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THE NEW LEARNING

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A b s t r a c t: this explorative rather than scientific paper analyses trends in the way we learn and teach. It distinguishes three historic modes of learning, Classical Learning, Industrial Learning and the emerging New Learning. After describing these modes, the article identifies forces for change in our way of education, resulting in a sketch of future learning.

The learning challenge

«We stand on the brink of a technological revolution that will fundamentally alter the way we live, work and relate to one another. In its scale, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society». This citation[1], from professor Klaus Schwab, founder and executive chair of World Economic Forum, continues to list some of the emerging technologies: «artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage and quantum computing». He could have added genetic engineering, block chain technology and a host of other new technologies, all of which have digitisation as a common base. Further in this article: «The demand for highly skilled workers has increased while the market for workers with less education and lower skills has decreased. The result is a job market with a strong demand at the high and low ends, but a hollowing out in the middle».

Hyperbole? Well, nobody doubts the impact of the technologies now being developed. Just about every day we are confronted with estimates of the alarming number of jobs that are going to be destroyed, making you wonder whether anyone will have a job in the not too distant future. Yet, the passage quoted above could have been written equally well in say 1880, when electrical power, (international) railways and motorised shipping, telegraph, telephone, photography, motorised farming and eventually aviation were entering into the lives of our great-grandparents. They certainly «involved all stakeholders of the global polity, from the public and private sectors to academia and civil society» (op cit). Closer in time, many of us will remember the massive lay-offs of administrative staff when computers became a commodity. Despite these enormous shifts, unemployment levels have remained low and not only because we work less. How come? The answer is: education. Each wave of technological change calls for workers with new skills, lured to the new professions by monumental salaries; think of the salaries of IT-staff at the end of the previous century. This is then followed by an expansion of educational capacity, resulting in more skilled workers and a return to normal salaries. Is this going to happen again? Of course it is, but there is one big 'but'. Higher education has expanded significantly: in 1945 there were 500 universities across the globe, in 2018 this has expanded to 20 000 and we should continue increasing[2]. The 'but' is that we not only need more educational efforts but also an increase in the effectiveness of learning and teaching.

Learning and teaching

While learning and teaching have remained essentially the same during the past millennia, strong forces of change lead us to expect we are entering a new era. We have seen such a paradigm shift before when teaching became industrialised during the Industrial Revolution and *Classical Learnin*g turned into *Industrial Learning.* We will briefly discuss these ap-

proaches, then turn to the forces of change and end with a speculation of what we will call *The New Learning*. Note that these approaches to learning coincide, not surprisingly, to the three generations of universities as outlined in *Towards the Third Generation University*[3].

Classical Learning

Classical or First-Generation Learning is characterised by the direct interaction between teacher and student. The picture is familiar: the teacher in front of the classroom – 'the sage on the stage' – transfers his knowledge to students who sit in benches and make notes. Some of the lectures are interactive, others are monologues. It was practiced in antiquity and the Middle Ages and it still comprises the major part of our learning system. 'Direct interaction' did not mean something like private lessons; hundreds and perhaps thousands of students came to hear Abélard and other famous scholars during the Middle Ages. Students and teachers ran universities together; the word *university* means 'the unity of teachers and students'. Ecclesiastical and civil rulers picked up the cheque (now US$ 200 billion per year in the US 4) and kept a watchful eye.

Learning was and is a container concept that incorporates such different things as:

- Instruction, i. e. communicating indisputable facts, like telling a child the difference between a chair and a table or an electrician that the brown wire is plus and the blue one minus;
- Talent development, as in art schools but also for a medical doctor on how to communicate with a patient;
- The art to solve problems or mysteries, as in scientific research and analytical activities.

It was understood since antiquity that learning yields great benefits for students as well as society. Without properly educated and loyal theologians and lawyers Church and state could not be run. This led to a rapid expansion of Europe's universities after the onset of the Renaissance. For students, developing one's talents and skills is a source of happiness and wealth. Learning has vast economic and social effects; one may safely say that research and learning form the basis of our prosperity.

