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REPORT 4 UPDATE:

Creativity, technology and learning – a review of recent literature

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This report updates Futurelab's 2003 Literature Review in Creativity, New Technologies and Learning and should be read in conjunction with that report. This can be found at www.futurelab.org.uk/litreviews

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INTRODUCTION

1 INTRODUCTION

The first literature review 'Creativity, New Technology and Learning' was written in the early months of 2002. The brief was to provide a sound theoretical and empirical basis to inform the development of policy and the design of digital learning resources, and to encourage communication between the educational research community and the commercial sector on the subject of the teaching and learning of creativity with ICT. The purpose of this second review is to identify what progress, if any, has been made in the area through research, development, policy and other activities since that date. It is not an exhaustive account, but an overview of how the framework presented in 2002 has helped us to think about practice and policy, and how we might look differently at the field five years later.

In this review, I present an argument that there has indeed been a growth of activity in the development of policy, practice, digital resources and research; each of which plays a role in the nurturing of creative processes, environments, and outcomes. The sharper focus on creativity has also raised awareness of some of the rhetoric and dilemmas which face educators as they place debates about pedagogy and curriculum in the wider landscape of the economic, social and cultural purposes of education in our society (Banaji, Burn and Buckingham 2007; Craft 2005). These tensions, debates and the emergence of new practices and projects since 2002 will form the focus for the discussion.

POLICY DEVELOPMENTS: CREATIVITY FOR EDUCATION

2 POLICY DEVELOPMENTS: CREATIVITY FOR EDUCATION

It is clear that creativity is promoted in national educational policy developments and initiatives across the UK, and indeed 2006 was a fruitful year for reviews, reports, recommendations and responses on initiatives from early years education to creative industries. The NACCCE Report 'All our Futures' (1999) has undoubtedly been a key influence on the evolution of initiatives, from early discussion documents to the independent review 'Nurturing Creativity in Young People' (Roberts 2006). Table 1 presents a selected overview of educational policy discussions, projects and reports which have shaped practice across the UK.

Scotland	**Creativity in Education (2001)** A discussion paper
	Creativity Counts – Portraits of Practice (2004) Case studies of school projects
	A Curriculum for Excellence (2004) Review of 3–18 curriculum
	Progress and Proposals (2006) Commitment to promote creativity in curriculum
	Future learning and teaching programme (2004-7) Pilot projects for innovation in learning and teaching
	Emerging Good Practice in Promoting Creativity (2006) HMIE report on inspection evidence
	Promoting Creativity in Education (2006) SEED overview of UK initiatives
Northern Ireland	**Unlocking Creativity: A Strategy for Development (2000)** Consultation report
	Unlocking Creativity: Making It Happen (2001) Objectives for future work
	Unlocking Creativity: A Creative Region (2004) Strategy across education, culture and employment
	Empowering Schools Strategy (200?-2008) Incorporating creativity and innovation with ICT
	Education (NI) Order (2006) Revised curriculum from September 2007

POLICY DEVELOPMENTS: CREATIVITY FOR EDUCATION

Wales	**Review of Welsh National Curriculum (2004)** Includes Creative Skills as a requirement **Revised Welsh National Curriculum September 2008** Proposed implementation
England	**Schools: Achieving Success (2001)** White Paper pledging a range of opportunities for creativity and curriculum enrichment **Creative Partnerships (2003)** Schools working with creative practitioners for curriculum innovation **Artsmark** Arts Council national award scheme for schools **Creativity and Cultural Enrichment Working Group (2001–2003)** Cross-agency reference and consultation **Creativity: find it, promote it (2003)** QCA's website of knowledge and practice to inform creative activity in the curriculum **Nurturing Creativity in Young People (2006)** Framework for creativity and creative portfolios **Government response to Paul Roberts' Report on Nurturing Creativity in Young People (2006)**

Table 1: A selected overview of educational policy discussions, projects and reports which have shaped practice across the UK

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3 CONTEXTS FOR DEBATE

The place of creative thinking and practice in education is being debated and worked out in a number of contexts: the purposes of creativity in our society and economy; the challenges of ownership and sharing of ideas and practice; the development of pedagogy for creativity; the approaches to assessment of creativity; and our understanding of the implications for individuals, communities and the wider world.

