

**RUPERT WEGERIF AND LOUIS MAJOR**

# **THE THEORY OF EDUCATIONAL TECHNOLOGY**

**Towards a Dialogic Foundation for Design**

**ROUTLEDGE**  


# THE THEORY OF EDUCATIONAL TECHNOLOGY

Educational technology is controversial – some see it as essential to providing free global learning, others view it as a dangerous distraction that undermines good education. In both instances, most theories that have previously been applied to educational technology do not account for the distinctive nature and vast potential of technology. This book addresses this issue, exploring how education has been bound up with technology from the beginning, and recognising that educational aims have already been shaped by technologies. Offering a ‘dialogic’ theory of educational technology, **Rupert Wegerif** and **Louis Major** respond to contemporary challenges to education within this book, including, but not limited to, climate change, misinformation on the internet and the impact of artificial intelligence.

Chapters introduce, discuss and contextualise key theories and illustrate through case studies their uses within a diverse range of educational contexts, spanning from primary education to adult lifelong learning. Each chapter also concludes with a short summary, demonstrating how these theories translate to practical implications for design.

A fascinating response to current developments in educational technology, this is a crucial read for all involved in creating, researching or making decisions about the use of technologies within educational contexts.

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# THE THEORY OF EDUCATIONAL TECHNOLOGY

Towards a Dialogic Foundation  
for Design

*Rupert Wegerif and Louis Major*

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# 1

## INTRODUCTION

### Why we need a theory of educational technology

There is nothing more practical than a good theory.

Kurt Lewin (1952, p. 169)

#### **Why do we need a ‘theory’ of educational technology?**

Most educational technology research is done with limited or no reference to theory (Bodily et al., 2019; Bond et al., 2019). And when theory is mentioned, this is almost always educational theory without reference to the theory of technology (An & Oliver, 2021). This chimes with the frequently expressed view that teaching should be led by pedagogy and not by technology. This claim is often asserted as a truism, as if no one could possibly disagree. A great deal of the theoretical literature on educational technology reinforces this assumption by expressing the concern that technology and technologists, possibly backed by money from the ‘EdTech industry’, are taking over education (e.g., Selwyn, 2017). In other words, the underlying framing here often seems to be that human-led education is good and that a technology-led education is bad.

At first glance, this makes perfect sense. On the whole, we use tools to help us achieve our goals. We like to think that we are in charge of the plan, not the tools that we select to help us. It would be odd to think of the tools as having agency on their own. Odd and also uncomfortable, perhaps even a bit frightening. The idea of technology taking over and telling us what to do is a common plot of dystopian movies and TV shows such as *The Terminator* or *Westworld*. But if we step back from this surface way of seeing things, to take a more theoretical perspective, it is not so clear that we can separate people from technology in any simple way. In Chapter 2, we argue

that humans have always been entangled with technology. We establish how a lot of the teaching and learning that most people tend to assume as being central to education serves the needs of technologies, especially communication technologies. The focus in primary education is on learning how to read printed signs in books, writing similar marks with a pen on paper, and how to use mathematical notations including numbers and a specialised symbol system. Because they have been around for a while, we sometimes forget that literacy and numeracy are technologies just as surely as social media apps on mobile phones or artificial intelligence (AI) language assistants.

It is interesting that we do not tend to think of literacy and numeracy as technologies. They are clearly neither natural nor universal. It is quite possible to be human without knowing how to use written sign systems. It is not obvious that oral societies are helped by education into literacy, indeed much of the evidence seems to point the other way.<sup>1</sup> Perhaps literate people are incapable of distinguishing themselves from their particular kind of communications technology and so assume that education that preserves and expands literacy is a universal human good. Taking a theoretical perspective or stance means questioning this kind of assumption. After all, non-literate oral societies also have education, and future societies in which the means of communication might be very different from what we can imagine now will also have education. If it is true, as we argue, that being human means to be bound up with technology, then it follows that education needs to change as technology changes. This is because when our technology changes, then so do we.

An overarching theme throughout this book is that we need to develop the theory of educational technology as a new strand in the dialogue about education. This is because, so far, our theories of education have not taken the distinctive point of view of technology into account. Technology does not just do what it is told and help us to realise our independently arrived at ends. Technology shapes us from the inside, it is always already there influencing how we understand ourselves and how we make decisions. This means that thinking about how we use technology in education is thinking about how we want to shape the future of education and, indeed, future humans. Designing educational technology requires thinking about what technology is, and what it could be, as well as thinking about what education is and what it could be.

