# Technology, technique, and culture in educational systems: breaking the iron triangle

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## Abstract

This paper presents arguments for a different way of thinking about how distance education should be designed. The paper begins by explaining education as a technological process, in which we are not just users of technologies for learning but coparticipants in their instantiation and design, implying that education is a fundamentally distributed technology. However, technological and physical constraints have led to processes (including pedagogies) and path dependencies in In-person education that have tended to massively over-emphasize the designated teacher as the primary controller of the process. This has resulted in the development of many counter technologies to address the problems this causes, from classrooms to grades to timetables, most of which have unnecessarily been inherited by distance education. By examining the different strengths and weaknesses of distance education, the paper suggests an alternative model of distance education that is more personal, more situated in communities and cultures, and more appropriate to the needs of learners and society.
Keywords: technology, culture, distance education, pedagogy, motivation, counter-technology.

## Introduction

What kind of system would we develop if we were to allow distance education to operate without the constraints it has inherited from in-person institutional learning? Before we can answer such a question it is necessary to understand what it *has* inherited, and why it did so. To help to explain that, this paper begins with a discussion of educational systems viewed as technologies, describing the broad structural features that are shared by all technologies and, especially, the kinds of technology that are distinctive to educational systems. Using this model, I explain how the technologies of education evolved in the first place, as an iterative process of problem solving and problem-creating through the invention of counter-technologies, and how distance education built upon those to emerge in the dominant forms it takes today. I will be arguing that many of the problems that the technologies of in-person education solve are not only irrelevant to distance education, but that their solutions may be positively antagonistic to distance learning. The paper concludes with a discussion of what a native approach to distance education might, in broad terms, look like.

## Education as a technological process

In the following subsections I will argue that the practice of education is fundamentally technological, mediated by and through technologies, including language, procedures, methods, techniques, and countless tools, encompassing those that are physical, organizational, virtual, digital, and conceptual. Distance education always involves the use of tools that are easily recognized as technologies, but all teachers use them, whether they be desks, classrooms, timetables, or learning management systems (LMSs). Pedagogies – by which I mean repeatable methods, models, or principles of teaching – are as much technologies as pencils, writing, transistors, and institutional regulations. Educational systems themselves may be seen as technologies, with a primary purpose of teaching, along with many other roles, from credentialing to maintaining social stability. Not *everything* about education is technological, by any means – there is, in particular, much that is social, concerned with helping the learner to form values and identity – but the ways in which it is implemented are, almost entirely, at least mediated through technologies. But what are technologies?

## Defining technologies

Alan Kay once quipped that 'technology is anything invented after you were born' (Brand, 2000). This perception of technology as 'other' is reinforced because, to a greater extent than ever before, the inner workings of many modern technologies are black-boxed and invisible to us. In recent years, it has therefore become more common to distinguish between 'technology' – which includes language (McLuhan, 1994, p.80), prayer (Franklin, 1999), and dance (Kelly, 2010) as well as more obvious examples – and 'tech', a less inclusive term that mainly refers to digital or digitally enhanced technologies, and others that are complex, reliant on scientific phenomena, opaque in their operation to most users, and new. The distinction is helpful because there are some generalizable differences between such technologies and most of their predecessors, but there are risks that we may therefore fail to see the common patterns that bind all technologies, and to arbitrarily over-emphasize the importance of some parts more than others. This is, as I hope to show, a dangerous distortion. Such technologies' complexity and opacity are also not unique. There are many much older technologies, from legal systems to management systems, that share these features but that we do not call 'tech'.

'Technology' is often difficult to define because it can be both a verb and a noun (Kelly, 2010). In other words, it can be both something we do and something that has been done, an action and/or a phenomenon. For instance, right now, I am writing, using the technology of writing, to create some writing. These are all technologies, and there are many other technologies that also play a role in all of them. I am using a computer, a screen, a desk, a chair, rules of grammar, techniques of rhetoric, an alphabet, and plenty (perhaps thousands) other technologies to write this .

Brian Arthur (Arthur, 2009) usefully defines technologies as the orchestration of phenomena to some purpose. This definition neatly encapsulates the fact that technologies involve some kind of active organization of stuff - matter, thought, or process – to do stuff. It also usefully resolves the action vs phenomenon dilemma because, whether the orchestration is embedded and the

technology exists independently of us, or whether it is something we do, or any mixture of the two, it is still an orchestration of phenomena for a purpose.

The definition is particularly valuable because of Arthur's insight that technologies are created and evolve through a process of assembly. Thus, many of the phenomena that may be orchestrated to some purpose in any given technology may be and usually are supplied by other technologies, from nuts, bolts, and wheels through to words, rules of grammar, and syntax, each of which orchestrates different phenomena of its own. Technologies are almost always combinations of other technologies, and often combinations of combinations. Even the humble pencil is the result of an unknowably vast range of technologies, from materials science to distribution systems (Read, 1958).

