other interests and concerns? I don't think so. Continuous learning has to become as normal as going to school when you are young. And although forcing adults to go to school may seem to be taking it a little too far, we do have to better facilitate adult education. What are we talking about?

It seems obvious that the secondary conditions have to be good. That means that people need to be financially able to take a course without placing too much of a burden on the family income. That also goes for the time people have to spend learning. This should fit in their daily lives. Paid leave (either full-time or part-time) may be a solution.

New technology can be an important tool to fit learning into our daily lives, but technology alone is not enough. The curriculum itself has to be good and match the student's life phase. For that, we need to change our thinking and ask many questions, like: How do we offer education? Is there still need for accreditation of educational programs? Can that be done in a more flexible way? And is it possible to make use of what people have learned elsewhere, for instance on their own using educational material? What does it mean having to learn when you are older? How do you make sure that what you already know won't have to be repeated? And then: how do you measure that? How do you validate informal learning?

Adults learn in different ways compared to youngsters, in part because they already have knowledge and skills, and in part because they (need to) manage the time they have at their disposal differently, which in turn is one of the things affecting their learning needs. That affects didactics, independence and flexibility. Can we adapt informal programs to their learning pace, to the knowledge and skills acquired elsewhere, to the way people learn and to new technology?

I am fully aware that the questions I have posed above are inspired by what we know now. I intentionally talked little about the new opportunities technology is offering and will offer. Technology provides means and certainly facilitates opportunities to organize education differently from how it is organized at the moment. If, for instance, implants would allow us to acquire new information while we sleep, the system would change. However, we still need to determine what knowledge is needed and identify the various ways it can be transferred. And we need to determine how learning fits in with the social structure in which we live. Those are the questions that we have to ask ourselves today and in the future. And those are the questions that are raised in this foresight study on the future of education. The aim is to stimulate, provoke, and inspire you to act. Because how we learn, when we learn and what we learn has become more important than ever.



1. INTRODUCTION

1.1 Motivation

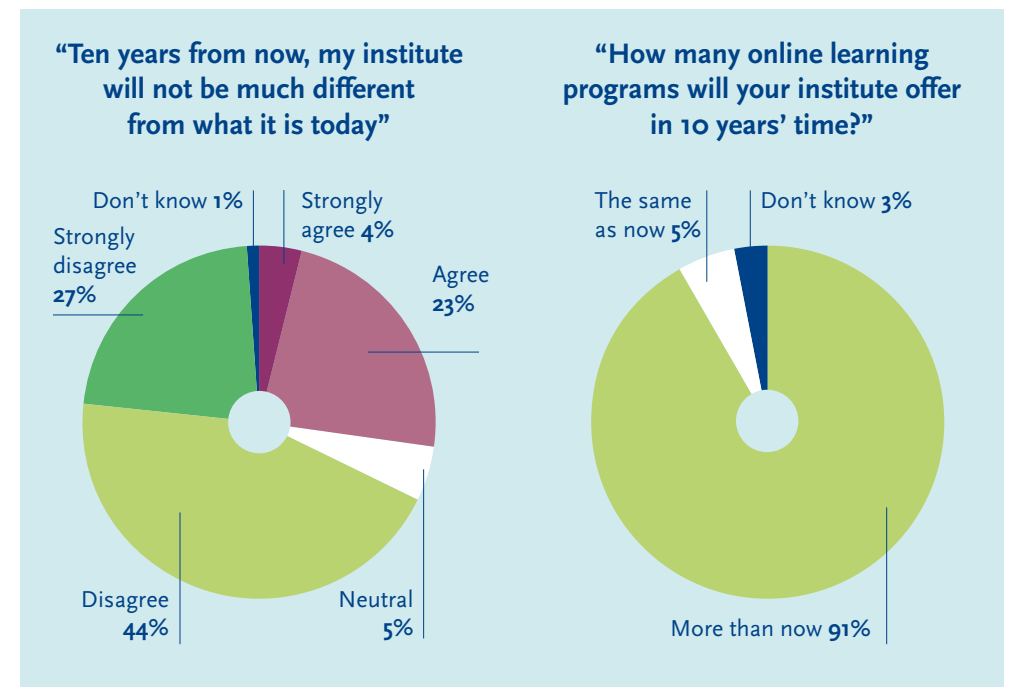
“Don’t forget that technology is subordinate to humans”, said the Dutch Minister of Education Bussemaker at the opening of the 2017 school year¹. Quoting Stanley Kubrick’s 2001: *A Space Odyssey*, the famous science fiction film, she wondered how technology will help us improve our learning. The movie featured futuristic technology, such as cryogenics, personal tablets and artificial intelligence that had advanced beyond human intelligence. Since the release of the movie, our technology has become a lot more powerful and a number of those futuristic ideas have become reality. Chatbots, chips and robots are now lining up, virtually speaking, to help us acquire knowledge and skills in different ways than before. Facilitated by new technology we can learn what we want, where we want and when we want. As far as information is concerned, the world is very much at our feet. We have access to zettabytes of data and can connect to each other in the blink of an eye. While technology is changing the world around us at breakneck speed, there are increasing fears that smart systems like Hal from 2001: *A Space Odyssey* will reach general human intelligence or go beyond it.

Bussemaker argued that because of that we need to keep a close and critical eye on technology. Technology is increasingly present in the educational domain, where “a clear vision regarding the relationship between education and technology is often still lacking”. According to her, technology should not be in the driver’s seat, but instead it should support and facilitate our own vision on learning.

As others have argued, society is quickly becoming more digitalized, while the education sector is still searching how to cope with digitalization (VSNU 2017). From booking our holidays to doing our shopping and maintaining relationships, our lives are increasingly mediated by technology. Expectations for the future strongly diverge. Some people warn us about the disrupting impact that the internet, robots and artificial intelligence will have on society and the labor market, while others merely see possibilities and opportunities. What almost everyone agrees on is that the solution to our societal problems is to be found in the way that we learn. Most reports about the future of our society address educators with the message that the future of our society to a large extent depends on the way we learn, the skills and competencies we learn and the outcomes of our education.

However, the far-reaching digitization of society does not resonate with today’s formal education and this calls the way that we organize our education into question. In a world where we have access to each other everywhere and at all times, do we need traditional classrooms and lecture halls in which groups of students learn simultaneously? Do we still need physical libraries that centralize the storage of knowledge? And should we not reassess how human relationships, for instance between student and teachers, are affected by technology?

According to the World Economic Forum, 65% of the children who enter primary education today will end up getting a job that does not exist yet (WEF 2016a). The intensified use of new technology by young people has led various scientists to conclude that, in the short term, technology will have a major impact on the way we learn, the curriculum and the learning environment (Schuck and Aubussen, 2010). A survey among 19 deans (see figure 1) shows that education managers expect that technology will have a huge impact on our educational institutes. More than two-thirds of the deans expects that, within 10 years, their organizations will have changed enormously and 90% expects that they will have many more online learning programs.



Insights from a Survey of College and University Deans / June 2017

¹ Opening of the year 2017, Fontys Hogeschool Eindhoven



At the same time, we see that learning environments adjust only incrementally and digitization is not a universal process. VSNU (2017) analyzes, for instance, that digital applications in the Netherlands can be seen in administrative applications – setting up schedules, collecting grades and using digital platforms to communicate with students are quite common – but that formulating digital educational objectives and using digital learning tools are less common. For example, the current core objectives for primary education and the final targets for secondary education contain little with regard to the development of digital literacy, computational thinking or programming. What educational institutes offer depends above all on the enthusiasm of the team or its individual members. The same is true with digital learning tools: there is certainly an increase in the use of digital possibilities in education, but there is great variation in the way they are used. In addition, the education sector is still defining its role in terms of shaping the new educational digital applications. The development of those applications, both generic and domain-specific educational software, primarily takes place outside of education, by commercial parties. The education sector has little influence on these digital innovations. Often, digitization is not given shape in or by the educational sector, although it is in particular through digitization that new opportunities for education are created that would allow educators to shape developments that could make education better, more attractive, more effective or more accessible.

As such, the issues concerning the future of learning are not limited to the education sector itself, or to the Minister. If we want to head for a future in which technology plays an increasingly prominent role in the way we learn, it is important to start a broad societal discussion about this subject. The education sector will increasingly have to work together and coordinate with technology companies to determine which technology is suitable and how content is developed. The business community will have to start a societal discussion about its role in the knowledge society – in particular when a vision on a life-long learning becomes more concrete. The government will have to think about new regulation and guidelines regarding technology and learning. And scientists have the important task of both contributing to and reflecting on these developments.

1.2 LEARNING AND TECHNOLOGY

Learning is a complex term that is related to knowledge, skills and education (UNESCO 2015). So when we talk about learning in this publication, what are we talking about? Ivan Illich outlines a basic definition and states that learning means something like “acquiring a new insight or a new skill” (1973, p.1). It is not just about knowledge or information, but also about the ability to do something new.

One of the important and constantly recurring discussions with regard to learning is whether we should see learning as a product, or as a process. In the past, learning was often conceived as a product, in which a piece of knowledge is transferred from one person to another, after which it becomes the ‘possession’ of the learning party. A modern metaphor that matches that notion is that of the brain as a computer: we can transfer and store data, which can then be replicated at a later date. Many teachers and students continue to see learning in those terms, but modern education experts think that learning is more complex and describe it as a process. Bruner, for instance, argues that “learning is not simply a technical process in which information is transferred in an adequate way” (1996, p. 146). Instead of the acquisition of knowledge, he believes that learning is an uninterrupted process of participation in which we interact with and understand the world. This second definition is less tangible, but it is interesting in the reflection on our existing educational models. Instead of organizing formal educational environments in which as much knowledge transfer as possible is facilitated at the start of our lives, this definition of learning argues in favor of a continuous learning process that never stops. In addition, it argues that learning cannot always be planned and in part can even be a subconscious process. That has implications for how we organize education. Because when we talk about learning, we usually mean education, the formal learning system that we organize in our society and in which we structure, monitor and accredit learning. This foresight study deliberately examines the notion of learning, and not education in a stricter sense, because it is possible that, in the future, we will adopt a broader sense of learning in which the boundaries between formal and informal learning, and between learning within and outside of the education system, will blur.

EduTech – or technology that is used to improve the human learning process – can play an important role here. To understand that, we need to briefly examine the term technology. In a general sense, technology can be seen as the process with which people modify nature to meet their wishes and needs. According to Volti, technology is developed to allow us to do things that we would otherwise not be able to do, or to make them cheaper, faster and easier (1992, p. 4). So technology is not limited to machines alone, but above all involves the innovation of human processes. This study does not focus on technology in the broadest sense of the word, but examines in particular new and expected digital technology. We witness a swift development of data-driven technology, social network technology, autonomous smart systems, and the integration of technology and our body. Slowly but surely, these trends enter the domain of human learning. Some are already successful, others are not. The expectation is that, in the short term, we will see more experiments, new applications, new regulation and new (ethical) issues emerge in this area. As such, the discussion about technology also has to be put in a broader context, one that includes the social context, regulations and underlying ideas. We have to ask ourselves which problems are solved through EduTech, whose problems they are and which new problems arise through the use of EduTech, the central question being what we, as a society, want.



1.3 WHY EXPLORE THE FUTURE

“The fact that you don’t know the future does not mean that you cannot – or should not – prepare for it. That is certainly true for a sector like education, which focuses in particular on the future”, according to Minister Bussemaker². Although much has been written about the future of learning, according to Neil Selwyn (2010), there is a tendency to see the future of learning either in utopian or in dystopian terms. In his literature review, he sees that one group of experts focuses especially on the harmful consequences of technology, like the alienation from regular educational processes, the loss of meaning and the aggressive takeover of existing processes by new players like commercial parties or technology itself (robots and artificial intelligence), while the other group sees a quick ‘technological fix’ of problems that affect education at the moment, like a shortage of teachers, a lack of resources, a lack of interest on the part of students or poor results. However, Selwyn concludes that both the utopian and dystopian scenarios are given too much attention, because the education system, historically speaking, tends to stick to ‘business as usual’ (2010, p. 173). Although the picture should be balanced, the emergence of technology and its integration in our daily lives does make way for a new approach to the way we learn. If future possibilities are not included in our discussion about learning, existing processes and institutes that were developed for that purpose risk becoming obsolete or stagnating (Schuck and Aubussen 2010).

As such, our reason for exploring the future is that it is necessary to revise education in the light of the digitization and increasingly technological nature of society. And although it is hard to predict the path technological innovation will follow, there is a need to discuss the possible opportunities and consequences of technological developments with regard to the way we learn. We do this by collecting images of the future, analyzing and comparing them. With this input we create new future scenarios, which we subsequently use to inform future-oriented policy.

² Bussemaker in *Education of the Future*, July 2017 See: <https://leerling2020.nl/wp-content/uploads/2017/05/Onderwijs-van-de-toekomst-juli-2017.pdf>

1.4 ISSUES

Fast technological developments make it necessary for governments, businesses and society to increase their grip on the future. Greater insight into the future creates greater possibilities to work towards desirable views on the future. That is why we chose to conduct a foresight study that addresses views on the future of learning and technology. The study has a contextual focus on the Netherlands, but aims to be relevant for an international audience, with the central issues being:

How will technology affect the way we learn in the coming decades?

- What is the history of EduTech?
- Which influential views on the future involving learning and technology have been created in the past 25 years?
- What will the consequences of the use of technology be on our education?
- Which future scenarios are plausible?

1.5 READER’S GUIDE

In this publication, we try to address these subjects by focusing on a sub-question in each chapter. In chapter 2, we start by providing insight into the methods we use to conduct this foresight study. In chapter 3, we discuss the history of the use of technology to facilitate learning. Chapter 4 takes a look at the history of the future, which means we analyze existing literature and reports containing images of the future. Based on this literature review and a quantitative meta-analysis, we present the main socio-technological trends involving learning and technology. In chapter 5, we discuss the results of a Delphi study we conducted to test the trends and images of the future. We also delve deeper into perceived optimism and pessimism concerning EduTech, and respondents arguments in favor of and against using it. Based on the trends and results of the Delphi study, we describe three future scenarios in chapter 6. We finish with an overview of the main lessons and points of discussion from this report in chapter 7.

Interview Dr. Robert Marzano

By Thijmen Sprakel³

*Robert Marzano is director of the Marzano Research Laboratory in Centennial, Colorado. He wrote over forty books about education, including *The New Art and Science of Teaching* (2017).*

What is your view on technology in education?

Students should know the basic principles of programming. The cognitive skills that play a role in programming are very concrete and strong. The basic principles of programming are closely related to our problem-solving abilities, decision-making skills and investigative abilities. As far as I am concerned, that is a new element of the curriculum. I do not call it technology, but coding, which obviously requires technology.

What will learning look like ten years from now?

I believe that human beings will always be important in education. But the teacher in front of a class of thirty students will become less and less important in that role. A teacher discussing a new subject and explaining it with examples could be replaced by technology, which might even improve the way the subject is presented.

Ten years from now, teachers will work with individual students in small groups. By that time, the teacher has become a ‘facilitator’ and guide for the students in the learning process. Students need to be involved in their own learning process and the way they are tested. Students need to influence that process and, if they do, the learning process will become much more efficient for them.

What is your message to politicians?

Be very specific when talking about subject content. Within the subject content, define elements that will be a measure for the level of control. There is a definable set of cognitive and meta-cognitive skills that can be taught within the curriculum. These skills need to be linked to specific subject contents, grades and subjects. An extension of this is competency-oriented education. Why not give students the opportunity to move through the curriculum at their own pace, instead of linking specific content to certain ages regardless of whether or not students are ready or already possess that knowledge. These are major changes that are within reach. •

³ Thijmen Sprakel is a teacher and educational innovator at a secondary school in Hellevoetsluis. For EduKitchen.nl, he interviews international scientists, innovators and education professionals to share tips, tools and best practices with the Dutch public and help improve education. All interviews focus on the question regarding what can be improved in education, what the role of technology in education is and what the future of education looks like. You can find the complete interviews on www.edukitchen.nl.



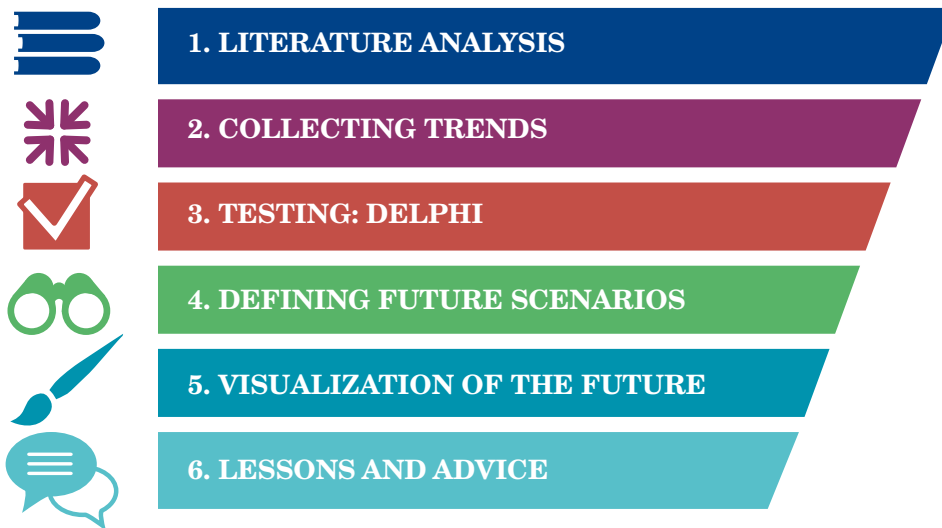
2.

METHOD

Education is the
kindling of a flame, not
the filling of a vessel.

Socrates, 470 BC

There are different ways we can examine the future impact of technology on our capacity to learn. This chapter addresses the different methods we used in this foresight study.



2.1 LITERATURE ANALYSIS

What did other people write about the future of learning and the role technology can play? As a first step, we conducted a literature study to position this foresight study within the debate about the future of education and to determine its added value. Within the framework of his thesis, Gerben Janssen van Doorn of Radboud University conducted a literature study into scientific publications and research reports discussing the future of learning. On the basis of a meta-analysis, his thesis aims to identify what the main trends are with regard to technology in education (See Janssen van Doorn 2017). This meta-analysis was conducted in accordance with the methodology developed by Van 't Klooster and Van der Duin (2012).

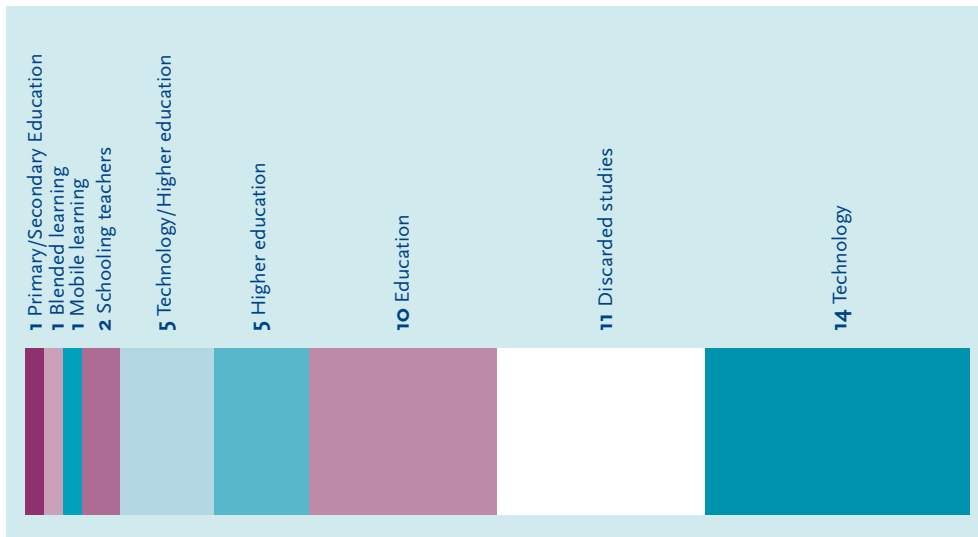
STRUCTURE META-ANALYSIS

1. **Determine the goal of the future study.** Goals can be placed on a continuum from narrow to broad. The breadth of a meta-analysis affects the number and diversity of studies that are included in the analysis. In this study, we only included futures studies the goal (or one of the goals) of which is to examine future developments in the area of ICT in education.
2. **Compiling a longlist of future studies.** In this study, we looked for studies on the basis of keywords that were deduced from the main and sub-questions. The keywords were: ICT, Technology, Education, Learning, Teaching, Schooling, Foresight Study, Trends and Scenarios. We looked in Dutch and English to identify both domestic and foreign studies. A number of experts then checked to see whether relevant studies were missing. The complete list of the publications we found is included in appendix 1.
3. **Selection and narrowing down of publications to a shortlist.** To make sure that the longlist of publications from step 2 is manageable, they were selected on the basis of three different characteristics, to create a shortlist:
 - Studies that focus on the role of ICT in education.
 - Studies that are the most cited
 - Studies that were published since 1998.
4. **Structuring the shortlist. The shortlist will have to be structured further to make analysis possible.** In this study, the shortlist was structured by the type of domain, like the general future of education, or a more specific topic like the use of iPads in education.
5. **Studying and coding the selected publications. In this step, the collected material is studied and analyzed.** In this study, special text-mining software (Atlas.ti and R) was used to code the text based on a number of keywords, after which manual analysis was possible. The coded futures studies were scanned for future trends and development related to the role of ICT in education.
6. **Clustering findings and defining FDSC's.** Because step five resulted in a long list with trends, it is important to cluster the trends into more general developments, or Forces Driving Structural Change (FDSC).
7. **Assessment of FDSC's: expert survey.** A survey was conducted about the impact and level of uncertainty of the findings. Based on the FDSC's with the highest impact and level of uncertainty, four scenarios involving education and ICT were created.
8. **Writing scenario's.** Writing the scenarios. Combining the two FDSC's makes it possible to create four different and plausible scenarios.
9. **Evaluation and retrospective.** The results of the scenarios were linked to the research questions from paragraph 1.



2.2 COLLECTING TRENDS

The initial search based on the selected keywords provided 50 studies, which were selected on the basis of the title and the document's abstract. Of these 50 studies, 11 were omitted, leaving a shortlist of 39 studies, which were then characterized per domain.



These studies were coded in the qualitative data analysis software ATLAS.ti by labelling all the (relevant) trends, causes and effects in the studies. This resulted in a list with 71 unique codes, which were further divided into 14 code families, with the possibility for a code to be used in several code families. Finally, the programming language R was used to apply data cleaning and quantitative word frequency analysis, allowing us to confirm or refute the results of the quantitative analysis with data from the qualitative text analysis. The quantitative analysis can indicate in what percentage of the studies a certain term was used and how often it was used per study.



2.3 DELPHI

To test these trends, a Delphi study was set up and conducted among 66 people from the scientific community, the business community, government and society in the second half of 2017. During three months and in various rounds, they were asked about the role of technology in learning. Below, we briefly discuss the method, the reasons for using it and the structure of the study.

The Delphi method is a research method that was developed in the early 1950s in the United States within Project RAND, which was set up in 1949 by General Arnold to provide information on the long-term development of weapons. When quantitative models, trend extrapolations and existing scientific instruments proved insufficiently capable of taking into account unexpected developments, the Delphi method was tested and developed. During the first few years, the method was used above all to explore the future role of technology in warfare. Later, it was also used in the education domain, to formulate guidelines, discuss standards or predict trends (see Green, 2014).

