



A Dialogic Theory of Educational Technology

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Education draws students into participation in ongoing cultural dialogues. These dialogues are mediated by communications technology in various forms from words, through books, to the internet and increasingly AI language assistants. Technology is therefore at the heart of education. However, the distinctive role and impact of technology has not always been reflected in theories of education. In this chapter, we put forward a dialogic theory of educational technology intended to serve as a foundation for design. The kind of designs this theory grounds are combined pedagogical and technical designs to facilitate the dynamic interweaving of educational dialogues at different spatio-temporal scales, linking short-term face-to-face dialogues to long-term and more global dialogues. Dialogic education with technology is, we argue, an essential response to two of the biggest challenges of our time—the challenge of the Anthropocene and the challenge of the Digital Age.

dialogue, dialogic, education, technology, EdTech, theory of education

Chapter 7

A Dialogic Theory of Educational Technology

Rupert Wegerif and Louis Major

7.1. Introduction: Definitions and Scope

Kurt Lewin famously said that there is nothing more practical than a good theory (Greenwood & Levin, 1998, p. 19). Following Diana Laurillard (2013), we understand education to be a design science like engineering or architecture. One core research method for education, as for any design science, is design-based research (DBR) in which different design principles are tried out and design frameworks are developed in a systematic and evidence-based way to be shared with the community. Design frameworks are often specific to projects. However, they are informed by more general theories or ways of seeing which, following Winograd et al. (1986), we refer to as

foundations for design. In this chapter, we provide the provisional and tentative beginnings of a dialogic foundation for the design of education technology (Wegerif & Major, 2024).

Articles about education technology design often refer to theory when developing designs. However, these tend to be general theories of education such as the behaviorist theories behind much instructional design, or the constructivist and social constructivist theories behind the design of many learning environments. The problem is that theories of education alone do not always take the distinctive ‘voice’ of technology into account. Technology, we claim, is inherently intertwined with education. As a result, we believe that the role of technology in shaping educational goals ought to be more explicitly acknowledged. Humans are now, and always have been, a combination of the biological and the technical. It follows from this that when technology changes, then what it means to be human changes—and thus, education also needs to change.

After explaining our understanding of theory and the importance of having a specific theory of education technology, the next question we want to address is why we need a distinctively dialogic theory of education technology. The advent of the Digital Age in a cultural historical timescale, and the advent of the Anthropocene in a geological timescale, both raise serious challenges for humanity—challenges to which technology-supported dialogic education offers, we argue, at least a partial response. The internet, which has emerged in recent decades as the new dominant mode of communication, has brought the majority of the human race together in what is essentially a single medium with the possibility of real-time, two-way dialogic interaction. While an extraordinary creation, this has presented many challenges. Initially seen as a potential support for democracy, the internet is now more commonly referred to as a threat to democracy with global social media platforms, such as Facebook, accused of encouraging extremism and the spread of “fake news.” Part of the problem seems to be that the algorithms, designed to boost advertising revenue, reward extreme views, and messages expressing outrage get more visibility and “likes”

than more moderate messages. In addition, social media often promotes “echo chambers,” in which those with the same views are grouped together by a pattern of mutual liking that excludes diversity, challenge, and development (Geeng et al., 2020). In relation to education, the internet is accused of disrupting the cognitive development of children by encouraging distraction and leading to shorter attention spans (Carr, 2010; Greenfield, 2015). There is also a fear that the internet is leading to families who are “alone together,” each on their mobile phones instead of talking together and so producing young people who are not able to connect to others except superficially (Turkle, 2011).

These concerns about democracy and childhood socialization are aspects of one big challenge of our time which is managing the transition from multiple, separate print-based cultures to a single, global internet-based culture. It is probably not coincidental that this transition to the Digital Age in what Vygotsky referred to as the cultural historical timescale, corresponds to an increasing awareness of the dawn of the Anthropocene in the much larger geological timescale. The Anthropocene is the idea that planet Earth has moved into a novel geological epoch characterized by human domination. Effects like global warming show that human actions are impacting on the quality of our environment such that collective self-regulation on a planetary scale has become essential if we are to continue not only to thrive but also, perhaps, simply to survive. The Anthropocene offers challenges to the future that imply the need for us to collaborate across different countries in order to understand and to solve problems, such as global warming, which cannot be solved by any individual country acting alone. This suggests a need to design education to promote a possible global collective intelligence for the future. In this chapter and elsewhere (Wegerif & Major, 2024), we argue that a better theory of dialogic education with technology might help us address the challenges posed both by the Digital Age and by the Anthropocene.

