A critical digital pedagogy for education in the 21st century

1. Command and control
"There is no such thing as a neutral educational process." Freire (1970)

As society and the health systems within it become increasingly complex and the needs of populations change accordingly, we are seeing increased calls for transformation, not only in how health systems are managed but in how health professionals are prepared to work in those environments. The ability to drive change in complex systems is a function of the ability to generate and connect ideas, and then implement new processes based on them. Not only do these activities take time but they are highly social, as success often depends on who we work with. In other words, teams are not only important for effective work but also for the kinds of generative, creative work that 21st century problems require. And yet health professions education continues to follow traditional lines of thinking and implementation, based in a pedagogical model that not only ignores our understanding of how people learn best, but also fails to consider the changing needs of the communities we serve (Frenk et al., 2010). The knowledge and skills required to work with wicked problems in complex systems are so diverse that it is impossible for a single individual or profession to make any appreciable impact. Taking this into consideration, it seems pertinent to ask if our current education system is capable of preparing physiotherapy graduates to not only work in such environments, but to thrive.

The positivist idealogy that permeates all levels of education can be seen in the way that teachers view knowledge, the way that knowledge is mediated through teaching methods, and the way students are taught to view knowledge. In this paradigm, knowledge is seen as being objective, bounded and something "out there" that can be neatly packaged and delivered to students. Specifically, knowledge is treated as an external body of information that is produced independently of human beings; universalised, ahistorical, and expressed in technical language that is value-free. Knowledge is therefore not only measurable and decontextualised but also impersonal. From a positivist point of view, knowledge is defined in terms that are verifiable and aimed at achieving goals that are unquestioned. Teaching in this positivist paradigm is usually discipline- based and categorises content into discrete compartments; domains of objective facts that can be collected and arranged in the interests of empirical verification (Giroux, 2011).

Ilich asserted that schools initiate students into a world where "everything can be measured, including their imaginations" (Illich, 1970). The message we send our students is that what counts is measured, and anything that is not measured does not count. This approach sees our students "reduced to cheerful robots" by a pedagogy of instrumental rationality that erases notions of justice, values, ethics, and power from the classroom. Efficiency and control are uncritically accepted as appropriate educational goals and then used to promote curriculum models that enshrine them as guiding principles (Giroux, 2011).

The objectification of students through measurement and their reduction to numbers in a spreadsheet by a positivist pedagogical model leaves them with little reason to generate their own meaning in the curriculum, or to evaluate their own learning experiences. When this point of view is used to guide curriculum design, our pedagogies are necessarily informed by the same notions.

Teachers working from a positivist perspective tend to see teaching as an act of depositing information into the minds of their students. When we confuse *teaching* with *talking* to students who passively receive information, the content of the narrative is lifeless and decontextualised. Freire (2005) says that our "words are emptied of their concreteness and become a hollow, alienated, and alienating verbosity". This type of narrative education emphasises the sonority of the words, rather than their transforming power and turns the student into a container to be filled. The more the student meekly allows themselves to be filled, the "better" they are. Education is therefore an act of depositing, where the teacher issues facts that are received, memorised and repeated by the student (Freiere, 2005). In this banking model of education, Freire describes knowledge as a gift bestowed by those who have it, onto those who they consider do not. The teacher is presented to the students as their opposite - knowledgable, authorative and powerful - and students then begin working to imitate and resemble their oppressors. Students, having been inducted into this system, believe that the more treatment there is the better are the results. They begin to "confuse teaching with learning, grade advancement with education, a diploma with competence, and fluency with the ability to say something new." (Illich, 1970). Once they have allowed their imaginations to be dulled by the curriculum, they are conditioned to accept - maybe even need - institutional planning on their behalf, leading to stagnation through education.

