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Rethinking Teacher Education for the 21st Century

Trends, Challenges and New Directions

Verlag Barbara Budrich

The publication has received financial support from the Polish Ministry of Science and Higher Education under subsidy for maintaining the research potential of the Faculty of Pedagogy and Psychology, University of Bialystok.

The organization of the ATEE 2018 Spring Conference "Designing Teacher Education and Professional Development for the 21st Century: Current Trends, Challenges and Directions for the Future" was financed under agreement 550/P-DUN/2018 with the funds from the Polish Minister of Science and Higher Education for the dissemination of science.

The conference and conference proceedings were made possible by the additional EduLAw project co-funded by the Erasmus+ Programme of the the European Union. The European Commission support does not constitute endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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Verlag Barbara Budrich
Opladen, Berlin & Toronto 2019

This book is available as a free download from
www.barbara-budrich.net (https://doi.org/10.3224/86649453).
A paperback version is available at a charge.

The page numbers of the open access edition correspond with the paperback edition.
ISBN 978-3-8474-2241-9 (paperback)
eISBN 978-3-8474-1257-1 (ebook)
DOI 10.3224/84742241

Verlag Barbara Budrich GmbH
Stauffenbergstr. 7. D-51379 Leverkusen Opladen, Germany

86 Delma Drive. Toronto, ON M8W 4P6 Canada
www.barbara-budrich.net

A CIP catalogue record for this book is available from
Die Deutsche Bibliothek (The German Library) (http://dnb.d-nb.de)

Jacket illustration by Bettina Lehfeldt, Kleinmachnow – www.lehfeldtgraphic.de
Language revision by Alison Romer, Lancaster, UK
Typesetting by Mieczysław Rabiczko, Bialystok, Poland

Printed in Europe on acid-free paper by paper&tinta, Warsaw

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Educational Agility

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ABSTRACT: Educational systems are facing a transformation process that includes not only changes in their methodologies and techniques, but deep evolution of teachers' mindsets and social perceptions. The need for a dynamic, flexible, and open learning environment for every child is creating the necessity of more complex but enriched principles for teaching and learning. The *Agile Manifesto* describes a mindset to be applied to the creative development of software. Educational agility can be seen as the application in the school context of the strategies, principles, and values that agile thinking has brought to software development. In this paper, the authors provide an initial reflection on what agile schools, agile teachers, and agile students bring to the scene for improving quality in education. They also suggest the elements for creating a community of practice to debate, apply, execute, and evaluate educational agility in the real world. Future case studies will provide evidence of how agile mindsets can change learning theory, communication theory, teachers' and students' roles, methodologies, strategies, resources, and assessment processes.

KEYWORDS: Agile learning, common good, education, emerging technologies, Industry 4.0, student-centred approach

Context

We are building a world where we face the evolution of information and communications technologies into 'smart', hyper-connected autonomous systems driven by artificial intelligence (Josefowicz, Gallon, and Lorenzo, 2017). In this world of Industry 4.0 we are asked to develop an economy of

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flexibility and dynamic change (Bouzol-Boitman et al., 2016). At the same time, intergovernmental instances are demanding sustainability, concern for the environment, and orientation to the common good (United Nations, 2015). Many indicators show that the traditional sequences used in education are no longer adapted to respond to these challenges, and more global skills are needed to combine both technology and humanism (Marope, Griffin, and Gallagher, 2018). More and more experts assert that education needs to develop new approaches towards what is called the 'age of agility' (Gaulden and Gottlieb, 2017).

Human cultures have evolved by converging technology (tools and procedures) and communication (language and its symbolic representation of the world, argumentation), articulated collectively in a way that facilitates interacting with the environment, both to adapt to it and to change it. This is a continuum that we have segmented into phases in order to study it more easily. From the point of view of modern economic production, we can speak of four major industrial revolutions (Lorenzo and Gallon, 2018):

– In the 18th century, the advent of steam power permits the first mechanical automation. Humans begin building powered, automatic machines.
– In the early 20th century, mass production techniques create the notion of industrialisation. Machines build machines.
– In the mid 20th century, the cybernetic revolution gives machines a role in performing massive calculations. Machines take on a role of helping humans to make decisions.
– In the 21st century, interconnected cyber-physical systems function independently, driven by artificial intelligence and powered by big data. Machines are now making decisions in the place of humans.

Communications technology, and the capacity for knowledge transfer, has always been a part of these types of advances. Printing helped humans pass from oral to written knowledge transmission. Electronic communication has enabled evolution from individual to collective, transmedia transmission. Today, we are developing a complex, highly automated, integrated global mass communications system. The education process should be able to help students operate in this extremely diverse environment, at personal or collective level, to manage content, learning processes, and a diversity of mindsets.