7.1.1. What is “Technology”?

Dialogic theory can be applied to understand the challenge of defining key concept words like “technology.” The Greek word “dia” found in “dialogue” and “dialogic” can be translated as “across” and refers to an essential gap or difference defining “dialogic” in contrast to “logic.” If “logic” refers to reason, then dialogic refers to “reason across difference.” The essence of dialogic theory is that meaning occurs only when there is a difference between voices and perspectives. This dialogic theory tells us, for example, that the meaning of a key concept word in a dialogue is not given by its dictionary definition but by the difference that it makes in a context (Linell, 2009; Rommetveit, 1992). If we apply this dialogic insight to “education technology,” often abbreviated in everyday contexts to “EdTech,” we see that when educators use the term “EdTech” in schools and classrooms they are making a useful distinction between the main activities of education, teaching, and learning, and extra supplementary tools brought in to support those main activities. In an everyday sense, the term “educational technology” has a clear meaning. It does not refer to pens and paper or to blackboards and sticks of chalk; it does not refer to desks and chairs or to textbooks and the curriculum; rather, it refers to digital machines, their software, and their support systems.

However, stepping back from everyday classroom practice to take a more theoretical perspective on educational technology, we note that the close association of technology with physical machines, particularly digital machines, is quite recent. The Greek word “techné” that lies at the root of the modern word “technology” referred to techniques rather than to machines. Techné referred to pottery, weaving, and music making. On this model, pedagogy and the curriculum could also be included in the concept of educational technology. In fact, the first widespread use of the term “educational technology” in the 1950s and 1960s, returned to this Greek original meaning of techné by referring not so much to machines as to any systematic application of learning science in classrooms (Skinner, 1968).

It is interesting to note that in shifting our gaze from everyday current practice to theory we are not just going back in time, but more significantly, we are stepping back from the surface of time to take a larger temporal perspective. This stepping back to see from a larger perspective enables us to consider, for example, that the meaning or understanding of the term technology changes over time to refer to that which is experienced as new. This theoretical stance reveals that the apparently obvious everyday distinction of technology with non-technology, where technology means digital, is a local manifestation of a broader distinction between that which is new and requires thoughtful consideration in contrast to that which is already established and so can be taken for granted. Technology, it seems, is not so much a thing in the world as it is a way of looking at things in the world in terms of their function and their design.

Things that we take for granted as already established in education, such as the use of books and desks, are not always seen as a technology; they are part of the context within which and out of which we act. However, when something new comes along like, for example, wall chalk boards which arrived in classrooms in the early nineteenth century, then the question of function and design is raised for practitioners. Shifting from only having individual slates to also using a wall-mounted chalkboard was a challenge for practice: “When first introduced, the chalkboard went unused for many years until teachers realized that it could be used for whole group instruction. They had to change their thinking from individual slates to classroom slates” (Slade, 2001 quoted in Russell, 2006). New tools are technology not because they are digital but because decisions must be taken as to how to use them in ways that help to serve the perceived function of education.

7.1.2. Theory and Practice as Dialogues in Different Timescales

Plato and Aristotle understood theory to be contemplation of timeless truths as opposed to the more engaged stance of *techné*, which was about making things within time (or “*poiesis*”). *Epistémé* (science) was said by Aristotle to refer to eternal knowledge, whereas *techné*, he claimed, referred

only to things that changed in time (Aristotle, ca. 350 B.C.E/1925, ch. 3). This distinction between timeless truths and temporal practice has continued in the Western tradition of thought. This can still be seen today in the way in which fundamental science is sometimes contrasted to engineering and technology as if the one was finding timeless ‘laws of nature’, and the other was about translating these into real-world contexts where they are applied to change things within time.

We agree with Aristotle that there is a useful distinction to be made between a theoretical perspective and a more practical perspective. Nonetheless, we disagree that they are fundamentally different in nature or that the theory perspective is outside of time: we claim that both are carried by dialogues within time but that they refer to dialogues operating at different scales of time. Conceptual understanding of the term technology from a more theoretical perspective still refers to the use of this term to signal a distinction within a dialogue. However, the dialogue of theory is longer-term and more global in its referencing than the dialogue of everyday practice.

The phrase “education technology” when used in everyday practical dialogues in classrooms refers to digital machines and so has a very different meaning from education technology as a concept in the longer-term dialogue of theory. Conceptually, to think of something as technology is to think of it in terms of function and design. This is a contrast to the idea of pure or contemplative knowledge of the truth (epistemé) and also a contrast to unreflective practice. The key conceptual distinction here then is not about things in the world (laptops as technology and handwriting as not technology, for example) but about how we look at and think about what we do. Any aspect of education, if consciously approached as a question of the best design for a specific function, could be seen as technology and therefore as “education technology.”

7.1.3. What Is “Education”?

If we look at how the term education is most commonly used in everyday language, we find that it refers to the education system of schools, colleges, and universities and is dominated by the closely

linked ideas of literacy and numeracy. Despite the advent of the Digital Age, basic education still tends to be seen as reading, writing, and arithmetic, while more advanced education is still commonly associated with the mastery of knowledge contained in books (Pea & Cole, 2019).

To step back and take a more theoretical view of education, it helps to consider how education occurs in different cultures and at different times. Oral cultures, for example, understand education in a different way.