The debates on creativity in education are taking place in parallel with commentary about the UK's place as a world-class 'hub' of innovation and creative industries. These discussions raise questions, not only about innovation in a growing market for creative businesses (NESTA 2006a), but also concerns about an 'innovation gap' and the skills and attributes required to create, absorb and exploit economic innovation (NESTA 2006b). Education systems in the 21st century are having to adapt to the changes, aspirations and anxieties about the role of creativity in our wider society, not only in realising personal learning potential in an enriching curriculum, but also in raising achievement, skill and talent for economic innovation and wealth creation.

Educational and economic policy presents creativity as a 'good thing' and desirable for growth. There are, however, some challenges of principle and practice which raise dilemmas for educators. For example, the instrumentalisation and commodification of creativity for wealth creation pose questions about who 'owns' ideas and products, and how these might be protected or used for further development of ideas. These questions are debated at all levels, by the general public showcasing their creative ideas on Flickr or MySpace, as well as corporate lawyers guarding intellectual property (Hartley 2003; Lessig 2004; Young 2002). The Creative Commons movement offers clear explanations and advice on how to make choices in making ideas and creative work available to others with different degrees of attribution and permission (see www.creativecommons.org).

Pedagogy can be considered as activity designed to enhance learning for others, encompassing the interaction between creative teaching and teaching for creativity. Developments in pedagogy are related to the contexts of the curriculum, purpose and ethos of the educational setting, and they express underlying theories of learning and what it means to be educated in our times. Pedagogy for creativity needs, therefore, to be able to design learning experiences and spaces which allow incubation, generation and analysis both in the curriculum and in the community (Creative Partnerships 2003; Donnelly 2004; Riley and Ahlberg 2004; Webster, Campbell and Jane 2006). An example of this approach to pedagogy is the development of professional knowledge in the Creativity and Professional Development Project (C&PD) based in initial teacher education. Digital technologies, such as digital video for example, can provoke teachers' thinking about the media, the organisation, and the knowledge and skills required to support learners' creative activities (Loveless, Burton and Turvey 2006).

The questions about the conduct of assessment for creativity with digital technologies are similar to those raised in 2002, namely the need to evaluate both

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process and product, and to recognise that our understandings of work created with digital media and tools are still emerging. There have been, however, interesting explorations of the role of digital technologies in stimulating and capturing creative activity. An EPPI systematic review of research literature, focusing on the impact on students and teachers of the use for ICT for assessment of creative and critical thinking skills, indicated evidence that computer-based concept mapping could provide summative assessment of critical and creative thinking skills (Harlen and Deakin Crick 2003). Project e-scape, based at the Technology Education Research Unit (TERU) at Goldsmiths' College, London, has focused on the development of an e-portfolio examination system that will enable students to develop their design and technology projects digitally, to submit them digitally (via a secure website) and for the examination authority to assess them digitally. Exploring the use of web-based systems and peripheral technologies, such as digital cameras, pens and PDAs, the project investigated the aspects of technology, manageability, functionality and pedagogy in the assessment of design innovation for GCSE national examinations for 16 year-old pupils (Kimbell and Wheeler 2005).

Craft elaborates on the challenges that educators must face in the organisation of curriculum knowledge, the balancing of professional artistry within a centralised pedagogy, and the awareness of tension in creative teaching, teaching for creativity and creative learning. These challenges are placed within the wider ends of creativity and why it might matter in education: in economic and community development; in social justice; and in

alternative imaginings of existence within our world (Craft 2003, 2005; Kaufman and Sternberg 2006). As educators we need to consider, not only the questions about what is creativity, who is creative and where does creativity flourish, but also the purposes of our using our imagination and creative capabilities, and how they contribute to our sense of self as individuals in relationship with others and the wider world (Kaufman and Sternberg 2006).