Industrial Learning

After Napoleonic times, learning became increasingly industrialised. Industrial learning, overlaying classical learning, still constitutes the bulk of today's learning. Born in Prussia around 1794 – hence after the onset of the Industrial Revolution – Industrial Learning has all the elements of this revolution such as:

- Specialisation: the number of professions and scientific disciplines has expanded and their content narrowed. It has exploded since WWII; we know ever more about ever less. The 'Renaissance man', who could muster several disciplines, all but disappeared. Secondary learning also specialised, according to intellectual level of students, their age, the trade taught, etc. The higher up the teaching ladder, the more specialised the courses.
- Standardisation: courses, diplomas, students and teachers became standardised. Just as a label saying 1 kg of sugar tells the consumer that the bag contains sugar, not salt, and a bit more than 1000 grams of it, the school or university diploma tells employers what they buy. School and university courses became standardised and so have diplomas. In contrast to the Middle Ages, it did not matter much in the Industrial Era at which university you would study or to which school you went. Students became standardised as well: the labels 1st, 2nd, 3rd year students and diplomas in subjects A, B or C tell us what is in the pack. Teachers likewise became standardised with their various standard qualifications;
- Synchronisation: Education connects seamless to work, or so it was until recently, with the diploma being the 'linking pin'. Diplomas are the communication tool between graduates and employers. Different types of schools and universities are interlinked, students can, to a certain extent, switch seamlessly from school to university and school to work, perhaps with the route of vocational education in between;
- Concentration: schools and universities became ever larger until they have become true learning factories. Lomonosov Moscow State University has over 40 000 students and it is by no means the largest university in the world. In universities, personal contact is usually confined to the later years; exams – often multiple choice that a housewife or computer can mark – have become likewise industrialised;
- Maximisation: Output of schools and institutes of higher learning was maximised as the more education, the more prosperity; in addition, there should be equal chances for everyone. For this reason, education enjoys a high esteem by politicians and employers. This esteem, however, makes the system very resistant to change. Maximisation applies to quantity as

well as quality of education with institutes competing for the 'best' results, 'best' meaning for instance the percentage of pupils who pass the school exam. Educational institutes increasingly became the subject of all kinds of (quality) measurement, often a hobby of bureaucrats, with the exception of the useful PISA test (Programme for International Student Assessment), a competition between 15-year olds in science, math, and teaching skills, commissioned by the OECD[5]. Universities boast of their high 'production' of scientific papers, just like a car manufacturer boasts about the number of card produced;

- Centralisation: In just about every country, the Ministry of Education sits at the top of the *National Education System*. The NES designs the educational system, implements, finances and controls it. In addition, it approves or designs courses, certifies teachers, sets examination targets and often conducts the exams itself. So, Big Education Brother is omnipresent. No part of society is further from free market principles than education, with the exception of the military, the police and the fire brigade.

As a consequence, Industrial Learning has been challenged since the Enlightenment in the middle 18th century; think of the attempts at modernisation by Rousseau and the like. These experiments died out until the late 19th century. Since then, a multitude of experimental new school types has emerged, some now well-established, like the Montessori schools. Schools and universities experiment with new types of teaching and learning. Distance learning has become a well-established dish in the menu. Home teaching has grown although it is statistically insignificant. Although the changes are only marginal in scale, we may say that the current educational and learning system is *Industrial Plus*.

Diplomas

Just a word about exams and diplomas. There are two kinds of exams: o*utput exams*, that give evidence that a certain course has been passed successfully, and input exams, as for instance for admitting students in higher education; we consider job applications also as entrance exams. Successful output exams are rewarded by diplomas. Output diplomas have two functions. For the student, they are highly motivational, vide the elaborate ceremonies followed by parties when a course is finally crowned with a diploma. For society, diplomas serve as an intermediary between graduate and the employer – the '1 kg of sugar' label. As output exams are only part of job entrance assessments, they are of little value in linking education to a job.

Note that in certain countries a school diploma automatically gives access to university courses, so output and input exams coalesce. Finally, state diplomas in areas of public interest, such as for medical practitioners, judges, gas fitters, are there to stay.

Forces of change

Back to learning. Recent decades have seen strong forces of change, both on the supply side (the 'technology' of learning and teaching) and the demand side (those who benefit from learning: students and employers). According to Bill Gates, it is «a special time in education»6. Let us examine a few such forces.