Education has long been used as a tool of oppression in society and it is no accident that classrooms resemble prisons. In addition to the physical appearance, schools mirror prisons in other ways too. Students are kept under observation, classified and tracked with numbers, and required to conform to professional and disciplinary norms that limit expression of their personal identity. In addition, there is no copying, no noise, and no chatter; the crowd is abolished. hooks (1994) has suggested that teachers' power over students dulls their enthusiasm and cultivates an obedience to authority, where students are managed in an assembly-line. Indeed, classrooms are designed and optimised to keep a population under control, and Illich went so far as to describe schools as places of confinement, "preparing students for the alienating institutionalization of life by *teaching the need to be taught*." (Illich, 1970). In the classroom, knowledge and authority rest within the teacher who stands at the front of the class. Students are arranged in rows, and must listen to the teacher who is the source of (the right) knowledge. Occasionally students may raise their hands and ask to be allowed to speak. Once these lessons are learned, students lose their incentive to develop as independent beings.

In order to better understand how the system manifests power in the classroom it is useful to consider Jeremy Benthem's notion of the Panopticon, a building with a tower at the centre from which it is possible to see each cell in which a prisoner is incarcerated. Bentham stated that power should be visible but unverifiable, so individuals always see the tower but never know if, or from where, they are being observed. The Panopticon therefore guarantees the functioning of power, even when there is no one actually asserting it. Over time, we develop passive learners because this is the only option available to them. There is no possibility of expressing oneself or of questioning the status quo. Most students (and teachers) accept this sitaution as an inevitable aspect of the system, coming to believe that they are impotent to control or change it in any way. The layout of the classroom and the way that control and authority are vested in the teacher seems purposively designed to develop within students an awareness that "their words have been stolen from them" (Freiere, 2005) and that the system - including teachers - cannot be trusted.

Health and education systems are increasingly recognised as complex adaptive systems that are characterised by high levels of uncertainty and constant change as a result of rich, non-linear interactions that cannot all be tracked. This means that complex systems are inherently ambiguous and uncertain, and that they lack predictable outcomes or clear boundaries. As systems have become more complex and integrated at the beginning of the 21st century, it is no longer possible for single individuals or even single disciplines to work effectively within these systems (Frenk, Bleakley, WHO). We must therefore ask if our classroom pedagogies - rooted in a positivist paradigm that sees knowledge as objective and independently verifiable - are suited to prepare graduates to thrive in complex, adaptive systems. Our pedagogies are instrumental, geared toward memorisation, conformity and high-stakes assessment, leading to classrooms that are what Giroux (2010) has called "intellectual dead zones", as far removed from expanding the imaginations of students as one can imagine. If the positivist view of the world is assumed it leads to a perception of teaching and learning as objective and value-free. When this point of view becomes a guiding principle of the curriculum, it influences our pedagogy so that teaching and learning practices are inherently bound by the same notions.

Education should be aimed at cultivating "...citizens who are critical, self- reflective, knowledgeable, and willing to make moral judgments and act in a socially responsible way." (Giroux, 2011). It must therefore be understood a process of emancipation guided by a pedagogy of liberation, as well as the cultivation of the intellect. But instead, teaching and learning have become fragmented processes reduced to a series of predetermined and lifeless gestures, stripped of it's moral component, striving only for accountability and measurement. Institutions of higher education are increasingly associated with "market competition, conformity, disempowerment and uncompromising modes of punishment", informed by corporate ideologies, standardised, managed, and reduced to job training sites (Giroux, 2011). Educators and students alike have found themselves more and more flummoxed by a system that values assessment over engagement, learning management

over discovery, content over community, outcomes over epiphanies. Education has misrepresented itself as objective, quantifiable, apolitical (Stommel, 2014).

Where some have suggested that the use of technology in the classroom is an opportunity for educational transformation, I argue that we have missed that opportunity and have instead used technology to further reinforce our authority and control over student learning. The use of technology has simply become a more powerful and efficient means of oppression in the classroom.