## Participation and technologies

Though concise, rich, and accurate, Arthur's definition assumes that we are just *users* of technologies, putting them to some use, or designers inventing them for some purpose. However, we are not just users of technologies: we are participants in them. Our participation can range from the trivial – pressing an on/off switch, say – to inventing and/or enacting the entire assembly without mechanical aid, such as when we dance, or give a speech. As educators, every time we plan or give a lesson, or write something on a whiteboard, we *create* part of the technology, combining other technologies in an assembly that is, almost always, unique.

When we have no choice as to how we should participate in order for the technology to work – for example, when winding a watch or correctly filling in a form – then the technology can be described as *hard*, in the sense of being rigid and inflexible. Hard technologies are often embodied in machines, because machines (including computer software) tend to be much better, more consistent, and often faster than humans in performing repeatable actions. However, many quite hard technologies – from legal systems to production lines - demand that humans act like cogs, playing their parts correctly.

When we must perform some orchestration of our own in order for the technology to work at all – for example, when using a paintbrush or programming a computer – then the technology can be described as *soft*, in the sense of being malleable. It may have some general purpose, but the purpose is to enable humans to create *further* technological processes and artefacts. Softness is not so much a characteristic of a process or tool as an absence. It is an unprestatable gap that must be filled in order for the technology to operate. Sometimes the gap is innate to the technology: a pencil, say, can do little of any value *without* a human adding processes and techniques to make it draw, write, mark a surface, or hold hair in place. Sometimes it is a latent possibility in something that already orchestrates phenomena for some other purpose: for instance, an electric fan may be designed to keep a room cool but, in assembly with other phenomena and processes, may be used to dry hair, power a toy sailboat, and so on.

Very few technologies are completely soft or hard. Most are assemblies of softer or harder technologies and so lie on a continuum between completely invariable and completely unconstrained.

There are other definitions of 'soft' and 'hard' applied to technologies with which these definitions should not be confused, such as when used to distinguish between human-enacted and physical technologies (e.g. (Hlupic, Pouloudi, & Rzevski, 2002; Bessant & Francis, 2005)) or to discriminate between technologies that are – as Boyd (1996) puts it - dominative rather than liberative (e.g. (Norman, 1993)) or that are more or less supportive of human values (e.g. (Baldwin & Brand, 1978)). The definition I provide here is both more intuitive – hard things are rigid, soft things are not – and, I hope to demonstrate, more useful because it describes the technologies themselves, not their uses, nor a contingent feature of their construction, and it allows generalized explanations and predictions of their behaviours, some of which do coincide with the concerns of earlier uses of the distinction.

### Techniques and methods

Few technologies are completely hard. Handwriting, for instance, is hard to the extent that letters must be recognizable to others. However, no one's handwriting is exactly like anyone else's: we each have our own *technique*. I use the word 'technique' here to mean what humans idiosyncratically add to a method that is not prescribed by that method. By 'method' I mean the set of processes that can be replicated and precisely explained or demonstrated to others. Technique – as I use the term here - is, at least in part, what makes each musician's rendition of a piece distinct, or your application of the same pedagogy different from mine. Any technique *could* be precisely duplicated as a method, at least in its outputs, but techniques are not just small versions of methods: they reflect who we are. A method of teaching ( a pedagogy), for example, might be as broad as 'start simple then work up to more complex topics'. This method leaves much to the teacher's own skill and imagination, which might include other hard repeatable methods and sub-methods that the teacher assembles, but that normally must include aspects that are unlikely to ever occur in the same way ever again. Others, such as scripted lesson plans, may be far more precise but almost always allow at least some personal interpretation. Techniques are fundamentally soft. They are ways of doing things rather than precise formulae to repeat them, and they emerge from the unique people and experiences that led up to them. The result is that, on the whole, though hard methods may repeat fairly consistently, and though it is often possible to impersonate someone else's technique, no one's technique is exactly the same as anyone else's for any soft activity. On the whole, technique improves with practice, and can usually continue to improve indefinitely, even when we are already experts.

## A systems view of education as technology

## Perspectives and boundaries

Whether a technology is soft or hard depends a lot on your point of view. A quiz system, say, may be very soft and malleable to the person setting a quiz, but very hard and inflexible to one required to take it. What may appear to be a single technology may in fact be (or, more accurately, may be part of) many different technologies, orchestrating different phenomena for different purposes depending on context. This frequently leads to misunderstandings and error. For example, it is common for researchers to investigate the effects of computers or whiteboards on learning as though they were a single technology when, in fact, what is most interesting about them is that they may be or may become (in assembly) a virtually infinite number of technologies, and it is these technologies that matter far more than the tools themselves. It is a mistake to generalize about the technologies of learning: though the components do matter, it is only in the assembly, in their relationships to one another and the ways they are orchestrated, that the technology of interest emerges.