This book is not simply about the theories that can be applied when designing or thinking about the use of technology in education. This common approach implies that theory is something outside of practice, which can be thought of separately, and then applied to shape practice. In education we often find that theory and practice are closely bound up together. The content of the curriculum and the way that teachers teach imply a theory of education, sometimes several different theories of education, even when this theory

aspect of educational practice is not explicitly articulated. The ‘theory of educational technology’ is, for us, a two-way street. We learn as much about theory from thinking about how it applies to the use of educational technology in practice as we do about the practice of educational technology from applying theory. If it is true – as Kurt Lewin said in the quotation beginning this chapter – that there is nothing more practical than a good theory, it also might be true that there is nothing from which theory can learn more than good practice.

To illustrate our argument that a distinct category of theory, the theory of educational technology, can be useful we offer two short case studies. These are very different accounts of practice with educational technology which are really stories about two different ways of framing educational technology (in Chapter 4 we refer to this kind of framing as the ‘grammar’ of educational technology). Throughout the book, we use case studies to illustrate the two-way relationship between theory and practice, and in particular how: (1) thinking about practice with technology helps us challenge and develop new theory, (2) thinking from a theoretical perspective helps us challenge and improve practice with technology.

### ***Case One: Personal devices to accelerate learning***

A primary school teacher writing a guest blog on Larry Cuban’s website describes how, after giving a class of eight-year-olds personal tablet computers, soon the teacher wanted to take them back.<sup>2</sup> Cuban is well known for his insightful criticisms of what he refers to as the ‘tech industry’, and how this has influenced education policy makers to invest in technology in ways which have few demonstrable education benefits (Cuban, 2009). This blog describes how the tablets were sold to the school board as a way to support greater student-centred (as opposed to teacher-centric) education so that each child could have a more personalised learning journey. They were also supposed to make education more efficient and more effective. In addition to technical issues, such as random alarms and the need to plan for contingencies in case some tablets were not working or if the broadband dropped, the teacher believed there was a more fundamental problem: the presence of tablets prevented effective collaboration. Specifically, the teacher felt students in her class needed more time to develop their oracy (spoken language) skills. However, after being given personal tablets, they interacted mainly with their screens. An example given was how learners no longer wanted to play together with LEGO on the carpet on a rainy day since now they each had their tablets to occupy them. The blog cited Sherry Turkle’s book *Alone Together* (2011) as offering evidence that the use of mobile devices is preventing children and young people learning how to talk together. It also cited an OECD report (2015) suggesting that educational technology does not accelerate

learning. The blog quotes a line from this report: ‘Students who use computers very frequently at school do a lot worse in most learning outcomes, even after accounting for social background and student demographics’.

### ***Case Two: Coding Pirates future island***

Our second example is from a Danish project called Coding Pirates Denmark<sup>3</sup> (Nørgård & Paaskesen, 2016). In an open warehouse-type space, up to 30 students aged 7–12, working with adult volunteer helpers, were given a variety of materials, glue guns, GoPro video cameras and variously coloured blankets and boxes with kit including LEGO programmable brick sets called WeDo. They were tasked to work in small groups of five or six to together design a ‘future island’ where they would like to live. After building a prototype with kit provided, they videoed their island explaining design decisions before posting the video on YouTube. This was followed by all groups collaborating to unite the best elements of their different islands into one big island. The exercise involved discussions about citizenship issues, what it means to be fair and what their ideal future society might look like. The authors describe how their ‘open-ended’ approach to education can help to foster and promote technological imagination, creativity, collaborative problem solving and critical reflection.

### ***Commentary on these cases***

The author of the first account was not positive about the educational role of the technology. The authors of the second account were, by contrast, very positive. We do not know enough from these short cases to say if they were correct in their assessments. What we want to draw your attention to is the very different ways in which the role and nature of the educational technology is framed. By ‘framing’ we mean how educational technology is understood in relation to other factors. This framing of educational technology is not done by the authors alone. It is also embedded in the institutional contexts, the design of the spaces, the funding, the culture, the curriculum and other often invisible contextual factors.

In Case One, educational technology is framed as supporting individual learning as opposed to collective learning. In Case Two, by contrast, educational technology is used as a support for small group and whole class talk and collaboration. In One it is framed as working against the development of communication skills, whereas in Two it is a support for multimodal communication between groups and an audience beyond the class through using video. In One, educational technology is framed as against physical play with LEGO. In Two, building with physical LEGO blocks is key to the use of technology. In One, educational technology is framed as a (failing) supplement

to an existing curriculum. In Two the technology – including use of blankets, tables and other building materials, along with digital – is framed as a central part of the educational activity. See Table 1.1.

**TABLE 1.1** Comparing frames in Cases One and Two.

<i>Case 1: Personal tablet devices</i>	<i>Case 2: Pirates future island</i>
Individual	Collective
Support for curriculum	The main curriculum
Virtual play through static devices	Physical play with dynamic devices
Instruction	Play
Monologue	Dialogue

Theory is valuable in unpacking and examining all the implicit frames that underlie practice but have often come to seem natural and so are ‘taken for granted’. Using theory also allows us to get a handle on the assumptions that lie behind practice so that we can challenge and develop these in a conscious design-focused way.