2. Weapon of mass instruction
"We shape our tools and then our tools shape us" (Marshal McLuhan)

Education is not neutral. It either serves to programme people into conformity or gives them the tools to engage critically and creatively with the world in order to transform it. Given that context, we can analyse the predominant way in which technologies are used in higher education, and ask if that use is oppressing or liberating our students.

The best thing we can probably say about the use of technology in higher education is that it serves to support traditional methods of teaching and learning; we use it to improve lectures with slides and interactive whiteboards, we make our notes available online, libraries provide access to digital resources, and tutorial discussions can be performed asynchronously online. These are positive, incremenetal improvements in the quality and flexibility of our classrooms, but are nowhere near being transformational (Laurillard, 2007). This is not the use of technology that I'm interested in. There is nothing wrong with teachers using techology to make small interative changes to their teaching and learning practices. However, for this chapter I want to get to the more insidious aspects of technological integration that needs our attention.

The Learning Management System (LMS) is by far the most ubiquitous use of technology in higher education. The LMS enabled universities to bring new technology into the institution without any of the bother of actually changing anything. The plug and play, template driven, user friendly LMS meant that we could provide universities with a digital facelift that made us feel like we were moving with the times. The reality is that we simply took an oppressive pedagogy and reproduced it in software. The LMS manifests a form of curricular design and implementation that substitutes technological control for democratic processes and goals, making both teachers and learners passive. At its core, the LMS means that course is behind a wall, and everything in the course happens behind that wall. At the end of the course students lose access to it, and to any of the content or data they've created as part of their learning process. In some cases, their creative works may be signed away as part of the Terms of Service. There is one instructor and possibly a few course assistants. They grade. They monitor the forums. The teachers are at the centre. The content is at the centre. The learner is not at the centre (Watters, 2014).

Insofar as the educational process can be controlled, the LMS is the digital equivalent of Benthem's Panopticon; the closest thing we have (so far) to a perfect system of observation and control. As we saw in the previous section, the Panopticon is a diagram of power reduced to its ideal form, increasing the number of people who can be monitored, recorded, and controlled, while at the same time decreasing the number of people needed to operate it. Digital technology has taken this concept to astounding new levels. An information Panopticon need not rely on physical arrangements, such as building structures and direct supervision. The information Panopticon is defined as a form of centralised power that uses information and communication technology as observational tools and control mechanisms. Software tracks and records everything about a student's online interactions, from the time a task is started to the time it is completed, and every click along the way. Based on the data that this process generates, the teacher monitors a students's performance and intervenes when necessary.

A central idea of Foucault's panopticism concerns the systematic ordering and controlling of populations through subtle and often unseen forces. Such ordering is apparent in many parts of the increasingly digitalised world of higher education (Giroux, 2011). The LMS, used mainly to distribute content and monitor progress along the assembly line, is a claustrophobic space where students consume information, rather than create knowledge. Students know they are being monitored at all times. Even if a teacher is not physically there, the software records their every move and this data is available to the teachers at all times. Like the prisoners in Foucault's Panopticon who never know if they're being watched, students feel the need to conform and satisfy the system rather than do their best work. The purpose of technology in higher education - as it is generally implemented via the LMS - is not to enhance learning, but rather to enhance the control of learning through surveillance, measurement and control.

How did we get here? Castells (2001) has argued that the events leading up to the production of a new technology determines the content and uses of the technology throughout its existence. If we want to better understand when and how we lost our way with educational technology, we must go back to the early days of the Internet. The system began as a military-oriented project that embodied the key elements for the military requirements of a communications network that was "suvivable": flexibility, absence of a command centre, and maximum autonomy of each node. Even though it was - at the time - rejected by the military it was reborn at ARPANET, an experimental non-military network that extended the communications architecture of the nascent network based on three main principles: 1) the networking architecture must be open-ended, decentralised, and multi-directional, 2 all communication protocols and their implementations must be open, distributed, and susceptible to modification, and 3) the institutions of governance of the network must be built in accordance with the principles of openness and cooperation.