The same is true for pedagogies. It seems reasonable to suggest that the use of good pedagogies is a necessary condition for effective teaching but there are limitless ways they may be combined with other technologies, or performed with poor technique, that would render them useless. Equally, poor pedagogies may be saved by an excellent teacher using them with compassion and skillful technique, filling their gaps with methods that save them. Perhaps most significantly, it is easy to assume that teaching is just what is done by a person we identify as a teacher but, in fact, the one we label as 'teacher' (from now on, the *designated* teacher) may not be the most important part of the assembly that teaches, and is never the only pedagogical agent. In the broader technology of an educational system, all of its stakeholders – most especially the learners themselves - are coparticipants, bringing different purposes, different orchestrations, different assemblies, and multiple pedagogies to be parts of a very much larger mechanism that no one person controls, in which any or every part of it may make a significant difference to eventual learning outcomes. Teaching is a fundamentally distributed technology, and it is the whole that matters, not any single one of the parts.

## The distributed teacher

Because they are the ones that are actually learning, the most important teachers in any learning context are always the learners themselves, who perform the final orchestration and assembly, using what they know and how they have learned to know to construct meaning. If the learners do not do this, no learning happens at all, no matter how excellent the rest of the pedagogical process may be.

Even if not explicitly used in the designated teacher's pedagogical design, other learners may model behaviours, share ideas, argue, offer critique, curate resources, and so on, in or out of a classroom, any or all of which may be important teaching roles.

Educational institutions and organizations have regulations and norms that almost always play a highly significant role in the teaching process: for instance, in determining when, where, and

for how long teaching occurs, in setting expectations for behaviour (and, too often, punishments for misbehaviour), in establishing curricula and assessment processes, and so on. These embedded pedagogical processes may be at least as significant as anything the designated teacher provides. If, for example, the institution demands that a teacher provides a grade at the end of a course, it becomes a significant extrinsic driver that may easily overwhelm any intrinsic motivation in students (Kohn, 1999; Ryan & Deci, 2017).

Many others in an educational institution may play one or more teaching roles that significantly affect learning outcomes, from moral support to organization of resources to direct assistance, including librarians, lab technicians, administrative personnel, computing support staff, instructional designers, career counsellors, and so on.

Textbook or article authors, illustrators, editors, designers, and so on are teachers too. The pedagogies of textbooks may dominate the time spent learning, and may often be more significant teachers than the designated teacher who uses them. Similarly, libraries teach both in what they contain and in how what they contain is organized, and librarians may often provide the help students need to overcome learning obstacles.

Cyberspace can easily add tens, hundreds, or even millions more teachers to the process. Sometimes they may number in hundreds of millions or more: for instance, the creators of hyperlinks and followers of them who contribute (mostly unwittingly) to search results in popular search engines play an important collective recommendation role (Dron & Anderson, 2014). Often, such contributors will be sought out and curated by learners themselves, beyond the view of the designated teacher.

Beyond these direct contributors, there are also countless teachers who, in the past, have contributed to teaching students how to learn, and who have affected the ways in which they now orchestrate phenomena in order to do so, each of whom will have provided, reinforced, or otherwise helped to shape parts of a process used by the learners when assembling their own learning. Prior learning, including the ways it was accomplished, becomes part of the assembly of future learning. Many teachers have similarly taught the other teachers who more directly make up the assembly, iterating back for countless generations.

Moreover, learning itself is seldom if ever performed by an individual mind. Our very cognition is distributed through our bodies (Clark, 2008), the objects with which we interact (Gibson, 1977; Clark, 2008), the people around us (Pea, 1993; Sutton, Harris, Keil, & Barnier, 2010), and our entire constructed environment (Norman, 1993). ‘Knowing’ something is often just knowing enough to be able to discover and use what or who can help, or how to operate the device that negates the need for knowing.

In brief, the processes of learning and teaching are, inherently, a distributed and creative activity. No single person or organization owns or controls this process, and very many people contribute to the methods and structures of which the gestalt consists. What and how a designated teacher teaches is only ever a part of the teaching that occurs when learners learn.

This is why bad teaching can often lead to (but very much not cause) good learning, and why more or less every method of teaching works (Hattie, 2013). Sometimes good learning happens in the total absence of a designated teacher, because there are so many other teachers who can orchestrate the necessary phenomena. There is no such thing as a true autodidact because we are always surrounded by teachers but, by exactly the same token, there can be no such thing as a fully dependent learner. We are always taught by many teachers: only the proportions of their contributions vary. We are coparticipants in educational machines. Teaching is always an act of learning, learning is always an act of teaching.

