ACADEMIC EDUCATION 4.0

Conference Paper · June 2016

2 authors:

Thomas Wallner
Fachhochschule Oberösterreich

Gerold Wagner
Fachhochschule Oberösterreich

ACADEMIC EDUCATION 4.0

Thomas Wallner & Gerold Wagner
Logistikum, University of Applied Science Upper Austria (Austria)

Abstract

4.0, this code had initially been used to mark the disruptive change, which takes place in the manufacturing industry through the pervasive application of Information and Communication Technology (ICT), coining the term Industry 4.0. Since then 4.0 has been applied to many other fields, which are equally affected by the rapid changes we are facing in the world of today in general, such as Work 4.0 or Healthcare 4.0, you name it.
As academic educators we have to confront the same changes and we are bound to undergo the necessary adaptations (although it often seems, as if many of us were not willing to accept this fact to its full extent). When rethinking academic education to meet these future challenges, we developed a set of propositions, to describe the fundamental principles we should follow, if we want to prepare our students for the future. Incidentially, some of these principles parallel those from industry 4.0.

Keywords: *Academic education, complexity, transdisciplinarity, self-organization, meta-knowledge.*

1. Introduction

We live in a VUCA World. A world which is characterized by volatility, uncertainty, complexity and ambiguity, Bennett and Lemoine (2014).

There are numerous studies describing the pervasive impact of Information and Communication Technology (ICT) in virtually any aspect of our lives, and corresponding studies predicting the related change of work. (Arbeit 4.0, 2015).

And there has a whole new field of research been emerging based on the new possibilities we have now in neuroscience. Owing to neuroeduction we do know much better now, how learning really happens. Spitzer (2007). We want to summarize some of these findings and describe how our field of academic education is affected by them:

Our students will have to succeed in a working environment which is increasingly globalized, automatized, virtualized, networked and flexible. Many jobs, such as Social Media Manager, Blogger, App Designer, App Developer, Big Data Analyst seem quite conventional to us today. However, they did not exist 10 years ago ("10 Jobs", 2016) – and these are not purely "digital" jobs either: they require a sound knowledge in the field of application as well.

Our students will work in peer-to-peer networks or organizations which are open and structurally liquid. They will be hired (and layed off) on demand or work as free agents. They will have to compete for employment on a global market. New skills and competencies will become more important such as non linear thinking, social and intercultural skills, self-management and self-competence (Arbeit 4.0, 2015)

Academic education is now more than ever torn between the conflicting requirements of pursuing the Humboldtian model on one hand and providing vocational training resulting in "employability" on the other. E.g. the vocational orientation is a legal obligation for Universities of Applied Sciences in Austria (according to FHStG, 1993, § 3).

How can we fulfill this obligation, when new professions pop up at an ever faster rate and relatively stable professional profiles are increasingly replaced by generalized skill sets?

The requirement for life-long learning has become a given. It is our obligation, to prepare our student for this future.

When looking at our everyday life in academic institutions, we can easily detect important drivers of complexity in our research and teaching activities. Let us list a few

• Increasing diversity among the students, (multiethnic /-cultural, full time vs. vocational, multilingual)

• The omnipresence of mobile devices and social media

• Modular study programs

• A variety of available settings, formats and technologies (e-learning, blended learning, inverted classroom, peer teaching… etc..)

• Growing demands in terms of studiability (Studierbarkeit), employability, high scores in all kinds of rankings.

• A rapid progress in virtually any discipline, constantly producing new knowledge

• The emergence of cross- and transdisciplinary problems and related fields of research

• The pervasive real-time-availability of any conceivable information, (often in edited formats, such as tutorials, presentations, complete courses)

Finally let us take a brief look at recent research in neuro-education. (Spitzer, 2007):

According to these findings, learning is first of all an activity. Teaching is not successful without active involvement on the side of our students. (And: Successful learning processes are a source of happiness.) Teaching can be seen as the enabling of these learning processes.