An agile approach to teaching and learning in modern environments should be able to offer a flexible, structured situation that is adaptable enough to offer multiple paths to meet growing demands for personalised learning.

In this paper, the authors provide an initial reflection on what agile schools, agile teachers, and agile students bring to the scene for improving quality in education. They also suggest the elements for creating a community of practice to debate, apply, execute, and evaluate educational agility in the real world.

What is agile?

Agility, as it is used in this paper, is based on a manifesto that was originally written for software developers. It represents a mindset, rather than a methodology, in which software is developed over multiple iterations, and each iteration represents a fully functioning part of the final product (Agile Alliance, 2001).

If we adjust the *Agile Manifesto* to the world of education, it reads:

> We value:
>
> Individuals and interactions over processes and tools
>
> Meaningful learning over the measurement of learning
>
> Stakeholder collaboration over complex negotiation
>
> Responding to change over following a plan
>
> That is, while there is value in the items on the right, proponents of the Agile Movement value the items on the left more (Briggs, 2014).

Figure 1 shows different iterations of learning processes where motivation drives and stimulates planning, analysis, design, building, testing, deployment, and review: the traditional elements of an agile cycle.

Many methodologies have been developed to implement agile, but anyone who follows one rigidly will miss the point. Adopting an agile mindset means changing the internal culture of learning institutions. One of the most challenging factors is the need to remain nimble in the face of change. Today's society is evolving so rapidly that information can become obsolete in the time needed to validate it, and that means we need to rethink our notions of success and failure. Indeed, failure is a great teacher when we validate the effort made and study what we can do the next time to make things better. "The faster we fail, the more solutions we try, and the smarter we fail, the more knowledge we bring to the next iteration. Instead of looking back at problems, Agile schools look forward to solving them" (Briggs, 2014).

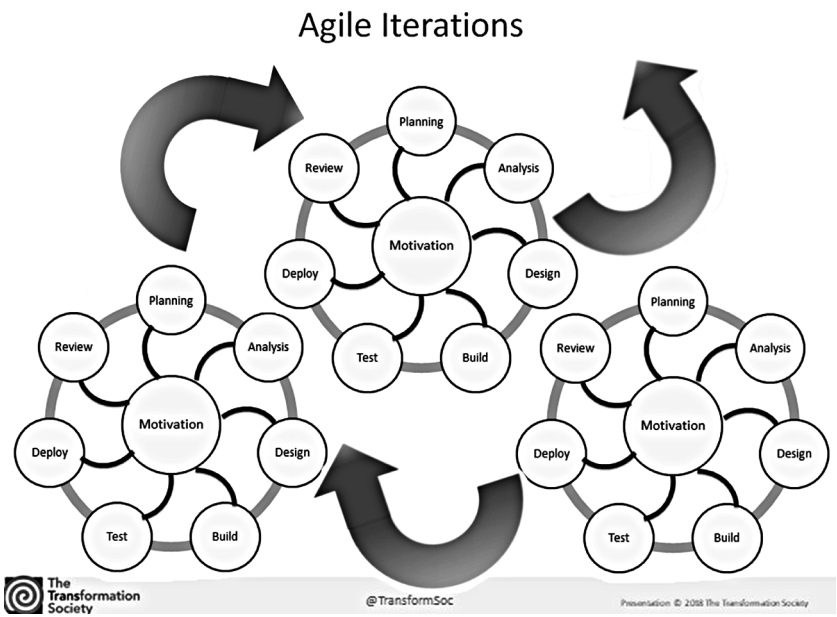

Figure 1. Iterations in agile learning
Source: The authors/Transformation Society

Agile development has twelve principles, and instructional coach Steve Peha, while working on a Gates Foundation project, elaborated a version of the twelve principles as characteristics of agile schools (ibid.):

1. Their highest priority is to satisfy the needs of students and their families through early and continuous delivery of meaningful learning.
2. They welcome changing requirements, even late in a learning cycle, and harness change for the benefit of students and their families.
3. They deliver meaningful learning frequently, from a couple of days to a couple of weeks, with a preference to the shorter timescale.
4. School and family team members work together daily to create learning opportunities for all participants.
5. They build projects around motivated individuals, give them the environment and support they need, and trust them to get the job done.
6. They recognize that the most efficient and effective method of conveying information to and within a team is face-to-face conversation.
7. Meaningful learning is their primary measure of progress.