The Internet is a cultural creation where the culture of the Internet is the culture of the creators of the Internet (Castells, 2003). To explore this culture, Castells draws on the lessons derived from an analysis of the history of the Internet. The first lesson is that the Internet grew from an unlikely collaboration between university based academics and graduate students (the hackers), and the government. The second is that the network was shaped by those who were using it.

In the 1960s and 1970s there was a flourishing of a culture of individual freedom across university campuses in the United States. The students involved were not social activists but nonetheless had strong beliefs about freedom, independent thinking, and cooperation. In most cases this culture was seeking technological innovation for the pure joy of discovery, and community networks were established in many university towns. But these networks were small and limited and in order to grow they needed a backbone anchored in more powerful machines. This was only possible through collaboration between science-based networks in government, and the student hacker communities in the universities. The second lesson that Castells derives from his analysis is that the early Internet was shaped as the users of the network became producers of the technology by adapting if for their own purposes. The source of the Internet's strength was its openness. For example, the development of the world wide web was only possible because Tim Berners-Lee was supported by the Internet community and his project stimulated by contributions from hackers all over the world. Some of these contributors went on to commercialise the web, seeing it as a space of enormous opportunity, while others, including Berners-Lee continued working in the public interest.

One interesting side effect of the openness embedded in the culture of the early hackers is that changes to the network were communicated back to the whole world in real time. This is the reason why the Internet grew - and continues to grow - at unprecedented speed. When the Internet was first conceived, it was made open as a way to learn and share, designed to provide people with the power to free themselves both from governments and corporations (Castells, 2003). Thus, the internet emerges as "a tool of liberation", expressive of individual freedom produced through the practice of openness both in its technical architecture and its social organisation (Castells, 2003). However, at the same time, the network was also influenced by the contributions of government-based entities with an interest in controlling the network, and entrepreneurs focused on commercialising it. Without the cultural and technological contributions of these early groups, the Internet may have been very different today.

The Internet has been alarmingly robbed of its historically open architecture. What we currently have is a theoretically open network, infiltrated by capitalist and governmental motives that disregard openness as crucial for the Internet to continue to be an instrument in acquiring knowledge, aiding innovation, and encouraging democratic engagement.

Back to the present where we can now better understand our current predicament in the roots of our history. Unlike the early days of the Internet that saw little distinction between the users of the Internet and the creators of the Internet, we could reasonably ask how much development in the domain of educational technology is being driven by teachers? How are we contributing back to the network, ensuring that the tools developed by third party organisations are designed with learning in mind, rather than shareholders? It is increasingly clear that education is influenced by a Silicon Valley narrative proclaiming that more technology is always the answer to whatever problem we're currently experiencing - as well as for some things that we didn't know were problems. More servers, more apps, more data, better algorithms and more integrated services mean that we'll be able to make better choices. Maybe we don't need better relationships with students, we just need more technology. How much time did that student spend on the page? At what point did they exit the book? The emphasis is a preoccupation with the instrumental use of knowledge, where it is "prized for its control value — its use in mastering all dimensions of the classroom environment." (Giroux, 2011).

The Internet is indeed a technology of freedom - but it can free the powerful to oppress the uninformed, it may lead to the exclusion of the devalued by the conquerors of value. While the "world wide web" is still considered to be relatively open, and individuals can create private spaces through blogs and social networks, our freedom as online actors is constrained by governments and corporations (and, as we have seen here, universities). When the intentions of these corporate and government actors are made clear, one questions how freely the self can be extended in this conceptually liberating space.

We had an opportunity to choose the open web over the LMS. To choose creativity and opportunity over limitation and constraint. But we made poor choices because we - the teachers - were not involved in the process of building the web we need for democratic and critically informed learning spaces. This is why we have third parties who control our digital learning environments, who profit from our work and the work of students, and who allow learning materials to exist on their servers only as long as it makes financial sense. We're in danger of losing what's made the Internet so important: a decentralised platform where people don't need permission to communicate, create, and innovate. (Gillmor, 2014). The open web has increasingly become the corporate web and despite their frequent invocation of "personalisation" in learning, these technologies present users with a very restricted, restrictive set of choices of what they can do, of who they can be." (Watters, 2014).

