

A modern mixture, Agency, Capability, Technology and ‘Scrum’: Agile Work Practices for Learning and Teaching in Schools

Karl Royle

University of Wolverhampton
Walsall Campus
Gorway Road WS1 3BD UK

Jasmina Nikolic

University of Belgrade
Studentsski Trag
Belgrade Serbia

Abstract

This paper introduces a pedagogical method derived from agile work practices, particularly the scrum method of project based working. It will discuss how this agile method can be aligned with teaching and learning in formal schooling and project based learning developing an agile pedagogical approach which can lead to: greater agency for both learners and teachers; the purposeful integration of digital tools into practice; and the development of human capability and functioning through a change in learning design. It goes further in conceptualizing the teaching - learning dynamic as a “technology for learning” in so far as technology is definable as a purposeful process of knowledge creation.

Keywords: Learning, Teaching, Scrum, Agile pedagogy, capability, human agency, teamwork, self organisation

Introduction

Education is faced with the challenge of developing our social, cultural, and economic future, but lacks pedagogical approaches or structures capable of efficiently and effectively responding to a world in which the underlying constant is change. Formal education is still using methods that prepare students for the working practices of the past within a dynamic of standardization and control. Recognizing and responding to change therefore, becomes one of the main responsibilities of education alongside developing adaptable self-motivated lifelong learners and developing their capabilities in order to live a life that they value. To achieve this, different pedagogical approaches and shifts in teacher/learner power relationships and identities are needed within formal education. This paper conceptualizes pedagogical approaches as “technologies” in the broadest sense of the definition in that it is a purposive process with an end goal that utilizes or generates knowledge, McGinn (1978).

As such, different “technologies” or methods of teaching and learning or learning designs need to be employed to satisfy the different goals of 21st century knowledge creation. If such new methods of teaching are innovative technologies they also need to be embedded within the socio technical networks and systems, Oosterlaken (2015), of the school and the wider educational value system. We often think of technology as objects so it is important here to establish a wider conceptual view of the term technology. McGinn (1978, p180) provides an ontology of sorts that defines technology as having: material outcomes; fabricates or is constitutive of those outcomes; is purposive; is resource based and resource expanding; utilizes or generates knowledge; is methodological; takes place in a social cultural context, and; is influenced by individual’s mental sets. Mitcham (1994, p159) highlights distinctions between “technology as knowledge, technology as activity and technology as object” a stance echoed by Arthur (2009 p9) where technology is defined as “a means to fulfill a human purpose. ... as a means, a technology may be a method or process or device”. These definitions are used within this paper to talk of “technology as knowledge” in terms of introducing a new technology or “method” for learning and teaching.

This includes: knowledge about the method, the purposeful carrying out of the method or activity of teaching and learning (technology as process or activity) and technology as object in its discussion of digital tool use within such methods. Tied up with this is the socio technical system or culture of learning into which the innovative 'technology' is placed and the positioned practice, Oosterlaken (2015), of the actors within the system and how such a change might affect their roles, identities and capabilities either negatively or positively. Any technology implementation will have both negative and positive effects upon the people who adopt it. In this regard the capability approach after Sen (1992) will be used as a conceptual/interrogative framework within which to situate the proposed new learning design/technology.

School based teaching and learning has generally been associated with the use of knowledge for the transmission of content and skills in preparation for a world of work that unfortunately may no longer exist. Traxler (2010, p105) notes: Changes in the nature of work itself, in the times and places of work and the relationships within work are changing, Insofar as 'learning' is understood as work, the implication of these changes for formal education is that expectations about where, when and how learning happens must change in the same way as work itself; insofar as 'learning' is understood as a preparation for work and the world of work, the content and style of education must continually change in order to stay aligned to the economy. The increasingly fluid economy ... constitutes a considerable challenge for many parts of the formal education system.

If the premise is taken that work practice is changing and our engagement with the digital is in part enabling this change, it follows that pedagogical approaches that enable us to work in synch with these phenomena in a period of rapid change are a necessity. Too often digital tools(technology conceptualised as object) are equated with innovation in learning and teaching whereas it is more often the pedagogic knowledge (what teachers know about learning and teaching: (technology as knowledge)) and/or change in practice (what teachers do: (technology as activity) and teaching as an informed learning design) that is innovative and more important. Equally, the role and identity of actors within such transformed, reinvented or redesigned practice will also have to change in order to integrate digital tools within learning for purposive endeavours. Therefore, learning designs that mirror the ways in which technologies are used habitually or are derived from such habitual engagement are desirable. Fullan (2014, p10) notes three qualities of new pedagogies for the development of what he calls "deep learning". These are:

1. New learning partnerships between and among students and teachers.
2. Deep learning tasks that re-structure the learning process towards knowledge creation and purposeful use.
3. Digital tools and resources that enable and accelerate the process of deep learning