The contrasting ways of framing in Cases One and Two are not new. A quite similar contrast between ways of framing the use of technology in education was seen in classrooms in the 1970s when Papert’s constructionism clashed with ‘instructional technology’ based on Skinner’s behaviourism (a struggle described in Chapter 4). The contrast between Cases also illustrates how writing about educational technology often seems to be either announcing the next best thing that will transform education (Case Two), or condemning the negative impact of technology on ‘proper’ education (Case One). Applying theory to reflect on different framings of educational technology might be useful in helping to transform the common, unproductive oscillation between these two opposed positions towards a more constructive dialogue, one that can perhaps deliver progress.

### **What do we mean by the words ‘theory’, ‘educational technology’ and ‘design’?**

Definitions of key terms are often useful for thinking things through together. When definitions seem surprisingly slippery, however, this does not necessarily mean that they have been misunderstood. Indeed, such slipperiness might be a side effect of ideas that really are intrinsically ambiguous and impossible to pin down. As discussed below, we take a dialogic perspective, one consequence of which is that we believe the meaning of words is not fixed or final. Words acquire meaning through the differences they make in conversations, and conversations always happen in contexts in which different



kinds of differences need to be foregrounded. This means that a single word can have many meanings, and that the meaning of any word is continuing to evolve even as we write and think about it. Fortunately, this slipperiness does not prevent us from being able to discuss and develop our shared understanding. This is because, in practice, key concept terms can be held to a number of relatively stable uses in specific contexts. When used by teachers in classrooms, for instance, ‘educational technology’, or ‘EdTech’, usually refers to digital technology. This does not mean that teachers are ignorant. They likely appreciate that books and whiteboards, pens and desks are also technology. But as the term ‘educational technology’ would not be useful if it referred to everything in a classroom, it is helpful to make a distinction between the normal activity of education and new digital tools brought in to support that activity.

However, educational technology also has a second relatively stable meaning in the context of theory. To say what that is we first must define theory. We consider theory to be the process of stepping back from practice to reflect on that practice by connecting it to other practices in other times and places. In this way, theory can be considered as a long-term dialogue, where the meanings of concepts evolve over time as they are used in relation to each other in a network of interconnected ideas. This evolution of meaning is driven by a process of questioning and answering, where new ideas are proposed and debated in light of evidence and experience. Importantly, theory is needed if a discipline is to learn from successes and failures and grow as a cumulative shared body of knowledge carried forward in a continuous dialogue between practitioners and researchers.

If we step back from everyday classroom practice to take a more theoretical perspective on educational technology the close association of technology with physical machines, particularly digital machines, turns out to be quite recent. The Greek word ‘techné’ that lies at the root of the modern word technology was used to refer to techniques rather than to machines. Interestingly, efforts to define educational technology by the Association for Educational Communications and Technology (AECT) have apparently taken the root meaning of techné into account in their current definition:

Educational technology is the study and ethical application of theory, research, and best practices to advance knowledge as well as mediate and improve learning and performance through the strategic design, management and implementation of learning and instructional processes and resources.<sup>4</sup>

This definition can be used to begin the enquiry into educational technology that is the main content of this book. The idea that educational technology includes the design of learning has been in the AECT definition since at least

1994 (Seels & Richey, 1994). From the perspective of theory, it seems that technology is not so much a class of things or technical objects, but more a way of thinking about things in terms of how they work as well as a way of acting on things to design them to work differently (Dron, 2022).

It follows from our definition that pedagogies, methods of teaching intended to produce learning, are technologies just as much as computers or textbooks. What makes any technology distinctively educational is the presence of a pedagogy or pedagogies (Dron, 2022). Some technologies are designed and sold as being educational, learning management systems for example, meaning that they include in the design some idea of how to use them to support teaching and learning. Many more technologies become educational technologies when combined with pedagogies. Excel spreadsheets used to teach functional programming, or LEGO bricks used to teach arithmetic, might be examples.

Things that we take for granted as already established in education, such as the use of books and desks, are not always seen as technology because they have become naturalised or taken for granted as part of the context within which we teach and learn. However, when something new comes along, like chalkboards which arrived in classrooms in the early 19th century, then the question of function and design is raised for practitioners. Shifting from only having individual slates to using a wall mounted chalkboard was a particular challenge for practice. When first introduced, the chalkboard went unused until teachers realised that it could be used for whole group instruction. Specifically, teachers had to change their thinking from individual slates to classroom slates (Slade, 2001 quoted in Russell, 2006). When the chalkboard first arrived at Yale University in the 1820s, a rebellion ensued as its introduction meant students were expected to solve problems at the board without the help of books (Frankel & Kerr, 2020). Over 40 students were expelled. It seems then that new tools in classrooms are technology not because they are digital, but because decisions have to be taken as to how best to use them.