### Structural enablement

Though the process of education is highly distributed, some exert more control than others. As in all complex systems, the large and slower moving parts tend to be far more influential on its overall behaviour than the small and fast moving (O'Neill, R.V., DeAngelis, D.L, Waide, & Allen, 1986). Mountains, say, are more influential than trees, that are more influential than ants, whose guts may constitute the entire ecosystem for the bacteria inside them. Path dependencies are also critical. What comes before both constrains and opens up affordances for what follows, so what we can do is strongly influenced (but seldom fully entailed) by what we have done. What follows is *enabled* (or constrained) by what precedes it (Kauffman, 2019). The general pattern underlying both path dependencies and the hierarchical structure of systems is that the less flexible – things that can change more slowly, if at all - affect the more flexible more than vice versa. Hard technologies – whether embedded in machines or enacted by humans as rules, fixed procedures, or norms – are therefore always more significant structural technologies than soft technologies. Because pedagogies are soft technologies, this means that pedagogies – at least those of the person playing a designated teacher role - can never come first.

The relatively lowly role of pedagogies speaks to a further peculiarity of education, that designated teachers are normally seen as being in charge. However, the designated teacher is not as structurally significant as the rules, norms, tools, and structures into which the teacher must fit their actions. Within educational institutions, designated teachers do have positions of significant power, but it is as a result of the technologies in which they participate, in which their roles are highly circumscribed. Though individuals may have much personal flexibility to teach in many ways, it is always within the bounds of the system that gives them that role. They are not just shapers of the process but, more profoundly, are components of it.

## In-person education: technological constraints and pedagogical counter-technologies

### Pedagogical constraints in in-person education

The fact that the designated teacher is generally perceived to be in charge is in part because they *do* traditionally play a large directive role in guiding student learning, albeit limited to specific times of the day or week. One of the main reasons that they have this role is a result of

a network of counter-technologies (Dubos, 1969) that were developed primarily to deal with the effects of one fairly basic invention that became embedded and emblematic early on: the lecture.

There has always been a need for the transmission of the knowledge from those with skills and experience to those without. It is what makes us smart, both individually and as a species. Over countless millennia much of this was possible through imitation, or through an apprenticeship model that allowed a gradual increase in participation of the young. Such methods are still a large part of how we learn everything from language to social values. They play a significant role in communities of practice (Wenger, 1998), and in the broader networks that infiltrate our lives (Wenger, Trayner, & de Laat, 2011). However, as societies became more complex, and knowledge became more distributed, such mechanisms were less able to cater for the exponential increase in hard skills and knowledge required simply to participate in them (Dewey, 1916). Technologies became more complex and, especially in historical times before substantial automation emerged, demanded that we should develop many hard skills to use them, from reading and writing, to farming, to the correct operation of the technologies of prayer.

Historically, when there was a need to pass on knowledge held by a few to the many, with the exception of artworks, public inscriptions, and so on, this was mostly only possible in person. Beyond a few public inscriptions, writing was too expensive to share widely in any other way, and the skills needed to operate the technologies of reading and writing were (and remain) complex, difficult to acquire, and were shared very unevenly among the population. The technology of the lecture overcame some of the problems of cost and scalability while still enabling adequate information transmission.

The lecture created its own problems, such as getting people in one place at one time, allowing the lecturer to be heard by all, and presenting it in an effectively digestible form, not to mention doing so at a large enough scale to keep it economically viable. To address such problems, counter-technologies like classrooms, lecterns, rules of classroom behaviour, schedules, courses, semesters, and timetables were invented. As a side-effect, lecturers (and, to an increasing extent, the institutions that employed them) became dominant actors in the process, simply to make the technologies work. A designated teacher in a classroom – especially when using the technologies of lecturing – must normally, by default, control every second of the event, otherwise there would be chaos or, at the very least, a reduction in efficiency. Designated teachers must fill their allotted time, which has (historically) led to some weak pedagogical choices such as lecturing continuously for an hour when student time might be much better spent on other activities. Even when they relinquish control, it is and must be always theirs to reclaim at any moment.

This model of teaching was established millennia before the widespread availability of viable alternatives such as printed books or the Internet and, when such technologies *did* become available, especially given the fact that they were initially very expensive, rare, and difficult to access, they were incorporated into the existing assembly rather than overturning it. This

pattern of assembly is, as we have seen, the way that all technologies evolve, building upon, incorporating, but seldom fully replacing what came before (Arthur, 2009; Kelly, 2010).

## Pedagogical counter-technologies in in-person education

### *Intrinsic motivation: autonomy, needs for competence and social relatedness*

Two critical problems have beset traditional in-person teaching since its inception, both of which occur as a direct result of the classroom model built around lecturing. Firstly, it results in students who do not (always) want to be there. Secondly, it results in students doing things that they may sometimes find boring and sometimes too difficult.