Maximising the opportunity for individuals to achieve a life that they value is also an important core facet of education. The capability approach Sen (1992) Nussbaum (2011) Robeyns (2005) is concerned with how individuals and groups are able to do this within the limitations of the context they are in. Using the capability approach for analyzing any pedagogical/technology innovation in terms of its impact on individuals' ability to achieve a life that they value is pertinent because of its connection to the ability to exercise personal agency. Within Sen's (1992, 1999) articulation of the capability approach the ability to achieve value is located in the notion of freedom of choice and personal and collective agency. As the pervasive social and cultural use of digital technologies (technology as object)and their affordances (Norman, 2013; Gibson, 1977) can enhance potential functioning and develop a person's innate capabilities, Oosterlaken (2014) it is important that educational institutions recognise and value those technologies and their status in people's lives so that opportunity is not denied. To do this, the pedagogic practices within formal learning environments need to be examined and innovative practices that support learning in a connected, collaborative way need to be modeled and legitimized.

Connectivism, Siemens (2005, page 2) supports this need for new ways of approaching learning design. "Connectivism presents a model of learning that acknowledges the tectonic shifts in society where learning is no longer an internal, individualistic activity. How people work and function is altered when new tools are utilized."

This paper outlines a learning design for practice enhancement derived from agile work practices and research observations of collaborative project based learning. This design facilitates the development of both learner and teacher capabilities through the construction of a shared space that propagates learner and teacher agency in the co-development of learning. Knowledge in this dynamic is authentic and situated in knowledge artifacts, objects, other people and databases and real learning skills are developed in the application of knowledge to authentic problem/solutions and in the ability to collaborate within a diverse community. These are not skills that people are born with but they are within human capability.

This requires a paradigm shift that facilitates seamless collaborative working with digital tools, and redirects the role of the teacher from pedagogue to facilitator of self organisation and leader of learning processes in both face-to-face and digital spaces. It also requires learners to use the agency released and transferred by the methodology/design to become self organizing, self reflective learners within a structured space. As such the design is more about knowledge creation and transfer than the replication, dissemination and recall found to a large extent in current practice. As mentioned above the suggested “teaching and learning technology” is framed by lens of capability theory and connectivism and informed by a broad understanding of learning and teaching as a process based technology,

Human Capability

The capability approach is a way of thinking about the manner in which human beings are able or otherwise (due to particular contexts or systems) to achieve the sort of life that they value. Sen, (1992, p 40) describes the approach as follows: The major constituents of the capability approach are functioning’s and capabilities. Functioning’s are the “beings and doings” of a person, whereas a person’s capability is “the various combinations of functioning’s that a person can achieve” Zheng (2011) notes, quoting Sen (1992)that, “A functioning is an achievement, whereas a capability is the ability to achieve.” This means that capability is the range of possibilities open to individuals that can subsequently be converted into valued functioning’s. This range is dependent upon their context and the systems and processes, goods and services etc. that may extend their capabilities or constrain them. Of equal importance is the degree of agency and choice that people have to achieve the functioning’s that they value. Engaging with the conceptual thinking of the capability approach is pertinent for examining educational processes and systems to ensure that they are not limiting adversely an individual’s capability or potential to achieve valued functioning’s.

The ‘learning process or “design” that is employed will have a bearing on this. For example, two students may have the same perceived innate capability and be offered an opportunity to achieve or develop that capability in school but they may not actually both reach the valued achievement. This allows us to look at why this might be so, especially where digital tools are concerned. For example if we consider a universal innate capability such as reading, a student with auditory dyslexia (which manifests as the inability to distinguish phonemes amongst other issues) will need an approach other than standardized synthetic phonics in order to learn to read. In the capability approach conversion factors, Sen (1992), are given as an explanation of why capability may or may not be developed into valued functioning. Conversion factors are the way in which a good or resource or technology can be used to either develop or limit capabilities depending on the conversion factor in play. In the example above the predominant teaching method (technology as activity) may be a limiting factor for some. If this is examined further, we can see that no “technology” or learning design is neutral or universally good. Synthetic phonics may be responsible for developing the innate reading capability of the many but may have adverse effects on others. Conversion factors in the capability approach have been classified into three groups, personal, social and environmental, (Robeyns, 2011, p 2.4) where:

Personal conversion factors are internal to the person, such as metabolism, physical condition, sex, reading skills, or intelligence. Social conversion factors are factors from the society in which one lives, such as public policies, social norms, practices that unfairly discriminate, societal hierarchies, or power relations related to class, gender, race, or caste. Environmental conversion factors emerge from the physical or built environment in which a person lives. In the digital sphere a student may have the capability to network and share knowledge digitally but if this is not a valued functioning of the education process then that functioning will be confined to social spaces and capability denied or not fully developed for learning purposes. The conversion factor at play here will be a social conversion factor where education practices are focused on particular skills required by the current education system. The learning design employed within education will support the norms and values within the system which are arguably predominantly based on values that supported industrial age requirements rather than those supportive of the knowledge age. As Drucker (1994 p5) noted: Traditionally, and especially during the past 300 years (perhaps since 1700 or so, at least in the West, and since about that time in Japan as well), an educated person was somebody who had a prescribed stock of formal knowledge. Increasingly, an educated person will be somebody who has learned how to learn, and who continues learning, especially by formal education, throughout his or her lifetime. The ability to be a lifelong learner and knowing how to learn and apply that learning to changing circumstances is a capability with a set of functioning’s that education practice and learning design should develop.