Marshal Mchluhan said that the medium is the message, and that new communication paradigms change what can be imagined and expressed. The printing press didn't just mean that we could do better calligraphy, and the web is not just a more efficient telegraph (Campbell, 2009). We didn't realise that we could use the web to transform, instead of simply to transmit. Remote proctoring tools can't ensure that students will not cheat. Turnitin won't make students better writers. The LMS can't ensure that students will learn.

All will, however, ensure that students feel more thoroughly policed. All will ensure that students (and teachers) are more compliant. We can't get to a place of listening to students if they don't show up to the conversation because we've excluded their voice in advance by creating environments hostile to them and their work (Stommel, 2014).

Audrey Watters has asked if we've even considered the implications of adopting tools that surveil and extract and control students? What happens to identity formation under these circumstances? What happens when we give students little leeway in expressing themselves as learners online? What are the implications of adopting tools that give students only a small range of avatars and status updates and profiles and backgrounds? Education technology has become a new and powerful way to demand conformity from students – and to demand they play out that conformity in the classroom (Watters, 2014). The Internet is no longer a free realm but is instead a contested space, where a new, fundamental battle for freedom in the Information Age is being fought (Castells, 2001).

As teachers we need to ask, what are we going to bring to that battle?

3. Education as the practice of freedom
"The classroom, with all its limitations, remains a location of possibility." (bell hooks)

Begin by trusting students.

Education is fundamentally a moral and political enterprise, meaning that we must reject the notion that it can be reduced to a private good, available almost exclusively to those with the financial means. Critical pedagogy offers the best chance for students to develop and assert their rights and responsibilities so that they are not simply being governed (Giroux, 2010). Through a critical pedagogy we can show students that the system of oppression is not closed with no exit and that it is only a set of limiting circumstances that can be transformed through action. In other words, we can show students how to change the system. But to do so, teachers must first work to shift the balance of power away from themselves, so that students are able to take action within the curriculum and undermine the beliefs and practices that are designed to silence them.

Critical pedagogy encourages students to act on the knowledge, values, and social relations they acquire by being responsive to the most important problems in society. It moves students beyond familiarity with and demonstrates how classroom knowledge, values, desires, and social relations are implicated in power. Guided by passion and principle, critical pedagogy helps students develop a consciousness of freedom, recognise authoritarian tendencies, empower the imagination, connect knowledge and truth to power as part of a broader struggle for agency, justice and democracy (Giroux, 2010). But it is not an a priori method of teaching and learning that can be applied regardless of context and it cannot be reduced to a set of instructions. Critical pedagogy isn't a prescription – it is a continuous moral project that enables students to develop a social awareness of freedom (Coles, 2014).

Freire believed that education offered students the conditions for self-reflection, a self-managed life and critical agency and Giroux suggests that a critical pedagogy encourages students to read texts as "objects of interrogation" (2011) rather than unquestioning acceptance; to read both the word and the world (2010). In this sense, pedagogy connects learning to social change, challenging students to critically engage with the world in order to act on it (Giroux, 2010). Under these circumstances, knowledge is not simply received by students but actively transformed, open challenge and related to the self as an essential step toward learning how to govern rather than be governed (Giroux, 2010). In this context, students learn how to expand their own sense of agency, recognising that to be voiceless is to be powerless. Central to this approach is the shift of emphasis from teachers to students, and making visible the relationships between knowledge, authority and power (Giroux, 2010).