Self-determination theorists and others have conclusively proven that intrinsic motivation cannot emerge unless a person feels that they are behaving autonomously (Ryan & Deci, 2017). Teacher and institutional control is antagonistic to this requirement. To make things worse, when the teacher is controlling the pace and content of teaching, it is only natural to target their teaching at the average student or, at least, the largest number. Students are therefore sometimes too confused (they are not yet ready to learn whatever the teacher is teaching), and sometimes too bored. This is often because they know it already: indeed, it is not uncommon for half of what is ostensively taught in classes to be already known (Nuthall, 2005). Again, self-determination theorists demonstrate that, unless needs for competence and achievement of challenge are met, intrinsic motivation cannot occur (Ryan & Deci, 2017).

The art of good teaching in-person *must* therefore, to a large extent, incorporate a response to these two problems. Good teachers find ways to enthuse students, to help them find motivation in themselves and those around them. They can make use of the third pillar of intrinsic motivation, social relatedness (ibid), which is inherently supported by in-person contexts. Teachers can capitalize on this by helping to build supportive learning communities, and by showing that they care. They can support autonomy by helping students to find relevance in what they are being taught, with pedagogies designed to support diversity and autonomy. Good teachers make learning personal, supporting those that need more help, finding ways to allow different paths for those who are already competent, perhaps by building processes that encourage them to help those in need, perhaps by the use of problem-based and similar approaches that allow them to explore and extend the boundaries and goals. Good teachers find ways to support and nurture intrinsic motivation or, at least, higher levels of internal regulation that give students more ownership of the learning process. They need to invent such counter technologies because intrinsic motivation is, by default, diminished by the classroom context. It is tempting to speculate that many of those who are not so much affected might go on to become teachers themselves.

*Extrinsic motivation: rewards and punishments*

When such methods fail, or when designated teachers lack the sufficient time, skill, or compassion needed to make them work, there is an alternative way to motivate students: rewards and punishments. This works quite reliably, to the extent that students can usually be made to comply, and to achieve whatever goals teachers have set (if only for the duration of the course), but the costs can be extremely high. Often, students are as likely to remember what they have been taught once the need to pass a test has been met about as readily as we remember our hotel room numbers when we are no longer staying there, because the purpose has been transferred from learning to the credential. Worse, it often leaves reluctant, less able, or more able students with bad feelings about the subject, because it is associated with feelings of disempowerment, confusion, or boredom. Worse, it teaches students a more general lesson that learning, a naturally motivating activity, is something that needs to be done under duress. By making the reward the focus, it also encourages students to behave instrumentally and to take whatever effective means they can to achieve it. At best, this can lead to students doing what is needed and no more, or conforming with requirements when they would otherwise be inspired to explore beyond them (Kohn, 1999). At worst, it is a significant cause of cheating, which is a rational response when teachers (including the institutions that surround them) make the grade the primary purpose of learning. Such coercive methods are only needed because of the innate problems caused by in-person classroom teaching. Coercive methods are much less commonly needed, say, when working in small tutorial groups or with one-to-one tutors, because tutors can far more easily adapt their teaching to fit student needs, finding ways to at least enable students to find reasons within themselves to learn, to self-regulate their motivation, to show a level of caring that would make cheating a betrayal of a close and trusting relationship, and so on.  It is the hard technologies of instruction that use rewards or punishments to achieve their ends that cause the greatest harm.

Whether through pedagogies adapted to support intrinsic or higher forms of extrinsic motivation (those that are self-imposed and that reflect beliefs about themselves and aspirations that the learner considers valuable), or through the use of externally imposed rewards and punishments or lower forms of self-imposed extrinsic motivation (such as when we do things out of fear of consequences or guilt), the teaching methods that have been developed for in-person contexts are, to a very large extent, counter-technologies that are designed to address weaknesses inherent in the designs of educational systems themselves. Some may make sense in any learning context, but many – especially those that are punitive or that use extrinsic rewards - do not.

## Distance education: its strengths and weaknesses

### Distance education as an evolutionary offshoot of in-person education

Distance education tends to follow patterns set by in-person teaching at least in large part because it has mainly evolved from and within this existing context. Distance institutions must also normally continue to fit with norms and regulations set by the broader educational context, to maintain parity with in-person education. For instance, the length of a traditional course is determined not by pedagogy but, historically, as a counter technology to deal with European religious holidays and (perhaps) harvest times. Distance learning does not have such innate constraints. However, even when a distance institution offers a self-paced path to learning, the amount, structure, and form of assessment is almost always strongly determined by the need to schedule in-person classes

Though having many constraints of its own, distance teaching does not suffer the *same* constraints as in-person teaching. In fact, its native structure is the motivational inverse of in-person teaching. Firstly, distant learners naturally have more autonomy because they do not learn in a classroom under the control of a teacher. Even synchronous technologies like webinars or chat exist *within* a learner's environment, rather than *forming* it. Secondly, distance learners normally have better support for competence needs, because they can more easily control the pace, revisit things that are complex, and more easily seek alternative ways to learn. Even synchronous distance learners can often revisit recordings. Unlike recordings of classroom lectures, these show the entire event more or less as experienced by those co-present, not just a small vignette recorded by a camera. However, distance learning's support for relatedness tends, without the deliberate adoption of counter technologies to deal with the problem, to be much weaker. There are some gains– for instance, the ability to sustain backchat without rudeness in synchronous classes, and the benefits of the time taken to reflect in asynchronous threads - but there is seldom any tacit communication or incidental discussion, even when hard processes and tools have been designed to make it happen. The fact that all communication tends to be deliberate and instrumental, focusing narrowly on tasks and purposes mean that, though some things may be better articulated, it is much more difficult for teachers (including other students) to know much more than what learners intentionally reveal.