At a simple level, it's the difference between the learner who types capably on Facebook at home and can communicate rapidly by text but has poor handwriting at school. As such she/he is disadvantaged not because of any personal lack of intelligence but because of the norms within the school system and the lack of flexibility within it that does not recognize or value the functioning inherent within the digital social sphere that could ultimately enhance learning. Equally, if one is in a digitally enabled environment there may still be conversion factors that impact on this such as availability of appropriate technology (objects) or equitable access to communication infrastructure in the home which Oosterlaken (2014) calls the Socio Technical Networks. There is no advantage of living in a networked society if you are unable to connect to the network or if the network is intermittent. This leads to the question of why and how learners and teachers might be enabled to co design and develop learning designs that are both egalitarian and emancipator where individuals are able to flourish for the world as it is now. The capability approach asks us to assess our practices and policies to ensure that capabilities are realised. Without throwing up our hands and saying redesigning the education system is too big a task we can look for the spaces where we can make changes in an incremental fashion. Teachers do have a degree of agency and control over how learning is organized in their classrooms where learners spend a large part of their lives. This should therefore lead to examination of teaching and learning approaches, and power relationships within the classroom to examine whether they are inclusive, enabling, collaborative, democratic; and reflective of the way that people work in the current knowledge economy.

Integration of Digital Tools (technology as object) in Formal Education and Learning

Formal education in schools, in spite of a developing awareness of notions of digital literacy is predominantly still led by a focus on reading and writing print media and the transmission of a body of knowledge assessed through memorization and recall. As McLuhan Fiore and Agel (1967) noted, society tends to make new technology objects do the work of the old, so we see "interactive" whiteboards and "e"-portfolios and books mediated by apps on tablet computers rather than using digital tools that are ubiquitous to the population for anauthentic work or learning related purpose. Such a preoccupation with a commonly accepted corpus of knowledge (Traxler 2011) leads to the use of transmission-based pedagogies that are mediated by teachers and digital technologies that can be attuned to a predominant mode of "delivery". Research by Royle, Jenkins and Nickless (2010), Hadfield, Jopling, Royle and Southern, (2009) and Royle and Hadfield (2012) on projects that sought to integrate ICTs into education showed that the ICT used had to either, fit established pedagogy or that the pedagogical approach had to be radically altered in order to accommodate both the ICT and the digital practices that its use invoked. Equally, these "radical" changes to pedagogy were not sustainable outside of the particular projects due to their divergence from the perceived and valued function of schooling. It was found that when digital tools were introduced into what was previously a "fixed knowledge economy" the teacher was often left looking for a role and more importantly a pedagogical approach that was accommodating of both uncertainty and the variety of engagement emanating from the ways in which people now socialize and work through digital tools and spaces.

Agency and Control

Ashby's (1956) law of requisite variety tells us how a control system needs to deal with variety by employing variety. If the control system cannot match, the variety of the system it seeks to control then it tries to restrict the variety of the system. In the case of education this can be seen in the increasing implementation, (in the UK at least and also evidenced by the measuring of performance through Programme of International Student Assessment (PISA)), of standardised curricula and methodology. This is counterintuitive to a world that has infinite variety, rapid creation of knowledge and increased personalization and collaboration possibilities through networked public and private spaces. What is required in the face of this change is a teaching and learning system and learning designs that can nurture variety, be agile and adaptive to outside influences and provide a structure within which learners can practice personalized, self organised and collaborative approaches to learning. Adopting a learning design for developing capabilities is largely about promoting and enabling learners' freedom to choose a direction or realise a valued functioning. It is also about learning how to develop ones' own learning skills. It follows that one of the main purposes within education (and therefore a goal of learning design) should be to maximise the freedom to choose both how or what individuals learn by maximising an individual's personal agency or indeed the collective agency of a group of actors within a system, where agency is defined by Bandura (2001, p1) as the ability to "play a part in their own self-development, adaptation, and self-renewal with changing times." Thus, in a time of change, being able to adapt to change is a capability that needs to be developed through our educational institutions so that individuals can choose to function in that way as they move to adulthood.