In the Delphi study, a group of experts are asked questions in various rounds, while they have access to the (anonymized) answers of others. The aim is to generate new insights about a subject about which there is a lot of uncertainty, like future developments. The structure of the method reduces the total number of answers to a number of categories, to understand where there is either consensus or dissensus. The underlying assumption is that structured communication of a group of people provides more insight than individual assessments. An additional advantage is that, when policy issues are concerned, the method can be used to create broad support for ideas.

In the 1970s, the original Delphi method was reinvented by Turoff (1975). The first Delphi's aimed at creating consensus among experts and invited a fairly uniform group of experts to take part. The subjects being discussed were technical in nature and the experts had similar, often technical, backgrounds. Turoff developed the Policy Delphi, which instead tried to collect opposing perspectives on major policy issues (1975, p. 80). Instead of consensus, the aim was to map different views on the future. Policy-makers, according to Turoff, have no interest in trying to get one group of stakeholders to generate a solution to an issue. They very much prefer having an overview of different arguments or scenarios, to which they can anticipate in the policy process (ibid, p. 80). As such, the aim of this Delphi is not to arrive at a consensus (see also Van der Linde & Van der Duin, 2011). Our goal rather is to provide insight in the discussion on technology and learning, to show about which developments there is consensus and, in the case of disagreements, to show what the underlying arguments are.

To a large extent, we conducted the Delphi method online and submitted the questionnaires online. This approach has a number of advantages. First of all, the Delphi method is a research method used to collect the opinions of a large number of experts, which is easier in an online environment. In addition, an online Delphi avoids certain negative effects of group discussions; the risk of herd behavior and social pressure is smaller, everyone has a chance to voice their opinion and answer in the way they want, and the anonymity guarantees a high level of freedom of speech. In addition, the participants are given the opportunity to review and adjust their original answers, allowing them to answer questions they left open earlier or correct wrong answers, making the answers more reliable.



On the other hand, there are a number of risks that affect the results (Green, 2014). By setting up an anonymous online questionnaire, there is a risk that not all the desired respondents are included. Some people find filling in an online questionnaire less desirable (for reasons of form, preference or skills). Also, by including several rounds, the decline in the number of participants as the study proceeds is an potential risk.

As a countermeasure, we organized a meeting at the end of the process, facilitating a group discussion. The entire list of respondents (including the ones who did not respond) was invited to get together. During this meeting, a number of the main results were presented and the respondents entered into a discussion (based on the sector in which they operated). That way, we tried to deepen the results of the questionnaire and arrive at a strategic agenda.



2.4 FUTURE SCENARIOS

The future is shaped by the perspectives on the future that people have today. That is why it is important to examine existing ideas and work actively on new views on the future. In this foresight study, we do that on the basis of scenarios. A scenario is a plausible and simplified description of a possible future. Scenarios are based on assumptions about possible developments and do not try to predict the future, but map possibilities. They try to avoid the weaknesses of predictions. And where they lose specificity and accuracy, they gain ground by allowing people to discuss futures that may at first sight appear to be unlikely, but that are possible. That is why they are used a lot for strategic purposes.

The scenarios in this study were devised on the basis of trends from the literature analysis and the Delphi study, and address three directions education can take by means of the use of technology; namely personalization, socialization and qualification.

The scenarios do not try to predict the future, they are meant to identify a number of significant motivations that help determine our future (Giaoutzi and Sapio 2013). It is not the intention to put the scenarios away and check whether or not they were right twenty years from now. The intention is to have policy-makers, strategists and academics use them now as a stepping stone for a discussion about the future of learning and technology.

Say almost anything bold about the future and you will almost certainly sound ridiculous to someone, probably including most people in the future. That's fine. The future should be our theater. It should be fun and wild, and force us to see everything in our present world anew (Lanier, 2014).



2.5 VISUALIZATION

During the process, the documentary 'Leren, Leren, Leren' was made in collaboration with Broosdoc Films. In this documentary interviews with teachers, students, philosophers and experts illustrate some of the main trends and issues regarding learning and the future and make these issues tangible for larger audiences.

In addition, in collaboration with the Creative Industries Fund NL for the Arts and the Royal Academy for the Visual Arts, a research lab was set up in the fall of 2017. Students and professional artists were invited to visualize the future of our learning process. The lab was part of the Academy's curriculum and differed from normal subjects because students from all disciplines were invited to take part. Via the Creativity Industries Fund NL, students and professionals were brought together and STT helped shape the subject by organizing classes and events for the students. In September and December 2017, joint symposiums were organized in The Hague which involved presentations by (inter)national speakers and where the student art was displayed. After that, the Ministry of Education, Culture and Science scaled up the project by asking all Dutch art academies to visualize the future of our education. A select number of works was shown to the broader public during a major conference at Nemo Museum in Amsterdam in June of 2018, followed by an exhibition in the Dutch Education Museum in Dordrecht.



Still from the
STT documentary
'Leren, Leren, Leren'



2.6 LESSONS AND ADVICE

During the foresight study, an interdisciplinary think tank reflected on the results of the study, actively considering what the results mean in terms of strategy, policy, management and the here and now. The group had three functions:

- **Steering:** what is the scope of the study and what remains outside its scope?
- **Think tank:** how will technology change the learning process? How do we move from future scenario to impact?
- **Ambassadors:** publicize the foresight study

The think tank had a chairman, Anja Oskamp of the Dutch Open University, and included members of STT's management board and experts from the field (see appendix for the full list of group members).



Glocal Connections: The World is Your Teacher

By Hans Stavleu, Patrick van der Duin⁴

Jesse Frasa has decided to spend a year studying abroad. Although his final high school year is about to start, he's got it all planned out. After finishing high school, he wants to study 'Transcultural Studies' and he has mapped out his own roadmap that should lead him there. Actually, it's a very special roadmap.

Once he has his diploma, he intends to spend the intermediate year setting up small-scale education in Bulgaria. He already has permission from the Ministry of Education, Culture and Science. Via the Open Learning Initiative (OLI), he was immediately put into contact with Dr. Ivan Dimitrov, who would help him work out his proposal further.

OLI is a platform in which university lecturers, teachers and managers support students who develop international activities. All questions, answers, discussions and best & worst practices are shared on this platform.

Jesse spent many an evening scanning OLI. He did not know exactly what he was looking for, but he was sure OLI could help him with something he was not looking for specifically but was determined to find. After looking around in general and chatting a lot, his network on OLI kept growing and becoming more valuable. Suddenly, he found something interesting. It was Ng Kiow Leng from Singapore who responded to his profile.

Kiow Leng saw that Jesse had mentioned 'Transcultural Studies' in his profile. That triggered her, because, as a teacher at one of Singapore's Polytechnics, she has set up a 'Glocal Connect Village', a study center for transcultural education.

Jesse made an appointment with her early the next morning. Because of the time difference, it was difficult for him to set up a video call at night. Because of Dr. Ng's heavy Chinese accent, Jesse had to try very hard to keep up the conversation. It quickly became clear that all Polytechnic students of any course take different modules in the Glocal Connect Village for at least two weeks, to teach them about local and global cultures and how they can use this knowledge locally and in the rest of South-East Asia. They learn how they can transform local initiatives into manageable solutions for our places in the world. "Small but scalable", she adds.

They agree that Jesse will talk to a number of teachers and students via OLI to ask them about their experiences with the teaching methods that are used in the Glocal Connect Village. And in addition, they can show him something of the campus and of the Glocal Connect Village.

The virtual tour is a success. Jesse is treated in a very friendly and helpful way. Together with the students from Singapore, he creates a digital holographic about the possibilities of setting up a local version of a Glocal Connect Village in Bulgaria. From a competitive perspective, that will allow the Singapore Polytechnic to make a good impression at OLI.

He then contacts Dr. Dimitrov who, of course, has already been informed automatically of Jesse's digital holographic. He shares some knowledge about Bulgaria with Jesse to help him strengthen his proposal for setting up a Glocal Connect Village in Bulgaria.

Jesse sees his special path as part of a poem by Robert Frost: "Two roads diverged in a wood and I – I took the one less traveled by, and that has made all the difference." ●

2025

⁴ To appear in the book 'Towards New Comfort Zones. Future scenarios for our Education' (2018).



3.

EDUTECH, A RETRO- SPECTIVE

The past is as much a
work of the imagination
as the future is.

Jessamyn West

3.1 INTRODUCTION

Sometimes, to look ahead, it is good to first stand still and look back. This chapter takes a look at the history of EduTech, to show how it developed historically and draw lessons from both the development and the implementation of this type of technology. A historical perspective can help in a number of different ways. First of all, it places developments in perspective and shows that technological developments and policy decisions affect the future (Ortt and Dees 2018). Generally speaking, one technology does not simply replace another. There is such a thing as path dependency. The success of technology has a lot to do with the presence and success of preceding technologies. What this means is that we can only understand technology when we examine its history and the context in which it was developed (Selwyn 2016).

A second reason for looking back is that it is not always immediately clear whether a certain technology is successful. The adoption of technology has to do with all kinds of socio-technological reasons, like its safety, incidents that take place, marketing campaigns, political debates, etc. As a result, it is often not completely clear at first what the impact of technology will be. For instance, can we already grasp what effects blockchain or voice recognition technology will have on our society? And what are the consequences of these kinds of technologies on the way we learn?

Thirdly, it is good to look back because looking back provides a perspectives that transcends hypes. If we read certain EduTech blogs or magazines today, it looks as though technology will be completely disruptive. “New robots make teachers obsolete!”, neuroscientific breakthrough technologies will facilitate direct brain-computer interfaces, and virtual reality developments are likely to replace traditional classrooms. Without ruling out these options completely, history teaches us that, generally speaking, more time elapses between the discovery of new technologies and their use than people think at first. The mistaken notion that technology will revolutionize our lives in the very near future is of all times. In 1913, Thomas Edison predicted that books would very soon “no longer be needed in schools”. He suspected that one of the technologies involved, namely movies, would not only replace books, but teachers as well.

I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks. I should say that on the average we get about two percent efficiency out of the schoolbooks as they are written today. The education of the future, as I see it, will be conducted through the medium of the motion picture ... where it should be possible to obtain one hundred percent efficiency. (Edison, 1922)

In 1981, we could read similar predictions in a book called *School, Work and Play* (World of Tomorrow):

If we look further into the future, there could be no schools and no teachers. Schoolwork may not exist. Instead you will have to do homework, for you will learn everything at home using your home video computer. You'll learn a wide range of subjects quickly and at a time of day to suit you. ... The computer won't seem like a machine. It will talk to you just like a human teacher, and also show you pictures to help you learn. You'll talk back, and you'll be able to draw your own pictures on the computer screen with a light pen. This kind of homework of the future will be more like playing an electronic game than studying with books. ... Eventually, studying a particular subject will be like having the finest experts in the world teaching you. Far in the future, if computers develop beyond humans in intelligence, then the experts could in fact be computers, and not human beings at all!

And in 2018, the Rector of the University of Buckingham, in his new book *The Fourth Education Revolution*, writes:

Within 10 years a technological revolution will sweep aside old notions of education and change the world forever. It will open up the possibility of an Eton or Wellington education for all. Everyone can have the very best teacher and it's completely personalised; the software you're working with will be with you throughout your education journey. It can move at the speed of the learner. This is beyond anything that we've seen in the industrial revolution or since with any other new technology (Seldon, 2018).



3.2 A BRIEF HISTORY OF TECHNOLOGY AND LEARNING

The future will tell if Anthony Sheldon is right. In this chapter, we start by looking at the history of EduTech and discover that it goes back a long way. The abacus appeared as early as 2700 BC in Mesopotamia, while the ancient Greeks, Romans and Chinese, and ancient India already used physical learning environments. Around the year 425, the Byzantine Empire set up a formal education system to make sure that citizens were educated to serve the empire. In the Renaissance, this idea flourished further, and was accompanied by a variety of instruments and technologies. For instance, in the 17th century, Comenius produced the *Orbus Pictus*, or the world in pictures, the first textbook for children. The use of the blackboard in school classrooms from the 19th century onwards turned out to be such a success that they are still present in many classrooms today. In 1841, about the blackboard was written that “the inventor or introducer of the system deserves to be ranked among the best contributors to learning and science, if not among the greatest benefactors of mankind” (in Tyack and Hansot 1985, p. 40). So today’s digital technology is not the first EduTech to be hyped.

In the past century, three technological trends played an important role in the classroom: movies, television and digitization. In this paragraph, we discuss these trends and, when talking about digitization, we will pay attention to trends like MOOCs, Learning Analytics and Artificial Intelligence.

Educational Movies

But let us start with movies. A number of teachers in the United States and Europe started projecting images for educational purposes as early as the late 19th century. The teachers used film strips that they had to wind up to play. While they played them, they read texts out loud and provided comments. Several decades later, during the emergence of silent movies and newsreels, the use of movies for educational purposes became successful, not in the least because rich movie enthusiasts like Thomas Edison himself believed in the medium and made considerable investments in educational movies. In 1910, the Catalogue of Educational Motion Pictures had recorded over 1000 movies, which were divided among thirty or so categories. The introduction of film was coupled with the investment in infrastructure that was important for the wider use of technology in the classroom (Ferster 2014, p. 32). In addition to investments in material, like projectors, screens and special classrooms, at a national level, institutes were founded to promote and facilitate ‘visual instructions’. Organizations that manufactured projectors and movies, like Kodak, around that time also started working on movies for modern education themselves (Saettler 1990). According to proponents, movies brought education to life and one education commissioner from the USA even described movies as

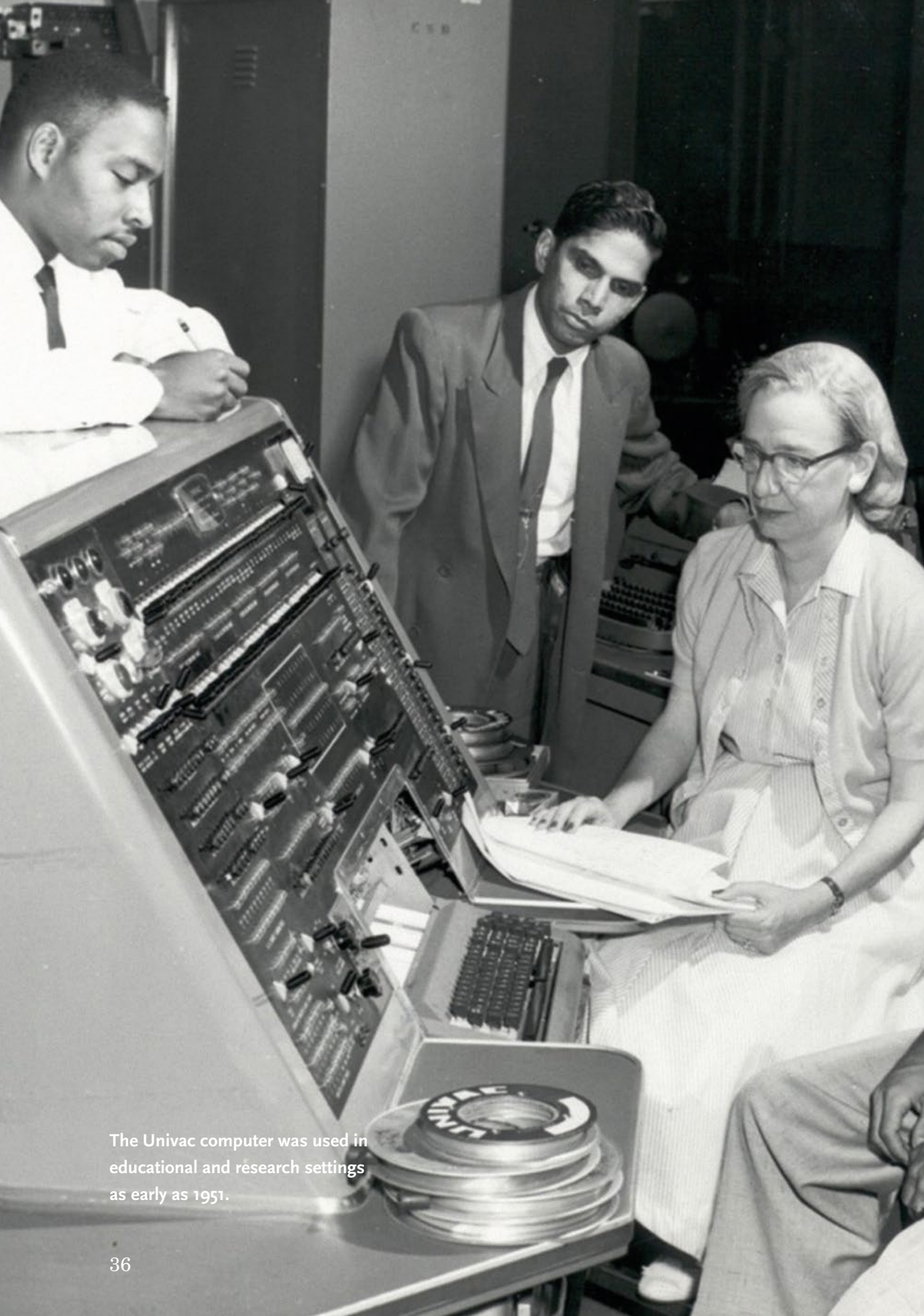
“the most valuable weapon for the attack on ignorance the world has ever known” (Tiagert 1923). Although these visions were broadly shared, in the following decades film turned out not to be particularly disruptive. Despite the popularity of movies as a form of entertainment, the medium was used sparingly in educational institutes and, although it was an addition to existing didactic tools, movies replaced only a very small percentage of regular classes. Literature lists several reasons for the ‘failure’ of the large-scale deployment of this medium, namely:

- A lack of knowledge among teachers
- High costs of films and equipment
- A lack of central coordination and investments, and
- A shortage of fitting content (Selwyn 2016).

Education television

Despite its failure, film turned out to be a successful icebreaker for another educational medium, namely educational television. With the large-scale emergence of television in the second half of the 20th century, several stations and programs focused on education. In the USA, the Federal Communication Commission decided to reserve 242 channels for educational purposes as early as 1952. The Dutch Educational Television (NOT) emerged from the Dutch Educational Film Foundation and was founded in 1962, followed in 1963 by the creation of an educational broadcasting company called TELEAC. In 1980, Great Britain’s national broadcasters made more than fifty educational programs a year and the programs in question were used in 75% of schools. Like film, television was seen as a medium with which both the quality and the quantity of education could be improved, and as a medium that brought students more closely into contact with actual experiences. Although it proved a welcome addition to the educational pallet, educational television did not fulfill the visions of Edison and other proponents. Today, schools still use the medium, but not all of them do and if it is used, educational television does not represent a large percentage of the curriculum. The researchers Moss, Jones and Gunter, who examined the subject, argued that this has to do with the poor quality of the programs, the costs of television and video equipment and the lack of training in operating the equipment on the part of teachers (1991).





The Univac computer was used in educational and research settings as early as 1951.

Digitization

Perhaps the most important form of educational technology to emerge in the 20th century (and one that continues to this day) is digital technology. As early as the 1960s, mainframe computers were used at universities for the first time for educational programs. Within a short time, there were experiments with 'computer-assisted instructions'. In 1966, psychologist Patrick Suppes talked about the computer tutor:

as an apparent saviour of school and university education, capable of providing education to any child or adult on a flexible and individualised basis. Plug-in instruction would ensure the equitable future of educational provision and allow everyone access to top-quality teaching and learning (Suppes 1966).

Because it allowed for interaction with technology, the medium went beyond the one-sided instruction of existing technologies and led to new technology-driven forms of education:

- **Instructions for self-study and coaching:** with the computer presenting material to the student and then asking questions about it. A computer-based 'tutor' monitors the interaction between the student and the system and decides when and how to intervene;
- **Drill instructions:** the computer helps the student acquire skills through repetitive exercises (spelling, math, vocabulary and foreign language grammar);
- **Solving problems:** the student is given a problem and 'discusses' the result with the computer in conversational style;
- **Dialog systems:** the computer develops extensive dialogs with the student;
- **Simulations:** the computer provides simulated versions of experiments, with the students observing the results of their actions on a screen;
- **Use of the database:** the computer offers large files with instructions that the student can go through selectively;
- **Educational games** (Martin & Norman, 1970).

Through government programs and donations from ever-richer technology companies, educational computers quickly obtained an important role in educational institutes. In 1981, 18% of all American schools had computers, but by 1991, that had increased to 98%. In the early 1980s, the then French Minister of Education viewed the use of computers in education as 'le mariage du siècle' (cited in Hawkrigge 1983, p. i). Enthusiasm was global and intense.

A new idea surrounding this educational medium was that computers would cause a revolution because they would shift the focus from the teacher to the student. Digitization would allow students to work in their own way and at their own pace. And also, contact with this medium would prepare students for a future in which digital technology would play a central role. So contact with the medium in itself became one of the goals, and the acquisition of digital skills



quickly became a spearhead of computerized education. In the words of Howard Besser:

The main argument in favor of computer literacy is that of the ‘good citizen’ – the idea that, to be a productive member of society in the near future, you have to know about computers. (1993, p. 63).

3.3 EDUTECH IN 2018

Although computers have never left the classroom and have taken an increasingly prominent role, their introduction, also widespread, was not as dominant as people at first expected it to be. A study by Mundy shows, for instance, that more than half of all teachers only used computers for administrative purposes, and that half of the students used the computer for educational purposes only once a week (Mundy et al. 2012). The VSNU (2017) also states that the rise of digital tools in education itself was slower than that of the digitization in the processes surrounding education. It argues that the resistance to digitization in the Netherlands was in part motivated by the fact that people saw it as an efficiency drive in disguise and, in the 1990s, the hype surrounding e-learning and the world wide web in the Netherlands quickly changed to a sense of disillusionment about their slow implementation.

Like with educational films and television, researchers attribute this to the high costs of the technology, the poor curriculum (which failed to meet the schools’ needs sufficiently, if at all) and teachers who were not trained or did not feel comfortable using the medium. The latter was not just an explanation provided by researchers, but changed to active resistance. Various sources indicate that teachers resisted the use of computers. In 1970, Martin and Norman wrote, for instance: “Most of [the teaching profession] is avidly looking for reasons to hate computer assisted instruction” (1970, p. 130). Teacher unions protested and more recent studies show that, forty years later, teachers still do not view the adoption of computers as an added value (Mundy, 2012).

An interesting new argument against the use of computers was the concern about commercial interference in the education process, which would result in a) the erosion of the public education system, b) a changing and increasingly less important role for teachers and c) a so-called communications effects gap, a gap between students or institutes that did have computers and those that could not afford them.