Despite these fundamental differences, the pedagogies of formal distance education normally closely resemble those of in-person education. Often, distance educators tend to double down on the use of extrinsic motivation to drive students to work as they demand, and it is common for distance learning materials to be far harder in design, more rigidly teaching to learning outcomes, more comprehensive in their coverage, and more structured in their approach, simply because the potential of in-person designated teachers to adjust and adapt to learners' needs in real time is not so easily available. Notice, though, the implicit (and, as we have seen, erroneous) assumption that the designated teacher is the only teacher that this reveals. What was a *by-product* of the technologies used to teach in-person has become a hard foundation of teaching online.

The power of a designated online teacher may, at first glance, seem potentially greater than that for a designated teacher in a classroom, inasmuch as they can in principle control at least part of the 'physics' and form of the virtual space, for example by embedding hard rules in the

machinery at will through adaptive systems and so on, by controlling access, or monitoring/controlling progress automatically. However, rather than being the context for learning that the classroom provides, the online learning system is simply *part* of the learner's own environment. It is not and, without extraordinary measures, cannot be so tightly controlled by the designated teacher. To achieve similar levels of control it therefore demands more hardening and the use of technologies that regulate to a greater extent. Online teachers most often accomplish this through reward and punishment, primarily through grading. It is not just the designated teachers that impose this on their students, however. In the first place, they are part of a system that expects and, often, requires it. In the second place students, too, have often come to expect it, having learned already throughout their schooling that learning should be accomplished under duress. They may actively resent it when teachers fail to give them grades and only give them useful feedback, for instance, or expect them to independently discover knowledge rather than just giving it to them. Such beliefs are among the phenomena that must be orchestrated – typically through counter technologies like explanations and discussions of the reasons for it - if a distance teacher wishes to avoid taking away the autonomy of their students. The more we attempt to make online learning resemble in-person teaching, the more counter technologies are needed to bend it into shape.

## Separating learning from life

Perhaps even more pervasive than teachers' need for control is the assumption that education should be separated from everyday life. For in-person teaching this is the default because, in institutions, there are few alternatives, notwithstanding that other educational methods such as apprenticeship, work placements, and internships have a long and effective history both within and beyond formal education. Learning that is divorced from the contexts, the society, and the cultures in which it may in future be applied has long been seen as problematic. It is too often irrelevant to students (Dewey, 1897) as well as to those hoping to benefit from their learning, such as future employers, their own social networks, and society at large. While there can sometimes be benefits from exploring complex skills in a safe and isolated environment, or from simplifying a context to make it easier to learn, as well as benefits to be had from retreating from the world to contemplate and reflect, it is normally positively counter-productive to do so across the entire learning experience. Education is a complex activity, a process of meaning-making and identity-forming in a social context and, if that social context is not authentic then there will be much more learning needed when it comes to be applied, whether in social communities or the workplace.

As well as limiting the value and effectiveness of learning itself, separating learning from its context has a number of knock-on effects that reinforce the harm. It is common, for instance, for teachers who have made a career of teaching to lose touch with the contexts of application to which it might apply outside academia. Teaching itself is a very time consuming job, with its own cultures and practices that can easily overpower those in which the teacher may have less investment. An area of study then too easily then becomes a self-contained subject or field that is of intrinsic interest to scholars and to some students, but is perhaps not so much to many who are forced or cajoled into learning within that context.

Learning is always at the very least partly concerned with negotiation of meaning and identity-forming within a community (Wenger, 1998) – the development of culture - so, if that community is too far removed from those in which the hard skills that underpin it will be applied outside the ivory tower of education, it may be inadequate, inappropriate, or ineffective in these other contexts. For this reason, academia is most effective as a means of teaching people to be academics. Career academics, who (almost by definition) have thrived within the system and who spend much of their lives surrounded by people who have thrived within the system may be poorly suited to teach students who are not so well adapted to or interested in its particular cultures.