However, the following principles have to be considered: Learning is construction, and as such it requires structure and application. Learning is also a social activity. Emotions and motivation play an important role in successful learning processes. The same is true for the space, where learning takes place.

Now let us put the pieces together and reconstruct academic education.

2. Academic education 4.0

In order to be successful in the endeavor to prepare our students for the future, we suggest to consider the following propositions:

1) The complexity we find in the 'outside' world is reflected in each and every aspect of our academic work. When it comes to cope with complexity, standardization is always tempting. But, standardization always means simplification, and thus standardized programs cannot deliver what we need. Wallner (2012).

2) We can only effectively respond to complexity with complexity. Remember Ashby's law of requisite variety! Ashby (1956). However, we cannot create this complexity as lecturers or provide it in our programs by creating individualized study offerings. This is simply not possible due to capacity reasons. Still, there are individual learning processes we can build on.

3) To create the requisite variety of the learning processes in our universities we can build on self-organization, both on the individual and on the collective (team and class) level. Hence this is our first task: to enable and support this self-organizing capacity of our students.

(Employing the self-organizing capabilities of the people involved is a basic principle in many conceptual approaches when it comes to dealing with growing complexity. (E.g. Laloux (2015), Pfläging (2009), Wallner, Laskowski and Menrad (2013)).

4) It is a prerequisite for the fruitful development of self-organization, that students define their own study goals. We have to guide and support this process too. By doing so, we should encourage our students to focus on two key criteria: Their talents and their individual purpose in life. This will by the same token enhance their self-competence. Focusing on their talents will enable fast, committed and satisfying learning. It allows for the realization of the full potential of our students and for the achievement of mastery in their specific field of expertise.

Focusing on their individual purpose ensures meaning in their studying endeavor. As human beings and as societies, we are open, multidimensional and purposeful systems" Gharajedaghi (2006). "All human behavior and social interaction can be seen as a system of purposeful events" Ackoff (2005). Findings in motivational research as well as in research about the performance of teams and companies emphasize the importance of purpose. (Vaill 1982; Braga 2010; Pink 2009).

Autonomy (self-organization), purpose and mastery are the fundamental elements of intrinsic motivation. (Pink, 2009).

5) Our future challenges are increasingly interdisciplinary and transdisciplinary. We see robotics in health care and car insurance offers including hardware devices for automated emergency calls; our students will design smart cities and create social businesses. We can assume that a stable and well defined range of subjects is becoming more and more obsolete. What our students need is a structural overview in their field of study to be able to integrate the knowledge they are constantly acquiring. We have to provide this frame of reference.

6) Individual learning processes require individual assessments. Standardized tests or general exams are useless, except for those courses where structural knowledge and methodological skills are acquired. Beyond that an examination of the student's performance can only be based on

a. a substantial individual reflection of their own learning progress

b. their contributions to the collective learning process (e.g. based on the feedback of their fellow students and our observations as lecturers.)

7) The information our students need are abundant and available everywhere (books, articles, search engines, blogs, MOOCS etc…). We are no subject matter experts anymore. We cannot compete with the WWW. (Everyone, who is in academic teaching and has ever faced in the class room this wall composed of flipped open laptops will support this statement.) But we can integrate the WWW. The challenge is to make use of these new possibilities.

8) To transform available information into individually useful knowledge requires reliable meta-knowledge and methodological skills. In this regard we do have an enduring expertise and the requisite experience and to make these resources available to our students is one of our prime tasks.

9) E-learning is dead. Long live WE-learning. Not least, learning is a social activity. We have to open our campuses and invite students in to use this space as a place for meetings and encounters, for discussion and cross-pollination. We have to create the appropriate social settings, where students can discuss and work on real life problems, which are preferably directly related to the world they live in. This ensures excitement, meaning, diversity, intense interaction, all of which are crucial for sustainable learning. On the contrary alone for reasons of studiability we should reduce mandatory attendance time and keep it tight and effective. The necessity to gather all students of a course at the same time at the same place must be reserved for joint activities, which create a true added value. This can be found for instance in an intense and topic-centered interactions of all students.