A central term when talking about the erosion of the education system through the use of new technology is unbundling. This is the process whereby technology helps “cut up” a traditional sector and replace it with technological products. Clay Shirky mentions the example of the

gramophone record, which made it possible for people who could not afford to go to a concert hall to listen to a symphony.⁵ At first, the quality of the technology was inferior to that of the more expensive original, but at some point the quality became so good and the service so cheap that it completely changed the experience of music. A similar thing could happen with learning; by unbundling modules, learning could be separated from education and formal training. Clayton Christensen of Harvard Business School argues that EduTech can be disruptive in that way by first simulating the simplest modules of our education and then improving the quality, the service, the accessibility and the price:

You know, Harvard Business School doesn’t teach accounting anymore, because there’s a guy whose online accounting course is so good. He is extraordinary, and our accounting faculty, on average, is average. Some [universities] will survive. Most will evolve hybrid models, in which universities license some courses from an online provider like Coursera but then provide more-specialized courses in person.⁶

Experiments with technology-driven package solutions replacing public education are emerging. The best known example is AltSchool, which was set up in Silicon Valley in 2014 by a former Google employee and whose main investor is Facebook’s Mark Zuckerberg. On the basis of playlists, AltSchool students follow different educational activities, both offline and online, but always data-driven. All student activities are stored, analyzed and communicated with teachers via apps and sensors.

This kind of unbundling and repackaging can also be seen in the Netherlands, where private parties provide homework supervision, tutoring and exam training (VSNU 2017). The best example in higher education is that of the Massive Open Online Course (MOOC).

MOOCS

The MOOC was initially developed inside universities. A major breakthrough in the area of EduTech was the decision by the Massachusetts Institute of Technology (MIT) to make all its courses available online for free via OpenCourseWare. An Open Education movement was created, and soon top universities from all over the world placed videos and other course material online, and IT platforms were developed to facilitate thousands of students per course. Since the first MOOC in 2008, this type of course has really taken off and by now, millions of students take online MOOCs. These courses are digital, easy to distribute and repeat, and are not limited to the physical boundaries of a classroom. In 2018, the number of registrations for a single course surpassed the 1 million mark. Students can work at their own pace and in their own time, and there are clear benefits as well with regard to accessibility and costs. On

⁵ <http://www.shirky.com/weblog/2012/11/napster-udacity-and-the-academy>

⁶ <https://gigaom.com/2013/02/13/clay-christensen-first-the-media-gets-disrupted-then-comes-the-education-industry>



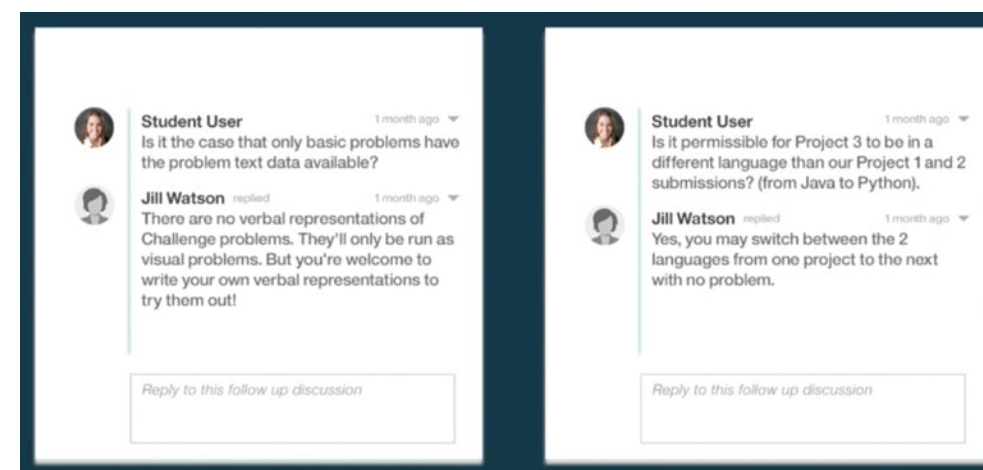
the other hand, the current MOOCs have more drop-outs than regular education, many people experience them as impersonal and it is still hard to monitor student progress. Testing and certification are among the main challenges for MOOCs (Daniel 2015). In the United States, Harvard and MIT have started with XSeries, a certification program for students who complete more than seven courses via EdX, a non-profit MOOC platform. Validation and security are hard to realize with this type of courses, because the MOOC student is located elsewhere and cannot be verified. It is hard to determine who is at the computer during the exams. Technological solutions, like biometric scans, or Coursera's automated remote keystroke recognition engine, which recognizes the keystrokes of individual students as a unique profile, could offer a solution to this problem.

In spite of these challenges, this model caused a shock in the university world when the question was raised "why students would continue to pay for mediocre campus education, when they had access to top quality online?" (VSNU 2017, p. 12). Would online learning lead to competition from which only the top universities benefit? And, with the rise of (semi) private parties like EdX and Coursera, the question arose as to how long traditional education institutes would maintain their position and the added value. More and more employers accept MOOC certificates and encourage employees to take such courses to determine certain skills, according to researchers Banks and Meiniert (2016). That way, the MOOCs keep developing and improving technically, as well as becoming more diverse, for instance in the form of MOCCs (Midsized Online Closed Courses), SPOCs (Small Private Online Courses), ProfEd (professional education, aimed at working people) and Micromasters (online programs at Master level that issue certificates for a specific labor market).

Data-driven Education

These platforms increasingly use learning analytics – the digital collection, measurement and analysis of learning processes – with the aim of providing more insight into, and optimizing, the learning process. After we cautiously started collecting and storing information about our health, our heart rate, sleep, diet and mobility, the dream is to collect more data in the future and to organize it in a more structural way and use it in the learning process. Data-driven education allows students to monitor themselves, provide teachers with more information about individual students, and proponents see that this makes the learning process better, faster and more effective. There are also examples of learning environments that are reorganized by analyzing the data from students and the people using the buildings. For instance, the iSpots program of MIT uses the Wi-Fi data of all users on campus to allow them to use the campus and rooms in a better, more social and more efficient way by reorganizing them so that workplaces, coffee spaces and facilities are located where people use them the most.

For decades, people have predicted that artificial intelligence will be disruptive in data-driven environments. Since a few years, the debate concerning AI has shifted from speculation towards major investments. In 2016, market leaders like Google, IBM and Baidu invested billions in AI, and there is an aggressive race underway involving patents and intellectual property. New developments are also visible in the education domain. AI is used to automate activities such as the checking of test answers. Smart algorithms support software to adapt to the user and personalize the learning process. And AI is the engine behind physical robots, chat bots and digital assistants that are increasingly able to answer students' questions. Professor Ashok Goel, for example, used a virtual assistant to answer the large number of questions from students on Georgia Tech's education platform.



Online conversation between student and AI study assistant

Initially, the virtual assistant was called Jill Watson, a reference to IBM's Watson AI platform, and now it has many identities. Even when students were told that, in addition to human assistants, there were also AI assistants, most of them were unable to tell which assistants were human and which were not. Interestingly, also the number of questions from students increased.

In fall of 2015, before Jill Watson, each student averaged 32 comments during the semester. This fall it was close to 38 comments per student, on average. I attribute this increased involvement partly to our AIs. They're able to respond to inquiries more quickly than us.⁷

⁷ <http://www.news.gatech.edu/2017/01/09/jill-watson-round-three>

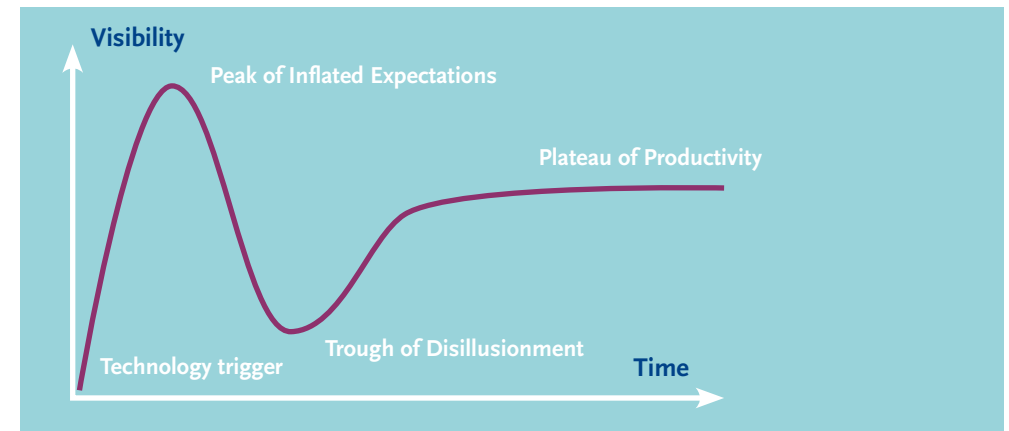
AI not only drives digital platforms, it is also given physical shape in drones, machines, sensors and robots. Amazon, for instance, delivered its first packages via drones that were not operated by people. There are experiments with drones that can remember learning environments and guarantee safety. There is more and more attention to educational robots with specific tasks. For instance, the Dutch municipality of Breda has purchased five robots to allow students with psychological issues or serious illnesses to take part in education. The robots replace students who, due to physical, behavioral or social problems are unable to come to school themselves, but who are able to control the robots remotely to attend classes. Robots are also used to help students with their performance anxiety (see the STT documentary ‘Leren, Leren, Leren’ on www.stt.nl).

Virtual Learning Environment

In addition to man-machine interaction, we also see that digitization leads to new learning environments or can enrich existing environments. A lot of our current education is aimed at reading, understanding and producing texts. With the arrival of Virtual and Augmented Reality technology, a number of education technologists hopes we can learn in a more embodied manner. The technology has the potential to facilitate simulations, allowing people to learn by doing. These kinds of simulations are already being developed for the aviation industry and medical sector. In 2018, VR is used, among other things, to train neurosurgeons, give anatomy classes (with no cadavers required), perform therapeutic exercises with autistic students, conduct job interviews and take students on school trips. As systems become more powerful and affordable, the dream is that they will become increasingly common within our curriculum. In addition, proponents of VR dream of realistic digital learning environments that will make meetings in the physical world obsolete.

3.4 LESSONS FROM THE PAST

What lessons can we learn from the historical development and implementation of education technology? When analyzing the implementation of film, television, computers and other technologies, we see a number of recurring trends and responses. First of all, the introduction of technology in a social context does not happen as quickly as people initially hoped for (See Ortt and Dees, 2018). Somewhat comparable to Gartner’s well-known hype cycle, there appears to be a cycle of hype, hope and disappointment, before a technology lands in an educational system.



Hype Cycle by Gartner

When a new technology or technological product is first introduced or invented, initially there is a period of excessive attention for the technology in question, which is accompanied by extreme predictions in which the technologies replace existing processes, actors or learning environments and make them redundant. This is translated into the hope of being able to solve existing problems and later a disillusionment if the adoption of the technology is lagging or the future visions and goals are not realized. Eventually, the technology reaches a stable state and is often adopted and used in new ways. Although the initial hope and future visions are rarely realized, we see that technology is important for the next wave of technology. The institutes, technical infrastructure and skills that were acquired to produce a certain technology are important for future technologies. And the problems of earlier forms of EduTech are often tenacious. We see a number of recurring practical issues surrounding the implementation of EduTech:

- A lack of money
- A lack of central programs
- An incomplete curriculum
- Suboptimal performance of technology
- A lack of trust among users

What is striking in the cases being described is that, generally speaking, the adoption of a technology is not based on user demand, in our case the teachers, students of schools. The push for technology comes from elsewhere. First of all, there is a societal enthusiasm for technology. As the STT’s Future Monitor (2016) shows, we live in a techno-optimistic era, which means we tend to view technology as something that will bring short-term as well as long-term benefits. Secondly, ideas about progress and modernization are often linked to technological development, which is reflected above all in the education domain. Finally, politicians, managers and technology companies are often proponents of the idea that technology can help solve

existing problems. According to many researchers, the problem here is that social problems are much more complex than technological problems. The implementation of technology is not only a technological issue, but the success depends above all on human actions, organisational culture, institutional actions, etc. What we cannot simply claim, according to Selwyn (2016), is that technology has led to a structural improvement of our education, at least not if we look at the cases being discussed here. It is important to take these historical perspectives on board in a responsible way in our expectations for the future. For, as Mark Twain once wrote, history may not repeat itself, but it often rhymes.

Interview Prof. dr. John Hattie

By Thijmen Sprakel

John Hattie is professor of education and director of the Melbourne Education Research Institute at the University of Melbourne. He is the author of the bestseller Visible Learning (2009).

What role does technology play in education?

In the last 50 years, there have been 140 studies on the impact of technology on education. They show that the effects of technology on education have been limited, despite the quick developments within technology. I wonder why technology has not helped improve education. It is time for educators to wake up when it comes to technology, because students are much further in the use of technology. The last fifty years, we have been unable to let education benefit from technology.

What is your message to politicians?

Design a system in which the expertise of teachers is recorded in a reliable manner. In many countries, including the Netherlands, you are simply a teacher, no more, no less. In Australia, we have developed a system that consists of four levels: 1) the beginning teacher, 2) the advanced teacher, 3) the expert teacher and 4) the teacher leader.

What is its use?

In South Australia, teachers with an expert or lead status who choose to work at an underprivileged school are paid better. And that works very well. So in underprivileged schools, there are some positions for which only expert and lead teachers can apply. That way, you can attract the kind of people to underprivileged schools with the background and expertise that those schools need.

This experiment has been going on for three years now and it works very well. If you apply for a job outside of education, you are hired on the basis of your competencies and your skills. In education, it is primarily the number of years of experience that you have. However, even if you have been a teacher for 30 years, you can still be at a starter level. Or you can be a teacher for five years and already be an expert or lead teacher. Those differences need to become visible. •





4.

BACK TO THE FUTURE

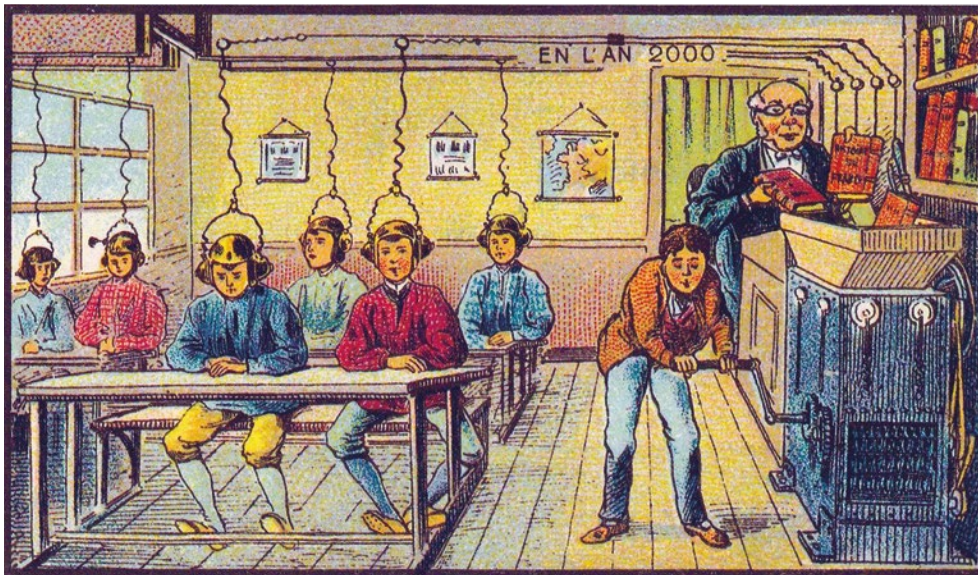
Who messes up
the present, is a slave
to the future.

Seneca

4.1 INTRODUCTION

This chapter focuses on the history of the future. That is to say, we discuss existing literature containing future visions and scenarios about learning. We start with a small journey in time past the most influential futures studies of the last few years.

4.2 EXISTING FUTURE VISIONS



En l'an 2000, Jean-Marc Côté (1899)

When children were asked about their images of the future as part of the Dutch 'Education Platform 2032', they answered as follows:

- We will have a computer chip in our head, so that we can access all existing knowledge whenever we want.
- Computers are there, always and everywhere, including at school and at work.
- We will learn with VR goggles, allowing us to experience how things really are or also how they were.
- We will no longer do anything with photographs, there are always moving images. Even photographs are moving.
- Holograms will play a major role.

In recent years there have been various publications about the future of education, the education system and the curriculum (SER, 2015; UNESCO, 2015; Dutch Education Platform 2032, 2016; SCP, 2017). Although many of these publications started by focusing on education, they cannot avoid the question what learning will look like in the future. To map the most important trends and developments, we present a chronological overview of the most authoritative views on the future of the past decades below. We'll start with 'Learning: The Treasure Within' (1996) by UNESCO, in which the concept of a life-long learning was elaborated on, and continue with 'Scenarios for the future of schooling' (2001) by the OECD, which discusses re-schooling and de-schooling. The EU added a number of core challenges for the future of learning to the existing pallet in its study 'Future of Learning: New Ways to Learn New Skills for Future Jobs' (2010). We then move to the national Dutch level and present the Rathenau/VSNU scenarios (2014) about the future of universities. Finally, we will discuss the report of the Education Platform 2032 (2016), which focuses above all on the Dutch curriculum for the future.

1996

Jacques Delors, the former president of the European Commission, wrote 'Learning: The Treasure Within' in 1996 as head of a UNESCO commission. It was meant to be a new educational vision for the 21st century and focused very much on life long learning.

A key to the twenty-first century, learning throughout life will be essential, for adapting to the evolving requirements of the labour market and for better mastery of the changing timeframes and rhythms of individual existence. (Delors, 1996)

Although, in 1996, learning throughout life was not a new concept, Delors' report was fundamental in launching new discussions about life-long learning and how this could be achieved. The commission listed four pillars that were to play a central role in learning:

- **Learning to live together.** This is possible by learning to understand other people and their history, traditions, spiritual values, and by recognizing an increasingly interconnected world in which we all depend on each other.
- **Learning to learn.** In a fast-changing world, it is important to have enough basic knowledge, as a kind of passport to a life-long learning, and to have the skills to acquire domain-specific knowledge.
- **Learning to do.** This has to do with the acquisition of skills to work together, deal with unforeseen circumstances and carry out applied work.
- **Learning to be.** This last pillar has to do with independence, personal responsibility and self-actualization.

As such, the report argues in favor of broadening the concept of learning and calls on educational institutes to develop a more diverse, more flexible and more integrated curriculum. In addition, people should have the right to study at any point in their lives. The vision distances itself from the dominant economic utility approach to education, in favor of a more integral humanist vision of learning (Tawil and Cougoureux 2013, and Turkenburg and Herwijer 2016).

2001

In 2001, the OECD published the report ‘Scenarios for the future of schooling’, consisting of three blocks with two scenarios each about the future of education. The goal of the report is to use these scenarios to understand how schools can develop in the next 20 years and to think about the role of long-term policy in managing that process.

The ‘status quo extrapolated’ Scenario 1: ‘Robust bureaucratic school systems’ Scenario 2: ‘Extending the market model’	The ‘re-schooling’ scenarios Scenario 3: ‘Schools are core social centres’ Scenario 4: ‘School as focused learning organisations’	The ‘de-schooling’ scenarios Scenario 5: ‘Learner networks and the network society’ Scenario 6: ‘Teacher exodus - the meltdown scenario’
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The first block extrapolates the status quo into the future. In the first of its two scenarios, our education model is characterized as a robust bureaucratic system which, despite some criticism from parents, employers and the media, resists radical change and sticks to its course. The second status quo scenario also maintains the basic goals and structures of the current education model, but widespread criticism of the public education system allows market players to play a major role and take over tasks, resulting in a large variety of education providers and professionals, and inequality in the provision of education.

In the case of re-schooling, the idea is to recreate the education model based on a new vision and goal. In scenario 3, the vision focuses on society and the idea that schools are the most effective platform for countering fragmentation in society by creating a sense of community and networks. There is a strong focus on informal learning and an emphasis on the use of IT to reinforce networks, and there is a shared responsibility and interconnectedness between schools and other societal institutes and organizations.

In scenario 4, on the other hand, schools focus very much on knowledge, learning and science, instead of on a social agenda. The emphasis is on experiments, innovation, connecting to the business community and R&D departments, the aim being to create ‘learning organizations’. Finally, there are two de-schooling scenarios, in which the influence of formal education is reduced. Scenario 5 envisages a network society as a future vision, with powerful cheap technology making it possible to connect people and allowing them to learn in small-scale and large-scale networks, giving rise to new learning professionals, while the classic relationship between teacher and student, parent and teacher, and education and society, are eroded. In scenario 6, there is a shortage of (good) teachers, which leads to a meltdown scenario in which schools as we know them become dysfunctional and their added value comes under pressure.

2010

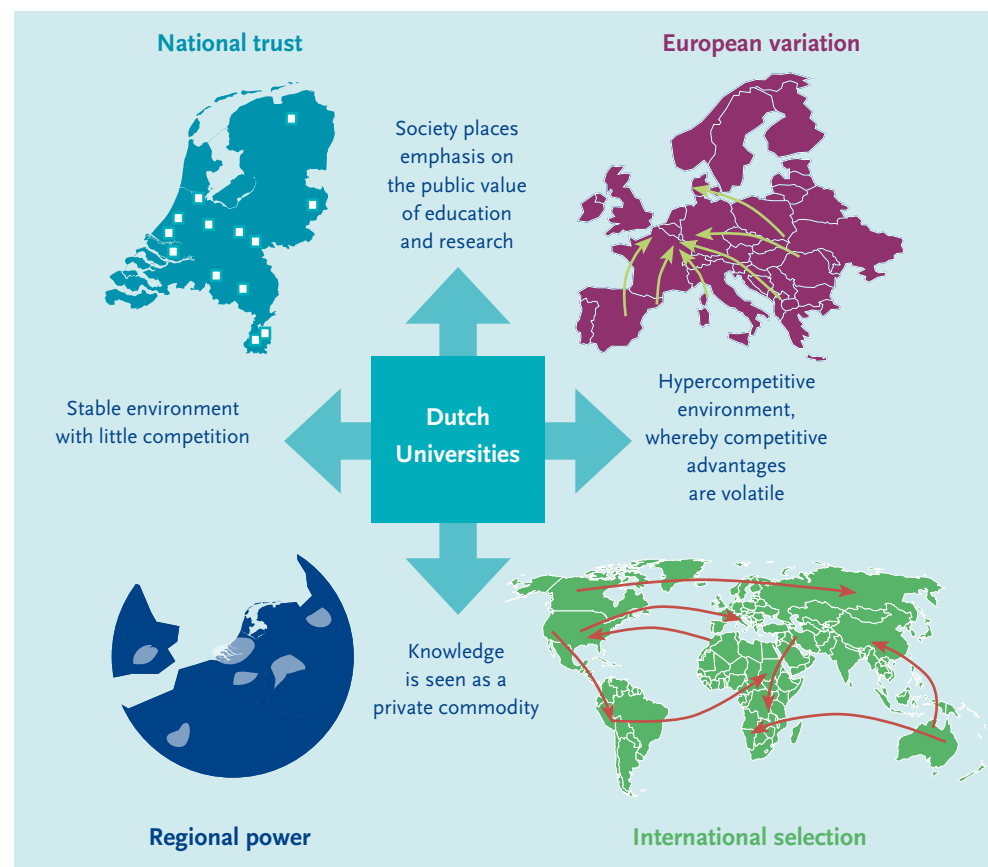
In 2010, the EU looked at the knowledge and skills students need to prepare them for the society of the future. That resulted in the foresight study ‘Future of Learning: New Ways to Learn New Skills for Future Jobs’. The study presented a number of core challenges for the future of learning: multi-cultural integration to address immigration and demographic change; countering early drop-out rates to combat unemployment and create a strong personnel pool; realizing a smoother transition from education to work, and a focus on continuous re-schooling and extra schooling to make sure all citizens stay competent and are able to deal with a fast-changing work environment.