Changes on the 'supply-side'

1. Results of pedagogical research. This, together with plain common sense, challenges the current system. Why should students be working in year classes, rather than in multi-age groups? Why should a student be forced to repeat a year – and waste time and motivation – if only some subjects are below standard? Some grammar school pupils do not finish school for the simple reason that they have no affinity to, say, mathematics, while they are brilliant in every other subject. And: why should pupils and students follow standard programmes when neither they nor the jobs positions they are going to fill are standard? Industrialised learning is highly demotivating for students and teachers alike; people differ and don't like to be cramped into a straightjacket. So, the trend is towards self-study, learning in small groups and individual tutoring. Another trend is 'phenomenon-based learning' as in Stanford's d.school, Maastricht's Medical Faculty, Finland's Design Factory and practices at Olin University. Students work on a project, either alone or in a team; fourteen-year olds can perfectly well build a drone, learning on the way, especially if they have to make it ergonomic and write the manual in French. The Fins call it «phenomenon-based learning»[7]. Then there is 'embedded' learning, that is, getting assignments in industry or other employers while still at school or university. Here we meet a German tradition, especially in vocational training (the *Fachhochschule*), which is considered as one of the sources of Germany's economic success. It seems that the UK is lacking such a practice focussesing much of its educational budget on top research, neglecting vocational training[8]. Finland is building a completely new set of

schools. Gone are the classrooms with benches; instead, there are 'lounge-like islands' in an open space where attention has been paid to acoustics and comfort. 'Classes' with pupils of different age are smaller than 19 students. There are neither school inspectors nor teacher evaluations (an ombudsperson comes instead), school days are short and summer breaks lasts ten weeks. Students are being assessed by their teachers; there are no exams other than for those who want to continue learning, more of an entrance exam in fact. Teachers are well paid and enjoy high social status which fits the traditional respect of the Fins for learning. Students have much say in the management of the school. Because of this, Finnish schoolchildren are far ahead in math, science and reading in comparison with their European counterparts[9]. Teachers still matter. a study of the University of Melbourne that analysed 85 000 papers on the effects of hundreds of interventions on the learning of 250 million pupils, found that 'teacher expertise' is the most effective way in learning[10].

2. Internet. Internet already has a vast impact, partly because of specialised companies that put courses in the market – Udacity, Coursera, EdX and the like. One such company, Kahn Academy, has six million subscribers who solve three million math problems each day. In Russia, universities like TSU have specialised units that design on-line courses, for their own students or anyone who wants to use them. The popularity of MOOCs, a rather primitive way of learning, has taken great flight. On-line learning has great potential and this will be augmented by:

3. Artificial intelligence. Despite much publicity, AI-assisted learning is still in its infancy but it holds vast promises. «AI and machine learning will improve the process of scientific discovery» says Demis Hassabis, a co-founder of Deep Mind, the company known for its programme to defeat the world's best Go-players. Robots at the University of Aberystwyth can carry out an entire scientific process: formulating hypotheses, designing and running experiments, analysing data and deciding on further experimentation[11]. Carnegie-Mellon uses virtual assistants that can tutor and guide personal learning; this gives the same results as human tutoring in fewer hours of study. Georgia Tech found no differences between robot and human tutoring.

4. Brain research. a vast amount of research into the workings of the brain is ongoing, all over the world, aided by ever sophisticated scanning techniques and a host of new tools such as Neuropixels, a probe, 1 cm long and 70 microns across, that is inserted into the brain and that can read signals from groups of brain cells[12]. Much efforts go into the design of brain-computer interfaces, allowing persons with artificial limbs to move them by the power of thought, just like we do naturally[13]. Together, these efforts have led to remarkable results and also to new insights into the workings of the brain. These billions worth of research are bound to throw more light on the workings of the 'last unknown organ' of the human body. We know now that intellectual exercise, like learning a new language, is 'training' the brain like one can train a muscle: the 'muscle' expands upon exercise but is reduced once the action is discontinued. However, as yet we know little of how the brain stores and retrieves information, whether the different modes of learning reside in different (older and younger in terms of evolution) parts of the brain.

Changes on the 'demand-side'

On the 'demand-side' both parties in the labour market are changing: graduates respectively employers.