In oral societies, education tends not to involve schools, and nor does it involve the idea of knowledge in the form of representations that can be transmitted and stored in memory. As well as apprenticeship education through personal relationships (Rogoff, 2003), most oral societies have initiation ceremonies drawing young people into a living relationship with more generalized cultural voices sometimes referred to as ‘the ancestors’ (Turner, 1987). There is usually overlap between what might now be classified as education for productivity and education for cultural identity. Ethnographic accounts suggest that in most truly oral cultures, learning many activities involves initiation into a living relationship with the appropriate ancestor. Malinowski brings out how the symbols of ancestors carved in the prow of fishing canoes in Melanesia were conceived as an essential part of productive technology (Malinowski, 2013, p. 116). In a similar way, the so-called “songlines” of Australian aborigines embed much useful productive knowledge in the form of a relationship with the land, animals, and plants and with the ancestors who first made the trails (referenced in the songs). Education into the songlines is not conceptualized as learning a store of useful representations, but rather as learning to hear the voices of the ancestors as they sing to the tribal member through features of the landscape (Watson & Chambers, 1989).

Stepping back to take a theoretical stance enables us to see the more general pattern that underlies both education in oral cultures and education in print literate cultures. Education can be characterized as guided induction into participation in the temporally long-term and spatially

widespread dialogues of culture of which knowledge is an aspect. Knowledge cannot be separated from dialogues as it takes the form of answers to questions that are asked within dialogues, and answers change when the questions change as the dialogue develops. Education has two main interconnected functions: identity formation and the continuity of cultural practices. Guided induction into cultural long-term dialogues enables biological individuals and newcomers to the community to learn how to become “fully” human (i.e. culturally human as well as biologically human) by appropriating the culture which usually means learning how to talk with the ancestors and finding one’s place among them. Guided induction into cultural practices is closely related to identity formation; it is about learning how to use the tools and techniques handed down by the ancestors and how to participate in dialogues about their use. In both strands, identity and practice, each generation explores and learns, both consciously and unconsciously, adding a little more to the stories and to the technologies of the culture and transmitting this additional information to succeeding generations.

7.2. Dialogism

We have already introduced the key idea of dialogic; that the meaning of a word in a dialogue is not fixed by its dictionary definition but depends upon its role within the dialogue. Significantly, the meaning of a word depends not only on what the speaker wants it to achieve but also on how it is actually taken up and used. This simple observation has profound consequences.

7.2.1. The Dialogic Gap Is Constitutive for Meaning

A difference between voices is essential for dialogue and for meaning. Dialogue occurs when two voices from different perspectives have to engage in a process of explaining things to each other. If two voices merge into complete unity then the dialogue between them ceases, and so the meaning ceases (Holquist, 2003). Voice is a term in dialogic theory for a unique perspective on the world that is the unit of analysis of a dialogue. Individual humans can speak with many voices. Things can

also be given voice. Nations and abstract conceptual entities can similarly take on voice. Dialogism means that wherever there is meaning there is more than one voice in play.

7.2.2. Dialogic Space

Dialogic space is the space of possibilities that opens up when two or more incommensurate perspectives are held together in the creative tension of a dialogue (Wegerif et al., 2019). The use of the word incommensurate here is significant: it means that the different perspectives in the dialogue cannot be reduced to a single frame of reference or a single correct perspective. If that were to happen, the flow of meaning would cease. This dialogic space of multiple possible meanings is not reducible to any single “objective” external perspective. Externally a dialogue might be bounded within a classroom at a particular time taking place through audible words that can be recorded as sound waves and correlated with measurable neural changes, but internally it has a space of meaning that is unbounded and might range freely across many spaces and many times. This is not a simple ontological dualism; the inside and the outside of any given dialogue are inextricably bound up together as two aspects of the same unique dialogue.

7.2.3. The Inside:Outside and Outside:Inside Nature of Dialogic Relations

In any dialogue the person you are speaking to, the “addressee,” is always already there at the beginning of the utterance just as you are there already on the inside when they frame their reply to you (Rommetveit, 1992). This can be understood if you think about where an utterance in a dialogue starts. If we respond to a question from a young girl playing with Legos, we use a different voice from when we respond to a line manager asking about productivity. In any dialogue we do not just address ourselves to the other as a physical object, a body, but we address them from within a relationship in which the words used are often as much theirs as ours.

This inside-out and outside-in nature of dialogues explains how education is possible at all. Education, as opposed to training, always requires what Bakhtin (2010) calls the persuasive voice that speaks to us as if from the inside.