REVISING OUR UNDERSTANDINGS OF ICT AND CREATIVITY

4 REVISING OUR UNDERSTANDINGS OF ICT AND CREATIVITY

In recent years the discussion of theories of learning and teaching with ICT have developed, particularly in our understanding of the relationship between technology and context. In the late 1990s, the distinctive features of digital technologies were described as provisionality, interactivity, capacity, range, speed and automatic functions (Department for Education and Employment 1998). There is a danger of locating the power of these features in the technologies themselves, rather than recognising how they emerge in interaction with human agency and purpose. A more helpful way of thinking about the potential of the tools that we use to support our creativity is to consider their affordances – the opportunities and constraints that they offer in relationship to wider, interactive contexts (see for example Conole and Dyke 2004; Gibson 1986; Greeno 1994; Howells 2005; Kennewell 2001).

In considering how digital technologies might support learning, the affordances of the technologies can be described in 'clusters' of purposeful activity: knowledge building; distributed cognition; community and communication; and engagement (Fisher, Higgins and Loveless 2006). These clusters are also useful in thinking about what digital technologies might offer to foster creativity, and are outlined in Table 2.

Knowledge building	• adapting and developing ideas • modelling • representing understanding in multimodal and dynamic ways
Distributed cognition	• accessing resources • finding things out • writing, composing and presenting with mediating artefacts and tools
Community and communication	• exchanging and sharing communication • extending the context of activity • extending the participating community at local and global levels
Engagement	• exploring and playing • acknowledging risk and uncertainty • working with different dimensions of interactivity • responding to immediacy

Table 2: Clusters of purposeful activities with digital technologies for learning (from Fisher et al 2006)

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5 PROJECTS AND PRACTICE SINCE 2002

In 2002, the review used a framework to identify and describe the range of creative activities supported by digital technologies:

- physical and virtual learning environments
- developing ideas
- making connections
- creating and making
- collaboration
- communication and evaluation (Loveless 2002).

These categories are not mutually exclusive and many of the activities described express one or more of these processes. In reviewing activity at the beginning of 2007, it is clear that there are many case studies of projects and ongoing work in schools and colleges that are similar to the examples described in those categories. This update is therefore not comprehensive, but focuses on selected recent developments that draw our attention to a particular question: how are learners and teachers engaging with digital technologies in ways which continue to open up debate about the nature of creativity and learning?

5.1 CREATIVITY IN PHYSICAL AND VIRTUAL ENVIRONMENTS

The places and spaces in which we live, learn, work, relax and relate to others have many layers of meaning for us; in experience, perceptions, memories and meetings. In recent years digital technologies have developed which bring together both physical and virtual experiences of space, affording opportunities for exploration, play, risks, reflection and encounters with others. Mobile devices, such as mobile phones, PDAs and GPS systems offer portability, social interactivity, context sensitivity, connectivity and individuality, and can be used to capture, compose and communicate creative responses to physical settings.

Attaching information in the form of text, images and sound to particular locations can open up possibilities for imaginative role-play, problem-solving, collaboration and new perceptions of place. The recent development of digital resources for creating 'mediascapes' has moved from role-playing and exploration of mediascapes authored by others, to opportunities for learners and teachers to create and author their own ideas in response to a sense of place. One example of this is the MScape software, developed by HP Labs, which is used in a developing project community (www.mscapers.com). These approaches have been taken further in the development of educational resources for Create-A-Scape. These enable teachers and learners to download authoring software to create their own mediascapes, attaching traces of personal experience and history, and fashioning new landscapes, from rainforests and the surface of the moon to imaginary parallel worlds (www.createascape.org.uk). The sharing and mapping of 'local knowledge' in a community and physical space has also been explored in projects such as Urban Tapestries and Social Tapestries, developed by Proboscis in collaboration with other partners (socialtapestries.net).

Digital technologies can also be used to sense and respond to people's presence in

physical space. Artists such as Rafael Lozano Hemmer works on grand-scale interactive installations, turning the night sky into a switchboard of light connecting people on their mobile phones (www.amodal.net/intro.html), or a public plaza into a gigantic projection emerging from the shadows of the passers by in the crowds (www.lozano-hemmer.com/video/bodymovies.html). Other examples of the creative use of digital technologies in space include projects such as Leeds City Poems (www.centrifugalforces.co.uk/citypoems/pages/01_01.html); Jen Southern's memory maps (www.centrifugalforces.co.uk/surface patterns/pages/editable/tours.html); Squidsoup's Come Closer (squidsoup.org/comecloser); and Futurelab's MobiMissions, Fountaineers, La Piazza, Savannah and Mudlarking (www.futurelab.org.uk/projects).