2014

In 2014, the Rathenau Institute and the VSNU examined how universities can fulfill their knowledge functions optimally in 2025. The scenarios they developed were a tool that was used to formulate answers to questions such as: what are the core functions of a university? What does it train people for? Who invests in education and research? Where are the boundaries with other knowledge institutes – for instance higher vocational education, private schools, public knowledge organizations, industrial R&D? How do they connect to the labor market? The researchers identified two uncertainties, namely public versus private institutions, and ample competition versus little competition.



Placed on a pair of axes, that produced four scenarios for the future of universities:



Rathenau/VSNU scenarios for the future of universities (2014)

The four scenarios can be characterized as follows:

1. **National trust.** Knowledge above all has a public value, and there is little competitive pressure. Education and research are especially important to the Netherlands. Higher education is free, universally accessible and aimed especially at teaching – which means universities are assessed on the basis of their performance regarding education.
2. **Regional power.** Knowledge has private benefits for individuals and organizations. Thanks to a solid embedding in the region, institutes have stable incomes. At a regional level, university research is closely connected with opportunities and possibilities in the local economy. Funding education and research has shifted towards private parties.

3. **International selection.** Knowledge is seen as a private commodity. There is strong global competition for the resources of education and research. International mobility is high – universities spend a lot of time and money on attracting and retaining internationally renowned scientists. A high score on international rankings is essential. Universities at the top of the reputation pyramid are the most popular and as such can afford to apply strict selection criteria, enabling them to attract the best and most talented students.
4. **European variation.** Scientific knowledge has primarily a public value. The environment of the knowledge institutes is hypercompetitive. Education is highly stratified: it is offered at every level and for every form or talent. Education occupies a central position in all forms, but the way education is provided varies per level. The top 10% of students is educated in small-scale classes; at the lowest levels, education is provided to everyone who is interested via MOOCs and large-scale lectures.

2016

In 2016, after an elaborate social dialog with almost 10,000 participants, the Dutch Education Platform 2032 published its recommendations regarding the future of education in the Netherlands. The goal was to arrive at a vision regarding the knowledge and skills students have to acquire in light of (future) developments in society. The Platform distinguishes a number of characteristics of the desired future education, including a strong emphasis on personal development, in addition to knowledge development and social development. To realize those goals, the report proposes a curriculum based on a national basic level of knowledge and 21st century skills. In addition to Dutch, English and numeracy (including mathematics), that includes digital literacy and citizenship as mandatory elements of the core curriculum. The platform foresees a highly technological digitized society and focuses on teaching students digital skills and 'media savviness' to learn to deal with that. Core questions that are included are how best to use new technological products and services, how to interpret and process digital information and how to deal with (digital) media and images. Teachers should play a special role in implementing this vision; they will have to be more in charge of what they teach and, together with their colleagues, shape the curriculum. The Dutch Parliament approved the curriculum revision that was prepared by the Education Platform 2032 by adding two new subjects to the curriculum: digital literacy and citizenship.

4.3 SOCIO-TECHNOLOGICAL TRENDS

The perceptive reader will have noticed that these views on the future have a number of things in common. The various foresight studies argue in favor of a life-long learning, a shift from knowledge based education towards skills-based education and a broader vision on the role of education. There is specific attention for the use of technology in learning and the foresight studies signal a number of related shifts in the core components of the education system. These socio-technological trends, which become possible as a result of technological developments, are in accordance with the quantitative meta-analysis that was carried out in this foresight study (Janssen van Doorn 2017). They can be divided into three interrelated, yet clearly distinct, concepts:

- Personalization
- Networking
- Informalization

In the remainder of this chapter, we address these similarities; the socio-technological trends, the call for life-long learning and the shift from knowledge towards skills.

Personalization

One of the themes mentioned the most in relation to learning is that of personalization. Personal customization would make education more valuable to students by tailoring knowledge and skills to the interests and needs of the student. EduTech could offer a contribution to that by providing adaptive learning systems that monitor what people have learned (and know). Different types of personalized systems can be distinguished, like intelligent tutors, adaptive learning environments and learning management systems that use data-driven technology, machine learning, analytics and artificial intelligence to personalize the education process. An advantage of technological personalization is that the systems can take into account students who deviate from the average, either because they have trouble learning or are ahead of the others. EduTech could help make a distinction in learning styles, learning pace and the management of the learning process, and in a broader sense seriously consider differentiation in learning groups.

Networking

Technology makes it possible to link and interconnect people, organizations, knowledge and data more intensively. IT makes it easier for students to connect to different institutes and create a more varied and expertise-oriented learning path (Oyaid, 2009). Technology also makes it easy to share teaching material with students, teachers as well as other (inter) national institutes, allowing for new forms of collaboration. It can help make collaboration between educational institutes and employers more relevant and interesting. And it can lead

to new connections between different types of schools, for instance between high schools and universities or vocational education, or international expertise classes. Social networks can increasingly be integrated with teaching material, to encourage communication and motivation between students (Attwell, 2007), making collaboration, between students, but also among teachers, an important skill to improve the quality of education and tailor the teaching material to students (Delors, 1998; Bottino, 2004). Furthermore, this collaboration can lead to a shared cultural understanding and advanced knowledge of other cultures since students are used to working together with international students (Bonk, Kim & Zeng, 2006a).

Informalization

One of the criticisms of the current education model is that it is mostly limited to formal education and does not move beyond the walls of the institution; “education systems have failed to extend opportunities for learning outside the institutions and into wider layers of society at a widespread level” (Attwell 2007, 5). Technology can play an important role in breaking through this barrier by making sure that learning is no longer limited in time and place, making it possible to realize a higher level of flexibility and blur boundaries that students often experience as barriers. New forms of certification, like micro-credentials and digital badges, make it possible to harvest knowledge and skills that were acquired in different contexts and allow students to engage in registered forms of learning wherever and whenever they want. As such, EduTech is also seen as an important way to come into contact with the students’ world. The use of known digital tools, like computers and mobile phones, can lower the learning threshold and at the same time make education more concrete by experiencing lessons in an applied context outside of the school.

4.4 LONG LIVE LEARNING!

The ideal of life-long learning is an important element in most futures studies. And the socio-economic trends mentioned above further emphasize the ideal. Because technological developments make it possible to make education more informal, network-oriented, adaptive and personalized, they contribute crucial building blocks for a life-long learning.

That is why former Dutch Ministers Asscher and Bussemaker declared the theme to be a government policy spearhead: “For this government, life-long learning will be a spearhead in the coming years. More than ever, there is a need for continuous schooling, and this will only increase in the future”.

And it is also mentioned in the current coalition agreement.⁸

⁸ <https://www.parlement.com/9291000/d/pdfs/Regeerakkoord20172021.pdf>



It is the primary responsibility of employers and employees for employees to remain employable. The government provides the necessary conditions. An important success factor is a breakthrough involving 'life-long learning', which allows future generations of working people to work in a healthy and productive way, right up until their retirement (From Coalition Agreement 'Faith in the future', 2017).

The most recent SCP⁹ report, 'Into the future', writes that, in spite of life-long learning becoming a mantra, the initiative for realizing it lies above all with citizens themselves and that not much is being done as a result (2017). This has divisive consequences: while highly educated people with access to capital keep learning, people without a steady job and irregular or low incomes do not have the means to do so.

What makes this gap bigger is the fact that, in a country like The Netherlands, there is a strong correlation between learning and earning. Our education model has a fairly simple path: try to get as much formal education early on in life and reap the rewards for the rest of your life. The Economist¹⁰ states that every year of formal education equals an 8-13% increase in salary. And the Central Bureau of Statistics Netherlands shows that the risk of becoming unemployed is lower when education levels are higher: "So it pays to keep learning, for those of us who didn't know it yet", which is even more the case in times of economic adversity.

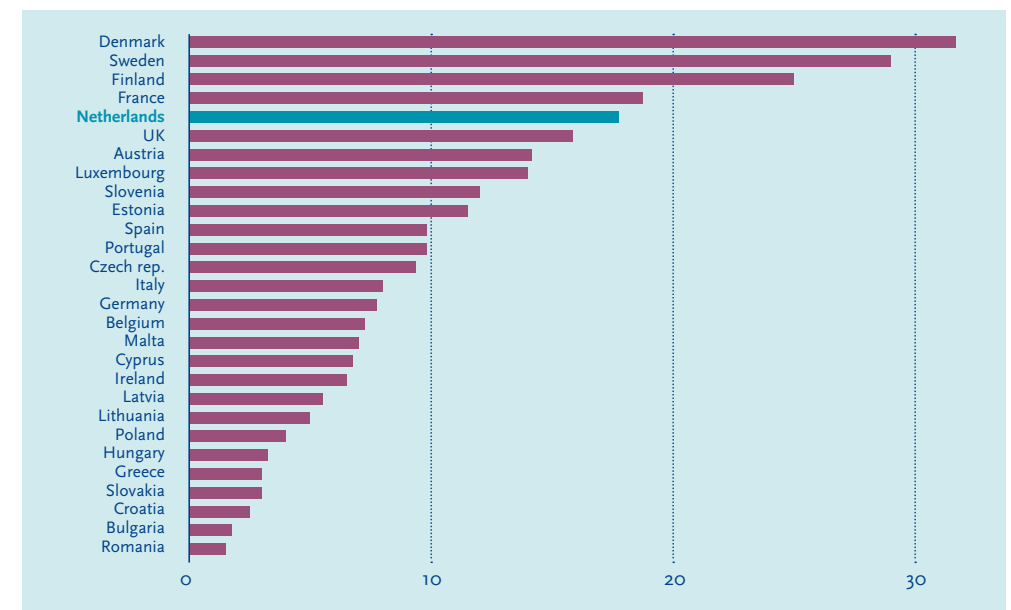
Many believe that technological change in society will only increase this gap. Based on a report by Osborne and Frey (2013), the BBC created a website where you can see whether or not your job will still exist in 20 years.¹¹ According to Osborne and Frey a staggering 47% of all jobs in the USA and 35% in the UK are in danger of disappearing because of digitization and robotisation. Jobs that require less education stand a greater chance of being 'pushed out' by technology.

A worrying trend is that employers, according to the Economist article mentioned above, are less and less willing to train people on the job. In Great Britain, for example, schooling on the job was cut in half to 0.69 hours a week between 1996 and 2009.

A study commissioned by the Dutch Education Council (Onderwijsraad 2012), in its publication 'Why is life-long learning not growing more quickly in the Netherlands despite the many recommendations?', has made the concept of life-long learning more concrete and recognizes four basic functions.

- **Repairs:** People who were unable to be educated at a young age, should be able to catch up later.
- **Career changes:** People who, at a later age, discover they want to do something else or discover different talents, should be able to get the education they need to make a switch.
- **Staying up-to-date and getting ahead in society:** Adults should keep their competencies up to date to maintain their labor market potential and work on improving their position.
- **Socio-cultural and personal function:** People do not learn for their career alone, but also to keep developing in a general sense.

In a future where people have longer careers and technology creates changing types of jobs, people increasingly see the need to keep educating themselves throughout their lives. A recent study by Pew indicated that 54% of Americans think that it is essential to acquire new skills during their careers, and 61% of respondents under 30. A study by Manpower from 2016 showed that 93% of millennials is willing to invest their own money in continued schooling and development. More and more people see the need to institutionalize a model of life-long learning.



In Europe, the Netherlands have a relatively high score with regard to life-long learning.

⁹ SCP is the Dutch Social Cultural Planning Agency, a national governmental think tank.

¹⁰ <http://www.economist.com/news/special-report/21714175-systems-continuous-reskilling-threaten-but-inequality-retraining-low-skilled>

¹¹ <http://www.bbc.com/news/technology-34066941>

4.5 FROM KNOWLEDGE TO SKILLS

In addition to life-long learning, most futures studies emphasize the shift from knowledge to skills, also a strongly rooted but little realized view on the future. As early as 1981, the American education commission focused on the ideal of a learning society and stated that education reform was needed to realize this ideal. The commission wrote that there was an urgent need for new basic knowledge (like mathematics, social and computer sciences), but that a strong focus was also needed on new skills, like understanding technology, critical thinking, applied learning and communication skills.

The call for new skills has since then increased and an important and popular question at the moment is which 21st century skills we will need in decades to come. According to the World Economic Forum, there is now, more than ever, a gap between what people learn and what they need in the future (2016). A shift is going on from a knowledge-oriented education system towards a system that focuses on skills. The WEF¹² is putting EduTech forward as a way to go about it in a cost-effective way. According to them, technologies like Artificial Intelligence, virtual reality, MOOCs and learning analytics make it possible to have a more interactive learning experience that places learning skills in a more central position. But which skills exactly?

Since 1981, the labor market, technology, education, society and our prospects have changed a lot. That is why we asked the respondents of our Delphi study what new skills we will need in the future – in addition to knowledge development. By clustering the answers, we derived the following six important skills for the future (see p. 60/61).

¹² <https://www.weforum.org/reports/new-vision-for-education-fostering-social-and-emotional-learning-through-technology>

4.6 CONCLUSIONS: CHANGING ROLES

In the studies we examined, the influence of technology is so great that certain core components of the education system appear to come under pressure, become obsolete or have to be replaced completely. This is in accordance with the work of Robert Kozma, who conducted research in 28 countries into the effects of technology on learning (2003). He predicts that EduTech will lead to a number of important changes in the core components of the education system and describes the following shifts:

- **The new student:** a shift from a passively listening student to an actively and digitally connected student.
- **The new teacher:** from an expert who instructs, towards a coach who helps students find their learning and development path.
- **The new institute:** increasingly integrated institutes, not only to each other, but especially to society as well.
- **The new curriculum:** aimed at skills, personal development and socialization.

With an eye on the future, we added two more shifts to the list:

- **The new learning environment:** from a building that was built to house classes, towards new and different (digital) learning environments.
- **The new testing:** from standardized testing, towards an increasing holistic (data-driven) approach.

Although Kozma assumes that the classic education institutes will continue to exist, that is something we deliberately leave open. Do we need a school building in the future? Or a university? And what consequences does the rise of artificial intelligence have on our classic approach to teaching? The arrival of smart data systems gives rise to new future visions with regard to the way we test, accredit and automate education.

For all these core components, we outlined views on the future that we derived from existing studies, and presented them to more than 60 respondents. We asked them whether they considered the developments desirable or undesirable and why. We present our findings in the next chapter.



SKILLS FOR THE FUTURE

Digital Literacy

Digital literacy refers to the knowledge and skills that are needed to understand digital technology, to be able to deal with different kinds of technology and to understand its use, possibilities and limitations.

Learning to Learn

Learning to learn is the ability to adapt to new and uncertain situations. An important element of this is information skill, which means that people are able to formulate learning objectives clearly and analyze information. It is about searching and finding new sources and using them for critically and systematically selecting, processing, using and referring to relevant information and for assessing and evaluating this information in terms of its usefulness and reliability.

Creative Thinking

Creative thinking is the ability to arrive at new and/or unusual ideas. In addition to the innovative aspect, there is attention to applicability and usefulness in a specific context, for instance to solve existing issues in an alternative way.

Working Together

Working together is about the ability to complement, lead or support other people and define and reach a goal together. More specifically, it is about effective communication, functioning in diverse groups, and asking for, giving and receiving help.

Critical Thinking

Critical thinking involves the ability to arrive independently at balanced and argued considerations, assessments and decisions. This requires thinking skills, while reflection and a self-regulating ability also play a role.

Social and Cultural Skills

Social and cultural skills refer to the ability to learn, work and live with people of different backgrounds.



Chronic Regret in Digital Times

By Hans Schnitzler, philosopher and author

Chronic regret, all moralists agree on this, is a highly undesirable feeling, writes Aldous Huxley in the introduction of his dystopian novel *Brave New World*.

Although undesirable, we have to acknowledge that in many senses our human condition is a regrettable condition. If you compare us to other species, you are inclined to conclude that we are flawed creatures, unable to survive without the help of tools, that is: extensions of our disabled constitution. Unlike animals, we simply lack natural, inborn qualities necessary for survival. Without the help of artifacts - our prosthesis - we are doomed to disappear. The fact that we are invalids by birth, defines our technological fate.

As technology-dependent and driven creatures, there is a tendency towards hybris. This shouldn't come as a surprise. The ancient Greek myth of Prometheus shows how this archaic titan, by stealing the fire from the gods on mount Olympus and giving it to mankind, safeguarded us, disabled persons by birth, from becoming superfluous. So fire, symbol for technological ingenuity, is a divine power. And as you surely know, divine powers in hands of mortals can become an instrument for unjustified vanity, omnipotence and repression.

But is our technological condition necessarily a regrettable condition, let alone a source of chronic regret? Well, not necessarily. Marshall McLuhans' famous statement that "the medium is the message" (or the message if you wish) may serve as a guideline. It means that we shouldn't be blinded by the content of a new medium, but that we have to focus on its form or architecture, on the way the medium itself (for better or worse) shapes and controls the scale and form of human association and action.

As French Philosopher Bernard Stiegler has articulated: technology serves as a pharmakon, that is: a medicine that can poison us or cure us, that can darken or enlighten human well-being, that can lead us into a dystopian or utopian version of history.

But let's keep our spirits high in these dark days before Christmas and focus on the... dystopian version. My motto: Dare to despair! Why? Well, because, as you surely know, the moment of desperation is at the same time the moment of truth and possible change. In this sense desperation should be understood as an ultimate form of optimism.

So, my first optimistic remark: As the information revolution hurdles on, its poisonous potential is becoming more and more evident. But insight in the pitfalls that plagues the journey of us, the first cybertopians, might function as a disclaimer and hopefully helps to create a more healthy, open and sustainable digital environment, for our cities, homes, schools and universities alike.

Starting point for this small dystopian journey is the observation that the strongest tyrants are those who allow themselves the strongest questions. From this perspective the strongest tyrants these days are mainly to be found in Silicon Valley, there where most of our tech-titans reside.

To give a striking example: Last summer, during a Q & A session with his followers, Facebook's CEO Marc Zuckerberg announced that he is working on a telepathic social network, a network where virtual friends can share their thoughts instantly and without mediation. Or to put it in his own words (quote): "You're going to just be able to capture a thought, what you're thinking or feeling in kind of its ideal and perfect form in your head, and be able to share that with the world in a format where they can get that; Wouldn't that be great", he cheerleadered.

Well, I'm not so sure. We, info-consumers of the digital era, are selling our souls to omnipotent tech-titans like Zuckerberg in return for so called free information and communication services, a package deal in which we allowed them to ask us the strongest and most intimate questions. They track, target and profile us, follow our digital footprints up into our bed-, living and class rooms, and in that process they succeed in deciphering our most private longings, anxieties, hopes and thoughts.

Here's the catch: If you lose, voluntarily or not, control over your psyche - over your hopes, dreams, fears and thoughts - you actually lose yourself. And when there is no more self, when you are just an object, a pile of information, reduced to raw material for data traders, then inevitably you will become an object of manipulation. Exclusive access to your thoughts is the necessary precondition for self-determination. The human being that loses this privilege, is a naked human being, stripped of its freedom and dignity.

Belgian Artist and singer-songwriter Stromae visualized in quite a supreme way what this situation means. As a small intermezzo I would like to share this with you.¹³

¹³ <https://www.youtube.com/watch?v=UKftOH54iNU>



Harvard business school professor Shoshana Zuboff, recently coined the term surveillance capitalism for this reality, an up to date version of Michel Foucault's panopticon. What Zuboff is elaborating on is a form of surveillance that aims at making human actions and behavior predictable or, if you wish, to mold them so that they can serve the data delirium of the new gold seekers of our time: the data brokers and big data owners.

This surveillance capitalism reaches far beyond the conventional institutional terrain of the private firm; it redistributes rights, and challenges principles & practices of self-determination - in physic life and social relations, politics, governance and education. The logic of this surveillance economy extends to our institutions and to the public as well as to the private domain.

Through the internet of things - that whole pig-sty of smart devices that communicate with us, each other and invisible third parties - through this internet of everything the gazing eye of the Putins, Trumps and Zuckerbergs of this world infiltrate and manipulate the societal network. And in their craving for predictable consumers and citizens an irresistible and insatiable data-hunger has bewitched public and private partners alike.

Allow me to put this in a brief historical context. Western thought has always been obsessed by a deep rooted suspicion towards human actor-ship in general and human motives in particular. Our actions are not only irreversible, their consequences are highly unpredictable and messy. One single action can ignite a whole chain of reactions that literally continues until the end of times, to paraphrase philosopher Hannah Arendt. It is an equally fascinating and disturbing thought. Actually it means that humans who act, never know what they are doing.

This human, all too human state of being has stimulated thinkers and doers during the course of history to try to formulate an answer to the following question: how to tame the human herd so that it will not confront us with unwelcoming surprises? The desire to tame the human masses, to make its actions predictable and manageable, is what links them to all those big and small despots in history that dreamt of disciplining & optimizing the human masses, neutralizing their capacity to ignite spontaneous and new beginnings, that is: to act. From Plato's ideal state, where king-philosophers should impose absolute criteria onto the masses, until the big tyrannies of the 20th century, one has worked on the realization of this assignment.

Data and algorithms that nestle themselves in smart devices, are bringing the accomplishment of this dream within reach. A dream that represents a new ideology:

dataism. The belief that human beings can be reduced to information generating machines. In a dataist society data subjects will have outsourced their capacity for spontaneous new beginnings to machines, that is: to companies like Facebook and Google.

In other words: they will give up their capacity for autonomous acting, precisely that quality that identifies them as dignified or undignified creatures. The meaning and the authority of their actions will be determined by smart systems and, to quote the Israeli historian Yuval Harari, author of *Homo Deus*, "whoever determines the meaning of our actions, also gains the authority to tell us what to think and how to behave."

As soon as new technologies find their way to the market place or class rooms, users will use them, up to the point that they get hooked up to their new gadgets. Companies like Google and Facebook are in the business of attention grabbing. Their business models are successful insofar as they succeed to glue their users to their screens and capture their available brain time - our present day economy is first and foremost an attention economy.

Or as ex-Facebook president Sean Parker recently stated on the objective of his former company: "How do we consume as much of your time and conscious attention as possible?" Also recently Tim Berners-Lee, inventor of the world wide web, stated the following: "People are being distorted by very finely trained AI's that figure out how to distract them"

The battle for our attention is fierce and grim. As on any battlefield the collective mobilization of attention is accompanied by an equally collective destruction of attention. Always on alert and standby with our vibrating smartphones in our back pockets, we are constantly being banned from the here and now to a diffuse everywhere and nowhere. Result: contemporary Internet pathologies like attention deficit disorder, Facebook addiction, infobesitas, social media stress and twitteritis. As the French philosopher Herbert Marcuse once stated: individual insanity reflects the insanity of the whole.

The disruption of one of our most valuable and intimate capacities - our ability to give attention - isn't a free ride. Attention should be considered as a vulnerable human resource, like air or water. Where pure air lets us breath, pure attention lets us think and feel. Attention equals love, dedication and connectivity. It is the precondition for connection with ourselves, our fellow human beings and the world around us.