## Reducing cultural distance

As Moore (Moore, 1997) showed long ago, distance need not and should not be seen as simply a physical phenomenon. For Moore, distance is better seen as the psychological and communications gulf between learner and teacher, measured in the relative degree of structure and dialogue of the pedagogical process. There are other kinds of distance, though, and it is possible that cultural distance might matter at least as much. Cultural distance can be seen as a measure of the degree of difference between the social and technological context of application and the social and technological context of learning, and may spread over many dimensions, from easy-to-identify tool or vocabulary mismatches to differences in ethical and aesthetic values.

Distance learning, especially when mediated online, has the capacity to bridge this cultural gap, if only we let it, because it occurs within a student's own cultural context. If the learning is appropriate to a learner's needs, then learning in the place that it is applied can become relevant, fulfilling personal needs and interests at the point at which it is useful. Learners can be more in control, doing work that is meaningful and useful to them. There are other benefits, too. Since Otto Peters defined his industrialized model of distance education (Peters, 1994), the benefits of distributed teaching have long been recognized, but seldom taken further than in team-driven approaches to course material design, and distributed tutoring or call-centre models of delivery. If we can better recognize the innately distributed nature of the teaching process then the technologies we create and use, and the communities of people with whom we participate can play a stronger and more intentional role in learners' education, and our own roles can become more like guides and co-travellers on the learning journey. In order for this to work, it is critical that teachers must be aware of and to learn about the students' own contexts, including the other teachers from whom they are learning. Lacking the direct observation and close interaction that is possible (though too rarely exploited) in the classroom, it is necessary to design pedagogical processes that support interaction, that expose the values, beliefs, and, above all, the other pedagogical processes that are contributing to the students' learning. Reflective learning diaries can play a large role in this, as can meetings, especially when structured to intentionally cause learning, such as through action learning sets (Revans, 1982) or similar tools. If assignments are given then they should be designed to reveal not just the end-result of learning but also the processes through which it is achieved.

The guiding principle should be to reveal how learners are learning – as Hattie (2013) puts it, to make learning visible – and to adapt teaching to suit learning needs. In many institutions there are already mechanisms and processes that support learning within a different cultural context, from work placements and sandwich programs to fully integrated programs such as those operated by the UK's Knowledge Transfer Partnerships, in which learners are placed within companies, co-supervised by academic and industry partners, and often assessed using an individualized set of outcomes and competences that are customized to the context, almost always requiring academic staff to become familiar with the organizations that support them.

Many of the benefits of context-aware teaching can, however, be achieved through pedagogical design, even in conventional courses. Rather than providing a set of structured learning materials and assessments that prove they have been learned, learning activities can be grounded in students' own experiences and contexts, using problems that can be applied in the workplace or drawn from their everyday lives. Using evidence-based approaches to assessment such as portfolios, rather than explicit quizzes or structured teacher-created assignments, can allow for flexibility in ways of learning that better accommodate integration with daily lives. There are many models of workplace learning, such as communities of practice (Wenger, 1998) or action learning sets that can be adapted to support flexible, contextually situated learning.

## From iron triangle to flexible lattice

The disadvantage of more contextually situated methods, when viewed from the perspective of traditional educational systems, is that they tend to be very resource-intensive and/or they rely on students who are already mature and skillful learners. It is normally expensive for traditional institutions to support in-situ learning because every learner must be doing something different from every other, so no standard curriculum will suit all needs unless it is extremely broad and open, in which case it is very soft and therefore demands of creative and original teaching. This trade-off is what results in what Daniel et al. (2009) calls the 'iron triangle' of education of access, cost, and quality. As long as education is seen as something done by teachers to students, increasing access invariably increases cost and/or reduces quality, increasing quality increases cost and/or reduces access, and so on. However, when education is viewed as a distributed technology, consisting of vast numbers of technologies enacted by vast numbers of co-participants, the triangle may, in principle, be broken or, rather, re-envisioned as a flexible lattice consisting of the many interacting agents who contribute to teaching, in which the costs are not concentrated in a small subset of designated teachers and learning designers, but spread throughout the network of distributed teachers.

Given that so many problems are caused by the power relationships inherent in in-person teaching, perhaps the most obvious solution to distributing the teaching load is to invert the usual control structures of educational systems. Rather than controlling the process, institutions may be seen as providers of services to support the learners' control of their own learning, offering teaching, facilities, just-in-time learning activities, and resources on demand as needed. This approach pays explicit attention to the nature of technologies as assemblies,

effectively providing a construction kit from which multiple diverse learning experiences can be assembled, transferring much of the management of the overall process from the institution to the learner, offering small, well designed chunks that can be orchestrated in different ways and for different purposes.