8. Their processes promote sustainability. Educators, students, and families should be able to maintain a constant pace indefinitely.
9. They believe that continuous attention to technical excellence and good design enhances adaptability.
10. Simplicity – the art of maximizing the amount of work done – is essential.
11. The best ideas and initiatives emerge from self-organizing teams.
12. At regular intervals, teams reflect on how to become more effective, then tune and adjust their behaviour accordingly.

According to Steve Newhall, of Korn Ferry Consultants, the objective should be to achieve these five characteristics of agile learning (IEDP Developing Leaders, 2014):

> Mental Agility – how comfortable are they [learners] in dealing with complexity?
> People Agility – are they skilled communicators who can work with diverse people?
> Change Agility – do they like to experiment? Are they not afraid to be at the forefront of change?
> Results Agility – can they deliver results in first-time situations?
> Self-Awareness – do they recognise their own strengths and weaknesses?

Agile education is still in early stages of development. In part, it is a response to problems that all modern societies are having as their schools evolve and change, pushed by emerging technologies (Lorenzo and Gallon, 2018b). The initial conceptual framework for such change was built on the idea that changing the tool would change education. Very quickly, however, it became obvious that having the most advanced computers in the classroom will not change how teachers relate to students if there is not, at the same time, training to help teachers change their approach to knowledge, power, and assessment.

To pass from a traditional teaching approach, usually based on linear sequences and evolutionary methodologies, to an agile mindset defined by holistic and systemic approaches where simultaneous, iterative tasks are necessary to develop a project, is a huge challenge for schools and educational systems.

A new pedagogy with an agile mindset

For centuries, the instructional sequence at school has been presentation-practice-production. The teacher did the presentation, the students practiced and produced evaluable results. After this sequence, the teacher could assess the results and reorient the students' learning processes through repetition and drill. More elaborated versions of this also took into account the progressive development of students' capabilities, and proposed inverting the order of the sequence, giving the student a more active role. The new sequence became practice-presentation-product. In this case, presentation is not done by the teacher, but through common sharing and consolidating what the students have been practicing. This is more motivating and responds to a more natural learning process. Today, where the process and product are both considered results in education, with equal importance, a more holistic mindset requires sequences to be more diverse, flexible, and creative. We can start with a rule or a question, with debate, with a challenge or problem, or just with an intuition or a wish. A natural follow-on to this is that linear processes are reaching the limits of their effectiveness, and that classroom learning needs to adapt to the multi-focus, networked world that has developed around us. Neuroscience is now providing the scientific basis for these holistic approaches rooted in social constructionism (Lorenzo and Gallon, 2018a), connectivism (Siemens, 2004), and collaborative knowledge building (Scardamalia and Bereiter, 2003). All of these are well adapted to the agile mindset in hyper-connected environments.

As early as 1945, Dr. Vannevar Bush, director of the U.S. Office of Scientific Research and Development, wrote:

> When data of any sort are placed in storage, they are filed alphabetically or numerically, and information is found (when it is) by tracing it down from subclass to subclass. It can be in only one place, unless duplicates are used; one has to have rules as to which path will locate it, and the rules are cumbersome. Having found one item, moreover, one has to emerge from the system and re-enter on a new path.
>
> The human mind does not work that way. It operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain. It has other characteristics, of course; trails that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory. Yet the speed of action, the intricacy of trails, the detail of mental pictures, is awe-inspiring beyond all else in nature (Bush, 1945).

Dr. Bush's article is widely credited with being the first representation of what we now call *hypertext*, the ability to link directly from one source to another, inside a single computer or across the world via the Internet. This notion of associative thinking correlates research done by Roger C. Schank (1995) on *learning by doing*. According to Schank (1995), we integrate "scenes" – small activities we learn as we execute them – into the situation where we learned it, and can then generalize it to other situations. For example, we learn how to use the index of a textbook while in class at school, and we integrate it into a situation or, as Schank calls it, a "Memory Oganisation Packet (MOP)" that we identify as "school-task." We can then generalize that learning into a different MOP, for instance exploring a list of links online, that forms a MOP we identify as "online research." This generalization process is associative in the sense that Vannevar Bush meant in his article, and it creates learning development in what Vigotsky called the *Zone of Proximal Development* (Vigotsky, 1934, p. 208).