According to a scientific research executed by Microsoft, the average attention span of human beings has dropped from 12 to 8 seconds in the last 15 years. What this means? Well, that we have to acknowledge that the average gold fish is superior to us; apparently they can focus for 9 seconds.

In her latest book, reclaiming conversation, MIT-professor Sherry Turkle gives a forceful account of what it means when all-embracing attention is being distorted, especially for the younger ones. Because screens are increasingly mediating communication between them and their spouses, they tend to literally lose sight of the embodied creature that is in front of them. In other words; their capacity to read and understand bodily signals and facial expressions is undermined. This disembodiment, which comes along with the virtualization of reality, subverts their capacity for empathy.

When Turkle is being consulted by a school in Upstate New York, teachers share with her that they observe a disturbance in their student's friendship relations. The Dean of the school states the following: "These kids aren't cruel, but their connections seem superficial. They are not emotionally developed; 12 year olds play on the playground like 8 year olds. They don't seem able to put themselves in the place of other children. They are not developing the way of relating where they listen and learn how to look at each other and hear each other'.

In my latest book - A small philosophy of digital abstinence - my students at the Bildung academy, all of them millennials, shared more or less the same experience, but then the other way around. As part of the module digitization they go offline for a week, an educational experiment that helps them to raise fundamental questions about our digital reality in general and their personal relation to the screen world in particular.

During this period they experienced how their conversations became deeper, intenser and more conceptual. But moreover, by temporally stepping out of their digital cocoon, they created more room for inner dialogues and they became more aware of their surroundings, feelings and thoughts. As one of my students points out in my book: "Without technology your thoughts run free over things. Because you can digest them better, things become clearer and you gain more insights. It makes you more forgiving to yourself and to others."

So, where does this all leaves us? Let me begin by emphasizing that we are technological beings. So the problem is not the extensions of man as such - all those devices on which our digital reality can flourish - the problem is the unwillingness or

incapacity to impose societal demands on them. Taking our technological condition serious means building a digital infrastructure for our communities and for our educational system in which human dignity is incorporated.

The information revolution, the power to be seen and heard, is a potential source for enlightenment and emancipation. But simultaneously invisibility has always been and always will be a superpower. So safeguarding a successful digital revolution implies a healthy educational balance between visibility and invisibility, online and offline, real life and virtual life.

Now more than ever we, philosophers, artists and teachers, need to create rich environments of friction and attention for the next generations. We should help them to discover and explore embodied attention strategies with which they can master their talents and interests.

I have been writing on the subject of digitization for quite some years now, and more and more I feel that this battle against mental pollution - that is: the fight against the pollution of our ecologies of attention - is as urgent as our battle for a clean and sustainable physical environment.

All too intrusive attention grabbers should be expelled from the temples of experiences of our pupils. Goal is of course not freedom from our digital devices, but freedom to.

Or, to wrap it up with the words of Huxley again: 'Chronic regret, all moralists agree on this, is a highly undesirable feeling.'

What was at stake for him and what is at stake for the future of learning, is the freedom to live ineffectively, the freedom to play and to make mistakes, the freedom not to be optimized, the freedom to be a round pin in a square hole. •





5.

DELPHI IDEAS

We need technology in every classroom and in every student and teacher's hand, because it is the pen and paper of our time, and it is the lens through which we experience much of our world.

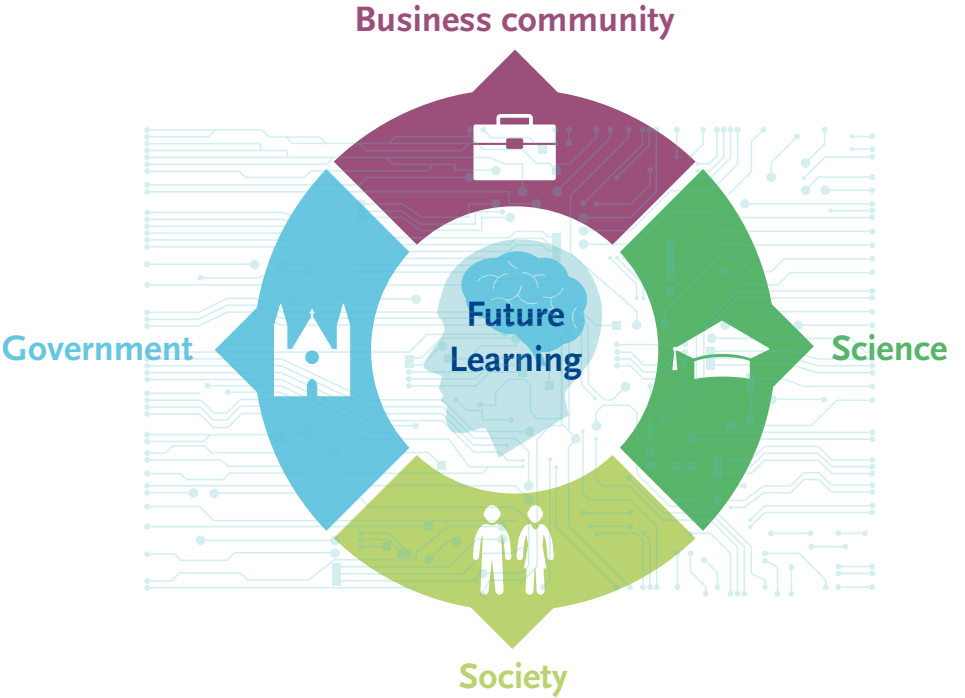
David Warlick

The literature study revealed a number of trends and shifts. To test them, a Delphi study was set up and carried out in the second half of 2017 on the future of technology and learning. As described in chapter 2 (Method), the structure of this study involved asking the opinions of a large number of experts. In a number of interview rounds, the answers were collected and communicated back to analyze about what there is a consensus, about what there is not, and to cluster diverging ideas and arguments. In this chapter, we address the most important results from this Delphi study. The complete results can be found in the publication *Long Live Learning! Directors about the Future of EduTech* (Snijders, 2017).

Who are the respondents?

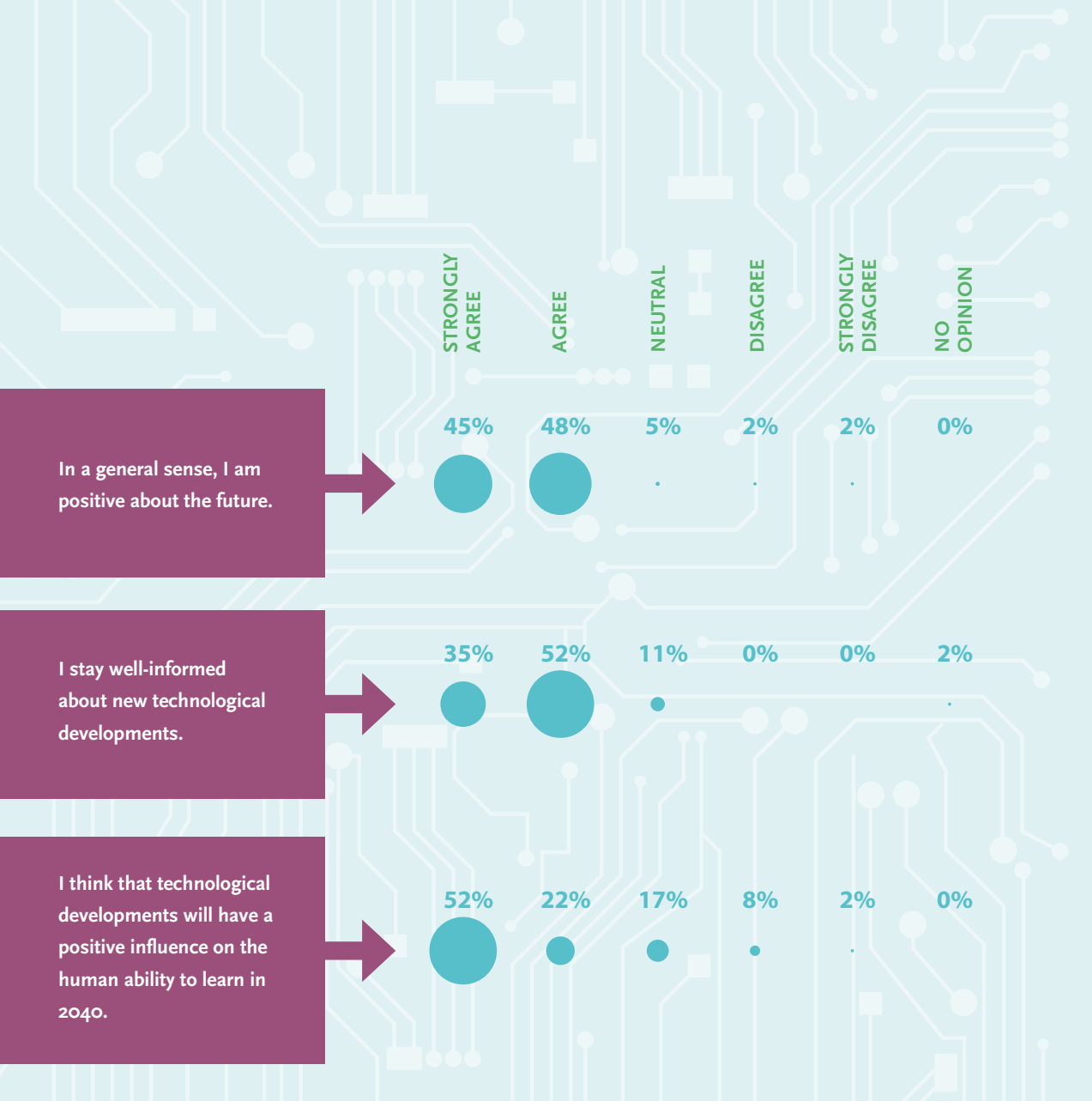
If a future awaits us in which EduTech plays an increasingly prominent role in the way in which we learn, it is important to engage in a broad discussion about this subject. In a foresight study about learning, the obvious thing to do is to select stakeholders and respondents from the educational domain. Various researchers have done so, but the added value of this study is that we invited a broad and diverse group of respondents. Education in the Netherlands is almost completely public sector-driven but, in a discussion about the future of learning, we think that, next to the public sector, other stakeholders from the quadruple helix – the business community, society, government and science – should have a place as well. We specifically asked directors to take part in this Delphi, because we see them as ambassadors of organizations, as decision-makers who play an important role in managing the organization, and as people who are in particular involved in strategy and shaping the future. In all, 66 respondents took part, who work at more than 50 different organizations and who are part of the STT network (see www.stt.nl). The primary invitees were top managers of these organizations, but we also gave them the opportunity to invite an expert in the area of learning and technology within their organization. The most common positions were those of director and manager. The research population was very highly educated (32% having PhD's) and most (65%) fell into the 45-65 year old category.

We asked the respondents what they think about the future of learning, what they are enthusiastic about and what they are worried about. As in previous STT studies (like the National Future Monitor, 2016), we asked the respondents about their expectations concerning technological developments, as well as the social consequences and desirability of those expectations.



BUSINESS COMMUNITY			
Achmea	KIVI	Oost NV	T-Mobile
Alliander	KNAW	Dutch Open	TNO
ANWB	Meratus	University	Delft University of Technology
Bank of America	Ministry of Education, Culture and Science	Biosana Pharma	Eindhoven University of Technology
Cisco	Ministry of Economic Affairs	Philips	UMC Utrecht
Deltares	Ministry of Social Affairs and Employment	Port of Rotterdam	Unilever
DNVGL	Ministry of Justice and Security	PWC	USG People
DSM	Nederland ICT	RIVM	UTwente
EMC	Nationale Spoorwegen	SAS	VitaValley
Eneco	NWO	Schiphol	VSNU
Essent		SCP	VVAA
Evides		SER	Wageningen UR
Fontys		Shell	
Friesland Campina		SIA	
IBM		Siemens	
Innogy		STT	
Interpolis		Tata Steel	

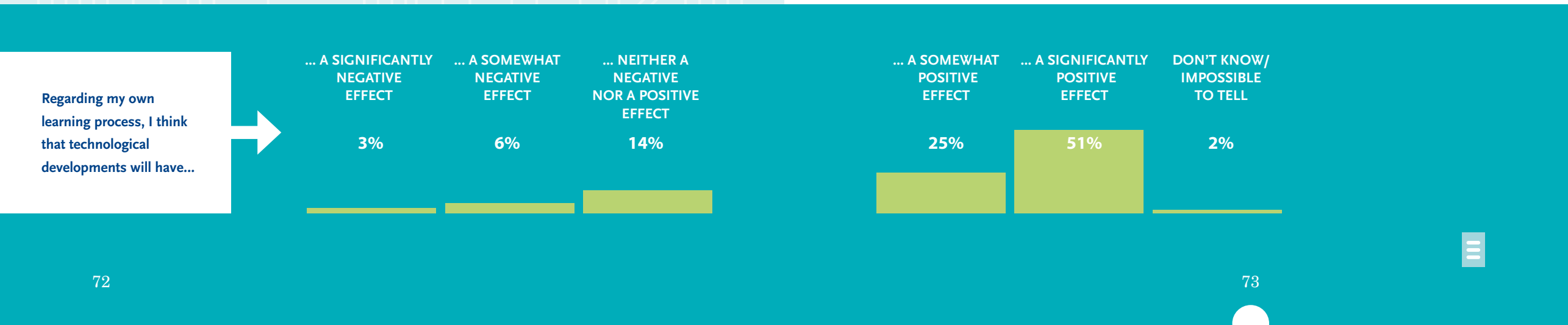




5.1 TECHNO-OPTIMISM

We started by asking the directors about their general expectations with regard to the future and EduTech. What stands out in the graphs is that this group is very optimistic about the future and developments in the area of technology. No less than 93% of the respondents are generally speaking positive about the future. When we asked the same question to more than a thousand Dutch people for the National Future Monitor (Snijders, 2016), only 26% of the respondents indicated they were optimistic. In this Delphi study, 87% of the directors indicate that they stay up-to-date about technological developments, which is also above average.

When we asked more specifically about the future role of EduTech, the respondents were also very enthusiastic. About 74% thinks that technology will have a positive impact on learning, and a somewhat higher percentage, 76%, thinks that technology will help them improve their own learning process.





THE ROLE OF EDUCATION TECHNOLOGY IN EDUCATION: HOPE AND FEAR



EDUTECH...

- ... stimulates personalization of learning

1

... leads to impersonal and unsocial education
- ... improves the quality of our learning

2

... not all skills and knowledge can be learned through technology
- ... increases the learning results

3

... dependence on technology
- ... provides a closer match to the students' experiences

4

... is bad for our health
- ... creates equal access

5

... creates exclusivity in education and unequal access

5.2 THE USE OF EDUTECH

By asking open questions about pros and cons of EduTech, we try to learn more about the techno-optimism of the Delphi participants. An analysis of the answers to those open questions produced the following five main arguments.

1. EDUTECH MAKES LEARNING MORE PERSONAL

The argument mentioned most often for using EduTech is that it would stimulate personalized learning. The positive expectation of more personalized learning originates in a broadly shared criticism of our current education. At the moment, people often learn in the same place, with the same material and at the same pace as everybody else. As Gingrich (2014) writes, we are stuck “with a 19th century model of education – we educate the average student instead of the individual. In an era in which knowledge is distributed digitally and is ever more personal – think of Netflix, Twitter, Facebook – we have to be able to do better than this”. EduTech could change this by providing adaptive learning systems that involve the long-term monitoring of what people have already learned (and know). One respondent writes that technology is needed to “bundle existing knowledge, so that the education process focuses on the missing links in people’s knowledge”. Aside from leading to better results, personalization also improves people’s personal development. The personalization of learning, which the respondents see as the customization of learning, appears to be a shared goal.

2. EDUTECH IMPROVES THE QUALITY OF LEARNING

By using technology in a smart way, we can improve the quality of learning. According to the participants, it will improve the teaching material, teachers, learning environments and conditions for education professionals. In addition, better access and availability of knowledge sources are mentioned as goals that can be achieved through the use of technology. The knowledge in question can come from texts or files, but network technology also makes it easier to “come into contact with experts and teachers, anywhere in the world.” And, according to some, in the long term, neuro-technology can realize a better and more direct connection between the brain and external knowledge.

3. EDUTECH IMPROVES THE RESULTS OF LEARNING

Another desire for the future of learning is that digitization and the use of learning analytics, Big Data, and predictive analytics will create learning situations in which people “can absorb and retain more knowledge”. The possibility of using more data and smart algorithms to create better and faster analyses could make learning smarter. And hopefully, computer-brain interfaces will lead to an improvement of our learning results because the technology will help us ‘improve our memory’.

4. EDUTECH PROVIDES A CLOSER MATCH TO THE STUDENTS’ EXPERIENCES

The motivation for using technology in education and learning in general not only comes from tech companies. Students and parents also want technology to be used because, first of all, it provides a closer match to their everyday lives and secondly, it prepares them for a future in which technology plays an important role. Respondents remarked that today’s students do not see technology “as something funny, as a toy”. They see it as an integral part of life and expect digital technology to be interwoven in everything, including in the way education is organized (see also Whitby 2013). The assumption is that the current learning system was not made for today’s students and should keep up with modern technological and social developments.

5. EDUTECH CREATES BETTER ACCESS

Using technology in learning is sometimes seen as a way to solve the problems of our current education system. The “classic education model does not work, is too expensive and has an outdated business model”, according to one of the directors. Technology can help by drastically reducing costs and creating better access for students from all over the world to high-quality learning modules.

5.3 WHAT ARE THE DOWNSIDES?

From September 2018, the start of the new school year, France has banned the use of smartphones on primary and secondary schools. There is already a ban on the use of the devices during classes, but that ban is now extended to breaks.¹⁴ Although, in our study, only 3% of the respondents were pessimistic about the use of technology in learning, they did mention a large number of possible negative consequences of EduTech. The most common arguments are listed below.

1. EDUTECH LEADS TO IMPERSONAL EDUCATION

Because of the dominant role of technology, there is a fear that interaction between students, teaching coaches and people in general will diminish. “The danger is that our learning process will take place too much in the digital world, causing human contact to disappear”, one respondent writes. An effect of this is that we will miss personal feedback, ‘the feeling of being seen’, which can lead to a reduction of the quality of learning and to further individualization.

¹⁴ See, http://www.lemonde.fr/education/article/2017/12/10/plus-de-telephones-portables-dans-les-ecoles-et-colleges-a-la-rentree-2018-annonce-le-ministre-de-l-education-nationale_5227485_1473685.html

2. EDUTECH WILL LEAD TO AN EXCESSIVE DEPENDENCE ON TECHNOLOGY

“More and more of our work is left to computers and robots, and people will ultimately get used to not having to think and as a result become dumber”. Technological developments are moving fast and lead to a high degree of automation, which means that we will have to rely on technology more and more in our everyday actions. This leads to two doom scenarios. Firstly, technology can become a single point of failure, which means we are lost if the technology stops working. Secondly, technology can be too good and make certain people or human functions redundant. And although, at the moment, there is a shortage of teachers, unemployment among teachers in particular is mentioned as a doom scenario. A broader philosophical question that came up for the future is what the place of learning is in a society where people are no longer the smartest beings.

3. NOT ALL SKILLS AND KNOWLEDGE CAN BE LEARNED THROUGH TECHNOLOGY

A common fear is that we will lose certain basic skills as we move into a high-tech future. For instance, in a world where we can look up anything online, we will become less trained in remembering information. And because of technology, we will forget how to use our own memory and ability to think. As one of the participants writes: “phone numbers, who can remember them without checking their mobile phone?”

4. EDUTECH IS BAD FOR OUR HEALTH

It is hard to escape the technology we use for our leisure time, hobbies and interests. For kids, but also for adults. Addiction, sleep deprivation, eye problems, problems with our posture, extreme distraction; various potential negative consequences technology can have with regard to our health are listed.

5. EDUTECH CREATES EXCLUSIVITY IN EDUCATION AND UNEQUAL ACCESS

As we saw when discussing the pros, it is argued that technology leads to cheaper and more accessible education. But the opposite is mentioned as well. Technology is often expensive and a high-tech scenario could mean that people with more capital can use technology to improve their social position while people with less capital would lag behind. EduTech could create “a gap between those who have access to the technology and those who do not”. New payment models for apps, MOOCs and simulations could make education “impossible and unaffordable” for many.

5.4 DESIRABILITY OF EDUTECH

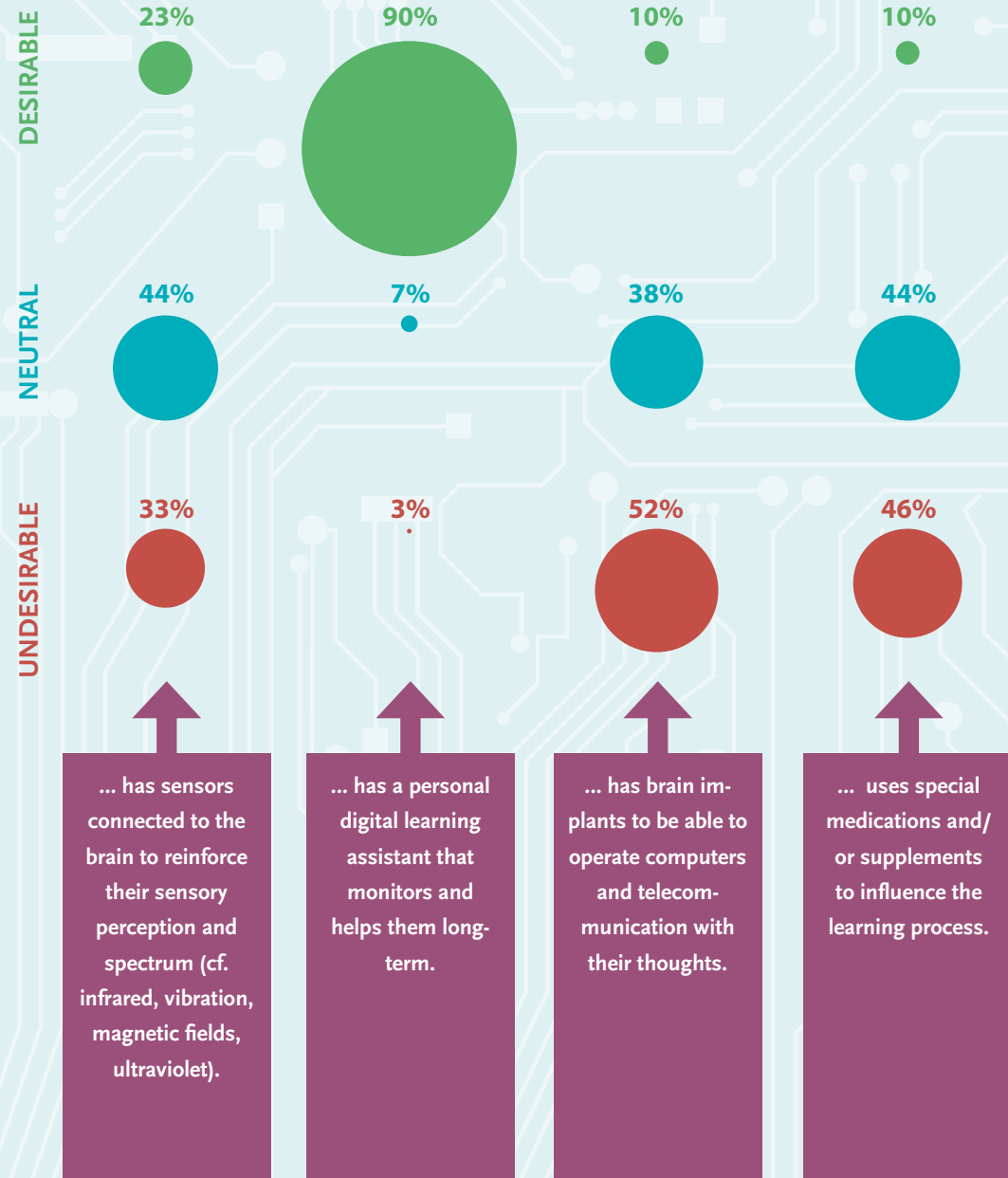
In this chapter we divided the effects of technology on learning into a number of important shifts in the core components of the education system.