In an increasingly connected and digitally enhanced environment, it is desirable that such engagement and enhanced range of capability in the digital social sphere is converted to value functioning within education. The “connate” technologies available to today’s learner have great potential for producing and sharing knowledge within a variety of contexts and yet they are used predominantly for consumption-based practices in social culture rather than for universally creative, collaborative, or constructive purposes within learning. As Zheng (2011, p72) notes:

To have access to the Internet does not necessarily mean that the person has the learning ability to benefit from the rich source of information; or that citizens are able to use information to pursue what they consider as important objectives. A clear role for teachers in an age of change is to develop learners’ ability to critically analyze their digital consumption and to integrate the use of digital tools into learning designs for: collaborative endeavor; the creation of knowledge; and productive work. As mentioned previously, if a large part of education is about preparation for work then pedagogical practice should in part mirror work practices where according to Hase and Kenyon (2000, p2). Change is so rapid that traditional methods of training and education are totally inadequate; discipline based knowledge is inappropriate to prepare for living in modern communities and workplaces; learning is increasingly aligned with what we do; modern organisational structures require flexible learning practices; and there is a need for immediacy of learning.

In the digital age in the world of work, taking the initiative, collaboration and self organisation within heterarchical organisation matrices are increasingly developing alongside the more traditional command and control of bureaucratic systems,(Stephenson, 2009), that persist within schooling. In this period of transition and flow between digital and analogue processes a learning design that can develop agency and nurture capability is needed. Such a design would have to balance the need to collaborate in interpreting and using knowledge from a variety of sources and connections in a just in time manner with formal education’s desire for system control and standardised outputs. Wherever the locus of control is located, be it at classroom, school or policy level a major paradigm shift is required that allows increased personal and collective agency to be enacted within existing organisational frameworks and structures. Bandura notes that “Among the mechanisms of personal agency, none is more central or pervasive than people’s beliefs in their capability to exercise some measure of control over their own functioning and over environmental events, “Bandura (2001, p 10).”

One such learning design, using techniques from agile work practices at the classroom level, is outlined below. Such an implementation should be conceptualized as an organic minimum viable change, Anderson (2013), where the smallest change possible to affect a change in behaviours is implemented within existing structures And existing School or policy paradigms. Using “agile learning” derived from agile work practices is more of a reform than a transformation but a reform that should ignite motivation within learners and teachers alike. In an educational environment where learners are increasingly less motivated by conventional practices and their lack of agency in schooling is counterintuitive to their connate digital experience it follows that formal pedagogical approaches that promote personal and collective agency and enable capabilities to be developed and realized could be transformational. Agile Learning methodology is one such work derived approach to producing new knowledge, creating content and practicing and acquiring the soft skills of collaboration and self organisation. To do this it uses “inspect and adapt” double loop learning in a structured iterative process. Double loop learning Argyris and Schön (1978) is contrasted with single loop learning where:

Single Loop Learning involves following routines and some sort of preset plan – and is both less risky for the individual and the organization, and affords greater control. Double Loop Learning is more creative and reflexive, and involves consideration of notions of the good. Reflection here is more fundamental: the basic assumptions behind ideas or policies are confronted... hypotheses are publicly tested... processes are disconfirmable, Argyris 1982: 103-4).As a consequence, reflection in and on actions taken is a fundamental part of the learning process. It isn’t an add on...where teachers say okay you have done this now let’s reflect on it ... a sort of plan do review for the 21st century, reflection is actually integrated into the learning design. This learning paradigm should also extend beyond the classroom and challenges teachers to ensure that what is produced in the classroom is also relevant to the changes and demands of society in a national and global context.

The Trojan Horse of Agile Learning Methods :Migrating Agile Based Working into Formal Education

In recent year's interest has been placed in problem-based and challenge-based learning Boud and Felletti (1997) and more recently product-oriented learning Zhao (2012) and agile pedagogy (Nikolic and Gledic (2013), Stewart et al (2009), Redden (2012), and Berry (2012)). These approaches to learning more-or-less move from a teacher centred role and identity as controller of learning to a teacher role based on facilitation and project direction from an informed perspective. They ask learners to become self-directed, team-oriented, but individually resilient lifelong learners. A movement from transmission of mediated content by teachers to content creation and skills development by learners alongside teachers in a collaborative yet competitive environment, mediated by technology, is a difficult but not impossible transition. As mentioned above, much of education has been about developing learners' knowledge and skills for a world of work that was standardized, which can lead to developing learners towards a predefined specification set by the curriculum and interpreted by teachers and learning institutions. In a world where the use of technology can enable a more personalised and diverse approach perhaps a different way of looking at human development is required.

None of this is remarkable as it echoes the work of Rogers (1994), Vygotsky (1978), Illich (1971), and Wenger (1998) in the previous century and more recently the work of Siemens (2005) on connectivism described by Kop and Hill, (2008) as a theory contributing to the development of new pedagogies where control is shifting from the teacher to learners with increased autonomy. However, what is new is the migration and adoption of current work practices which are closely related to working in a connected collaborative environment as a methodology for education. We propose here the adoption of "Scrum", an agile work practice, for use in education because it offers a method of working that allows both personal development and agency coupled to collaborative self organisation without undermining the role of the teacher or sacrificing teacher control. Scrum provides a method for structuring independent, project and team based learning so that students can be free to choose how they work and achieve but also where teachers can balance this with the needs of standards and learning objectives. Although this is not the place for a full exposition of the Scrum method in education its main aspects are outlined below and further references are given.