Following Diana Laurillard – and colleagues including Mike Sharples (Sharples, 2009) – we think of education as a ‘design science’ (Laurillard, 2012). The idea of design science was introduced by Herbert Simon in his influential book *The Sciences of the Artificial* where he writes that ‘the natural sciences are concerned with how things are . . . Design on the other hand is concerned with how things ought to be’ (Simon, 1969, pp. 132–133). Design sciences involve solving problems where there is no single optimal solution that could be found by the application of a rigorous method. Because design finds creative ways to resolve tensions between different drivers in the context of real constraints, it is often associated with natural evolutionary processes (Crilly, 2021). The biggest difference between design and evolutionary emergence is the involvement of humans. And this involvement of humans means the involvement of the future. Humans bring anticipation into the design

process, informing designs with a vision of a preferred outcome. Design can therefore be described as creative problem solving informed by anticipation of the future.

In Chapter 10, we discuss how research on educational technology might be best approached as a form of design-based research, in which design frameworks are tested and refined iteratively, evaluating the outcome and refining the design based on evidence (Bakker, 2019). Design frameworks are made up of sets of often related design principles which take the general form of the claim that ‘if we do  $x$  under circumstances  $y$  then  $z$  is more likely to happen’. For example, the claim might be that if we teach basic arithmetic to six-year-old students using an interactive video game then they are more likely to be engaged and motivated.

Design principles and design frameworks have to come from somewhere. They build on assumptions about the nature of technology and about what is important in education. We subtitled this book ‘towards a dialogic foundation for design’, rather than ‘towards a dialogic framework for design’, because we are not offering very specific guidance or a ‘how to guide’. Rather, we outline an orientation or way of looking at technology and education which we believe can provide a good basis for generating effective design frameworks.

### **Educational technology and the big challenges we face**

In Chapter 2, we consider how the first schools were developed to transmit the then new technology of inscribing signs in clay. This new technology of cuneiform literacy and numeracy was, some argue, a response to larger numbers of humans than before living together in one space; a challenge which required recorded contracts and written law codes (Pea & Cole, 2019). In a similar way, it is possible to argue that our current system of mass compulsory education into literacy and numeracy was developed as a response to the needs of industrialisation and to the challenge of maintaining discipline and identity in nation states. The theory of educational technology is not about stepping out of time, therefore, but about understanding education in the context of history and in relation to developments in technology. In this book, we do not offer an ahistorical theory of educational technology but one that is a response to the challenges that education faces now, offering a way forward to design the future of education as a response to those challenges.

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 education might be a response. The internet, which has emerged in recent decades as

the new dominant mode of communication,<sup>5</sup> now connects the majority of the human race.<sup>6</sup> Despite efforts to filter the internet in some parts of the world by blocking access to specific websites and services, the internet remains one technology. The advent of a global internet is an extraordinary development which has brought with it 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’ (Fisher, 2022; Geeng et al., 2020; Oliver, 2020). Recent advances in artificial intelligence (AI), which are widely seen to challenge existing practices in education, are also related to the rapid globalisation of the internet. The Large Language Models (LLMs) which now enable the writing of convincing examination responses in almost every area of knowledge are based on data gleaned from the internet using web-crawlers. One big challenge of our time, it seems from these pointers, might be seen as managing the transition from multiple separate print-based cultures to a more global internet-based culture.<sup>7</sup> It is true that the internet has been around for a few decades and there has been no simple switch to a single internet-mediated global culture. Nonetheless, there are many signs of a – sometimes slow, sometimes uneven – direction of travel towards more internet-mediated practices and identities which tend in the direction of being transnational and translingual.

The Anthropocene is the idea that planet Earth has moved into a novel geological age characterised by human impact on the planet. 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, many would argue, simply to survive. The Anthropocene offers challenges to the future that imply the need for us to design education that might support the possibility of a future characterised by global collective thinking and collective action. In this book, we argue that designing educational technology is about designing for the future, and that a better theory of education with technology might help us address the challenges posed by the Digital Age and Anthropocene, as well as many other challenges both known and as yet unforeseen.

### **Dialogic educational theory**

Our approach to theory development is interdisciplinary. This is inevitable since we incorporate insights from the theory of technology into the theory of education to produce a hybrid which we call an investigation into the theory of educational technology. Many, perhaps most, theories applied to education originate in disciplinary areas other than the academic discipline

of education. Psychology is a source of influential theories in education with behaviourism, constructivism, social constructivism and many more. Sociology also has an influence through functional theories, which emphasise basic socialisation and meeting the needs of the political economy, as well as critical theories, which highlight education's hidden role in reproducing social inequality. Physics has always enjoyed high status in interdisciplinary thinking and recently theories from physics, especially drawn from quantum theory, are being applied to education in theory often labelled 'new-materialism'. We take all these theories seriously as voices in the dialogue. Like other researchers, we consider that interdisciplinary research can help us to understand a great deal about education, and as a result are able to develop improved understanding about how best to design teaching and learning (Luckin & Cukurova, 2019). In Chapter 7 we also give a prominent place to theories that have come out of technology such as information theory, systems theory and cybernetics. However, despite being interdisciplinary, we remain rooted within education.