Vigotsky and Schank provide the learning theories that underpin a new agile educational mindset. To apply these theories practically in an agile classroom, some additional important pedagogical issues need to be considered:

- **Educational and social aim**: inclusion, consciousness raising
- **Communicative concept**: holistic interaction in the digital age
- **Psycho-educational theory**: connectivism, social constructionism
- **Teachers' roles**: facilitator, creator of opportunities
- **Students' roles**: protagonist of autonomous growth experiences
- **Skills and competences**: International frameworks for micro/macro skills for intrapersonal, interpersonal, and proactive development
- **Methodologies**: contextualised personalisation in hybrid environments (human-machine interaction)
- **Space, time, and additional resources**: meaningful tools, material resources, and organisational strategies, needed to apply a specific methodology
- **Assessment criteria**: principles for establishing multi-level indicators of success
- **Dynamics of change**: expectations for cognitive, social, and cultural transformation

Student-centred aims

The progression from tool-centred strategies towards a more interactive approach where teacher implication and student agency are seen as elements of a modernizing process, has brought a lot of techniques and strategies to the table during recent years. WebQuests (Dodge, 2001), flipped classrooms (Bennett et al., 2013), or design thinking (Buchanan, 1992) were seen as recipes for forcing the teacher to change roles, and for the student to become an active learner and protagonist in the process. We are starting to see now, that although necessary, strategies and techniques are not enough if they are not sustained and driven by a clear set of principles and values that respect students' needs, individually and as a group, as well as families' demands and concerns, social requirements, and participatory ethics. It is with this frame of mind that *agile* can become a highly advanced vehicle for introducing the idea that curriculum is not just a list of contents, or a collection of procedures, but a whole paradigm of proposals for applying healthy techniques, sustainable methodologies, and ethical values in assessment. Collaborative participation in networks that autonomously organise iterations of exploration and self-evaluation provide a collective platform for modelling, experiencing, and validating teaching and learning processes. In this type of agile network, we can reframe Peha's (2011) twelve characteristics of agile schools as twelve student-centred agile principles:

1. Students can receive attention according to their personal learning rhythms, their learning styles, and their families' requirements, with respect for the diversity of cultures around them.
2. Students benefit from flexible itineraries and fluid curricula so they are able to respond confidently to change and unexpected situations in the future.
3. Students will perform activities, tasks, and projects of different durations in different time scales, to achieve a globally continuous learning process.
4. Students will participate in decision-making processes together with families, teachers, and educators, to develop self-agency.
5. Students will participate autonomously in exploring different educational situations inside and outside school in order to develop awareness and respond to the trust and resources they are given.

6. Students will develop communication skills for interacting with others – both classmates and digital collaborators, with an emphasis on face-to-face interaction.
7. Students will use meaningful learning as the measure of their own process, through techniques such as project-based learning, problem solving, etc.
8. Students will practice self-engagement and continuously develop sustainable lifelong learning processes.
9. Students will emphasize self-imposed high standards and critical thinking and will creatively analyse continuous possibilities for rigorous improvement of technical quality.
10. Students understand the importance of efficiency through personal and collective engagement to find simple, sustainable solutions.
11. Students will participate in teams and groups that self-organise to implement creative responses and innovative solutions.
12. Students will develop inquiring minds by participating in regular collaborative self-evaluation sessions in order to propose improvement.

These agile principles are intended to contribute to an educational system where the student is at the centre and is the main protagonist of the entire learning process. Applying them can open new ways of understanding the teaching process itself.

Teachers need to abandon the traditional self-centred protagonist role in the classroom and start taking up the facilitating and guiding personas that give them authority through knowledge, planning, management, and evaluation of the whole process. The traditional instructional sequence can be replaced with any approach that affects the four main stages of children's learning processes:

Emotion – cognitive science has shown that the detonator of mental reaction is a biochemical process that occurs when a somatic stimulus alters brain chemistry to create an alert to interact – internally or externally – with the unknown (Arnone, Small and McKenna, 2011). The emotional response helps fix learning in memory.

Curiosity – natural curiosity can be quite disorganised or it can be rigorous and meticulous. Teachers can guide students through the first understanding of hypothesis and methodology, to help students see all the variables and acquire strategies for different disciplines.

Research – a planned process that creates the complete arc from problem to solution. It implies planning, provision for individual and collective action, production, and assessment of the results. It requires communication of the process, embedded in formal learning and applicable to nearly every discipline. The great danger is to get trapped in silos. This can be avoided by facilitating iterative collaboration among students.

Proactive innovation – this is the *rising above* stage. It is marked by a transcendent understanding, and must include all the previous stages. This is where the student integrates knowledge and experience, and consolidates competencies that allow her or him to generate innovation.

Why is agility important?

Our globalised society is constantly pushing out goals that can often be confusing and contradictory. We speak of growth and sustainability together, ask our technologists to make our machines autonomous and independent, but fear how they might affect our privacy, or even our safety. As educators, we are charged with preparing children to live in a world populated by these pressures and technologies, and with helping people of all ages to integrate and adjust to exponential change. An agile mind that has values oriented towards the common good is an essential part of that preparation.