1. New generations demand different work. While there is much hot air in the discussion about the millennials, it is undeniable that young cohorts of school leavers and graduates have different career objectives than had previous generations. The 'youth of today' take fewer drugs and alcohols than those before them, they enter into sex at later ages and stay at home longer. They are less violent than they used to be[14]. Millennials seek challenges more than money, they want to work for a coach, not a boss, they want to substitute the annual job evaluation for ongoing discussion in which attention is given to strengths, not weaknesses. Most of all, they focus on life, rather than the job; status does not interest them, many don't own a car, let alone a bling-bling one[15]. Millennials are twice as likely to invest in so-called responsible companies and are twice as likely to exit investments because of objectionable corporate activity as the average investor[16]. They don't fit well in the current labour market; no surprise then that 55 % of them feel unengaged at work. Millennials don't aspire to ideologies; they want to optimise their immediate living conditions. Employers complain that Millennials are selfish and inhibit no loyalty: on their first day of employment they start searching the net for the better job[17].

2. Changes with employers. But employers are also short on loyalty. «Nothing personal», an accountant was told when he was fired after having done a splendid job for twenty years; he just had to go because headquarters decided on a staff reduction programme, motivated only by poor quarterly results. No surprise then that human resource (HR)

management is at a crisis. Already for many years, HR practitioners advocate focus on human development, yet, in practice, employees are considered cost factors that can be disposed of as easily as garbage in a household. Instead of standard employees, employers need 'made-to-measure' personalities. This means that the output exams and diplomas rapidly lose their significance. At present, the selection and promotion processes are quite bureaucratic in most organisations. This system is being replaced by negotiations in which the employer brings in 'honest' job descriptions (either for the first or a later job) while the potential employee delivers a ''pitch' illuminating what he or she stands for, what educational pattern she has taken and what she is looking for. Students will have to learn how to design their mix of courses in order to fit both their own interests/motivation and the needs of the market. The changes on the employers' side are enhanced by what Klaus Schwab of the World Economic Forum calls the Fourth Industrial Revolution. The idea is that the «First Industrial Revolution used steam water and power to mechanise production, the Second used electric power, the Third uses electronics and information technology to automate production. The Fourth Industrial Revolution is building on the Third. It is the digital revolution that has been occurring since the middle of the last century. It is characterised by a fusion of technologies that is blurring the lines between the physical, digital and biological spheres» (quoted from the World Economic Forum website). We would add that the requirements of the digital age not only make it mandatory for specialists to be engaged in team work, but that most of them should have mastered more than one specialisation. We have called this *transdisciplinary research and development* – more specialists sit around the table than people. It followed mono-disciplinary, multidisciplinary and interdisciplinary R&D. Harrison has argued that significant changes be made to single discipline programmes[18]. All this means that students have to prepare bespoke courses with one eye on the market and one on what they find interesting and motivating.

Finally, there is opposition against the notion that learning is just a matter of cost/benefit analysis. Nancy Rothwell, President and Vice-Chancellor of the University of Manchester, posits that university courses are not only a purely financial investment. «Studying at universities should be a unique and transformational experience, challenge your principles, take you out of your comfort zone»[19]. I guess students as well as employers would welcome such 'enlarged' education.

Contours of the New Learning

Let us now speculate about the New Learning or Third Generation Learning:

- «No lectures, no classrooms, no majors, no departments» – Christine Ortiz at MIT[20].
- Teaching becomes a succession of team-projects and individual learning projects with increasing complexity ('levels', as in games) with students take their fate in their own hands in an entrepreneurial atmosphere. Students will choose such courses by matching their chances in the job market with their interests. They might take quite unorthodox combinations, such as mixing Mandarin and philosophy with a course in physics. In South Africa they call it 'blended learning', with pupils spending time in conventional classes and some time in a computer room where they complete lessons on the screen[21].
- Teachers become coaches rather than orators[22]. Teaching becomes a high-standard profession with transdisciplinary Institutes of Advanced Learning at major universities. In universities, teaching has always been a suppositious child; if you want to make an academic career you must publish and your quality as a teacher hardly matters. The result is bad teaching and a host of crap appearing in scientific journals. It now seems that teaching is undergoing a re-evaluation and becoming a profession by itself.
- Contacts with all kinds of employers start at day one.
- Students learn to pitch what they have learned and what they seek in employment.
- «Rise of the challenge-driven university» rather than coercion-driven education – Geoff Mulgan
- End of overspecialisation – knowing more and more about less and less – A. D. Lindsay of Oxford. Instead: return of the 'Renaissance men (and women) in transdisciplinary research (*Towards the Third Generation University*, op cit).
- Students are in charge of education, not the 'system'. This means a devolution of the National Education System; let students and teachers decide what and how to learn, top-down design of courses is contraproductive.
- Output exams and diplomas become just a festive celebration of the completion of a course. The power shifts to input exams. The world's top universities already apply this, requiring not only a good school diploma but engaging in a series of interviews with potential students.
- Back to education as a transformational experience. Students will be encouraged to engage in