- **The new student:** a shift from a passively listening student towards an active and digitally connected student.
- **The new teacher:** from an expert who instructs, towards a coach who helps students find their learning and development path.
- **The new education institute:** increasingly integrated institutes, not only with each other, but above all with society as well.
- **The new curriculum:** aimed at skills, personal development and socialization.
- **The new learning environment:** from a building or classroom built specifically for classroom education towards new and different (digital) learning environments.
- **The new testing:** less and less standardized and more and more adjusted to a holistic and data-driven approach.

For all these core competencies, we outlined views on the future we extracted from existing literature and in the Delphi presented them to the participating directors. We asked them if they considered the developments desirable or not, and why.



A MAJORITY OF THE STUDENTS ...



: THE NEW STUDENT

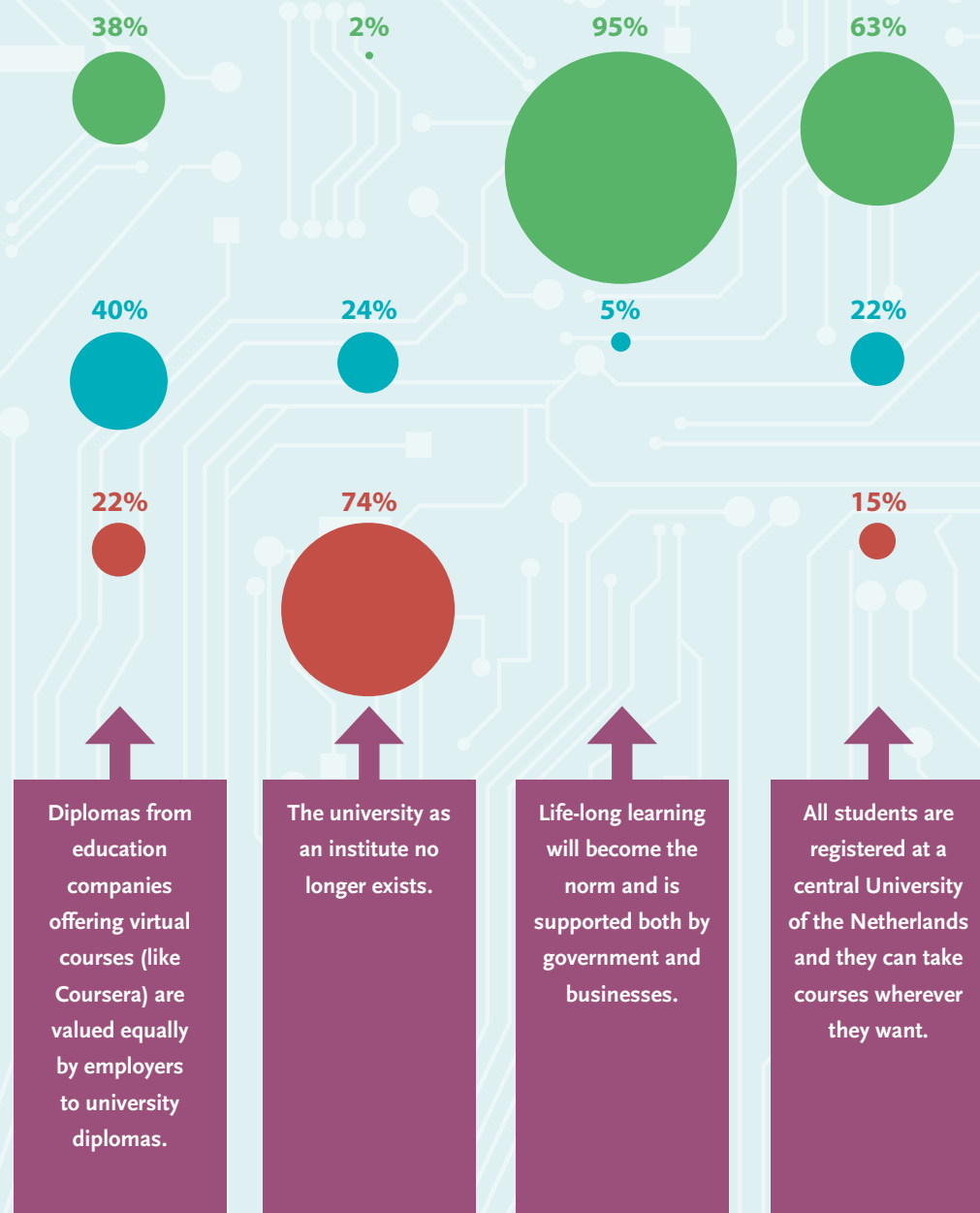
As many as 70% of the directors expect a majority of students to have a personal digital learning assistant before 2030. This is not a simple app, but a digital coach that uses artificial intelligence to give feedback on the learning process and that monitors students and helps them learn for a long period of time (not connected to a single education institute). Almost all respondents (90%) find this a desirable development. Some write that the foundation is already in place, and that such technology “is already available in a rudimentary form”. They do warn that this “will not be available to everyone and as such can lead to unequal opportunities” and for this reason we need to monitor and regulate both the technology itself and its providers.

The Delphi participants are not very enthusiastic about the use of technology to modify and improve our bodies. According to 46% of the respondents, the increase in special medications and supplements to improve learning is undesirable, although 25% of them expect this will happen before 2020, and another 30% believe that the turning point at which a majority will use them will take place before 2030. Even more respondents are opposed to neuro-technology (like brain implants or brain-machine sensors), and they also expect that these developments will not be applied in education on a large scale before 2040 for various reasons: because “we still only understand little of the brain”, because the technology has not yet proven itself and because it is “too expensive to be introduced on a structural scale”. There are critical questions regarding the aim of such technology. Why do we want to get the most out of everything? And “let human being stay human, we are not Homo Deus”.

DESIRABLE

NEUTRAL

UNDESIRABLE



: THE NEW EDUCATION INSTITUTE

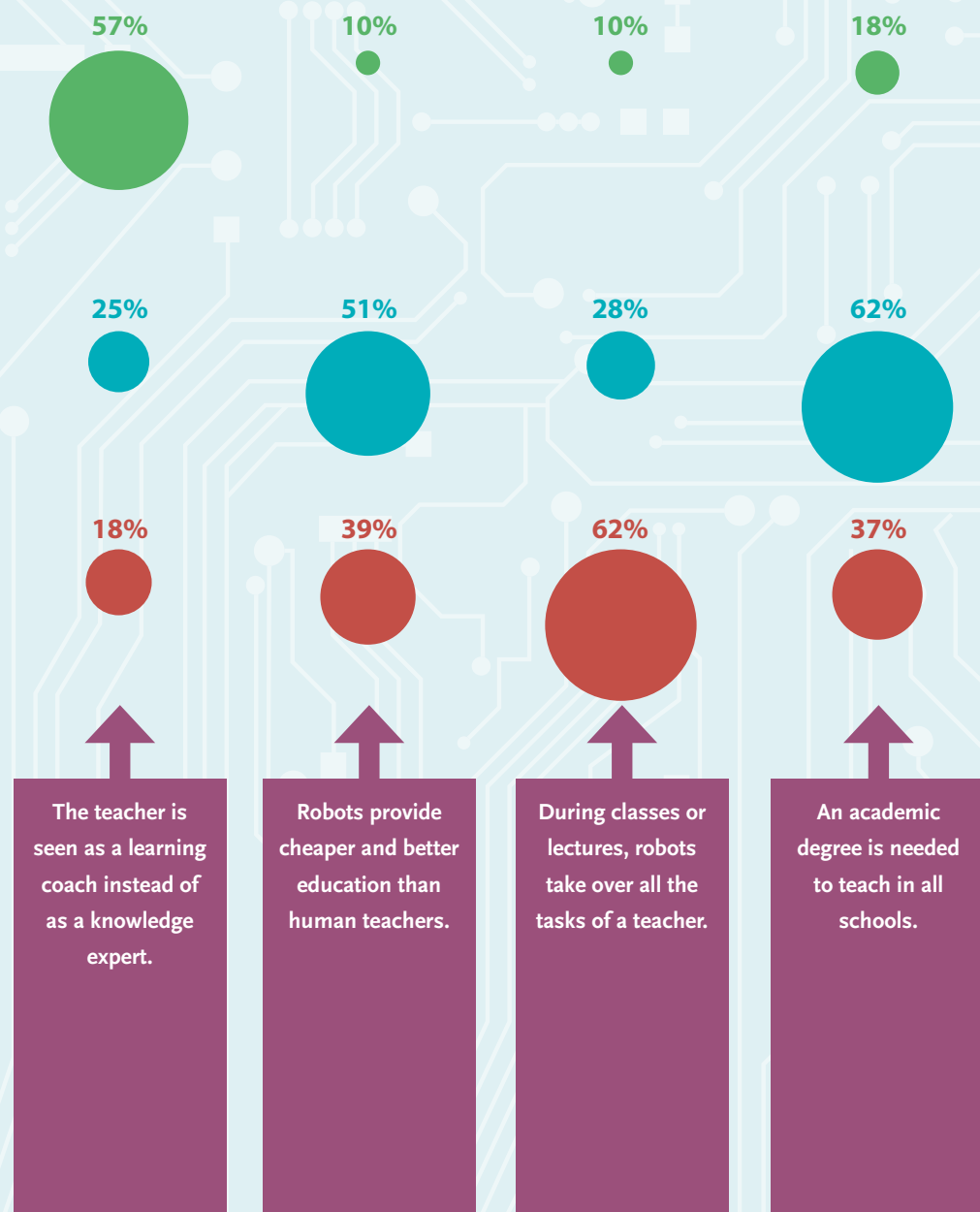
Recently, the Rector of the University of Utrecht wrote a book which poses the question ‘Will the university make it to 2040?’ (Van der Zwaan, 2016). To the directors taking part in this Delphi, the answer to that question is clear. No fewer than 76% expect that the university, as an institute, will never be discarded. However, although the university is an institute with thousands of years of history, the respondents realize that it faces a major challenge to go along with the demands of this age. For instance, 44% expect employers to value diplomas from educational companies equally to university diplomas before 2030, hereby referring to private parties offering virtual courses (like Coursera). This would increase the pressure on universities to modernize and force them either to work with this kind of parties or master the ability to offer new technology-driven types of education themselves.

Most of the respondents are positive about the idea of organizing a central University of the Netherlands. It would allow universities to work together and give students the opportunity to take courses wherever they prefer. However, the idea of facilitating the concept of life-long learning at an institutional level is the most popular. Three-quarters of the respondents think that it will have become the norm within 12 years and that it will be supported both by government and by businesses, and 95% thinks it is desirable. There is no other subject in this Delphi about which there is so much support and consensus.

DESIRABLE

NEUTRAL

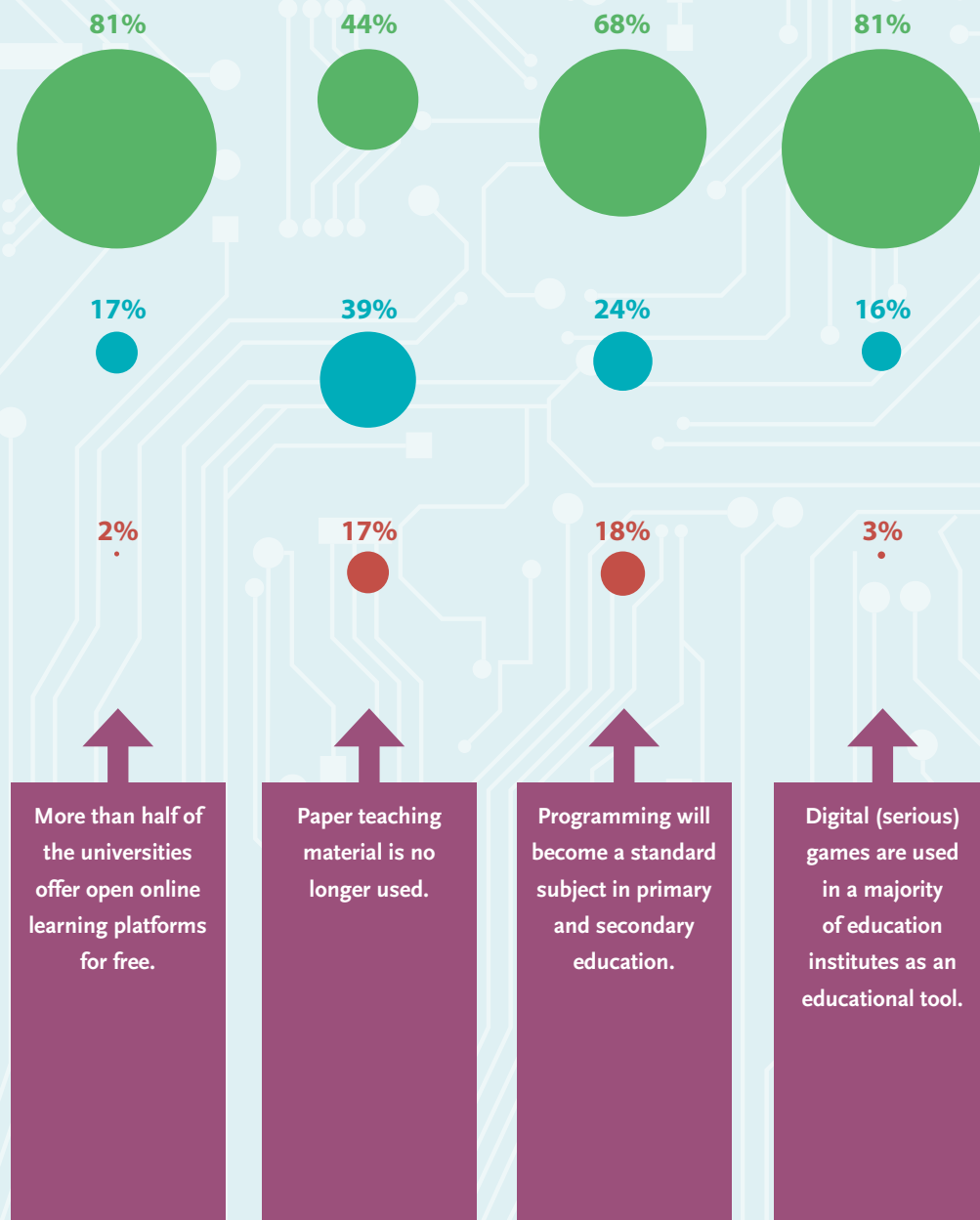
UNDESIRABLE



: THE NEW TEACHER

According to a majority of the respondents, the era in which teachers stand in front of the class, take the initiative, give instructions and transmit their knowledge as experts will soon be over. More than two-thirds (67%) of them think that, before 2030, teachers will be seen as learning coaches instead of knowledge experts. And according to the majority, that is a desirable development. “Knowledge becomes increasingly generally accessible. A teacher may help separate the wheat from the chaff and interpret, and it will still be important to do that well. Teaching physics without having any knowledge of physics or teaching German without knowing the language or history adds no value”. We asked the participants whether they preferred a system like the one that is used in Finland, where most teachers have a university education. Although a third of the respondents was positive about such a measure, 56% expects it will never be implemented. “The arrogance!”, writes one respondent, “as though a university is more suitable for teaching people necessary life lessons!”

We also asked the respondents about the possibility of giving smart robots a role in teaching, but most of them were negative about that. The turning point when, according to a majority of the respondents, robots could provide quality education more economically than people, lies somewhere between 2030 and 2040, but 39% think that is not a desirable development. It would be especially undesirable if robots were to take over certain classes completely. “Robots should serve people and not replace them”, appears to be the consensus.



: THE NEW CURRICULUM

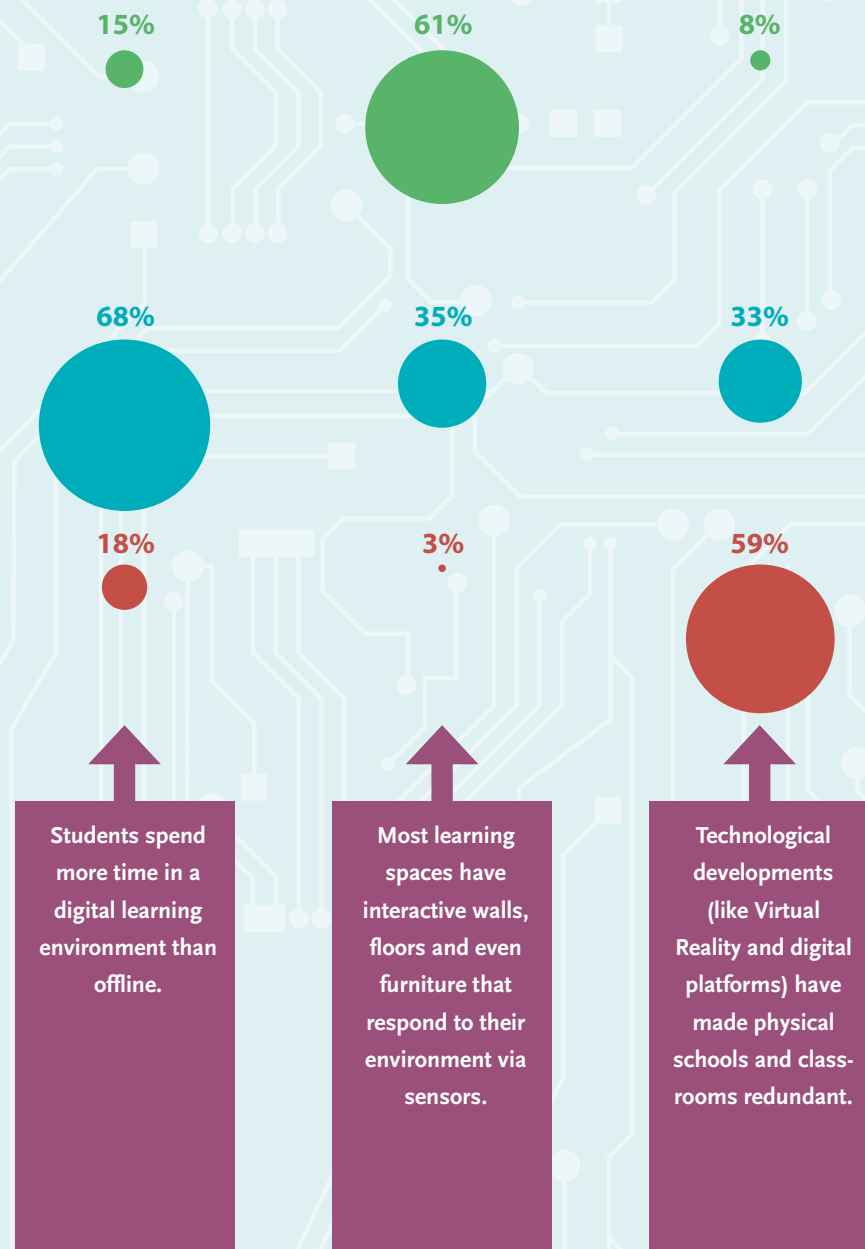
The respondents gave a positive response to all the statements listed above about the curriculum. According to the participants, paper teaching material has had its best time and can soon be discarded. About 60% expect that paper will be obsolete as teaching material before 2030. Using paper is seen as “a waste of natural resources”, and although the respondents value textual abilities, it is “not that important through which medium they are presented”. In addition to paper teaching material, they are especially positive about the use of serious games and digital simulations to encourage learning: 81% find it desirable to intensify these methods. “Of course it has been around for years, but it has proven to be effective and it is not used enough”. Furthermore, 81% also find it desirable for universities to offer online learning platforms, like MOOCs, for free, to provide access to and share publically funded knowledge.

In addition to alternative teaching methods, the respondents think it is important to include programming and coding in the new curriculum. Almost 70% expect that this will be the standard before 2030, although they express criticism in the open questions: “I doubt whether this will still be needed later”, someone writes, while someone else wonders: “Why? If people want to specialize in that, that is fine”.

DESIRABLE

NEUTRAL

UNDESIRABLE

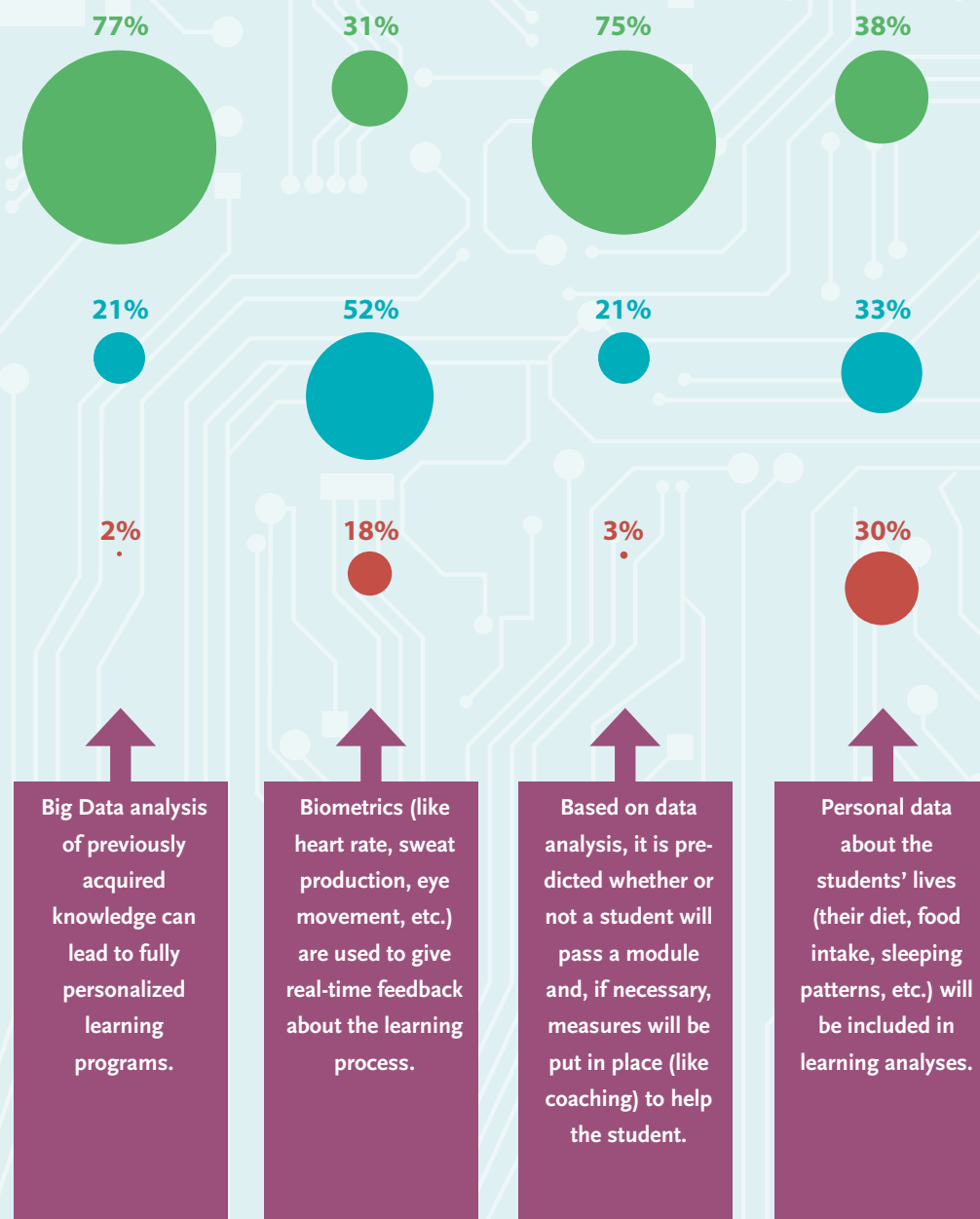


: THE NEW LEARNING ENVIRONMENT

In the short term, our learning spaces will change considerably through the arrival of new technology. Directors estimate that, within 10-15 years, students will be studying online more than they will be offline. According to 22% of the respondents, that will happen before 2020 even. They are divided about the question whether or not it is a desirable development; more than two-thirds give a neutral answer. According to the respondents, more online learning leads to place- and time-independent learning, with the possibility of being in contact with students from all over the world. However, many respondents fear that human interaction will disappear and online learning can only facilitate a limited form of social interaction. The challenge is to find a good balance between online and offline learning and not go for one at the expense of the other.