7.2.4. We Learn as a Response to a Call

Learning occurs in education not only as constructivism suggests, as the active intention of learners trying to make sense of the world, but also as a response to being called out by the other, whether this other is conceptualized as a Specific Other, Generalized Other, or Infinite Other (Wegerif et al., 2019). Developmental studies suggest that the autonomous individual self, the self that decides what to learn, is not a starting point but a result of dialogic interaction in which the self of a new baby is called into being by their mother or other primary caregiver (Gallagher, 2020). In a similar way, each new “self position” (Hermans, 2018) is called into being within relationship with others. Sometimes these others are stand-ins for long-term dialogues and, following Mead, we call these “generalised others” (Mead, 1962). The mathematics teacher, for example, stands in for the long-term dialogue of mathematics. She does not only talk for herself but also for the whole living dialogue community of mathematics. Through the teacher mathematics calls to the students, and if they answer, then their voices are joined in that moment with the larger dialogue and they become, however peripherally, members of the dialogue community of mathematics; or, more simply, they become mathematicians.

7.2.5. Dialogic Double-Voicedness

Entering into dialogue implies a kind of double-identity or double-voicedness, which often looks like an oscillation between two identities over time. To simplify the experience for the sake of clarity: in the moment of speaking, we identify as one voice within the dialogue, and in the moment of listening we identify with the dialogue as a whole. This is not only true of face-to-face dialogues but of dialogues at every level including, for example, long-term cultural dialogues such as the

dialogue of science. When we send a new article for review by a journal, we identify with that article and the specific contribution that it makes to the field; but when we review articles sent to us by a journal, we identify with the field of science that the journal represents and ask what contribution this article makes to the dialogue so far within that field. Being inducted into a dialogue is learning to be double in this way, both inside and outside at the same time.

7.2.6. Learning as the Expansion of Dialogue

Dialogic learning is not linear. Each new voice we acquire is a new perspective from which we can see the world. Acquiring a new voice does not necessarily mean that we must jettison our previous voices; more commonly we extend our repertoire of voices and expand our personal dialogic space, not so much progress from A to B as progress from A to A+B. Even when a new perspective is apparently much superior to an old one which it replaces (the way that Darwin's theory of evolution was superior to Lamarck's theory for example), the old voice does not completely disappear but hangs around in the dialogue as a site for alternative ideas to form. Recent discoveries about the inheritance of epigenetic traits have been described by some as a return to Lamarck; but if they are a return, this is only on the other side of Darwin. The same is often true in individual moral development, sometimes voices we thought we had gone beyond, childish voices for example, have aspects such as innocence or playfulness that return revalued after a period of being rejected and marginalized.

Dialogic learning as the expansion of dialogue is both personal and collective. Each new discovery of science, for example, brings something into the dialogue that was previously outside of the dialogue. Every discovery, whether it is that slime mold can run mazes (Alexander et al., 2021) or that literacy changes the brain in a way that reduces holistic thinking (Dehaene, 2011), is not just a fact to add to a list of facts but is also a new way of seeing other things and so a new voice entering into the dialogue.

Dialogism does not imply that all voices should be equally valued. In the development of science and in the development of ethics, new voices often try to repress older voices and drive them to the margins for what always appears to be very good reasons at the time. However, it is seldom true that such repressed voices completely disappear from the dialogue. They remain as voices ready to return in new forms if new discoveries or changed circumstances call for them. The idea of learning as involving the expansion of dialogic space is perhaps a bit like the idea that ecological systems such as the Amazon rainforest evolve to support a diversity of organisms precisely because such biodiversity proves to be a good strategy for adapting to changing circumstances. In order even to understand why we should value some voices more than others, Darwin more than Lamarck for example, we need also to hear and to understand those other voices. Education needs to induct learners into a whole expanding dialogic space of culture if they are to understand judgments of true and false, right and wrong, as judgments always made in the context of a dialogue that is constantly evolving and the students themselves participating in and taking forward. Dialogic education is not so much about learning this or that, Darwin or Lamarck, but more about learning the whole dialogic space which gives significance to this or that.

7.3. The Theory of Educational Technology

When Gilbert Simondon (2017) argues that technology has its own drive to development, he does not mean that technology has agency on its own without humans being involved at all, but rather that biological organisms and technology form a couple, and it is this couple that has agency. The role of the engineer in a complex machine is not to impose their will on the machine from the outside, but to get to know the machine, to play with it and to understand it. By doing this, the engineer and the machine can generate a space of reflection and internal resonance. Simondon gives the specific example of the development of internal combustion engines with engineers anticipating how the machines can be better integrated internally and in relation to their environments. Similar

arguments could be made about the role of educational theorists and designers in the development of education as a socio-technical system.

There is an understandable tendency to want to oppose human interests to technological interests and seek to return education to the needs of the authentic human. However, it is not possible to separate humans from technology. *Homo sapiens* emerged as a separate species of ape as part of the development of technologies of fire, flint tools, and language (Stiegler, 1998). Tensions occur because human technological evolution progresses at a different rhythm and timescale to human biological evolution. Some have argued that formal education was a response to the evolutionary challenge when technological systems developed too fast for biological systems to keep up (Geary, 2008). This view suggests that education augments biological humans with the technological skills that they need to support the larger socio-technical system that they are part of, such that this larger system can continue to reproduce and to thrive.