Agile, derived from the Manifesto for Agile Software Development (2001) looked at the way that work was organised and suggests that self organising and self managing teams were more effective than tightly controlled and directed ways of working. Agile and its main methodology "Scrum" (2001) focuses on the following key premises. People, individuals and interactions over processes and systems, doing things rather than the documentation of doing things (this means the focus is on how people work and learn together rather than the use of planners, goals and objectives). Outline plans over detailed specifications, (this means that people are focused on making and doing rather than writing about making and doing). Customer collaboration over contract negotiation (this means that people sit down together to commit to produce the best products rather than saying what they will and won't do) and responding to changes over following a plan (This means that people learn by trying things out rather than following a pre-set path, it promotes innovation and improvement). Whilst the latter half of each statement is valued in agile practice more emphasis is placed on the former. When one delves deeper into the actual management of tasks, Why Scrum? (2001) we find: teams that make decisions themselves with a facilitator to advise; short, "time boxed" self assigned tasks; a product owner who monitors the work-flow but does not interfere with the work of the team once it is on task; and built in review points to adapt, reflect on performance and change the product as work progresses.

The Scrum Framework in a Nutshell

The key roles, ceremonies and artefacts in Scrum; what happens and how they might be applied to teaching and learning are explained further below.

- The product owner (The Teacher) creates a list of product features called a product back log prioritised by value to the endeavour. Basically this is all the things you need to do to achieve a final product or outcome. Each item has specific acceptance or quality criteria that can be set by the product owner/teacher and is very much, like a lesson plan but working from the final product backwards. The product backlog is not a static thing; the product owner should refine it and modify it as the project progresses based on feedback from learners. If you think about it, this is what good teachers do.

They don't just stick to the plan regardless of what is happening in the classroom. With Scrum, it is an absolute requirement that this happens.

- The next step is Sprint planning and to do this you need a team and a Scrum Master. Along the way, the Scrum Master (team facilitator but also a team member) keeps the team focused on its goal and generally facilitates the group and tries to fix any problems or issues. In the first implementation, the Teacher may have to take this role too.
- During sprint planning, the Team (learners in a group) and Scrum Master-team (facilitator) plus the product owner if necessary (Teacher) break down the features from the backlog into tasks and decide what they can complete in the sprint (time available, given the resources to hand) and make a sprint backlog (list of tasks).
- The team has a certain amount of time, the sprint— (a sprint in the world of work is usually two to four weeks but in schools it depends on the duration of the project / product. For curriculum subjects we have used 30 minute sprints with success)— to complete its work, but it meets each day to assess its progress with a daily Scrum or 'stand up' meeting. Team members stand up and say what they have achieved, what they are going to do next and discuss any issues, challenges and help needed. Whilst team size is not directly set, we would suggest no less than three and no more than nine. However, in reality this number is not prescriptive. Basically, we need the right mix of people with a blend of skills and capabilities to get the work done. This will mean that in a class there will be several teams to manage. This can be facilitated by training Scrum Masters first in the way that scrum works and by tracking activities on an electronic Kanban board. (see www.trello.com as an example)
- At the end of the sprint, the work should be ready to use for the project. If not, it is sent back to the backlog and can be reintroduced to the next sprint if needed.
- The sprint ends with a sprint review in which the team and product owner (teacher) inspect what they have done so far and think about what needs still to be done. At this stage the team shows the product owner user stories that are done. This means that the acceptance criteria are met fully in accordance with the definition of done. This is the point where the teacher can accept or reject the work if it doesn't meet the criteria agreed so this ceremony is very important. A sprint retrospective may also be used to look at how the team worked together and if any improvements can be made. How did it all go and how can we improve in the next sprint?
- To start the next sprint, the team chooses more features from the product backlog breaks them down into tasks and makes their sprint plan and begins working again.