all kinds of social activities, urged to do so by potential employers.

The author[23]

Hans Wissema holds MSc diplomas in chemical engineering and control engineering and received a PhD from the University of Manchester. He studies the performance of organisations including universities, writes about it and gives advice. He was a part time professor in Entrepreneurship and Management of Innovation at TU Delft for 25 years. He wrote 16 books on management, two of which were also published in Russian[24,25], and one novel[26]. His latest book, Towards the Third Generation University – Managing the University in Turbulent Times was widely translated and has had a significant impact on the policies of universities around the world.

Literature

1. Schwab, K., *The Fourth Industrial Revolution: what it means, how to respond*, Published on the website of World Economic Forum, January 14, 2018.
2. Willetts, D., *A University Education*, Oxford University Press, 2018.
3. Wissema, J.G., *Towards the Third Generation University – Managing the university in transition*, Edward Elgar Publishers, 2009. Russian translation published by Sberbank University Press, 2016.
4. *Time to end the academic arms race*, The Economist, February 3rd, 2018.
5. *Must try harder*, The Economist, December 10th, 2016.
6. *Catching on at last*, The Economist, June 29th, 2013.
7. *Helsinking*, The Economist, May 14th, 2016.
8. Wolf, A., *Tilt Britain's education system back towards skills training*, Financial Times, 28 December 2017.
9. *Finland thinks it has designed the perfect school. This is what it looks like*, https://www.weforum.org.
10. *Teaching the teachers*, The Economist, June 11, 2016, and How to make a good teacher in the same issue.
11. Dodgson, M, and D. Gann, *Universities have sown the seeds of their own disruption*, Internet article, 9 August 2017.
12. James, J. et al, *Fully integrated silicon probes for high-density recording of neural activity*, Nature, 551, 232–236 (9 November, 2017).
13. The Economist January 6th, 2018, The next frontier and a Special Report.
14. *Teenager's behavior – the youth of today*, The Economist, January 13th, 2018.
15. Elizabeth Currid-Halkett, *The sum of small things: a Theory of the Aspirational Class*, Princeton University Press, 2017.
16. *World Wealth Report 2014*, World Economic Forum.
17. *What companies still don't understand about millennials*, The Washington Post, 13 May 2016.
18. Harrison, J., *The emerging links between Learning Capability, Experiential Learning and Research: Political implications for Higher Education*, paper presented at the Australian Association for Research in Education Conference, Melbourne, 2017
19. Rothwell, N., *There is more to university than money*, Financial Times, 16 March, 2016.
20. *Higher education – flying high*, The Economist, June 25th, 2016.
21. Schumpeter column, *School for frugal innovation*, The Economist, December 12th, 2015.
22. *E-ducation*, The Economist, June 19th, 2013.
23. The author wishes to acknowledge the inspiration given by Peter Hartkamp's book *Past coerced education*, The Quantum Company, 2016 (in Dutch).
24. Wissema, J.G., *Menedgment v podrazdeleniach firmi*, Infra-M, Moscow, December 1996. Translation of: Unit Management, Financial Times-Pitman Publishing, December 1996.
25. Wissema. J.G., *Strategitzki Menendgement*, Moscow, Finpress, 2000. Translation of: The art of strategic management, Kluwer Publishers 1986 (in Dutch).
26. Wissema, J.G., *Siberian lessons on Life, Love and Death*, Aspect Publishers (in English, Dutch and Bulgarian).