10) The transfer of knowledge in traditional one-to-many lectures does not generate this added value. Research shows, that traditional lecturing is less effective than active learning in terms of average examination and failing rates. (Freeman et.al., 2014). However, lectures are still the predominant mode of instruction. This is also reflected in the way our teaching buildings are designed, consisting mainly of lecture halls and class rooms. Research shows, that ambience is important to cognitive processes, that the possibility to design and arrange your own work space opens up new room for thought. Peschl and Fundneider (2012). We need "enabling spaces", which can be arranged according to these social settings we mentioned.

3. Closing remark

Let us briefly refer back to our starting point Industry 4.0. The apologists of Industry 4.0 promise to make economical lot-size-one production happen, meaning mass-customization at no increased costs. Weinländer (2015). They are excited about the vision of intelligent parts and products making their way through the system of interconnected production lines and logistics facilities. Of course there is also a "hype" which is pushed by industry lobbyists and political stakeholders (Schumacher, 2016). But there is also a pioneering spirit and recognition of the immense opportunities, arousing a new dynamic in an entire industry – even though it is evident that there are accompanying risks and unsolved problems as well, especially when it comes to the question of how to organize work under these new conditions. Of course it is difficult to do research on something, which is not yet there and consequently there is an abundance of conceptual studies on Industry 4.0 but not so many empirical results (Igelsböck et.al.). So the real challenge is, how to design the future? And in order to meet this challenge, a vision is in need (Schumacher, 2016) .

Whenever we bring up those ideas, we've just sketched out in our presuppositions, in discussions with fellow colleagues from our institution or other universities, the responses are divided: enthusiastic approval but also doubt and rejection. It is our personal observation, that those, who are rejecting our suggestions, are particularly concerned about the capability of the students, to find "their" path through the "system".

Let us take on the lot-size-one ideal as a metaphor and opt for the lot-size-one student; a student going through a truly individualized education, guided by talent and purpose and our – as academic educators – sencere concern for their best personal development. Why aren't we confident, that our intelligent students will make their way, just as "intelligent" parts and products do?

When doing some research, what future concepts other universities were considering, we came across the project Stanford2025 at Stanford University. Starting in 2013 Stanfords d.school developed

various futures (Stanford2025, 2016) and these scenarios are built in many ways on the same principles as our presuppositions are: Selforganization, meaning, personal mastery, cross- and transdisciplinary problem solving and skillfulness. The same is true for the conceptual ideas of many other thought leading institutions, such as Singularity University (http://singularityu.org) or Zeppelin University (https://www.zu.de/).

Yes, academic education of the future is a design challenge (instead of design, we prefer to use the German word "Gestaltung", in the sense in which it is used e.g. by Blachfellner and Werner (2016)).

Let us take on this challenge. The best way, to predict the future is to create it! Drucker (n.d.)

References

10 Jobs That Didn't Exist 10 Years Ago, (2016). Retrieved May 16 2016, from https://digitalmarketing institute.com/blog/10-jobs-didnt-exist-10-years-ago

Ackoff, R. L. (2005). *On Purposeful Systems: An Interdisciplinary Analysis of Individual and Social Behavior as a System of Purposeful Events.* Aldine Transaction Publishers, Piscataway, New Jersey

Arbeit 4.0 (2015), Megatrends digitaler Arbeit – 25 Thesen, Ergebnisse eines Projekts von Shareground und der Universität St. Gallen, Retrieved May 16, 2016 from https://www.telekom.com/static/-/285820/1/150902-Studie-St.-Gallen-si

Ashby, W. R.. (1956). *An introduction to Cybernetics*, New York, Wiley.