The improvement of digital learning opportunities will, according to the directors, not make classrooms and schools redundant. A majority, 51%, even thinks that that will never happen. "Physical schools serve a higher purpose than the learning process alone", one respondent writes, "you make friends there and learn how to interact with other people". Here, too, the main argument is that data-driven environments will not be able to replace physical environments and facilitate important social interaction processes. The directors do think that, even before 2040, physical environments will have interactive walls, floors and furniture filled with sensors that, thanks to a modern cyber-infrastructure, will respond to their environment and provide feedback on the learning process. According to 61% of the respondents, this is a desirable development.

DESIRABLE
NEUTRAL
UNDESIRABLE





: THE NEW TESTING


Through smart data and the use of Big Data, predictive analytics and artificial intelligence, we can work on learning analytics which, on the one hand, will provide more insight into the learning process, while on the other hand increasing our ability to manage that process. It is expected that, in the short term, such data-driven technology will increasingly be used to facilitate learning and to monitor and test in new ways. Before 2030, we will see that Big Data analyses of previously acquired knowledge will lead to completely personalized learning programs and make it possible to predict whether or not students will be able to pass certain modules or not. Before 2040, we will see that biometrics (like heart rate, sweat production, eye movement, etc.) will be used to provide real-time feedback on the learning process, while personal data about the students' lives (like food intake, sleeping patterns, etc.) will be included in the learning process. Generally speaking, the respondents are positive about these developments and 77% of them consider the use of Big Data analyses to personalize the learning process desirable. But they are critical about the way the information will be gathered and stored. Who owns the data? Who has access to and can use the data? And who benefits from the data? These are important issues that at the moment are already relevant in other domains and that need to be answered in the education domain as well.


5.5 TECHNOLOGY CALENDAR

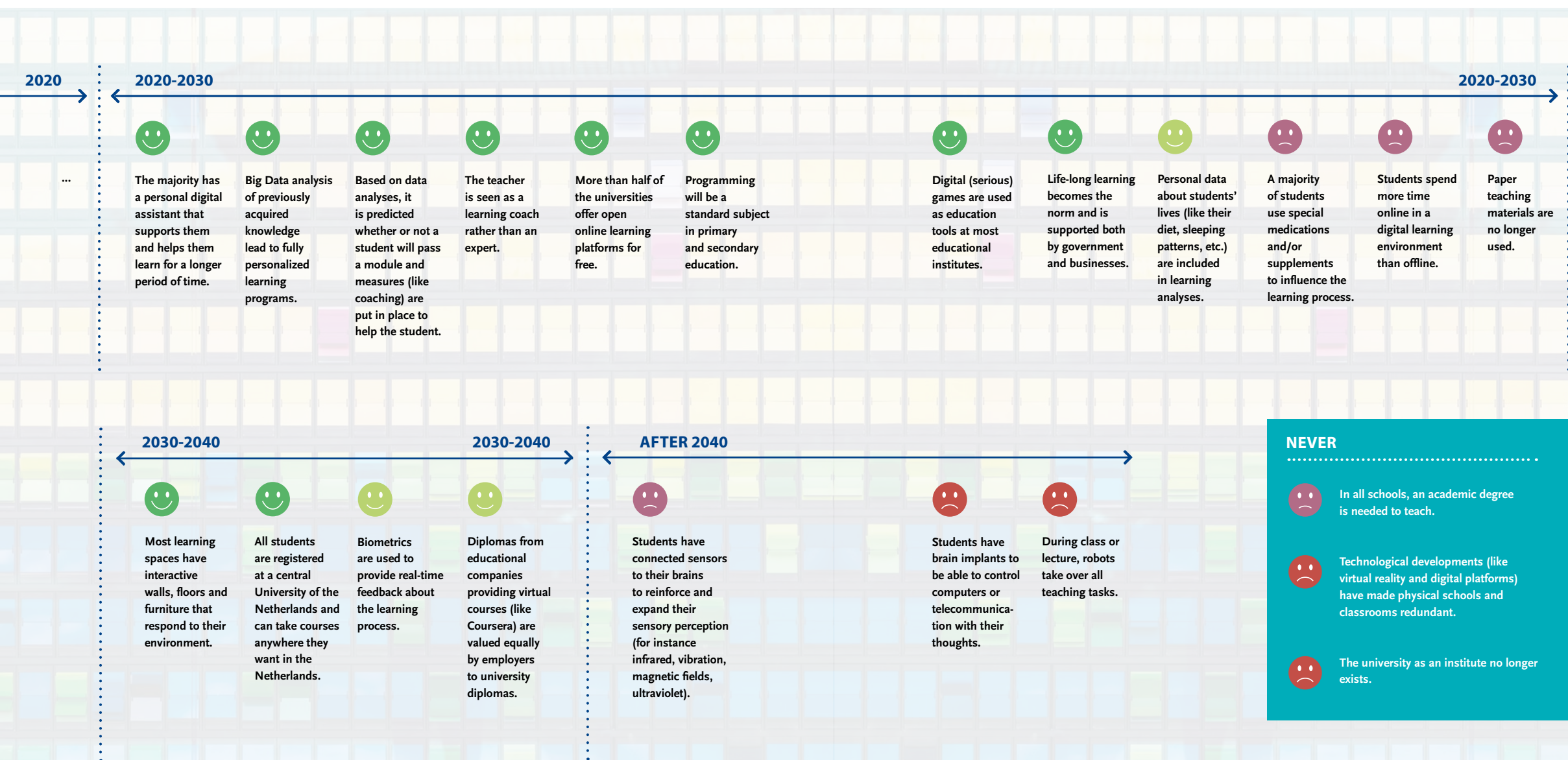
Directors have high expectations of the role of technology in society, and in particular of EduTech. But within what timeframe do they expect certain developments to take place? What will the learning environment look like in 2030? And in 2040? We tested this by asking the respondents when they expect certain technological developments to occur. We placed this on a time scale, with a scope from now until never.

 **VERY DESIRABLE**

 **SOMEWHAT DESIRABLE**

 **SOMEWHAT UNDESIRABLE**

 **VERY UNDESIRABLE**



5.6 LEARNING LESSONS

The Delphi study shows that people expect many changes to take place within a very short timeframe with regard to the way we learn, when we learn and where we learn. For instance, they expect us to have personal digital assistants before 2030 to monitor us and help us learn, and they think that students will spend more time online in digital learning environments than offline. Life-long learning will be official policy and it will be supported both by government and businesses. Paper teaching material will no longer be used, programming will be a standard subject in primary and secondary education and personal data about our diet, sleeping patterns and lives are included in learning analyses.

Not only do the directors expect to see lots of technological changes in the near future, generally speaking they are very enthusiastic about those changes as well. They are convinced that the role of technology in education will increase in the future. As many as 74% of them think that, in 2040, technological developments will have a positive effect on people's ability to learn. They think that EduTech will lead to an increased personalization of learning, as well as improve its quality and performance, increase the accessibility of education and provide a better match with the students' experiences. Next to hopeful views on the future, the directors also outline doom scenarios in which EduTech leads to impersonal and non-social education, too much dependence on technology, the loss of basic skills, a negative impact on our health and education that is in fact more exclusive. Resistance is strongest when it comes to technology taking over the role of people or human tasks, like the use of robots and artificial intelligence for that purpose. Although there is disagreement about the development and desirability of certain technologies, there is also consensus. For instance, 95% of directors thinks it is desirable that we move fast when it comes to life-long learning. They are of the opinion that technology should stay subordinate to people, that the human measure should remain a priority in all facets of education, that 'one size fits all' approaches should be avoided and that we need to work together to ensure that the infrastructure for EduTech is in order.

According to the directors, we are heading to a future in which technology will play a prominent role in the way we learn. Because there are few guidelines that have been laid down in this area, it is important to start up a social discussion about the subject involving not only the education community, but also the business community, technology developers, scientists and social parties. The aim does not have to be reaching a consensus, but it is important to know the perspectives of different parties and to map blind corners. After all, technology plays an increasingly central role in the way we communicate, absorb information and organize our lives, which affects the way we learn, as individuals, as organizations and as a society. As such, the impact of technology on learning is a subject we cannot ignore and one that demands new views on the future.

Interview Prof. Dr. Michael Fullan

By Thijmen Sprakel

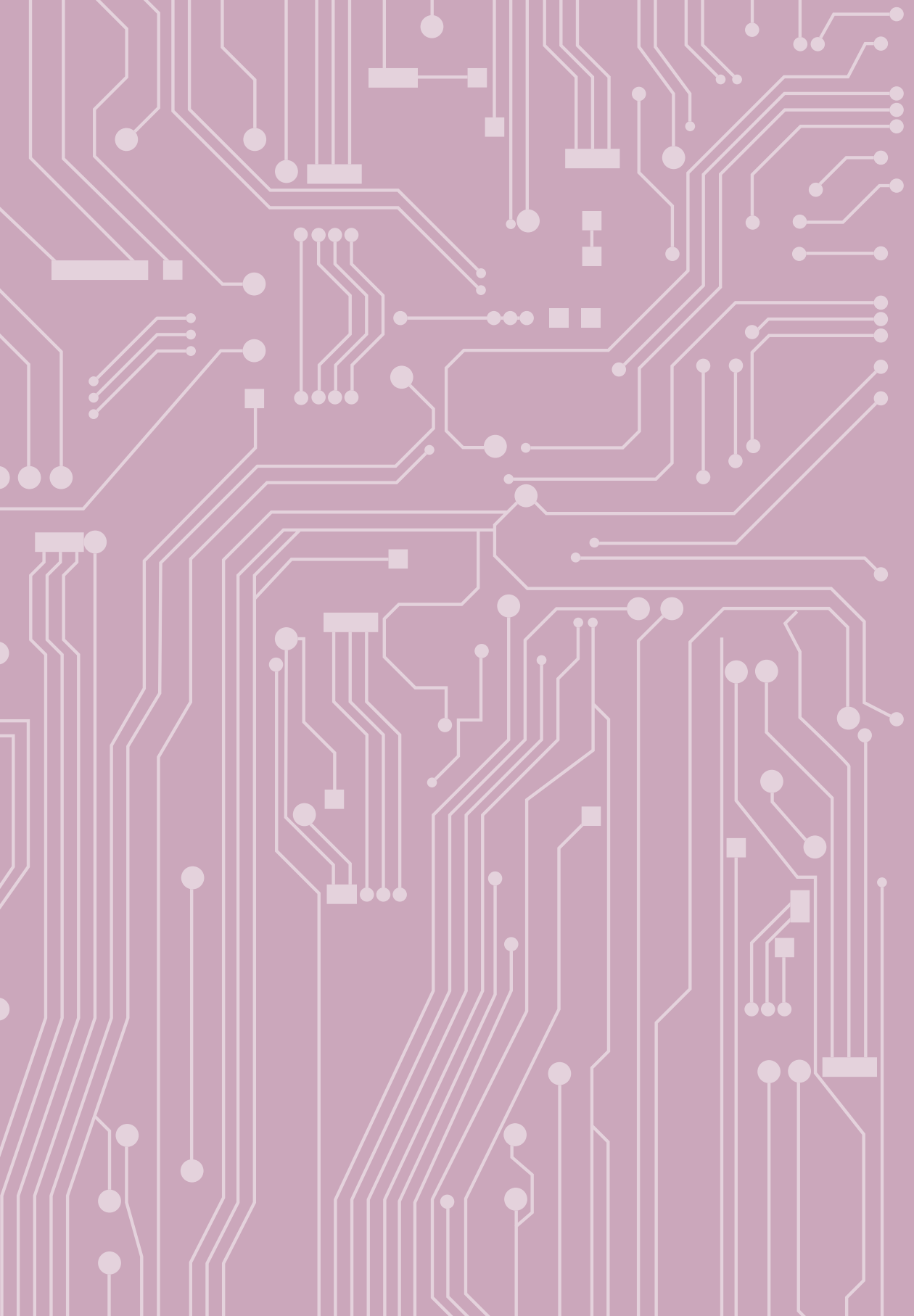
Professor Michael Fullan is the former dean of the faculty for Education Sciences at the University of Toronto and author of dozens of books about leadership in education, including Stratosphere (2012), Professional Capital (2012) and The New Meaning of Educational Change (2015).

What is your view on technology in education?

Technology is impossible to escape. It forces itself upon us. It is everywhere. Every society has to have wireless Internet. That is where the world is ultimately moving towards. Governments have to invest in it whether or not it costs money. Billions of people have a phone. So people have devices for going online. I don't think money is an issue when we talk about digitization in education. If you look at India or China, you see that the number of cellphones is growing exponentially. The only question is how to use this technology in education. The underlying didactics.

What will education look like in twenty years?

I think education will increasingly focus on the six C's: Character, Citizenship, Communication, Collaboration, Creativity and Critical Thinking. These are the skills that allow the student to keep learning all the time. Teachers and students will focus their activities around the six C's. The question is whether, in the future, there will be a school building as we know it today. If learning becomes more realistic, a representation of the world or region in which you live, there will be more collaboration and shared activities within the school. Fewer walls, more like a market instead of a row of classrooms. •



6.

FUTURE SCENARIOS

Sometimes I've believed
as many as six impossible
things before breakfast.

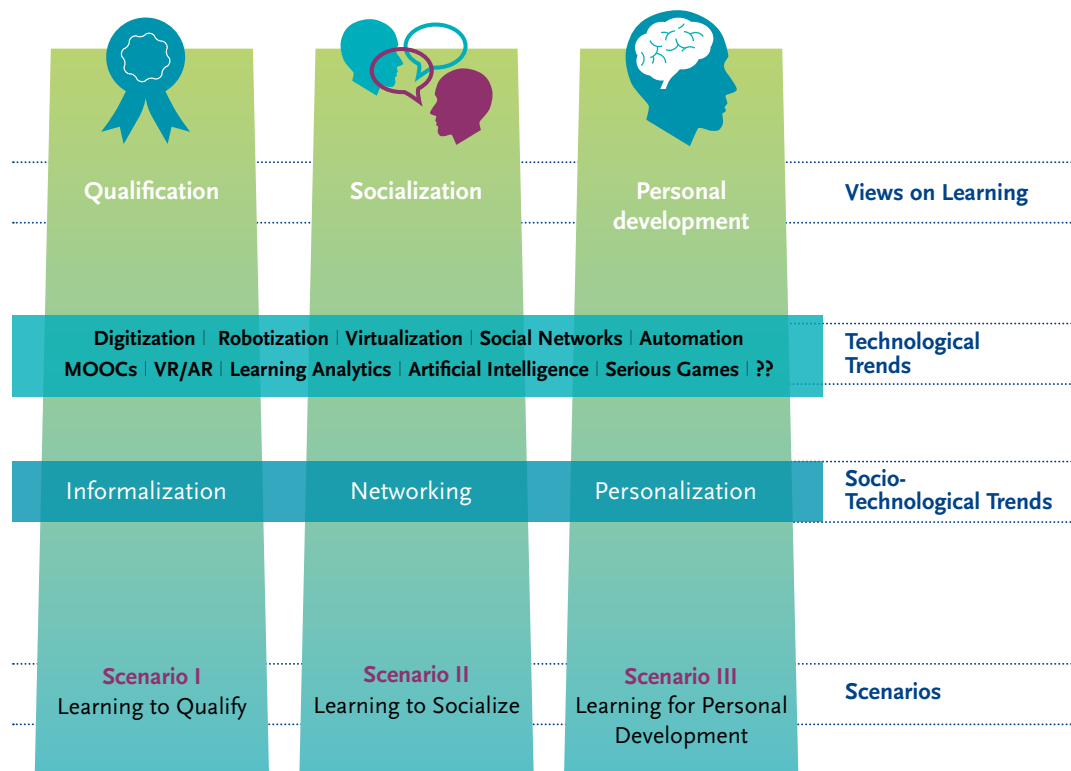
Lewis Carroll

6.1 INTRODUCTION

We think about the future constantly. When we get up, when we plan our day, at work when we discuss our agenda, or while planning a vacation. Usually, we think about the short-term future, but when we think about the long-term future, it is good to use instruments to increase our grip on possible futures and be able to take strategic decisions. In this chapter, we use the scenario method and discuss three possible futures in which learning and technology occupy a central position.

Different views on learning

The answer to the question ‘Why do we learn?’ is shifting. According to the literature study and the Delphi study, the problem is not that there is no vision on education and learning, but that there are several coexisting visions that are not in balance. According to some, learning should focus above all on connecting to the labor market, while others emphasize personal



From Vision towards an Image of the Future

development or the promotion of social cohesion. For example, historian Rutger Bregman recently emphasized the importance of personal development at the World Economic Forum: “I believe in a future where the point of education is not to prepare you for another useless job, but for a life well lived”. The OECD and UNESCO suggested there should also be attention to citizenship.

Professor Gert Biesta distinguishes three different goal domains in answer to the question what the purpose of learning is: qualification, socialization and subjectification.



Three target domains of Learning (Biesta 2015)

The first domain is that of qualification, which involves the role education plays in acquiring knowledge, skills and attitudes that qualify kids and youngsters to do something. That something can be very specific, like the qualification for a profession.

Next to qualification, education is also always a process of socialization, which involves the way education makes children part of traditions and practices. Again, we can think in specific terms, like socialization in a certain professional practice, or in more general terms, like socialization in a society, culture or democracy.

In addition to qualification and socialization, there is a third view that involves the way education affects the person, that is to say human individuality and subjectivity – also known as personal development or subjectification.

A point that is crucially important to the discussion about good education is that there is always tension between the three target domains. The different visions on why we learn are rarely in balance. For instance, “the emphasis on performance in the qualification domain may increase, and at the same time send a negative message in the personal development domain” (Biesta 2015). When answering the question what good education is, we always need to balance the pros and cons of the three domains against each other, especially with the increasingly influence of technology on education.

6.2 THREE FUTURE SCENARIOS

The previous chapters show that new technology does not automatically lead to a new form of learning, but it does allow us to view the status quo and the future from a new perspective. It helps us reflect on the question what the purpose of education is. To do that, we will work out three scenarios below that are based on the three leading visions on education of Biesta. Although there will usually be a mixture of the three different visions, the accent is always on a specific vision, which is why we have chosen a strict separation of the visions in the scenarios, to provide insight into the differences. In each scenario, the emphasis is on one of the three purpose domains as we discuss how the visions develop if the influence of technology increases, what the potential consequences are of technology on our learning visions and where the different visions disagree. That brings us to the following three scenarios:

- Learning to Qualify
- Learning to Socialize
- Learning for Personal Development

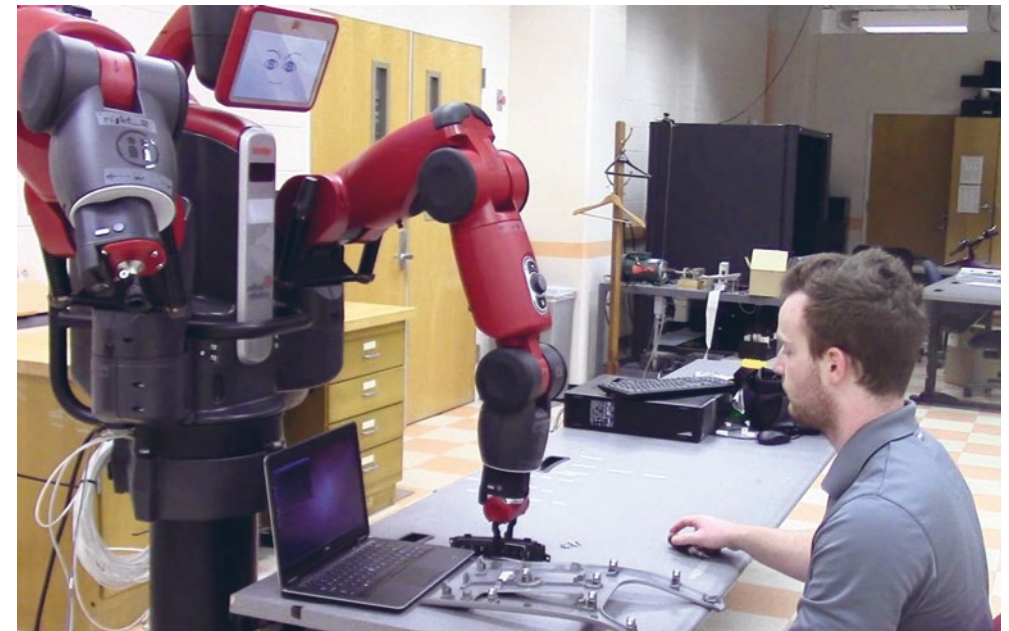
The first scenario focuses on the outcome of education, the second on social connections and emancipation, and the third on individual development. In all scenarios, we look 15-25 years ahead, far enough to take serious technological, social and political changes into account, but still within a timeframe we can imagine. In all scenarios, we assume an advanced technological and data-driven reality, and address the leading visions on learning, the dominant form of organization, the relationship between public and private parties and the specific use of technology.

6.3 LEARNING TO QUALIFY

In the Learning to Qualify scenario, learning is seen as an investment in the future of the Netherlands. The focus is on the market and learning outcomes; to maintain its international competitive position, it is important for the Netherlands to invest in talent and excellence. The formal education system is especially aimed at connecting to the (international) labor market. The curriculum is pragmatic, diverse and flexible in nature and, unlike the other scenarios, has no principle vision on learning. Learning is meant to lead to optimum performance, results and economic outcomes, but how that is achieved is less important.