Interesting issues about the convergence of technologies in mobile devices emerge from such creative works. How does the design of mobile and immersive digital technologies foster the creative capability and skills required to locate people, places and information; navigate to new and supporting information and texts; respond to and interact with places and people in those spaces; and communicate experiences and meanings with others?

5.2 DEVELOPING IDEAS – WHAT WOULD HAPPEN IF...?

Creative imagination not only generates ideas, but also discerns those with potential for growth. Creative processes are supported by opportunities for play, exploration, reflection and focused engagement with ideas, and digital

technologies have played a role in these activities since early simulations and Logo. Free play with digital technologies, however, does not guarantee effective or creative engagement or development, and there is still a need to support and guide children's interactions in informed ways (Plowman and Stephen 2005).

MediaStage and Jungulator are two contrasting examples of digital tools which allow learners to play and develop their ideas for composition in visual images and sound. MediaStage offers a 3D simulation of a TV studio with actors, sets, technical effects and props. 12-13 year-old students in English secondary schools worked with the simulation to develop scripts, sets and characters, weaving together creative processes to present carefully fashioned performances (de Freitas and Oliver 2006; Owen 2003). The Jungulator prototype software produced unpredictable and self-generative performances of visual and sound images from recorded samples. 14-17 year-old students drew upon their previous experiences and capabilities to make audio-visual pieces in which their own compositions interacted with the self-generative effects of the software. Trials of the resource raised interesting questions about the nature of 'originality' of students' creative compositions in interaction with computer-generated manipulations (Dillon 2005). Other means of developing ideas have been offered through tablet PCs for visual diaries with higher education students (Berry and Hamilton 2006), and Moovl, a portable drawing slate for young children with simulated physical properties (www.futurelab.org.uk/projects/moovl).

There are many digital tools for conjectural and provisional play – from Logo to multiplayer online games, and the digital

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worlds of simulation and gaming play a role in developing approaches to exploration, problem-solving and developing hypotheses to inform action (Gee 2004; Shaffer 2007). There is, however, continuing debate about the nature of learning in the interaction between such resources and the contexts of design, teaching and reflection (Kirriemuir and McFarlane 2004). The software tools also shape the production processes (Sefton-Green 2005). An important feature of such tools for creativity and learning is that they offer opportunities not for projection and demonstration of teacher-mediated material, but for learners to be 'hands-on-and-minds-on', asking questions and responding to the consequences of their decisions.

5.3 MAKING CONNECTIONS

There is a multitude of opportunities for making connections with information, case studies, exemplar materials, resources and creative practitioners in formal and informal settings – from international galleries and museums, to small-scale webcam connections. Social software, such as Flickr, YouTube and last.fm, enables the development of folksonomy tagging, and scrobbling, where users can categorise and retrieve web content, trace the links made by others and make connections with others with similar tastes and interests.

Table 3 indicates a limited selection of the many educational sites which offer portals to a wide range of connections with creative practice.

5.4 CREATING AND MAKING MEANING

In 2002, the review discussed examples of practitioners, teachers and learners using digital technologies to manipulate text, image and multimedia to engage in creative processes to express and share ideas and create and make meaning.

Photographic projects such as Postcards Home use digital image manipulation to support explorations of arts practice and expressions of identity as children work with practitioners from a local art gallery (Herne 2005). Such work is continuing and developing, and similar case studies can be found through many of the sites suggested in the previous section. In recent years, however, there have been notable developments in the educational use of digital technologies in areas of movie making and music. Digital video can be an engaging tool in constructing, editing and presenting identities in different contexts, and children can make choices about how they represent themselves in this medium working within and out of school settings (Pearson 2005; Potter 2005; Reid, Burn and Parker 2002). Machinima are new narratives created from the resources of computer games, such as Halo, Sims and World of Warcraft. Films can be shot in the virtual reality of a games engine using the resources of the game, such as backgrounds, characters and levels, and tools such as camera angles, editors, texture generators and reference sites. The films and series produced can be developed and shown in the machinima community which offers tips and techniques to develop new stories and meanings (see www.machina.com).