Figure 2 shows an agile relationship between goals and strengths, with recursive iterations that build learning processes through emotion, curiosity, research and proactive innovation. Each iteration of an agile learning process advances students closer to their goals, and builds their strengths, helping them to understand the common good by enlarging their initial vision into real action, and from there to deep transformation. The idea of considering learning as a personal transformative process is an inclusive conceptualization that recognizes individual achievements and collective evolution. International institutions such as the OECD, the European Union or the United Nations have all produced educational frameworks based on different stages of skills development and knowledge acquisition.

Dr. Mmantsetsa Marope and her group at the UNESCO Global Curriculum Network have provided a framework for curricula transformation in technological environments, that can also be useful for developing agile strategies in school and in lifelong learning. Her report stresses that individual performance cannot be fully mature unless it is also integrated into social development and oriented towards the common good. Agile schools

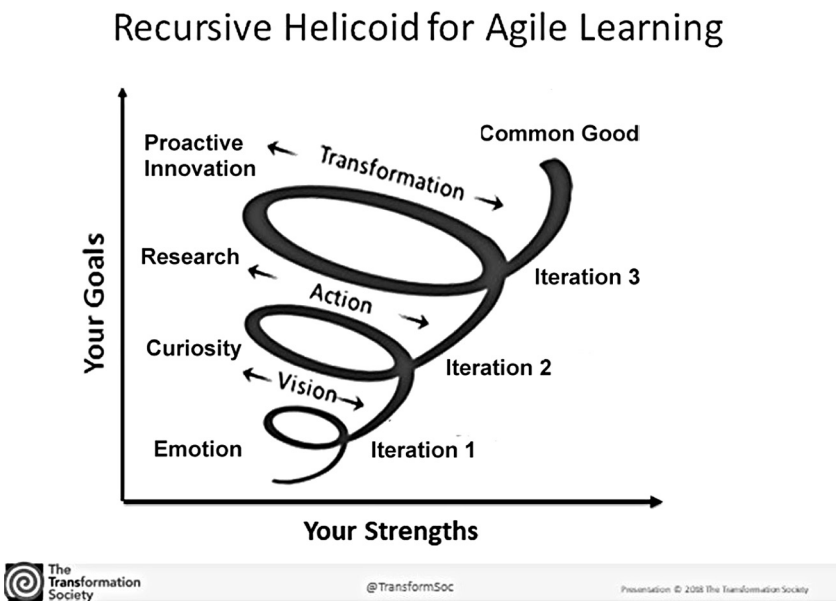

Figure 2. With each iteration in the agile process students advance in goals and strengths

Source: The authors/Transformation Society

can provide opportunities for students to explore how accelerating change affects the lives of individuals and communities at different levels. The UNESCO report (Marope et al., 2018) proposes that to engage and promote well-being, students need a minimum of:

- Awareness, Adaptability, Agility to Adapt
- Innovation Empowerment, Social Justice
- Productivity Sustainability, Efficiency
- Justice, Democracy, Good Governance
- Social Cohesion, Equity and Inclusion, Citizenship
- Domain Specialisation, Human Resources, Human Capital
- Functional Literacy, Digital Society, Health and Well-Being

Principles and values are essential to build knowledge and develop ethical and sustainable practices.

Conclusion

Agile in education is an opportunity to escape from rigid procedures and content silos, and to enter a dynamic mindset where transformation and improvement are the goals. *Agile* cannot be another fashionable recipe. It is a bridge between technique, strategy, and values, and it must be seen as an opening for teachers to reflect, debate, and rethink not only procedures, but the purpose of education. Only with debate and reflection can we find opportunities to put it into practice, do case studies, and discover evidence for agile possibilities in education. Open-minded research will provide a space for experimentation and learning, leading to an agile expert community of practice.

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Rethinking Teacher Education for the 21st Century

The growing complexity and diversity of teaching and learning in the 21st century classroom has firmly placed the quality of teacher education as the front-rank issue of educational research and policies in Europe and beyond. This book discusses the trends, challenges and directions for teachers' preparation in the modern world. A point of departure for the ideas developed in this book was provided by the Association for Teacher Education in Europe (ATEE) 2018 Spring Conference. In line with the main theme of the conference, this edited volume deals with the strengths and limitations of different models, strategies, approaches, policies and practices of teacher education at institutional, national and international levels. These include issues of identity in teaching and teacher education, collaboration in teaching practice, the implementation of (and dealing with) technology, and the tensions and paradoxes of teacher education reforms, among others.

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ISBN 978-3-8474-2241-9

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