The role of specific technologies, such as print literacy, in our thinking is perhaps becoming increasingly apparent because we are in a time of transition as significant as that which occurred when literacy replaced oracy as the dominant form of communication. In words written down by his student Plato, the oral thinker Socrates complained about the negative cognitive and moral consequences of writing that was, in his lifetime, sweeping through Greece (Plato, 2008). Ironically, we only know this because Plato wrote down Socrates' reflections on writing in the dialogue with Phaedrus, where he is reported as describing written words as like "orphans," "ghosts," and "dead seeds put out on flagstones in the heat of the sun" (Plato ca 400 B.C.E./2008). Today we hear very similar complaints from those concerned about the cognitive and moral dangers of the way young people are now shifting away from print literacy to internet communication, which is more multimodal, more interactive, faster, and more fragmented (Poster, 2018; Pea and Cole, 2019).

7.4. Conversation Theory

If we accept the argument that what it means to be human is shaped by technology, especially the dominant mode of communication technology, then most theories of education that we use are now outdated because they uncritically assume the technology of print literacy. It follows that it might be useful to learn from more recent theories informed by advances in information and communications technology. One such theory is the “conversation theory” developed in the 1970s by cybernetician, Gordon Pask.

Conversation is understood by Pask as the most basic process of learning, the means by which voices (perspectives which could be human or machine) become informed about each other’s “informings.” Higher level coordinations take the form of “tokens” for lower-level coordinations (objects and events), which are themselves tokens for stabilities of sensorimotor activity and regular couplings with the environment. To form a “conversation,” participants must formulate descriptions of themselves and their actions, explore and extend these descriptions, and carry forward the understanding that they generate together to a future activity. In order to learn, a person or system must be able to converse with itself and with others about what it knows (Pask, 1976; Sharples et al., 2010).

Pask influenced theories of education with technology put forward by later professors of Education Technology at the UK Open University, Diana Laurillard and Mike Sharples. Both Laurillard and Sharples, in their different theories of education with technology, claim to follow from Pask’s conversational theory of learning that to be able to engage in productive conversation, all parties need access to a shared language and set of tools that enable the construction of shareable representations of whatever topics they are conversing about.

To elaborate, Pask’s conversation theory has been applied by Sharples et al. (2010) and Laurillard (2002) to describe the processes involved in learning conversations supported by modern

communications technologies. Sharples and colleagues develop and apply Pask in what they call ‘a mobile theory of learning’ describing learning as a technology-mediated process of coming to know through conversations across contexts. Whereas learning was previously mostly described within institutional contexts, mobile technology it is claimed, allows for ‘seamless’ learning between different contexts; but it does so through the conversational mechanism of feedback loops and resulting clarifications that Pask describes. Laurillard similarly develops and applies Pask in what she calls a ‘Conversational Learning Framework’ (2002) which can be applied as a design framework for education in general (2011). Laurillard maintains that all complex learning involves “a continuing iterative dialogue between teacher and student, which reveals the participants’ conceptions and the variations between them There is no escape from the need for dialogue, no room for mere telling, nor for practice without description, nor for experimentation without reflection, nor for student action without feedback” (Laurillard, 2002, p. 71). Laurillard’s conversational framework is a theory of learning for the Digital Age, as the different aspects of dialogues and types of dialogue are matched to the affordances of different communications technology (e.g. attending to information through video then exploring through a web search, discussing in a webinar experimenting with a simulation, and finally expressing understanding using productive media which might be a word document or modeling software).

7.4.1. Commentary on Conversation Theory

Pask intended his theory of learning to work for machine learning as well as in hybrid human–machine contexts. Given that the technology he was working with, yes–no logic circuits, has no internality or awareness of how things feel, this implies the reduction of meaning to a single exterior surface. As system theorist Leydesdorff (2021) puts it, most technical theories, systems theory, and appeals to “big data” to understand learning assume an ontological monism that is incoherent. It is incoherent because there is no ‘view from nowhere’ (Nagel, 1989). Biological

systems begin at cell level precisely with a membrane distinguishing inside from outside. All that we know and can know must reach us filtered through—and generated by—such inside–outside membranes that separate systems.

Strangely, Pask’s conversation theory is not dialogic. Dialogic meaning is not robotic interaction but an inter-illumination of different internalities that are external to each other. Dialogue works not by reducing differences to a single true external vision—a single text of explicit meanings expressed clearly in a shared language—but by expanding the shared space of reference and resonance (Bakhtin, 2010).