We think it is possible to be both interdisciplinary and rooted in the discipline of education because educational theory is always already interdisciplinary, incorporating many strands of thought. What makes educational theory coherent and distinct is not the origins of the ideas that it brings together but a focus on the two fundamental educational questions: '*What should we teach and learn?*' and '*How should we teach and learn?*' Implicit in these two questions is a third even more fundamental philosophical question: '*Why should we teach and learn?*'<sup>8</sup> Education, as a discipline, has not always enjoyed high status. However, there are reasons to think that it might perhaps be the most important discipline. After all, it lies at the beginning of all the other disciplines and includes them all within itself. It is noticeable that every human culture understands the concept of education and engages in educational practices. However, very few non-modern cultures would recognise physics, psychology or any other current university discipline. This is possibly because education is an essential precondition of human culture (Tennie et al., 2009). The relationship between education and other disciplines is perhaps like that in biology between stem cells, which have the potential to develop into any type of cell in the body, and specialised cells that only have a specific function. Most academic disciplines are specialisations dependent upon, and contained within, the larger human activity of education.

Our issue with most educational theories, theories that attempt to provide answers to the questions of what we should teach and learn and how we should teach and learn it, is that they do not sufficiently consider the role of technology. We think that education has always been bound up with technology. In investigating the theory of educational technology, and developing a dialogic theory of educational technology, we are therefore also interested in proposing a new theory of education, one that takes the voice of technology seriously.

The dialogic theory of education that we often call upon in this book is a distinctively educational theory. It has emerged from decades of practical research with learners and teachers that addresses the two big educational questions (Mercer et al., 2019). Although dialogic theory is often attributed to sources in philosophy such as Bakhtin and Buber, and it is influenced by the ideas of psychologists such as Vygotsky (all thinkers we discuss later in this book), the recent dialogic education theory that we build upon is a distinctively educational theory.<sup>9</sup> This theory is based on observations of how students learn, as well as the findings of multiple research projects that explore how to teach more effectively using a combination of dialogue and technology (Major et al., 2018; Wegerif, 2007, 2013).

Dialogic educational theory begins with the observation that learning is not only ‘transmitted’ explicit curriculum knowledge but nor is it only ‘constructed’ by the learner: learning requires dialogue and so is first called into being by someone or something outside the self, perhaps a peer, parent or a teacher, or perhaps just an interesting event in the world that makes the learner want to find out more. The dialogic relation that makes learning possible is one in which the learner is already partly outside themselves entangled up with the other. The ‘other’ here might be a person or it might be an environment. A key question for the design of education, and education with technology, is how to establish the kind of relationships and dialogic encounters which will enable students to respond and be drawn into participation in educational dialogues.

In everyday speech, the term ‘dialogue’ can be used to refer to almost any kind of social interaction where words or other signs are exchanged between people. However, the term ‘dialogic’ is typically used in at least three different ways in education which we think broadly correspond to three ‘levels’, the first more superficial and the last more profound.

### ***Level 1: A dictionary definition***

The term ‘dialogic’ is defined by dictionaries like the Oxford English Dictionary as an adjective applied to describe anything ‘relating to or in the form of dialogue’. This is the first level of definition that can be applied to dialogic education. Where there is group work, or a high level of open-ended teacher–student interaction, this might be referred to as ‘dialogic education’ without specifying any more technical meaning for dialogic than that the teaching and learning takes the form of a dialogue.

### ***Level 2: Epistemological definition***

Dialogic is often used in a more technical way to refer to the idea that the meaning of spoken words or utterances is constructed within a context that includes more than one voice. The meaning is not determined by a dictionary,

but rather depends on the position and role of the words within a larger dialogue. Words spoken are a response to previous utterances and also have an impact on future utterances (Linell, 2009; Rommetveit, 1992). To put this another way, if a friend sends a message with a happy face emoji, the meaning of that message does not stand alone but depends on the previous message and also on how you respond to that message.

This focus on how we construct meaning from a play of voices in a context gives a second or epistemological level of definition for dialogic education. It suggests that education should be understood as engaging students in an ongoing process of shared enquiry taking the form of a dialogue (Linell, 2009; Wells, 1999). For example, the Dialogic Teaching approach developed by Robin Alexander (2020) is epistemological in focus and involves drawing students into the process of the shared construction of knowledge. A similar epistemological focus can often be found in the community of enquiry approach in Philosophy for Children (Lipman, 2003), in the promotion of Exploratory Talk (Littleton & Mercer, 2013), and in the promotion of Accountable Talk (Michaels et al., 2008).