Over the years, belief in the value of public education has suffered and education is largely privatized; through unbundling, public education systems were cut up into small modules and taken over by market parties providing much of the content, the applications, the learning tools and the learning environments (often in-house at companies).

International technology companies as well as accreditation organizations play an important role in managing the quality of the education. A more diverse set of stakeholders is involved in the governance side of education. Together with market parties, the government sets the framework and manages efficiency, the balance between costs and benefits and the quality of education. For the professional population, life-long learning becomes the norm and employers play a significant role in managing people's education at work.



The Role of Technology

In this scenario, technology is everywhere and data is sacred. Learning environments consist of large networks of sensors that register, store, analyze and share audio, video and biometrics. There is a lot of attention to standards, digital infrastructure, bandwidth and the Internet of Everything. After a lengthy battle, the open source model for content lost out to paid and protected content models. Copyright is very important and there are more and more business models where users pay via freemium accounts, by allowing access to personal data and personalized commercials, by co-creating the content, by linking the other users or via paid subscriptions.

Teachers are now called learning professionals and their tasks include producing content and coaching people who use it. Film and animation studios work together with technology companies to animate AI assistants and teaching material. The worldwide web has produced a number of 'teaching rock stars' with millions of followers who present popular MOOCs.

6.4 LEARNING TO SOCIALIZE

This scenario focuses above all on the social importance of learning. The central education system is seen as the most important platform for promoting citizenship and helps to bring people together in an increasingly diverse and fragmented society. More public money is invested in education, and social organizations and the government work closely together. Schools are organized locally and are at the center of society, while there are powerful national policy programs that provide social and digital infrastructure, especially among weaker communities. Schools have become a crossroads in society where people not only meet other people within their age group, but all kinds of people and social groups, and teachers are not individual knowledge carriers, but work together in teams and acts as guides and caretakers, and they connect students and society. Because they are a part of the structures, teachers are seen as partners who have a specific role within the democratic learning networks. They are connectors and moderators who know how they can set up and facilitate online communities. The curriculum focuses on citizenship, social cohesion, battling segregation and inequality, but also on manners and values. Learning is not limited to knowledge, but emphasizes social and cultural skills especially.



The Role of Technology

In this scenario, communication and network technology are used to develop human talents to be able to work together better. It is realized that many hands make for light work and the wisdom of the crowd is used to work together with peers on assignments, but also to create new content and assess performances. Research data, content and learning methods are open source and peer-to-peer technology is used optimally to create networks between learning institutes, research institutes, businesses and the government. As a result, the production of knowledge is not just the domain of experts, but involves new forms of co-creation. There are breakthroughs in unexpected places now that there are direct connections between professors, civil servants and even toddlers. Based on data analyses, people are brought together at an (inter)national level to create strong teams; technology is not a driving force, but it does facilitate meetings that take place online more than offline.

6.5 LEARNING FOR PERSONAL DEVELOPMENT

This scenario is all about personal development and there is a very strong focus on the intrinsic value of education, learning, self-realization and development. Personalization and flexibility are the keywords. One-size-fits-all-approaches are not accepted and the main function of technology is to emphasize individual students and their choices. Learning is informal and learning situations are spread across different locations, technological platforms and a wide range of activities. They do not have to be at a specific location at a specific time; learning takes place completely independent of place and time. There is less stability and less structure, and the boundaries between learning and not-learning, between different disciplines and between online and offline are things of the past. There are few physical classrooms and everyone is connected to each other.



The Role of Technology

Technology is embraced as an essential communication and learning tool. People live in smart environments with ambient intelligence in which all machines are interconnected and allow for digital and mutual interaction. Technologies that are used as extensions of the human body, smart wearables, provide immediate feedback on the learning process and give information about the environment to the student while at the same time interacting with that environment. Everyone has a digital personal vault containing data that can be kept private or be shared. The vault contains information about the individual's health, basic public administration and registrations, communication, as well as the learning profile. This way, people are no longer dependent on the databases of institutions, but are able to gather, collect and analyze data about their learning process throughout their lives, and between different organizations and modules. In this scenario, the use of learning analytics has developed a lot; all the students' learning activities are stored and compared to those of millions of other students to identify trends, patterns and predictions about their learning behavior. Based on that information, learning is personalized even further and, using the personal learning goals, it is indicated what people already know, what gaps there are and which subjects could do with a refresher course. Serious games and gamification are popular methods for providing extra motivation to students and to persuade them to initiate learning activities themselves.

6.6 SYNTHESIS

Our reason for conducting a foresight study is that we have to reexamine education in the light of the digitization and increased use of technology in society. And although it is hard to predict the development of technological innovation and there are no general rules when it comes to how societies use technology, there is a need for a discussion about the possible opportunities and consequences of technological development with regard to the way we learn. In this case, we do so by presenting new future scenarios, which we use to propose alternatives, bring clarity to the debate and inform future policy. The three scenarios can be characterized using the following keywords:

Future	Learning to Qualify	Learning to Socialize	Learning for Personal Development
Focus	Results	Society	Individual
Goal	Investing in the country's future	Social Cohesion	Formation and realization
Technology	High tech	Low tech	High Tech
Organization	Decentral fragmented	Central bureaucracy	Individual
Public-Private	Private	Public	Public-Private
Sociotechnical Trends	Personalization	Networking; Informalization	Personalization; Informalization

These scenarios help formulate and evaluate policy and map different visions and possible blind spots that different stakeholders in the education domain may have (See Hermes and Zonneveld 2015). The workings of scenarios is important in this respect, because it shows how stakeholders who envisage a certain scenario look at reality. After all, scenarios are narratives and, as such, perspectives on reality. Everything that falls within the focus of a scenario, is observed with clarity. Whatever falls beyond its scope, remains opaque or even invisible. It is sensible to ask regularly which scenario is being used. What do we, as well as other participants in the social and political debate, overlook? Such question can be answered if one is aware of the different narratives and is able to identify them.

Moreover, a scenario analysis can shed light on the dynamics of a debate. Hereby, it is important for stakeholders not to tie themselves to one scenario, but also to recognize and acknowledge alternatives. It shows that balance is important when creating new visions; if there is only attention to one vision on education, that can be risky, because the other stakeholders may feel they are not being heard.

Interview David Ross

By Thijmen Sprakel

David Ross is the CEO of P21 (Partnership for 21st Century Learning) in Washington DC. P21 is a non-profit organization that stimulates collaborations between governments, the business community, education and society about the framework of skills and knowledge that are essential in today's and tomorrow's world.

What will education look like in ten years?

There is a movement going on towards competence-oriented education and that means that people go through education at their own speed (education looks at the existing competences of each individual). The principle of putting kids of the same age in a classroom and let them take the same steps at the same time is ridiculous. It is not based on reality. Students develop knowledge and skills at their own pace and not at the pace the school dictates. A student who completes the subject of mathematics in a month may need two years for the subject of English. The year-based class system is not something you talk about anymore, it should be abolished.

Schools will change towards centers that service the community 24 hours a day. They will house healthcare, government services and financial institutions. Keeping a school open for eight hours a day and then closing its doors is totally inefficient. The school should be the center of every community and that includes adults. So I am hoping that schools will become community centers for people of all ages, where they have access to different services and facilities.

What is your message to politicians?

I think it would be good if every teacher were to take a sabbatical to spend some time at an internship in the business community or the non-profit sector. The government should fund that. Teachers should take a year to see how things are on the work floor of these companies. Technological progress is much faster within these companies than it is within education. In addition, teachers can learn about doing business, budgeting, making a profit, legislation, etc. Teachers then take that knowledge back to school, making education richer, better and stronger. •



7. LEARNING FROM THE FUTURE

Technology is, of course,
a double-edged sword.
Fire can cook our food
but also burn us.

Jason Silva

When the Greek gods gave knowledge and skills to humans, the result was disastrous. Other earthly beings were smarter, faster and stronger. That changed when we encountered technology. Prometheus stole fire from Hephaistos, a god that forged robots and other machines, and distributed it among mankind. Humans mastered technological development and were taught to anticipate and look to the future by Prometheus, whose very name means 'he who thinks ahead'. However, time and again, people got burned by technology. Prometheus himself was punished by the gods and chained to a rock while an eagle picked at his liver. Other mythical figures, like Icarus, fell to the ground when they became overambitious in using technology.

Technology is, according to Heidegger, in essence something that humans cannot control. Since antiquity, we have experienced a difficult relationship with it. Technology defines us and alienates us at the same time. We are playing with fire, which at times leads to new recipes and insights, but can also lead to explosive situations.

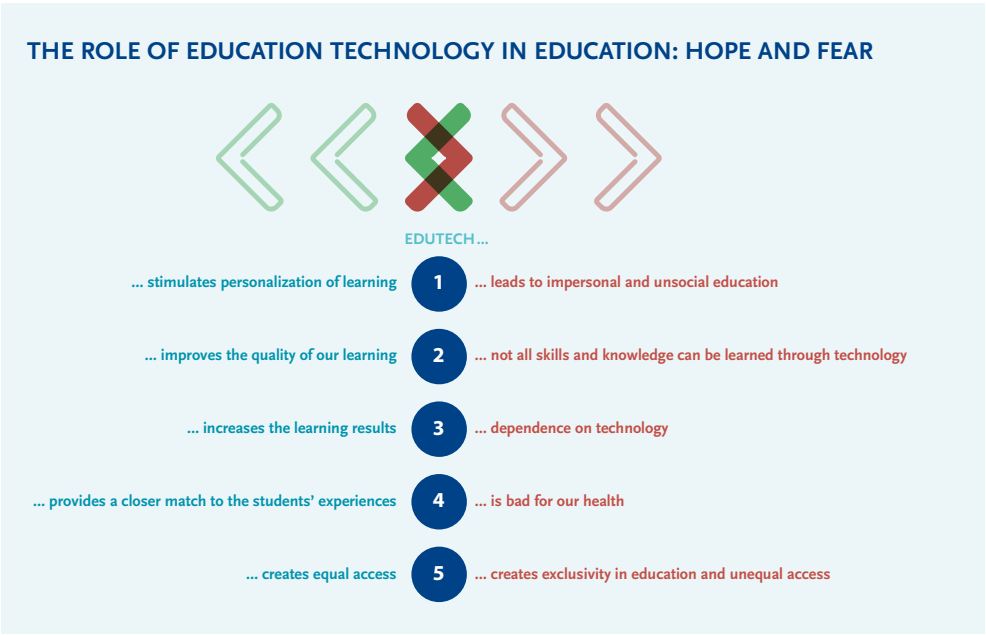
Having said that, the respondents in this study are predominantly positive about the future of technology and specifically the use of technology in learning. As many as 74% of the people we interviewed think that technological developments in 2040 will have a positive influence on the human ability to learn. According to the study, EduTech will lead to a more personal approach to learning, higher quality and performance, more accessible education and a better connection between education and the technology-driven world of students. However, next to those hopeful visions, the study also outlines potential doom scenarios, with EduTech leading to impersonal and non-social education, too much dependence on technology, the loss of basic skills, a negative impact on our health and exclusive education. The highest level of resistance involves technology taking over the role of humans or human tasks, like the use of robots and artificial intelligence with that purpose. In addition, the study indicates that we have to be careful not to let the new gods, the robot builders of this age, become too powerful and that we should make a concerted effort to steal back their fire and distribute it evenly among society.

7.1 DO NOT TREAT PEOPLE LIKE MACHINES

The fire metaphor is frequently heard in education, and represents passion, curiosity and the will to learn. We see it as an important task of teachers to ignite a flame in students. And, as seen in this foresight study, we use the fire metaphor to describe what learning is. Education is not like filling a bucket but, as the Greek philosopher Socrates put it poetically, education is like kindling a flame. It is a development that is never finished and that reminds us that we should see learning as an uninterrupted process of participation and interaction, rather than a mechanical process of managing and storing information.

We argue in favor of further embracing this metaphor of learning as kindling a flame. The associated definition of learning is becoming more common, but is still at odds with our existing education models. Instead of organizing formal learning environments that facilitate the transfer of as much information as possible early on in our lives, this approach sees learning as a continuous process throughout our lives. In addition, it represents a broader definition of learning, where the boundaries between formal and informal learning, between learning inside and outside the education system, and between the various existing disciplines and demarcations, should crumble.

We also argue that we should stop treating people as machines. This is a plea that is aimed at teachers, policy-makers and algorithms alike. As David Thornburg put it: if a teacher can be replaced by a robot, he deserves to be replaced. Teachers must continue to offer added value in the age of AI and robots. And in the shift from knowledge transfer towards learning as continuous process of participation and interaction, there is plenty of room for that.



Besides the redefinition of social roles in the educational process, the education system and learning environment should be adjusted as to make education less mechanical. Education systems should no longer be modeled on a Taylorist factory where students are separated based on their construction year, processed as standardized products, and given a stamp as they roll off the assembly line. Humans are too complex and dynamic for this. As Ken Robinson puts it: “If you sit kids down, hour after hour, doing low-grade clerical work, don’t be surprised if they start to fidget. Children are not, for the most part, suffering from psychological conditions, they are suffering from childhood” (2006). But not only should people not treat students like machines, machines should also not treat people like machines; technology has to be programmed so that people are not reduced to information systems or are seen as data packages. Especially not within a narrow outlook where profit is the overriding concern. EduTech has to be programmed in a socially and educationally responsible way. That means that, in the development of EduTech, there has to be concern for things like privacy, autonomy, security, control over technology, human dignity, justice and power relationships (Kool et al. 2017).

And having said this, we should also not treat machines like people. Technology is not something that will find its way and that autonomously integrates in existing processes; the implementation of technology has to be done by people. People have to be taught how to handle technology, people should be convinced of the pros and cons, and people should be made aware of the relationships between technology and humans. In that sense, too, the human factor is decisive.

7.2 THE PAST AND FUTURE RHYME

Many of these lessons are not new. In our analysis of the implementation of older EduTech, we saw several trends come back again and again. First of all, the introduction of technology does not happen as fast as people initially hope (See Ortt and Dees, 2018). Somewhat comparable to Gartner’s well-known hype cycle, there appears to be a cycle of hype, hope and disappointment, before a technology finds its stable position in an educational system. But secondly, there are a number of recurring practical issues with regard to the implementation of EduTech:

- Lack of attention to the users
- Lack of trust by the users
- A lack of centrally coordinated programs
- A lack of capital and means
- An incomplete curriculum
- Underdeveloped technology

What stands out in the cases we described is that, generally speaking, the adoption of technology does not originate with a demand from users, in our case the teachers, students or schools.

Often, the initial push for technology comes from politicians, managers and technology companies who are often in favor of a technological fix or the idea that technology can solve existing problems (Selwyn, 2016). Secondly, we get carried away by a societal enthusiasm for technology. As STT’s Future Monitor (2016) puts it, we live in a techno-optimistic age, which means that we see technology as a positive contribution to our lives and society in the short term as well as in the long term. Thirdly, ideas about progress and modernization are often linked to technological development, which is certainly the case when we look at education. The problem however is that social problems are much more complex than technological problems. The implementation of technology is not just a technological issue, and its success depends on human activities, organizational and educational culture and institutional actions.

7.3 TECHNOLOGY IN THE FOREGROUND

It is important to safeguard the human factor as we head for a future in which technology will play a prominent role in the way that we learn. Learning environments contain more and more sensors, learning processes generate more and more data, students are increasingly connected and education systems increasingly operate independently. The respondents we interviewed in this study expected digitization and robotization to cause significant changes in the way people learn, what they learn, when they learn and where they learn within the next 10 years. For instance, they think that we will have digital personal assistants before 2030 that supervise us and help us learn, with students spending more time online in digital learning environments than offline. Life-long learning will be official policy and supported both by the government and by the business community. Paper teaching materials will no longer be used, programming will be a standard subject in primary and secondary school and personal data about our diet, sleeping patterns and life will be included in learning analytics.

Not only do the respondents expect to see many changes in the short term, generally speaking they are also very optimistic about these developments. They are convinced that the role technology plays in education will increase in the future. For instance, 95% of the people we interviewed thinks it is desirable to move towards a life-long learning model as soon as possible. They think that technology should remain subordinate to people, that the human factor needs to remain a priority in all facets of education, that we need to avoid one size fits all solutions and that we need to make sure that the infrastructure for EduTech is in order.

7.4 BROADENING DISCUSSION NECESSARY

Because there are few policy-guidelines for Edutech, it is important to start a societal discussion, which would include people from the field of education as well as the business community, technology developers, scientists and civil society. The aim of this discussion does not need to be consensus, but it is important to know the perspectives of different parties and to map the blind corners. The scenarios that we developed within the framework of this study help do that. We distinguish three existing future visions of learning – qualification, socialization and subjectification – and show how they will develop in the future. The intention is to gain more insight in how different stakeholders look at the future and how the visions either align with other visions, or exclude them.

What we see with the current use of EduTech is that it focuses on learning in a narrow sense; as a technical process focusing on the adequate management of information. There is a strong emphasis on qualification, efficiency, effectiveness and learning performance, and less room for broader learning goals like socialization and personal development. Possibly this is because of a lack of discussion between the various stakeholders who play a role in the development and use of learning technologies.

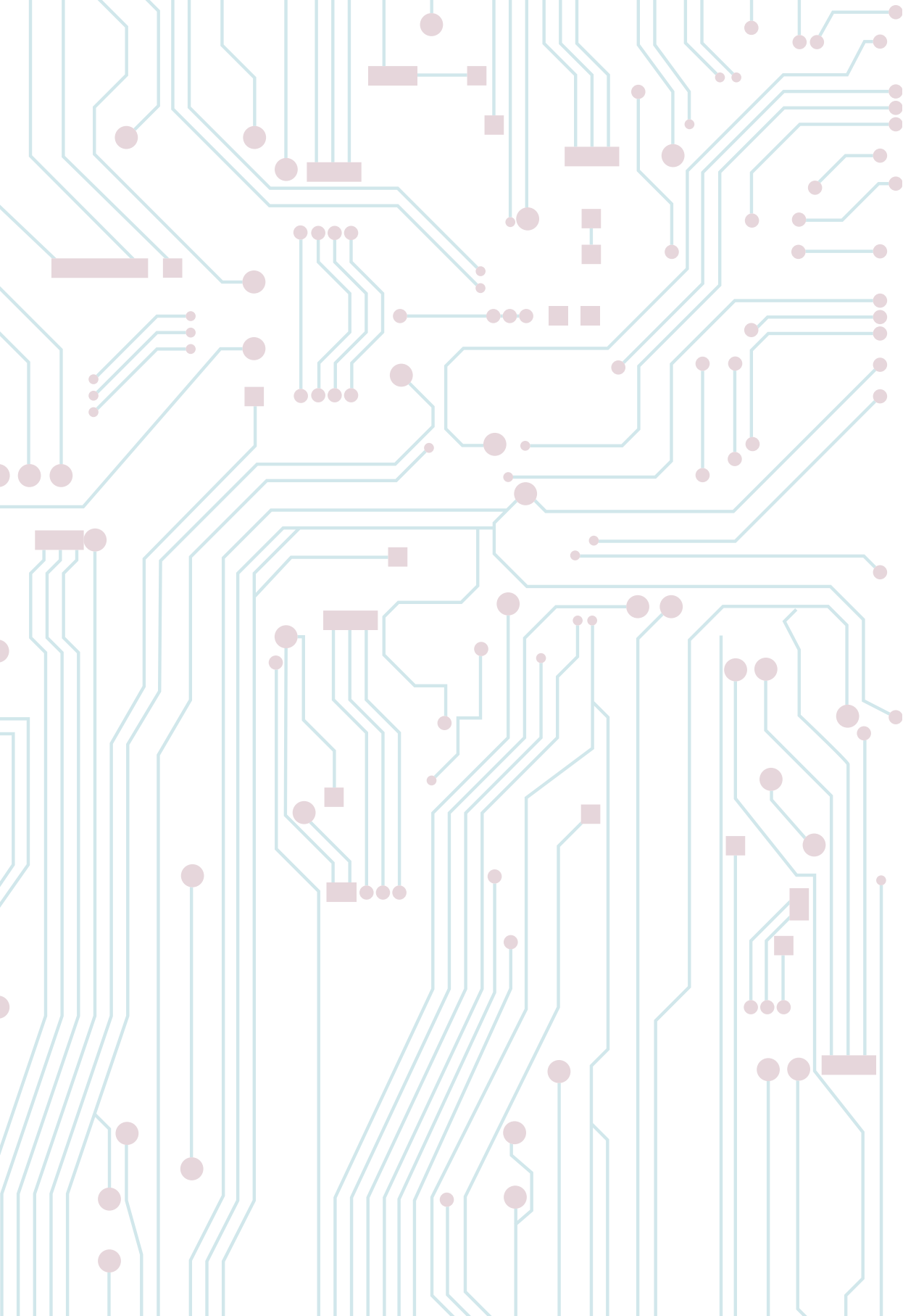
7.5 STARTING A FIRE

To conclude, technology has come to play an increasingly central role in the way we communicate, absorb information and organize our lives. This has consequences for the way we learn; in educational institutes, in business communities and elsewhere. That is why it is important for everyone involved in teaching to think about the complex relationship between learning and technology. It is a subject that we cannot ignore and one that demands the development of new visions on learning. This should be done by schools, student classes, ministries, technology companies and, in particular, individuals. After all, most fires start with a single spark.

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APPENDICES



: ABOUT STT

The Netherlands Study Centre for Technology Trends (STT) was established in 1968. STT is an independent non-profit foundation, funded by financial contributions from the Dutch government and industry and science.

Our foresight studies

STT carries out society oriented technology foresight studies. For that purpose STT facilitates a free space in which enthusiastic stakeholders, experts and creative minds from industry, society, science and government take part. There are often more than 100 participants per project. Young people from schools and universities are increasingly included in discussions. The participants create views on the future of technology in society. They are stimulated to think ‘out of the box’, 20-30 years ahead, and to leave present principles and constraints behind. Through knowledge fusion, new insights and ideas emerge and a willingness to explore new ways of cooperation between stakeholders. Topics are explored broadly (cross domain and interdisciplinary) and sub-topics are studied in-depth. The focus is on the interrelation between technological and societal developments.

: COMPOSITION THINK TANK

Name	Function	Organisation
Anja Oskamp (chair)	Rector Magnificus	University of the Netherlands
Anwar Osseyran	Director	Surf Sara
Simone de Ritter	Professor	Radboud University
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Tim Schokker	Strategic Advisor	Ministry of Education
Patrick van der Duin	Director	STT
Richard Slotman	Director	SIA, NWO
Marijke Kral	Lector ICT&Education	HAN, iXperium
Janine Huizenga	Designer/Head of Department	Waag Society/KABK
Thijmen Sprakel	Teacher and Blogger	Helinium Schooling Collective



LEARNING FROM THE FUTURE

Chatbots, chips and robots are lined up virtually speaking to help us absorb information in a different way than we have done so far. Facilitated by new technology we can learn what we want, where we want and when we want. We have access to zettabytes of data and can be connected to each other in the blink of an eye. While technology is changing the world around us at a rapid pace, there are already fears that smart systems will surpass or replace human intelligence. That is why the question is not only how technology will change our learning process in the coming years, but also what the role of learning will be in our future society.

These are the central questions in the STT foresight study 'Long Live Learning!'.



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