On the inside looking out, we are a perspective on the world or an opening on the world. Viewed by others on the outside, we are apparently located within one single objective or exterior world. In a dialogic ontology, the same duality is true of every figure since, as Bahktin said, “I hear voices in everything” (Bakhtin, 2010; Friedman, 2005). A figure, or concept term, or one of Pask’s tokens, is only understandable in relation to its background or context. This relationship between figures and their grounds is not static but dialogic, giving rise to what Bakhtin called “an infinite potential for contextual meaning” (Bakhtin, 2010, p. 162). Dialogic learning, therefore, involves more than just making conceptual understanding explicit and external. It also encompasses the development of intuition and creativity by expanding empathy and understanding, even in situations where what has been learned cannot be verbally articulated. Whenever we teach a concept word, we also need to induct the student into the shared dialogic space within which the use of this word makes sense. Dialogic education is not therefore only about clarifying concepts and transferring explicit knowledge, but also about expanding the dialogic community or shared internality, such that those concepts have meaning.

7.4.2. Connectivism or Learning as Networking

“Connectivism” is claimed to be the first new theory of learning to emerge in the Digital Age. The theory came out of practice. Siemens and Downes taught a course called Connectivism and Connective Knowledge (CCK), at the University of Manitoba in 2008, with 25 registered fee-paying students but over 2,000 students online taking the course for free. The course used various technologies, including online broadcasting (RSS feeds), Second Life, blog posts in Moodle, and synchronous online meetings. These technologies supported processes that facilitate learning, selecting, and ordering resources—using tools like Flipboard—and creating, sharing, and consuming content using social media like YouTube, blogs, and Flickr.

This 2008 course was described by Cormier and Siemens (2010) as a massive open online course (MOOC). Later, as MOOCs were developed using traditional transmission pedagogies, this first MOOC was retrospectively called a cMOOC (connectivist MOOC) in contrast to the sort of MOOCs run by EdX (created by MIT) and Coursera (originating out of Stanford) which were labeled as xMOOCs (eXtended MOOC, based on a traditional university course model). What makes cMOOCs different is the theory of connectivism created by Siemens and Downes (2005), which builds on the new affordances of the internet for education, viewing learning as networking and emphasizing the ability to traverse networks and integrate distributed knowledge.

Some critics have argued that this is not really a new theory but just a version of social constructivism. In response, Downes (2007) makes a clear distinction between constructivism and connectivism:

In connectivism, a phrase like “constructing meaning” makes no sense. Connections form naturally, through a process of association, and are not “constructed” through some sort of intentional action. . . . Hence, in connectivism, there is no real concept of transferring knowledge, making knowledge, or building knowledge.

This is a very interesting claim. It challenges the cognitivist bias Downes claims lies behind all previous theories of learning, suggesting that learning is not just about memories in minds, but is also about real structures in the world. Non-human systems, machine learning programs or simple life-forms like slime mold, for example, can also learn to connect different sources of knowledge more efficiently in a way that helps them perform functions better (Alexander et al., 2021).

7.4.3. Commentary on Connectivism

As with conversation theory, the main theoretical problem with connectivism is the reduction of meaning to an exterior surface defined in terms of nodes and links. Linking nodes might explain how some computer programs learn, after all connectivism owes a debt to connectionism or building artificial neural networks that mimic some aspects of how the brain learns. It might also illuminate some kinds of cognition found in nature. But a dialogue between two people is not the same as a network linking two nodes because each partner in the dialogue has a kind of “internal” model of the other “external” person that they develop in the dialogue at the same time as reflecting on, and changing their own, thoughts and behavior as if from the perspective of a third party or witness position in the dialogue (Wegerif 2013). It is from this expansion of self-consciousness in dialogues that we learn to see from new perspectives and become ‘bigger’ than we were.

7.5. A Dialogic Theory of Educational Technology

Combining a dialogic theory of education with the understanding of the central role of technology in education and with what can be learned from the strengths and weaknesses of conversational learning theory and of connectivism leads to the outline of a new dialogic theory of educational technology. This has three overlapping themes: connection, participation, and expansion.

7.5.1. Education Technology for Connection

Both the strength and weakness of connectivism as a theory of learning can be said to be the simplicity of its grammar: an ontology of nodes and links. However, education is not simply about

forming networks; this might describe learning in some machines and some life-forms, like slime mold, but learning is only education when it impacts on identity and consciousness (Stojanov, 2017).

The idea of dialogic education has some overlap with the idea of education as networking, but it goes further by considering how learners expand their identity to include other voices. Essentially, dialogic education is about using the network to its full potential so that the network becomes a launching pad for new, more inclusive understanding, and a new dialogic community. The expansion of consciousness here is not based on a model of consciousness as tied to individual bodies, but of consciousness as an aspect of materially embodied dialogues. As Simondon explains, the “value of the dialogue of the individual with the technical object” is “to create a domain of the transindividual, which is different from the community” (2013, p. 343).