Teachers must connect classroom knowledge to the experiences, histories, and resources that students bring with them but also link that knowledge to the goal of increasing their capacity to be critical agents, responsive to social problems of the time, and to recognise the importance of collective struggle. At its most ambitious, critical pedagogy helps students learn how to lead a meaningful life, hold power and authority accountable, and develop the skills, knowledge, and courage to challenge commonsense assumptions while all the while being willing to struggle for a more socially just world (Giroux, 2011). This kind of problem-posing education only works by breaking the contradiction of the "teacher-of-the-students" and the "students-of-the-teacher", and embracing the notion that education concerns "people who are attempting, together, to learn more than they now know." (Freire, 2005). Students are not passive listeners but rather, critical co-learners in dialogue with the teacher. To achieve this, they must be partners of the students in their relations with them (Freire, 2005).

Teaching is deeply personal and political work, through which pedagogues cannot and do not remain objective. Rather, pedagogy, is work to which we must bring our full selves, and work to which every learner must come with full agency (Stommel, 2014). The role of the problem-posing teacher is to create with students the conditions under which knowledge can be constructed by students (Freire, 2005). A classroom informed by critical pedagogy is a continuing, unfinished project aimed at helping students develop meaningful lives where they actively transform knowledge rather than simply consuming it (Giroux, 2011). An education in the practice of freedom consists of acts of cognition that lead to change in the world, and not merely transferrals of information. It is about developing independent thinkers who will not bend to the will of teachers (Laurillard).

Giving students the opportunity to be problem posers and engage in a culture of questioning in the classroom foregrounds the crucial issue of who controls the learning environment, and how specific modes of knowledge, identity and authority are constructed within particular sets of classroom relations. At the same time students also learn how to

engage others in critical dialogue and be held accountable for their views (Giroux, 2010). Schools must develop a commitment to civic courage and social responsibility that ignites bravery and moral courage in students to realise that they have the power and opportunity to challenge the status quo. Critical pedagogy is therefore a praxis that counteracts the dominant message that students receive during their schooling; that their voices and their lives are meaningful and powerful, and that by questioning the taken-for-granted assumptions that drive much of society - including higher education - they have the capacity to change the world.

bell hooks (1994) retains her optimism even in the face of all that is problematic in education, calling the classroom a place of possibility where - through a critical pedagogy - we labor for freedom, and demand of ourselves an openness of mind and heart, collectively imagining ways to move beyond boundaries. To transgress.

4. Teaching at the edges of chaos
"The truly creative changes and the big shifts occur right at the edge of chaos" (Robert Bilder).

It's interesting to note that progress sometimes means looking to the past to find ideas that we can use to better understand today. It's easy to convince ourselves that the world we find ourselves in was inevatible; that history progressed in a regular, stepwise fashion leading from one rational outcome to another. But, as Audrey Watters reminds us, corporate educational technology is not inevitible and that are alternatives to the data-extraction, control, surveillance, privatisation, and profiteering in the domain of educational technology. Technology includes ideas and practices, as well as myths and different models of reality. And like democracy, technology changes the relationships between us, forcing us to examine and redefine our notions of power and of accountability (Franklin, 1990). It is possible to see beyond the immediate confines of one's experiences and imagine a future that does not simply reproduce the present (Giroux, 2010). Or, as Watters has put it, we can disrupt the Silicon Valley narrative of disruption.

The LMS is the dominant paradigm for educational technology in higher education. The problem with a dominant design is that almost all innovation is aimed at improving it rather than exploring any competing alternatives, regardless of which design is actually a better fit for purpose. As we've seen in universities across the world, the LMS continues to improve incrementally in ways that do little to enhance students learning (Wilson et al., 2007). If we want to take advantage of the possibilities enabled by digital and online learning environments, we must begin by challenging the dominance of the the LMS. In order to graduate young professionals who are capable of adapting to dynamic and complex systems, we cannot afford to continue teaching learning in spaces defined by the rigid and unimaginative constraints of the LMS. Frenk et al., (2010) suggest three fundamental shifts

in health professions education that are necessary to bring about transformative learning experiences. We need to move from:

1. Fact memorisation to searching, analysis, and synthesis of information for decision making.
2. Seeking professional credentials to achieving core competencies for effective teamwork in health systems
3. Non-critical adoption of educational models to creative adaptation of global resources to address local priorities

In order to respond to this call, teachers must move away from a positivist definition of knowledge that informs how they teach as well as how they expect students to learn. Knowledge in twentieth-century thinking is described as static, stable and something that exists 'out there', apart from human beings. In this conception, teaching and learning take place through the controlled transmission from authorities into the minds of passive learners. In contrast, twenty-first-century thinking sees knowledge as dynamic, complex and uncertain, socially constructed as people try to make sense of the world through more symmetical relationships in networks of their peers (Gilbert, 2009).

Centralised, authoritarian and hierarchical structures are inefficient and non-resilient as they can't manage problems with unbounded data and are not able to react nimbly to changes in conditions. As a result we are experiencing a shift from vertical communication structures that privelidge hierarchies of control, to horizontal structures - like networks - that embody coordination, cooperation and collaboration (Bleakley, Bligh, Browne & Brice Browne. 2011). Successful networks rely on an engaged community, robust knowledge exchange, and self-governance, where collaboration is encouraged and facilitated, curators are enablers but not authorities, and the system is controlled by multiple iterations of social negotiation as via an evolutionary algorithm. The network is non-hierarchical, self-governed, distributed, maximally connected, multi-domain, semiotic and where the behavior and outputs can not be predicted by the characteristics of the nodes as they change when they communicate with each other (Cormier, 2008).

Building our personal learning networks is getting easier as billions of people connect to the Internet, exposing us to new ideas, information and opinions in a process that is often chaotic, unstructured, and random. This leads us to the kinds of serendipitous learning outcomes that are impossible to predict or plan for as they are the result of the influence of more interacting variables than is possible to track. In addition, learning networks help us think critically if they are are open, transparent, and diverse. In these evolving communities of practice that are composed of both strong and weak social ties, we find an ideal space for mixing learning and work while sharing advice and knowledge (Jarche, 2015).

The shape of a space affects how one can move, what one does and how one interacts with others. In the classroom, desks and chairs are set up in rows. There is a front and back to

the room. The teacher stands in the front. The students sit, facing the teacher. There is a power relationship that is set up by how we configure our bodies in space, and this default configuration determines how we teach. Is it because this configuration of physical space represents the optimal learning environment for our students or have we just accepted the default? In the same way, we have accepted the LMS as the default configuration of our online space, where teaching revolves around discrete containers of outcomes, content and assessments. Students move through the course – from one concept to another – until they get to the assessment at the end, which signals the end of the course. Courses as containers are formalised, standardised and ultimately, more about compliance and conformity than creativity, ingenuity, innovation, or mastery. Stommel has suggested that the best learning doesn't happen inside courses, but between them.

In an open and networked learning environment, the content of the course can be negotiated by participants in the context of their own life experiences, values and beliefs. This enables the course content to be built around the critical examination of concepts, hierarchies and assumptions that exist in the group. Just like the best stories aren't the ones that take you down a predictable and narrowly defined path, the best courses do not have neat and tidy resolutions. Outcomes and assessment can be designed collaboratively as part of a process, rather than being predetermined. The course is designed to outgrow itself because it is not limited to the template decided by the IT department, creating new spaces for community engagement that extend beyond the boundaries of the institution. And like stories can stay with you long after you finish the last page, so the thinking and reflections generated in the course should continue long after the final task is completed. A networked learning environment built on the open web means that students control their content, their data and the direction that their learning takes.