Teachers' TV	www.teachers.tv/search/node/creativity Examples of creative practice and ideas
TeacherNet	www.teachernet.gov.uk/management/atoz/c/creativityinschools A summary of definitions and links to reports and practice
Creative Partnerships	www.creative-partnerships.com Examples of projects in schools working with creative practitioners to develop a broad, balanced and relevant curriculum
Find it, Promote it	www.ncaction.org.uk/creativity QCA website focusing on creativity in the curriculum
Futurelab	www.futurelab.org.uk Examples of innovative digital technologies for learning
Connected	www.ltscotland.org.uk/ictineducation/connected/articles/8/news/creativityineducation.asp Learning and Teaching Scotland: Creativity in Education Online
Learning and Teaching Scotland	www.ltscotland.org.uk/creativity Learning and Teaching Scotland: Creativity in Education, links to practice case studies
Becta	www.becta.org.uk/corporate/display.cfm?section=21&id=2663 Creativity in Digital Media Awards
ArtisanCam	www.artisancam.org.uk Links to practicing artists

Table 3: Making connections with ideas and practice in education

Research in the contribution of digital technologies to the music curriculum focuses on a variety of tools for composition, notation and performance (Farbood, Pasztor and Jennings 2004; Gall and Breeze 2005; Reynolds 2003). The Creative Music Project at Trinity College Dublin, for example, has produced Drumsteps, a software environment to support children's listening, performing and composition, both as individuals and multiple users collaborating in networked community spaces (McCarthy, Bligh, Jennings and Tangney 2005).

Such activities draw attention to the processes and activities through which learners can fashion, manipulate and craft in order to make meanings. They can express their ideas and make

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new connections, relationships and representations, through active engagement with the tools and media.

5.5 COLLABORATION

Creative collaborations can be supported by digital technologies in a variety of ways, offering opportunities for connections between learners and practitioners, and for shared spaces for making and developing work with others. Collaboration between creative practitioners and learners is the focus of initiatives such as Creative Partnerships and organisations such as The Cloth of Gold, which work with schools to develop creative ICT activities (www.clothofgold.org.uk). It is, however, the use of virtual 'space' or 'studios' to create and share work which offers a distinctive contribution to collaborations across time and place. Virtual Puppeteers was developed to offer children opportunities to make virtual 3D puppets and imaginary stage settings; create puppet plays in real-time in networked collaboration with remote users; and watch and listen to their plays (www.futurelab.org.uk/projects/virtual_puppeteers). This type of collaborative work enables people to produce creative outputs together and moves such activity beyond capturing, publishing and visiting other people's showcases.

The use of digital tools for creative collaboration and remix also raises interesting challenges for our understanding of intellectual property, copyright, open source and creative commons (Ghosh 2005; Lessig 2004). Jo Twist, a BBC News science and technology reporter, noted that the possibilities for producing and sharing creative content

with the channels and tools of the internet were set to disrupt the relationship between traditional institutions and loosely organised networks of collaborators (Twist 2005). The collaborative creation of knowledge, representation and meaning can take place in virtual studios or across digital networks, disrupting our familiar formats, pedagogies and communities of practice (Dron 2007; Green and Hannon 2007).

5.6 COMMUNICATION, PUBLICATION AND AUDIENCE

The presentation and celebration of creative work has continued to develop from the slideshows, online galleries and websites discussed in 2002. The need to consider the purpose and audience for presentation and exhibition is just as critical in publishing creative work for wider evaluation, yet the range and scope of material, media and audiences have proliferated. Awards and exhibitions select and show a wide range of creative works. The Becta Creativity in Digital Media Awards and annual event Be Very Afraid, presented by the British Academy of Film and Television (BAFTA) in association with Professor Stephen Heppell, are examples which highlight both the celebration of creative activity and the judgement of originality and value. (www.becta.org.uk/corporate/display.cfm?section=21&id=2663 and www.heppell.net/bva2).

Undoubtedly, in recent years new practices have emerged in the use of digital technologies for showcase, feedback, folksonomy tagging and networking. Sites such as Flickr and YouTube enable users to publish their creative digital work for others to visit, evaluate and offer

comments, and schools and colleges use virtual learning environments for sharing and publishing work for a more enclosed audience (Turvey 2006). Web 2.0 technologies take this further by offering opportunities, not only for people to show their work to a wider audience, but also to engage in networks where the 'content finds you' as an audience (Owen, Grant, Sayers and Facer 2006, p10).