To give an example of how a dialogic theory of education technology builds on connectivism but goes further, let us consider how *Pol.is* works (<https://pol.is/home>). *Pol.is*, described as an AI-supported online debate and decision-making system, has been used in many contexts, perhaps most famously in Taiwan where it was introduced by digital minister Audrey Tang to improve democratic decision-making (Chang, 2021). *Pol.is* maps where people ‘are’ in a dialogue, generating a kind of network with nodes being statements of opinion made by participants. Because of the map, participants can see where they share opinions or if they are at an extreme, and also exactly what they agree and disagree upon with others. In practice, the result of this software is to encourage people to converge on a shared solution through dialogue by deepening their understanding of divisive issues and valuing creative emergent solutions.

When an individual writes an opinion in a *Pol.is* debate, they naturally focus on their unique individual thoughts and experience. They locate themselves, through their “token,” as a node in the

network. However, stepping back and looking at the network they shift perspective to see themselves as if from the whole dialogue community. What develops from this is a more dialogic identity, both “my” voice on the inside talking outwards but also seeing or hearing the perspective of the dialogue, as if from the outside looking inwards to define and locate “my” voice as just one voice among others. In this process the individual does not lose their identity in the collective, but they expand their sense of identity to consider the point of view of the collective. They become more dialogic selves—double-voicedness as described previously—where “self” is not a static “thing” but a dynamic process, a continuous dialogue between inside and outside points of view. This approach to political decision-making was tried in Taiwan partly in response to the perception that traditional methods of democratic decision-making were no longer working well. While early days for this kind of experimentation, it is possible to hope that the combination of dialogic education and technologies such as Pol.is could enable people to reach out across ideological and community divides in the direction of the common good (Chang 2021).

7.5.2. Education Technology for Participation

Pask’s conversation theory claims that conceptual understanding emerges from dialogue and needs to be constantly refined and developed through a dialogue between many voices. We agree. However, this theory is limited in so far as it only seems to work for learning clear explicit concepts and does not aid in the understanding of dialogic space associated with those concepts. Its focus on the clarity of concepts fails to include the aspect of learning that is a shift in identity and an expansion of identity. As already outlined, the opening of dialogic space enables the expansion of identity as a double-voiced identity, taking on and becoming the dialogic community while remaining one voice within it. The dialogic space needed for education does not fall away once the key concept has been learned. That space remains essential to using and adapting the concept in new situations. It is a space of possibility needed for the emergence of innovation.

In educational design terms, this means that we need to open, widen, deepen, sustain, and focus dialogic spaces. Opening a dialogic space is often done by an educator who can point out an issue or a problem within a relationship with the student or students. Once a dialogic space has been opened, it is possible to widen it with a range of views which could be taken from voices on the internet, ranging from different interpretations of quantum theory or perhaps different ways to cook eggs. While this approach applies to every area of education, it is possibly most relevant to how we might be able to form a more collective and inclusive sense of global identity. Internet-mediated dialogues about identity issues between young people from different cultures have been shown to shift and expand identity in the direction of dialogic open-mindedness (Wegerif et al., 2019). Deepening is often a product of widening. The difference between views are sometimes such that conceptual frameworks that underpin them need to be examined and, in the process, deepened.

Technology can sustain these dialogues by giving them a physical form, perhaps a wiki, a web forum, or a website that is a focus for an online-mediated community of practice. Technology can also focus these learning dialogues by, for example, bringing together people with different views on the same concept so that they can teach each other (Abdu et al., 2021) or by potentially using a conversational agent to ask challenging questions, raising the key distinctions that the “human” interlocutors might not have raised (Tsivitanidou, & Ioannou, 2021).

7.5.3. Education Technology for the Expansion of Time

Earlier in this chapter, discussing the concepts of technology and education, we brought out the difference between local short-term practical dialogues and larger longer-term theoretical dialogues. Textbooks tend to represent the claims of the larger time context as if these were timeless truths. We suggest there are no truths outside of time but only cultural dialogues that education can help students participate in. Our dialogic theory of education technology is about how technology can be used to weave together small, local dialogues and long-term, more global dialogues of culture. This

is a two-way movement, both a descent so that the insights carried by the larger dialogues can be brought to bear in interpreting immediate events, and an ascent, so that the larger longer-term level of dialogue can learn from each new experience and continue to develop. Successful education requires what Lemke called a “heterochrony” or bridge across timescales such that the timescale of local, face-to-face dialogues can be joined to the timescale of long-term, cultural dialogues (Lemke, 2000). Wertsch and Kazak (2011) suggested that concept words can be used in education as a kind of “ski lift” between levels of conceptual understanding from the more contextual to the more academic. We extend this metaphor to digital technology and replace the rather slow one-way ski lift metaphor with something more like a broad fiber-optic cable that can serve as a channel for electric sparks of dialogic inter-illumination.