Without resource-intensive ongoing and continual interaction, though, one of the primary difficulties with doing this is that, by definition, learners are likely to be ignorant of at least some aspects of what needs to be learned and, even if they do know what to learn, they may not know how best to learn it. Often, being in control means delegating some parts of the process to someone else (Dron, 2007). It is also quite difficult to learn disciplines of thought and action without at least some direct and sustained guidance, especially when immediate needs rely on a larger framework of ideas and skills. We must acquire hard skills and knowledge needed to act proficiently as well as develop habits of thought and values that bring mastery, in whatever field of interest or work matters to us. Moreover, though independence and autonomy are critical values, they must be counterbalanced by the social value of education as a means of establishing shared values, common understandings, cultural continuity and cultural growth. At least part of the role of educational systems is not just to support societies but to help build and maintain them. There must be a balance between needs of the individual and needs of society. Traditional educational motifs like courses, programs, and institutions can and do provide this, so some may continue to be useful. If they are offered, however, it is possible to design them in ways that, at the same time, allow more freedom to learners, for instance through evidence-based assessment rather than objectives-driven assignments. They may (with careful design) provide a social context in which to learn and reinforce values with, through, and for others. This can be very valuable, especially when learning hard skills that are easily transferred to multiple contexts.

Courses and programs are prebuilt assemblies that are, essentially, black-boxed. They are thus hard and inflexible. One way to deal with this would be to treat such courses as malleable templates that could be used as-is, or could be disassembled and reassembled into different configurations according to needs, by the learner in partnership with designated teachers, employers, support groups, and others involved in the teaching process.

The context of a traditional institution is often culturally distant from its context of application, can be very difficult to customize to individual cultures, and emphasizes teacher control with all its aforementioned consequences. This may be sufficient for the learning of hard skills and knowledge that can be applied in different cultures, but it is much more difficult to support the development of soft skills that are required to assemble those hard skills and knowledge, without imposing the cultures of institutional education. Too much of a focus on hard skills ignores the reasons that those hard skills matter in the first place. In order to adapt education to learner and societal needs, it is therefore necessary that, rather than forcing students to be part of the culture of educational institutions, separated from the world in which they live, designated teachers should either become part of the culture of students' contexts or find ways to be far more aware of them so that they can be integrated into the learning experience. It would be most useful for designated teachers to work in partnership with organizations,

families, community groups, and so on, in order that the soft skills that are of paramount importance are developed in authentic situations. If not, then it is necessary that they are aware of the contributions those communities are or could be making to the student's learning experience.

## Conclusions

Viewing education as a fundamentally technological process allows us to more clearly see its deeply distributed nature, and to better understand the ways that the technologies we use – including pedagogies - are profoundly interconnected and co-dependent. Moreover, the assemblies we create with them are invented anew each time we coparticipate in them. Education as a technology is thus profoundly soft, even though it is assembled from much that is hard, so it adapts to its surrounding environments and cultures, as well as (on a broader timescale) affecting how they evolve.

The nature of technological evolution means that it was at first natural and, to an extent, necessary to mimic in-person educational technologies in a distance context, especially as distance education must at least acknowledge structures of assessment built for in-person learning. However, simply simulating in-person education will almost inevitably fail to match up to the original, because the problems distance learning solves are not all the same. Meanwhile, simulation replicates the compromises and weaknesses that had to be made in in-person learning's design.

The benefits of distance learning can and should go far beyond freedom of time, place, and pace that currently drive its adoption. If we intentionally design it to do so, distance education can bridge cultural distance, can empower learners, and can enrich communities of place because learning is shared with those around them. It allows learners both to apply their learning where they live and work, and to use their local communities as support for and the context of their learning. It does not need to replace in-person learning so much as to shift the in-person elements to weave in with the social and working lives of learners wherever they may be. Far more than in-person learning, distance learning can make use of the countless teachers that surround all of us, filling gaps and adapting to context, rather than defining an entire environment. This is a shift in emphasis not just from the institution to the individual learner, but from institutional culture to the cultures in which learning is applied.

This small shift in emphasis may have profound consequences to education, to individuals, and to society. For the learner, education may become part of life rather than something that is separated from it. For educators, the walls that separate disciplines, and that separate the institution from the society it serves, can break down, opening up vistas of opportunity to learn from and with others, to understand better how knowledge is applied, and to be more sensitive to the different outcomes and support that every learner needs. For the economy, productive work can occur while learning happens, the skills and knowledge of professors can directly

benefit the workforce, and the vast costs of moving people to expensive places of learning can be reduced. For society as a whole, learners can to a greater extent remain in their communities and share their learning with those around them. Furthermore, it greatly reduces the need to take large amounts of time out, and education can be spread more evenly across lifetimes, as and when it is needed.

Like all technologies, such a shift involves Faustian Bargains (Postman, 2011), because all technologies have unwanted and often harmful side-effects. It is for this reason that counter-technologies of the sort we have seen to shape our educational systems were developed, and there is no doubt that many would emerge were we to see this change in educational systems, the consequences of which could easily be worse than those they replace. Educational systems are complex systems, operating in still more complex systems around them. However, the benefits,, especially in a world that is learning to adapt to post-pandemic ways of living, make a compelling case for change.

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