In thinking about audiences for our creative work, a key issue of 'value' emerges. The term 'value' can be considered to have different meanings, from the originality and worth of a piece of work, to the attribution and price of the intellectual property. The technologies give us the opportunity to 'rate' our experiences of commercial media as well as each others' more informal work. This in turn raises questions about how we understand and value creativity itself; how we might wish to recognise and acknowledge it in others; and the place that 'value' and 'recognition' might play in the creative process at all.

THE FUTURE...?
IT'S DIGITAL, BUT IS IT CREATIVE?

6 THE FUTURE...?
IT'S DIGITAL, BUT IS IT CREATIVE?

This overview has presented a picture of development in creative practices with digital technologies. There is evidence that activities have increased both in frequency and scope, in which the technologies themselves are more transparent and part of a familiar landscape of developing ideas, making connections, creating and making meaning, collaboration, publication and exhibition. In looking back over the five years between the two reviews, there is, however, one area of significant development which offers promise and challenge to our understandings of creative practices – the creative experience of physical and virtual space.

Digital technologies are being used to locate, search and capture information in a variety of forms; to connect networks; and to attach meanings to spaces. In physical space, some creative practitioners use costly and complex installations to detect and project, others make use of ubiquitous and easy-to-use mobile technologies to capture, communicate and collaborate. At present, ubiquitous mobile devices are limited in their potential for manipulation and fashioning of ideas, yet they are useful tools to stimulate imagination, support interaction and communication, and enable artists, designers and participants to express ideas of space, time and experience. In virtual space, people are using Web 2.0 technologies to share, to show and to collaborate in making creative work which can engage new audiences and disrupt traditional structures and commercial interests. One might argue that the degrees of originality and creativity differ, from the creativity of

iconoclastic artists and innovators in their field, to the creativity of the general possibility thinking that everyone can demonstrate at different times. Our attempts to reconceptualise the design of learning environments will need to address questions raised by our vision for creativity in the interaction between physical and virtual spaces (Rudd, Gifford, Morrison and Facer 2006)[1].

The great challenge is to continue to revisit our understandings of creativity. Digital tools allow us to capture, store, navigate, manipulate, respond and present in the media of text, images, sound and sense. There is always the danger that descriptions of creativity be reduced to just having ideas, recording, mimicking and showing – remaining in the initial stages and processes without the opportunity or desire to take these further. There is also a need to recognise our engagement with imagination, fashioning and flow, and ask questions about the purpose, value, worth and cost of creative activity to individuals and communities. The word 'creativity' is often used synonymously with terms such as 'innovation', or 'good learning', yet it contains more than these. We need to be informed by creativity fostered and expressed in other cultures, both locally and internationally, and use other people's understandings as 'grit in the oyster' to provoke the growth of our own. Our knowledge of creativity emerges as we think at the edges of our practice, and figure out how to use tools and media in distinctive ways to express our imagination and capabilities. In 2012, will we look back and be proud of the ways in which we designed our learning environments and digital tools for creativity?

[1] See also the work of the Commission for Architecture and the Built Environment at www.cabe.org.uk

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About Futurelab

Futurelab is passionate about transforming the way people learn. Tapping into the huge potential offered by digital and other technologies, we are developing innovative learning resources and practices that support new approaches to education for the 21st century.

Working in partnership with industry, policy and practice, Futurelab:
- incubates new ideas, taking them from the lab to the classroom
- offers hard evidence and practical advice to support the design and use of innovative learning tools
- communicates the latest thinking and practice in educational ICT
- provides the space for experimentation and the exchange of ideas between the creative, technology and education sectors.

A not-for-profit organisation, Futurelab is committed to sharing the lessons learnt from our research and development in order to inform positive change to educational policy and practice.

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Written by leading academics, these publications provide comprehensive surveys of research and practice in a range of different fields.

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Drawing on Futurelab's in-house R&D programme as well as projects from around the world, these handbooks offer practical advice and guidance to support the design and development of new approaches to education.

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