The education technology literature offers many examples of how malleable artefacts can facilitate a dynamic dialogue between levels of time. One evocative example is the use of electronic whiteboards is reported by Sara Hennessy (2011), who describes how students could inscribe their own opinions about Elizabethan history on top of images of old works of art taken from that time. Learners then return to these, after further inputs and discoveries, to see how their views had changed over the scheme of work. Here, learners are not just learning about history, but actively participating in dialogues about how to interpret history. This sense of participation in the longer-term dialogue of history was then reinforced by the teacher guiding them to relate their views and points of disagreement to the debate continuing today among academic historians. The same shift from short-term dialogues, to long-term dialogues, applies in every area of the curriculum. For instance, we could move from everyday discussions of the meaning of “force” in the playground, to the concept of force that emerges from experiments like those conducted by Galileo, to listening in and vicariously participating in debates about conceptions of the meaning of force today in relation to gravity by research scientists.

The role of technology in the expansion of time is to link short-term dialogues to long-term dialogues, not only by providing a medium for the long-term dialogues but by providing dynamic links between the two timescales, connecting the experiment in the classroom, for example, to online video debates that carry forward the dialogue of science.

7.6. Discussion and Conclusion

In this chapter, we have put forward a dialogic theory of education technology intended to serve as a foundation for design. Our dialogic theory of education is that education is expanding dialogue, both by teaching students to be better at learning from dialogue with others and with otherness and through drawing them into participation in the long-term dialogues of culture. Communications technology has always played an essential role in mediating between different timescales, especially for educational purposes (i.e. the timescales of local, short-term dialogues and global, long-term dialogues). As mediating communications technology advances, so the form that education takes also has to change. Oral cultures facilitated an encounter with the living voices of tradition, the ancestors, using technologies such as masks, carvings, and cave paintings (Lewis-Williams, 2011). Inevitably each education system was limited to the members of the tribe, those who regularly spoke together face-to-face. Literate cultures have developed education systems for those who read the same print media, which understands itself as the transmission of objective knowledge, stored in the form of representations. The internet, with mobile and multimodal digital technologies, makes it possible to return to the dialogism of oral education. However, now, interconnected communications technology has the potential to support collective consciousness (Simondon's "transindividuality") at a global level. Dialogic pedagogy and technology design can first initiate students into dialogue as a means of learning, before then mediating between short-term local learning dialogues and longer-term global learning dialogues.

We began by outlining some of the challenges of the Digital Age and of the Anthropocene and claimed that a dialogic approach to the design of education and technology might help us to respond more effectively to these challenges. Having discussed how agency works in human–technology coupling, such that human engineers take on the function of anticipation in the larger machine of which they form a part, we are in a position to consider an alternative perspective. Indeed, it is possible to perceive our current state as the emergence of a global human–machine entity, shaped by the perspective of the future. Education technology is not just a way to reproduce our way of life, it is also a way to consciously design ourselves and to design our collective future. The reason we need a theory of education technology that goes beyond a simple theory of education is that the design process requires, as Simondon (2017) puts it, ‘a dialogue with technical objects.’ To design the future, we need to work constructively with the ‘voice’ of technology as part of a broad synthetic vision of what flourishing means for the emerging global bio-socio-technical system of the future.

The theory of education technology that we propose as a foundation for design is taking dialogue seriously and designing for expanding dialogue. Provisionally and tentatively, we proposed a design framework for education technology consisting of a set of linked principles:

1. design for connection: drawing into networks through dialogic encounters with voices at different levels, the voices of individuals, and the cultural voices of generalized others;
2. design for participation: opening, widening, deepening, sustaining, and focusing dialogic spaces;
3. design for the expansion of time: building supports for a sustainable, two-way dialogic interaction between dialogues at different timescales from the short-term and local to the long-term and global.

Education technology integrates the design of pedagogy and the design of technology. It is about the design of more dialogic selves as well as the design of technologically supported dialogic spaces. In a successful dialogue, a collective identity is formed without subordinating the individual voices involved. On the contrary, when dialogue works well, each participant feels expanded and enriched. One hope that we have for this dialogic theory of education technology is that it might help to facilitate a direction of overcoming not only the apparent alienation between humans and other humans, but also the apparent alienation between humans and technology. The vision motivating us is that an expanded dialogic collective consciousness might one day be able to appropriate the increasingly interconnected global network of technologies to promote a global flourishing that is more than simply human flourishing. It is as if we have been building a collective body together, a giant body with fiber-optic nerve-ways connecting a vast number of powerful and wonderfully intricate sensing devices and productive machines. But this new giant that we have built together lacks a soul. Dialogic education with technology is about how we can grow together to become the collective soul needed to inhabit our new collective body. We began this chapter with a rather negative story of how, if we want to continue to thrive and perhaps even to survive, we need to respond to the challenges presented to us by the Digital Age and by the Anthropocene. That is one way of looking at our situation—a reactive way. The proactive alternative version of this same story is that the convergence of the Digital Age and the Anthropocene offers an extraordinary opportunity, a chance to create something that has never been seen before in history: a planetary-wide, self-regulating organism. A dialogic theory of education technology is not going to achieve this epochal transformation all on its own (Wegerif & Major, 2024). However, we put this theory forward as one tool that might be useful: a foundation for the design of the kind of education needed if we are to flourish together in the future.

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