Royle and Nikolic (2016) Forthcoming E book

Educationalists have interpreted agile/scrum implementations in various ways; Redden (2012) for example, applied it to a training environment and Berry (2012) to the UK school system with particular reference to ICT education. What is clear and at its heart is that it is a way of working that engenders agency in its participants. The focus on people and their individual needs, through the system of "scrum" working ceremonies where each team has a daily meeting where individual issues and problems are raised, when coupled to the educational ethos of capability and capacity building should allow capabilities to be recognised and nurtured. Equally, the active, hands on nature of doing rather than "documenting doing" leads itself toward problem based and discovery learning and ultimately, functioning's that are part of a co-constructed value system rather than one which is received from without. The focus on outline plans over detailed specifications highlights the need for teachers to be experts in the flexibility of learning approach rather than followers of a received regimen of over planned learning. As Berry (2012) notes:

The agile teacher concentrates on developing useful, working knowledge, skills, and understanding rather than detailed lesson plans. This is about starting at the beginning, rather than the end, making use of what learners know already and building on that rather than taking the next step in a pre-planned sequence to a pre-determined destination. Objectives are important, in both agile development and agile teaching, but they're immediate objectives in a short "time box", and ones which are immediately useful. Perhaps the most important facets of the agile approach are ownership of the work and a collaborative supportive approach that builds in a reflective planning and review process. The team is the main driver and controller of work and the individual is important within the team. As outlined above the teacher can take a designated role of either scrum master (team facilitator) product or project owner so still has input into the overall activity but has a more collaborative rather than leading role. They can take part in task reviews and act as mentor, coach and guide.

In the second research project reported above teachers became the manager/leader of learning in multiple projects owned by learners but worried about a lack of structure and focus. Scrum is designed to deal with this complexity and provide self-managing frameworks and intrinsic rather than extrinsic motivation for task definition, completion, and evaluation. In using scrum (in education), knowledge is co constructed, and decisions about how and when to learn and achieve tasks is delegated or owned by the team collaboratively. Into this framework for organising activity, any particular problem based content can be placed. This loose - tight framework is also concentrated on product development and as such the tasks needed to develop a product (where product is defined as object/knowledge or media) can use digital tools accordingly for research or content creation as part of the process and the scrum process itself can use real world project and process visualization tools such as www.trello.com or www.slack.com

Project based learning issues

Scrum can be used to solve the control and diversity issues of problem or project-based learning (PBL). PBL defined simply by Thomas (2000, p1) “as learning that is based on projects” has the power to motivate and enthuse but also has its drawbacks in formal schooling.

Thomas (2000) lists the attributes of PBL as:

- complex tasks, based on challenging questions or problems, that involve students in design, problem-solving, decision making, or investigative activities;
- giving students the opportunity to work relatively autonomously over extended periods of time;
- and culminating in realistic products or presentations.

Other defining features found in the literature include:

- authentic content,
- authentic assessment,
- teacher facilitation but not direction,
- explicit educational goals,
- cooperative learning,
- Reflection and incorporation of adult skills. “

A Risky Business. In times of increased standardized assessment and high stakes outcomes for education and schooling, it is a big risk to embark on PBL. Not only are you unsure of the outcome of PBL, you cannot readily, as a teacher, assess individual performance on a project. Zhao (2012) outlines three models of project-based learning described in the table below.

Table 1: Project Based Learning Models.

	Expected Outcome	Control	Setting
Academic model	Academic Content and outcomes	Teacher Led	Single classroom
Mixed Model	Product within constraints of academic requirements	Teacher and student collaboration	Single or multiple classes and community
Entrepreneurship model	Product	Student led	School and Community

How Learning with Scrum Can Help in PBL. In each of the models above, Agile Learning with Scrum can provide a framework for PBL that satisfies each of the control requirements thus minimising the RISK for teachers. What Agile Learning using Scrum does is supply a robust framework for project-based learning.

Scrum in Education

- Treats every learning project like a real world project and uses authentic skills
- Provides a mechanism for autonomous working
- Monitors the quality of outputs or learning outcomes,
- Monitors and assesses both team performance and individual contributions using digital real world tools.
- Focuses on “just in time” applied knowledge
- Always works in a context (solves a problem)
- Focuses on processes and outcomes

- Is authentic
- Is iterative
- Is collaborative
- Is motivational through developing personal agency and capability
- Allows technology to be used purposefully

The onus is upon the team to solve the issue and organise themselves to achieve the task(s) required. These mechanisms place the emphasis on self-help within the team in order to achieve the set tasks. Accordingly, if an individual highlights a difficulty then the team must help them solve it. Going deeper into agile elicits various controls on quality of outputs in terms of the team and the product owner negotiating a “definition of done” for a completed project. It is here that the product owner (teacher) can look at quality specifications or assessment criteria which would sit alongside each team’s “definitions of done” to improve performance. What agile does is provide a rule based egalitarian pedagogic space that promotes learner agency. What it doesn’t do is give a free space that is unstructured. The use of digital tools such as trello.com which use a Kanban system can visualize the learning process for individuals and teams.