### ***Level 3: Ontological definition***

Epistemology is about how we know things. Hence, any purely epistemological approach in education does tend to assume that there is a knowing self on the one hand, and an external reality that is known about on the other. However, taking dialogic seriously as a theory of meaning implies that it is not just a means to knowledge construction mediating between selves and reality, but that selves and reality are also part of the dialogue. Applied to education, this more ontological interpretation of dialogic suggests that dialogue is not only a means or tool to be used in education to help construct knowledge, but more than that, engagement in dialogue is a way to change ourselves and to change our reality.

Different versions of ontologic dialogic education focus differently on either understanding and transforming (1) the self, (2) reality or (3) social reality. Understanding the self as a kind of dialogic author, and education as developing both the freedom and the responsibility of this authorial self, seems to be a focus of one strand of ontologic dialogic educational theory (Matusov, 2009; Sidorkin, 1999). Another strand puts more focus on the transformation of reality, seeing education and science understood as dialogue as a journey of discovery from the naturally occurring illusion that selves and objects are separate substances within an external fixed reality, to the realisation that all identities are aspects of a kind of universal dialogue that we can learn to participate in more fully and more compassionately (hooks, 2014; Kennedy, 2014; Wegerif, 2007). A more political interpretation of dialogic education can be seen in the vision of Freire (1970), and those



influenced by Freire (e.g., Flecha, 2000), of dialogic education as a way to empower the oppressed such that they can learn to ‘name’ their own reality in a movement that is both an expansion of consciousness (‘conscientisation’) and at the same time a transformation of social reality.

In practice, despite some claims to the contrary (e.g., Matusov in Matusov & Wegerif, 2014), these three levels of definition are not mutually incompatible. Most approaches to education that describe themselves as dialogic incorporate some element of all three levels. It is not uncommon for approaches to dialogic education to combine a focus on facilitating dialogue where all participants have opportunities to contribute ideas, promoting knowledge and skills through shared inquiry, and fostering dialogic dispositions while valuing dialogue as an end in itself (e.g., Flecha, 2000; Lefstein & Snell, 2013; Nystrand, 1997; Phillipson & Wegerif, 2016).

Not all interactions lead to learning. Bakhtin distinguishes dialogues from the larger category of social interactions or conversations through the fact that dialogues involve a chain of questions and answers where each answer gives rise to new questions (Bakhtin, 1986). In other words, dialogues are where people learn together through a process Bakhtin refers to as ‘inter-illumination’. Education takes place through dialogues and dialogues require the opening of dialogic space. Dialogic space, which we explore in Chapter 8, is the space of possibilities that opens when two or more perspectives are held together in the creative tension of a dialogue (Wegerif, 2019). 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. Internally, however, it opens up an invisible space of meaning that is unbounded and might range freely across many spaces and many times. Technology, we argue, plays a crucial role in opening, widening, deepening and sustaining the dialogic spaces which make learning possible.

### **Theory and practice as dialogues at different scales**

Plato and Aristotle understood theory (*theoria*) to be contemplation of timeless truths as opposed to the more engaged stance of *techné* (technology) which was about making things within time. *Techné* was not simply the practice of making things but referred to the type of close-to-practice theory or knowledge required for making things. *Epistémé* (science) was said by Aristotle to refer to eternal knowledge whereas *techné*, he claimed, referred only to knowledge of things that change in time (Aristotle, ca. 350 BCE/1925). 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 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 (we say more about this in Chapter 9). The term ‘theory’ does not refer to stepping outside of time but, more simply, to stepping back from the surface way of seeing things – stepping back from the immediate activity in a local context – to try to see from a larger perspective. 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.

Understanding theory and practice as the same type of thing, types of dialogue, just operating at different timescales, enables us to understand the role that theory plays in relation to practice. Any practice which requires design requires a close-to-practice theory to inform the design. If you are teaching, for example, you use some sort of theory to tell you what to teach and how to teach it. Also, probably, this theory comes with stories as to why it is a good idea to teach whatever it is that you teach. This close-to-practice theory implies assumptions about reality and values that come from – and belong in – the longer-term dialogue of theory. Theory then provides foundations for the design of practice. This is why theories are potentially very useful.