Bennett N., Lemoine G. J., (2014) What VUCA Really Means for You. *Harvard Business Review, January–February 2014 Issue*, 5 13, 2016, from: https://hbr.org/2014/01/what-vuca-really-means-for-you

Blachfellner, S., Werner, L., (2016) Bertalanffy Center for the Study of Systems Science. *Socio-ecological Systems and Design*, retrieved May 15 2016 from http://www.bcsss.org/research/fields-and-groups/socio-ecological-systems-and-design/

Braga, T. 2010. Corporate Purpose Impact, Internal study by Burson-Marsteller and IMD Business School [online]. [accessed 29 September 2012]. Available from Internet: <http://burson-marsteller.eu/wp-content/uploads/2011/10/IMD-B-M-Corporate-Purpose-Impact-Study-2010.pdf>

Bundesgesetz über Fachhochschul-Studiengänge (Fachhochschul-Studiengesetz - FHStG) StF: BGBl. Nr. 340/1993

Drucker, P. (n.d.). BrainyQuote.com. Retrieved May 16, 2016, from BrainyQuote.com Website: http://www.brainyquote.com/quotes/quotes/p/peterdruck131600.html

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafora, N., Jordta H., and Wenderotha M.P.; 2014, Active learning increases student performance in science, engineering, and mathematics, *PNAS*, *Vol. 111*, no. 23, pp. 8410–8415

Gharajedaghi, J. (2006). *System Thinking, Managing Chaos and Complexity*. Elsevier.

Igelsböck J./Koprax I./Kuhlmann M./Link K./Zierler C. (2016): *Bestandsaufnahme Arbeitspolitik in Oberösterreich. Herausforderungen und Perspektiven von Industrie 4.0 und veränderten Marktanforderungen.* Institut für Arbeitsforschung und Arbeitspolitik an der Johannes Kepler Universität Linz.

Laloux, F. (2015). Reinventing Organizations. München, Verlag Franz Vahlen GmbH.

Pfläging, N. (2009). *Die 12 neuen Gesetze der Führung: Der Kodex: Warum Management verzichtbar ist.* Frankfurt / Main. Campus Verlag GmbH..

Pink, D. (2009). *Drive: The Amazing Truth about what really motivates us*. New York, Rivergate Books

Peschl M., Fundneider T.; 2012, Räume bilden Wissen: Kognitive und epistemologische Grundlagen der Ermöglichung von Wissensgenerierung, In: Schröteler-von Brandt H., Coelen T., Zeising A., Ziesche A. (Eds.), *Enabling Spaces, Raum für Bildung, Ästhetik und Architektur von Lern- und Lebensorten,* 2012, Reihe Kultur- und Medientheorie

Schumacher, M. (2016). Vorwort in Igelsböck J./Koprax I./Kuhlmann M./Link K./Zierler C. (2016): *Bestandsaufnahme Arbeitspolitik in Oberösterreich. Herausforderungen und Perspektiven von Industrie 4.0 und veränderten Marktanforderungen.* Institut für Arbeitsforschung und Arbeitspolitik an der Johannes Kepler Universität Linz.

Spitzer, (2007), *Lernen: Gehirnforschung und die Schule des Leben,* Heidelberg, Berlin: Spektrum Akademischer Verlag.

Stanford2025 (2016) Retrieved May 16 2016, from http://www.stanford2025.com/#fast-forward

Vaill, P. B. 1982. The purposing of high-performing systems. *Organizational Dynamics*, Autumn1982, Vol. 11 Issue 2. pp. 23-39.

Wallner T., Laskowski W., Menrad M. (2013) Was können projektorientierte Unternehmen von High Performance Work Systems lernen? in Nachbagauer A. Schirl I. (Eds.) *Human Resources Management in projektorientierten Unternehmen*), Wien. Linde Verlag.

Wallner, T. 2012 - The Return of the Human in: Jeschke, S., Hees, F., Richert, A., Trantow S., (Eds) *Prethinking Work - Insights on the Future of Work*, pp. 19-20, Münster, LIT-Verlag, 2012,

Weinländer M., 2014, RFID as Key Technology for “Industrie 4.0”, Radio Chips make Lot Sizes of 1 economical, *A&D Kompendium 2014/201,* pp. 89-90