Conclusion

If educators adopt a form of agile pedagogy they also need to think about how capabilities and skills can be developed through real or simulated activities that are negotiated by learners and recognised by all as leading to valued functioning’s. The difference between operating scrum as a learning methodology at work and in schooling is that formal education is predominantly about developing emergent capabilities and working and learning in a connected environment whereas in work one could assume that team members already possess varying degrees of expertise. Commentators often decry formal education without really putting forward any concrete alternatives. Not all children can self learn in public spaces or become coders or entrepreneurs, and mass schooling will not disappear in a digital whirlwind of change overnight. Agile learning methodology is a potential answer to transforming schooling from within by keeping structure but releasing agency and control within it by providing participant practice identities within a project. As such, agile learning is a learning design, a process and therefore a technology in its broadest sense which widens the range of skills and capabilities that can be evidenced within the school setting. It is about looking at what students can do and letting them contribute purposefully whilst also allowing opportunities to develop, from peers and teachers and experts on the net, the things that they cannot do. This paper is a first step towards validating the use of scrum and its potential as a working solution for emancipation and change within mass education.

This is the AGILE Pedagogy MANIFESTO: Whilst we acknowledge the things on the right of the page are an important part of learning and teaching we prefer the things on the left.

Table 2

Practice	-- preferred to --	Theory
Learner choice and agency	-- preferred to --	Learners being limited and controlled
Learning and applying skills	-- preferred to --	Learning facts
Collaboration	-- preferred to --	Competition
Customised learning	-- preferred to --	Standardised one size fits all
Co constructed learning	-- preferred to -	Teacher led
Authentic real world issues	-- preferred to --	Manufactured artificial issues

For teachers this means a movement:

Table 3

From	To
Problems	Solutions
Teacher as leader of their own project	Teacher as leader of many learner projects
Teacher as controller of learning	Leader and manager of learning
Broadcast style	Personalised facilitation
From the front of one group	From the middle and the edge of groups
One predominant media type	Many media types
Directed learning	Independent and guided learning
Reconstitution of received facts by learners	Solution devising through, research, analysis, synthesis, evaluation and transformation of knowledge by learners.
Focus on summative product	Focus on formative process and product
Consumption of knowledge	Production of knowledge
Learners as receivers of knowledge	Learners as co-constructors of knowledge

Royle and Hadfield (2012)

For learners and teachers this means

- More fun, independence, and choice.
- A more enjoyable experience
- A supportive and collaborative environment in which to learn new skills.

References

- Anderson, J. (2014). The Lean Change Method. Retrieved April 22, 2016, from <https://leanpub.com/leanchangemethod>
- Argyris, C., & Schön, D. A. (1978). *Organizational learning*. Reading, MA: Addison-Wesley Pub.
- Arthur, W. B. (2009). *The nature of technology: What it is and how it evolves*. New York: Free Press.
- Ashby, W. R. (1956). *An introduction to cybernetics*. New York: J. Wiley.
- Bandura, A. (2001). Social Cognitive Theory: An Agentic Perspective. *Annual Review of Psychology Annu. Rev. Psychol.*, 52(1), 1-26. doi:10.1146/annurev.psych.52.1.1
- Benton, M. C., Radziwill, N. M., A Path for exploring the agile organizing framework in technology education. Agile 2011, Salt Lake City UT, August 9, 2011. Retrieved August 2012 from http://nicoleradziwill.com/portfolio/BentonRadz_Agile2011AOF.pdf.
- Berry, M. (2012). The Case for Agile Pedagogy. Retrieved April 2016 <http://www.guardian.co.uk/teacher-network/teacher-blog/2012/may/16/agile-pedagogy-computer-programming-learning>
- Boud, D., & Feletti, G. (1997). *The challenge of problem based learning*. London: Kogan Page.
- Drucker, P. F. (1994). The age of social transformation. Retrieved April 22, 2016, from <http://www.theatlantic.com/past/docs/issues/95dec/chilearn/drucker.htm>
- Fullan, M., & Langworthy, M. (2014, January). "New Pedagogies for Deep Learning" - Michael Fullan. Retrieved April 22, 2016, from <http://www.michaelfullan.ca/wp-content/uploads/2013/08/New-Pedagogies-for-Deep-Learning-An-Invitation-to-Partner-2013-6-201.pdf> : Pearson: London
- Gibson, J. J. (1977). The theory of affordances. In R. E. Shaw & J. Bransford (Eds.), *Perceiving, Acting, and Knowing*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Hadfield, M., Jopling, M., Coleyshaw, L., & xxxx. (2010). Evaluation of the Training and Development Agency for ... Retrieved April 22, 2016, from http://www.researchgate.net/profile/xxxx/publication/237224766_Evaluation_of_the_Training_and_Development_Agency_for_Schools'_funding_for_ICT_in_ITT_Projects_Executive_Summary/links/54cb6b4b0cf2598f7116dafa.pdf
- Hase, S., & Kenyon, C. (2000). Moving from andragogy to heutagogy in vocational education. Retrieved April 22, 2016, from http://www.avetra.org.au/abstracts_and_papers_2001/Hase-Kenyon_full.pdf
- Illich, I. (1971). *Deschooling society*. London: Calder & Boyars.