Of course, it is often true that the two loops of theory and practice in education do not always work well together: theory can be out of sync with practice, or vice versa. Sometimes practices might continue with no theoretical reflection and development, repeating what has always been done and what has always been believed. The danger of this is that they fail to keep up with changes in the larger environment around them. This makes them at best increasingly irrelevant and, at worst, harmful. Or, sometimes, theory may run in a big loop of high-level concepts that does not connect to everyday practice and so does not learn from it. The risk here is that practitioners do not find this kind of out-of-sync theory useful and so become disconnected from the value of high-level or big-loop theory in general. Ideally theory needs to be constantly tried, tested and challenged through engagement with everyday practice. It is true that high-level theories of education cannot always be directly tested, but there is good reason to think that they can be indirectly tested through a kind of evolutionary competition between different approaches. We say more about how this can work in Chapter 10 when we look at research as a way of keeping the big-loop of theory and the smaller loops of practice in a constructive relationship. In this book, we aspire to

produce new theory that is both high-level and long-term in vision and yet also grounded in practice and useful as a tool behind the design of practical educational interventions.

### **A summary of what this book is about**

This book has a twofold purpose: to provide a broad introduction to the theory of educational technology and to offer a new ‘dialogic’ foundation for the design and practice of educational technology. Since we think that theory is practical, and that practice is a way of trying out and developing theory, we include many short descriptive case studies of educational practice that illustrate the two-way relationship between practice and theory. We have drawn these examples from the whole history of educational technology and not only from the use of the most recent technologies. This is a field in which memory often seems to be in short supply as the latest flashy technological innovations distract attention from general educational principles that have been learnt already long before. We use these case studies drawn from many contexts to exemplify the application of theory to practice in addition to exemplifying what theory can learn from engaging more closely with practice.

To understand the role of technology in education it helps if we step back from our current education system and look at it from a larger perspective. This is what we do in Chapter 2, which considers the history of educational technology and argues that there is an interdependence or entanglement between technology and education that goes back to the origin of humanity. We find that while educational technology is now commonly seen as a supplement to the main business of education, the first recognisable schools emerged to teach how to use educational technology as the core curriculum. The complex demands of teaching how to use stylus and clay to record trade deals and collective stories led to the emergence of formal schools in Ancient Sumeria. The need to teach the communication technologies of literacy and numeracy drove the spread of schooling after the development of printing and national education systems emerged closely dependent on, and influenced by, print literacy.

Investigating the difference between ways of understanding knowledge and education in majority oral societies and in majority print literate societies leads us to refer to the ‘cognitive affordances’ of different media. Oral societies vary in their approaches to education but one kind of education that oracy tends to make easy (or ‘afford’) in some contexts is a vision of thinking and learning as a dialogue between voices, often between human voices and ‘spirit’ voices. This was, for example, how the oral thinker Socrates is often presented by Plato as describing education. Print literacy, by contrast, tends to make it possible and perhaps plausible to picture reasoning as like making a proof in geometry. In Chapter 3 we trace the idea of affordances to

the perceptual psychology of James Gibson, and we investigate the influence on Gibson of Maurice Merleau-Ponty. For Gibson, perception was not best thought of as a product of ‘information processing in the brain’, as much cognitive psychology still claims. Rather, he saw perception as an aspect of the relationship between a ‘body’ and the world. Bodies perceive directly if a surface affords walking or if a bench affords sitting. But how we see the affordances of things depends not only on the physical possibilities of the body-world coupling but also on the meaning that a thing has (which is of course shaped by the culture and education). Whether or not a bench affords sitting or stepping, for example, might depend on whether you encounter it in a park or in a gym, and also on what kind of gym training or park induction you might have had.

Affordances turn out to be about meaning, and design of the affordances of educational technology turns out to be design for meaning. We locate meaning in the tension between the event of what a user actually does with a tool, and the horizon of possibilities around that event – all the things that the user could imagine doing with the tool and all the associations that it has for them.

In Chapter 4 we look at what, following Wittgenstein, we call the ‘grammar’ of educational technology: the ways in which this has been conceived and applied as ‘teaching machine’, ‘tool to think with’ and ‘learning environment’. These ways of framing educational technology are theories that shape the design and use of educational technology. However, they are not precise enough to be the ‘close-to-practice’ theory we call design frameworks because they could each support a wide variety of designs. Thus, they are examples of what we call ‘foundations for design’. This raises the question of how we select the best foundation for design. We see these different ‘grammars’ as competing for attention in the long-term dialogue of the theory of educational technology. Empirical research as to how effective they are in achieving their goals is certainly relevant, and we cite this when we can, but such evidence is – on its own – not enough to help us choose because each ‘grammar’ defines its own criteria of success and failure. We therefore offer a modest form of what could be called a ‘grammatical’ analysis exploring the coherence and implications of these different ways of framing educational technology.