Institutions could assign web servers to all incoming students, who choose domain names that give their online spaces a personal identity. Over the course of their studies students would build out an online presence on the web itself, experimenting with wikis and blogs, creating a variety of resources in support of their learning. They would learn how to archive and preserve their data, transfer content and ideas between various other services, always having control of their learning and information connections. They would become system administrators for their own digital lives. This personal learning network would be modified and extended throughout their university career — and would move with them after they graduate (Campbell, 2009). Through this proces they would not only would acquire important technical skills but also would engage in work that provides rich teachable moments ranging from multimodal and collaborative writing to information science, knowledge management, and social networking. These students would be able to shape their own thinking, learning, expression, and reflection in a digital age, in a digital medium (Campbell, 2009). In order to provide students the guidance they need to reach these goals, teachers will need to lead by example — to demonstrate and discuss, as fellow learners, how they have created and connected their own personal learning networks (Campbell, 2009).

There are no single platforms that constitute a PLN and no set frameworks that describe how they work because they are unique to each individual. However, there are some design principles to take into account (Downes, 2009):

- Diversity: Does the network involve a wide spectrum of points of view? Is it possible for people who interpret an idea one way, interact with people who approach it from a different perspective?
- Autonomy: Are students able to build on their learning of their own accord, according to their own knowledge, values and decisions? Are they free to make their own choices in their learning?
- Interactivity: Is the knowledge produced a product of interaction between members, or is it a (mere) aggregation of the members' perspectives?
- Openness: Is there a mechanism that allows a given perspective to be entered into the system, to be heard and interacted with by others?

In terms of the practical features of the PLN, it should enable the following activities: The *aggregation* of personally meaningful information, resources and ideas in a variety of formats e.g. text, images, video, links, tags, etc., from a variety of sources. The student should then be able to *remix* those resources into different formats by reinterpreting, combining and editing them using their own personal insights. It should be possible to *repurpose* the resources so that the student can use them for a different objective than what they were created for. The student should be able to publish the newly created artifact in a *feed forward* mechanism that adds new ideas to the world. In a PLN students would have a central online space that they control and choose how to best to use it for their learning. They choose the tools they're most comfortable with to aggregate information and filter information pulled in from other services (e.g. Twitter, Pinterest, etc.), work with that information and then publish their new works from their own platform but also into any combination of third party services.

Platforms that dictate too strongly how we might use them, or ones that remove our agency by too covertly reducing us and our work to commodified data, should be rooted out by a critical digital pedagogy. We must "handle our technologies roughly" because either we critically interrogate our tools or are subject to them (Stommel,). If you have no power to change the defaults then you're accepting the choices that others have made about how you can teach. Which may be OK, as long as you know that they didn't make those choices based on what is best for learning. Teachers are not simply consumers or creators but rather consumer-creators. We are "tinkerers who neither invent the wheel, nor are satisfied with the wheels already at our disposal." (Shaffer, 2014). We use new data to refine existing models and theories, repurpose a tool from one discipline for use in another, supplement a poor textbook reading with a lecture or better examples, and revamp course materials as professors that we acquired from our colleagues (Shaffer, 2014). As teachers we manipulate, re-create, break, and rebuild. We take the best of what exists and make it better, and in this

sense we are hackers at our core. And as hackers we must look to the systems we're embedded in and ask how to make them better (Shaffer, 2014).

5. Conclusion

"We live in an age of almost infinite information and learning opportunity, and so the key here is that we have to inspire people to have a sense of wonder and curiosity. And if we do that, they have what is essentially the world's largest knowledge machine at their fingertips. If we fail at that, they have the world's largest distraction device." (Michael Wesch)

"Knowledge emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other." (Freire, 2005, 72). Everybody has the capacity to think, produce ideas, and be self-critical. This demands a new kind of literacy and critical understanding with respect to the emergence of new media and electronic technologies, and the new and powerful role they play as instruments of pedagogy (Giroux, 2011). By giving students the chance to explore, question and create as part of the curruculum, we not only prepare them with the technical and operational skills to engage in a digital, networked society, but demonstrate that knowledge is socially constructed and may be used to drive change in the world.

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