- Kop, R., & Hill, A. (2008). Connectivism: Learning theory of the future or vestige of the past? *The International Review Of Research In Open And Distributed Learning*, 9(3). Retrieved from <http://www.irrodl.org/index.php/irrodl/article/view/523/1103>
- Learn About Scrum. (2001). Retrieved April 22, 2016, from <https://www.scrumalliance.org/why-scrum>
- Manifesto for Agile Software Development. (2001). Retrieved April 22, 2016, from <http://agilemanifesto.org/>
- Mc Ginn, R.E. (1978) What is technology? *Research in Philosophy and Technology*, 1,179-197.
- McLuhan, M., Fiore, Q., & Agel, J. (1967). *The medium is the massage*. New York: Bantam Books.
- Mitcham, C. (1994). *Thinking through technology: The path between engineering and philosophy*. Chicago: University of Chicago Press.
- Nussbaum, M. C. (2011). *Creating capabilities: The human development approach*. Cambridge, Mass.: Belknap Press of Harvard University Press.
- Nikolic, J. & Gledic, J. (2013). Going agile: Agile methodologies in the education of global citizens. In M. Stiasny & T. Gore (Eds.), *Going global: Identifying trends and drivers of international education* (pp. 119–127). Bingley, UK: Emerald.
- Norman, Donald A. *The Design of Everyday Things*. 2nd ed. Cambridge, MA: MIT, 2013. Print.
- Oosterlaken, I. (2015). *Technology and human development*. Oxford, UK: Routledge.
- Redden, R.J. (2012) Agile Training: An innovative pedagogical process for educators University Of Nebraska At Omaha, Masters Dissertation. Retrieved 4/08/2015 from <http://gradworks.umi.com/15/08/1508663.html>
- Robeyns, I. (2005). Assessing Global Poverty And Inequality: Income, Resources, And Capabilities. *Metaphilosophy*,36(1-2), 30-49. doi:10.1111/j.1467-9973.2005.00355.x
- Robeyns, I. (2011). The Capability Approach. Retrieved April 22, 2016, from <http://plato.stanford.edu/entries/capability-approach/>
- Rogers, C. R., & Freiberg, H. J. (1994). *Freedom to learn*. New York: Merrill.
- Royle., & Hadfield, M. (2012). From ‘Posh Pen and Pad’ to Participatory Pedagogies. *International Journal of Mobile and Blended Learning*,4(1), 1-17. doi:10.4018/jmbl.2012010101
- Royle. Jenkins, C. Nickless, J. (2010) Combining Analogue Realities and Digital Truths: Teaching kids how to hold productive learning conversations using pictochat on the Nintendo DS. *Journal of the Research Center for Educational Technology*, Vol 6, No 1
- Scrum Values. (2001). Retrieved April 22, 2016, from <https://www.scrumalliance.org/why-scrum/core-scrum-values-roles>
- Siemens, G. "Elearnspace. Connectivism: A learning theory for the digital age." *Elearnspace. Connectivism: A Learning Theory for the Digital Age*. N.p., 2005. Web. 22 Apr. 2016. <<http://www.elearnspace.org/Articles/connectivism.htm>>. Stephenson, K. (2009) Neither hierarchy nor network: An argument for heterarchy. *People and Strategy*, 32(1), 4–13.
- Stewart, J. C. De Cusatis, C. S., Kidder, K., Massi, J. R., and Kirk, A. M. (2009). Evaluating agile principles in active and cooperative learning: Proceedings of Student-Faculty Research Day, CSIS, Pace University. Retrieved 12-4-14 from csis.pace.edu/~ctappert/srd2009/b3.pdf
- Thomas, J. W. (2000). A Review Of Research On Project-Based Learning. Retrieved from <http://www.newtechnetwork.org.590elmp01.blackmesh.com/sites/default/files/dr/pblresearch2.pdf>
- Supported by The Autodesk Foundation 111 McInnis Parkway San Rafael, California 94903
- Traxler, J. (2010). Education and the Impact of Mobiles and Mobility. *Medienbildung in Neuen Kulturräumen*, 101-111. doi:10.1007/978-3-531-92133-4_7
- Sen, A. (1987). *On ethics and economics*. Oxford, UK: B. Blackwell.
- Sen, A. (1992). *Inequality Re-examined*. Oxford, UK: Oxford University Press.
- Sen, A. (1999) *Development as Freedom*. Oxford, UK: Oxford University Press
- Vygotskii, L. S., & Cole, M. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.
- Wenger, E. (1998). Communities of practice and social learning systems. Retrieved April 22, 2016, from <http://wenger-trayner.com/resources/publications/cops-and-learning-systems/>
- Zheng, Y., & Stahl, B. C. (2011). Technology, capabilities and critical perspectives: What can critical theory contribute to Sen’s capability approach? *Ethics and Information Technology Ethics Inf Technol*,13(2), 69-80.
- Zhao, Y. (2012). *World class learners: Educating creative and entrepreneurial students*. Thousand Oaks, CA: Corwin Press.