In Chapter 5 we continue to explore theories and approaches to educational technology by looking at ‘online mediated communities of practice’, ‘online multi-user role-play games’ and ‘connectivism’. Our analysis of the strengths and weaknesses of these grammars leads us to propose a new dialogic grammar or foundation for design. This new foundation for the design of educational technology builds on the connectivist theory of learning as a form of networking, but adds the importance of consciousness and identity. Dialogue, we claim, is needed to turn external networks of nodes and links

into an internal space of resonance: learning is not just adding nodes and links, it is also expanding the dialogic space needed to make sense of each new node by bringing it into dialogic relation with all other nodes in the network. From connectivism, we draw the idea of learning as connecting a network of relationships. From considering the value of online mediated communities of practice and of future-oriented role-play games, we highlight the importance of anticipation of the future, or being pulled forward into the expansion of knowledge, through a dialogic relationship with the horizon of all that which is as yet unknown.

Heidegger's discussion of the way that tools and technology enter into experience has had a profound impact on the philosophy of technology. In Chapter 6 we consider implications for educational design that follow from his account. We go further to interrogate his apparent criticism of modern technology as something that 'enframes' us in a way that cuts us off from a more authentic and nourishing relationship with the world. We find that while Heidegger described modern technology as a great danger, he also recognised it as an opportunity for a different kind of human future. His analysis of the potentially world-creating and world-revealing effects of inhabiting technologies from the inside turns out to be relevant not only to understanding the use of everyday craft tools like hammers, but also for understanding more modern tools like Generative AI and the internet.

In Chapter 7 we respond to the critique of modern technology from Heidegger and investigate how meaning relates to technology and, especially, to educational technology. It is common to contrast human meaning with technology in a way that poses the use of technology in education as a threat to human meaning. We challenge this view claiming that meaning, the sort of meaning that provides motivation, is an effect of 'anticipation' in self-organising systems. Meaning of this kind is therefore not exclusively human. Human meaning, the experience of meaning and purpose is tied, we argue, to a feeling that we get when we participate in larger systems. These larger systems that, in a sense, call us to meaning, always have a technological aspect, if only in the medium of communication that supports these dialogues and makes them possible. Education for meaning can then be understood as part of the self-organisation of bio-socio-technical systems. We introduce ideas from a philosopher of technology, Gilbert Simondon, who argues that dialogue with technology is needed for what he calls 'transindividuation' – the creation of collective forms of identity. We illustrate the argument with examples of how educational technology can be designed to support education as induction into larger, culturally mediated kinds of meaning.

In Chapter 8 we look at technology in relation to the idea of dialogic space and explore education as the expansion of dialogic space. Dialogic space expands when 'voices' that were previously not heard or understood become heard and understood, and when things that were previously unthinkable

become thinkable. Technology, we argue, has a key role to play in education understood as the expansion of dialogic space. The resonances between voices in dialogue together occur over time as much as over space. One aspect of education is the bridging together, and bringing into dialogue, different timescales through the mediating means of communications technology. In Chapter 9 we argue that new digital forms of educational technology can offer a particular affordance for inducting learners into participation in dialogues over longer-term timescales.

Research is essential to the development of theory. And the development of theory is essential to the development of practice. In Chapter 10 we offer a critical history of research on education and educational technology, arguing that changes in technology make new forms of research possible and necessary. We put forward a version of educational design-based research (EDBR) which is a form of action research and, potentially, a form of participatory action research. We call our version of EDBR ‘double-loop’ as it uses data and dialogue to reflect not only on the achievement of initial educational goals, but also to reflect back upon and change those initial goals in the light of the evidence. Finally, we relate double-loop EDBR to Merleau-Ponty’s idea of meaning as ‘Chiasm’, proposing that one way to do research on and with educational technology is as a dialogue that systematically inter-reacts and inter-illuminates ‘inside’ points of view, accounts of experience for example, with ‘outside’ points of view such as statistical patterns in the data.

Strands from all the previous chapters are brought together in Chapter 11 to outline a dialogic theory of educational technology. Education, we claim, is about drawing 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 AI language assistants. Technology in various forms is, therefore, at the heart of education. However, the distinctive role and impact of these different technologies need to be examined and better reflected in theories of education. Our dialogic theory of educational technology corrects this imbalance. It is intended to serve as a foundation for design. The usefulness of the theory can be tested, or at least explored, by building designs based upon it and testing how they hold up. We discuss the ethics of design, and propose dialogue, however difficult and messy this often is in practice, as the only practicable way forward. The kind of designs our proposed dialogic theory of educational technology grounds are combined pedagogical and technical designs to facilitate the dynamic inter-weaving of educational dialogues at different spatio-temporal scales, often linking short-term face-to-face dialogues to long-term global dialogues. Educational technology, we propose, should (1) engage students, providing opportunities and motivations to draw them into participation in educational dialogues; (2) connect students with others in wider learning

networks; (3) expand dialogic space and time by building bridges between short-term dialogues and longer-term larger scale dialogues; and, finally, (4) support students into forming a constructive relationship with the radical open-endedness and uncertainty of the surrounding horizon of all that which is unknown.

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