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Digital stories as a method for evidence-based practice and knowledge co-creation in technology-enhanced learning for children with autism

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Storytelling is a powerful means of expression especially for voices that may be difficult to hear or represent in typical ways. This paper reports and reflects on our experiences of co-creating digital stories with school practitioners in a project focusing on embedding innovative technologies for children on the autism spectrum in classroom practice. The digital stories were short films or narrated sequences of slides and images that conveyed key views about experiences and practices with or around the technologies. The creation of the digital stories aimed to empower schools and individual teachers to construct and share their own authentic narratives and to build case examples of creative technology-enhanced teaching and learning. Through focusing on our experiences with one of the schools, we examine the use of digital stories as a method for enabling knowledge co-creation with practitioners and we discuss the evidential potential of digital stories. We argue that the co-creation of digital stories enabled teachers to find their voice in critiquing the usability, usefulness, efficacy and flexibility of the technologies. Furthermore, the stories, both the process of their creation and the final artefacts, provided a concrete grounding for knowledge co-creation about teaching practices and authentic technology-enhanced learning.

Keywords: evidence-based practice; knowledge co-creation; digital stories; participatory research; schools; autism; technology-enhanced learning

Introduction

It is well established that there is a significant gap between research evidence and real-world teaching experiences and practice (Hargreaves 2007; Menter et al. 2010). Many commentators offer both potential solutions for narrowing this gap (Christie and Menter 2009; Hill and Haigh 2012) and critical perspectives on the very concept of evidence-based practice (EBP) in education (Thomas and Pring 2004; Hammersley 2005; Biesta

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2007). The recent BERA-RSA (2014) inquiry into EBP noted the importance of teachers' direct involvement in research such '... that wherever possible teachers are active agents in research, rather than passive participants' (8). Crucially, the report concludes:

> ... that amongst policymakers and practitioners there is considerable potential for greater dialogue than currently takes place, as there is between teachers, teacher-researchers and the wider research community. (8)

This stance is in contrast to other commentaries and policy initiatives from the government, which urge teachers to maximize pupil learning outcomes by focusing on 'what works' via certain teaching methods (cf. Goswami 2006; Thomas 2013). Biesta, Allan, and Edwards (2014) critique this rhetoric, whereby the basic assumptions about what constitutes valid research have been arrogated by the natural sciences' emphasis on gold standard experimental research designs. Consequently, instead of acknowledging the need to employ varying methodologies relating to research foci and diverse contexts, only technical instrumental research appears to be accepted as valid.

The research–practice gap has also been discussed widely in educational and therapeutic autism interventions research (Odom et al. 2005; Dingfelder and Mandell 2011); a field traditionally dominated by methodologies from experimental Psychology, with many studies being undertaken in laboratory settings rather than in classrooms (Parsons et al. 2013). There has been recognition of the paucity of research related to implementation of autism interventions in school settings and of the need for such research (Parsons and Kasari 2013), particularly to improve ecological validity and to generate evidence of long-term effectiveness (Kasari and Smith 2013). Given that the knowledge base of practitioners and the social setting in which practitioners exist are crucial to whether an intervention is applied effectively (Damschroder, Aron, and Keith 2009), the need to bridge the gap between research and educational practice becomes particularly important.

In order to identify the goals that are important for the autism community, for families and for practitioners, it is essential for meaning to be found in all stakeholders' respective lived experiences, and for research to invest in working *with* those stakeholders rather than *on* them (Pellicano, Dinsmore, and Charman 2014). This necessitates a shift of focus from learning that happens outside of the typical places where children spend their time (cf. Ogletree, Oren, and Fischer 2007) to the context and culture of where learning takes place (Thomas 2013). To understand education, we need to recognize that people function in material environments that are endowed with cultural meanings (Lemke 1997; Daniels 2001) which leads to a need to examine both the learning processes and the context of implementation. Such a focus calls for close involvement of practitioners and highlights the importance of action research whereby teachers research their own schools or classrooms to reflect on and improve practice and outcomes for learners (Rudduck and Hopkins 1985; Kemmis, McTaggart, and Nixon 2014).

Deriving from the action research tradition is the important aspiration of participatory research involving practitioners and researchers (Christie and Menter 2009; Leibowitz, Ndebele, and Winberg 2014), and of inclusive research that seeks to fundamentally change the power relationships between researchers and those who are traditionally researched (Seale, Nind, and Parsons 2014). Collaboration and dialogue are considered key to such research, where knowledge is understood to be

culturally specific and situated, and hence evidence is an outcome of knowledge co-creation (Fisher, Higgins, and Loveless 2006; Houston et al. 2010). However, despite the aspirational rhetoric of action research and inclusive and participatory involvement of teachers in research, much still remains to be understood about how such involvement can be facilitated and managed in practice and how the emerging outcomes can be meaningfully translated into knowledge that is applicable and relevant beyond the settings within which it was generated.

It is in this context that we discuss the role of digital story-making by school practitioners as a method for generating and sharing new knowledge about how to embed innovative technology-enhanced learning (TEL) in school classrooms. Our research uses digital technologies as both the objects of scrutiny and the methodological means for illustrating their use *in situ*, while enabling and empowering teachers to become active agents in the research. We first present the rationale for the research before providing an overview of the Shape project. We then examine and critique the process of story-making as an example of knowledge co-creation in TEL.

Stories as situated knowledge

Storytelling can be a powerful means of expression especially for voices that may be difficult to hear or represent in typical ways. In this journal's recent special issue on inclusive research (Seale, Nind, and Parsons 2014), many of the papers included aspects of storytelling as part of their methodologies (Black-Hawkins and Amrhein 2014; Hall 2014; MacLeod, Lewis, and Robertson 2014), as ways of sharing and creating meaning from diverse perspectives. Digital storytelling is another way of representing individual narratives and comes from the work of Joe Lambert and Dana Atchley in the USA in the 1980s. The main elements that form the structure and content of a digital story are explained, explored and illustrated in more detail in the latest version of the Digital Storytelling Cookbook (Lambert 2010) along with a specific process for developing stories through workshops and particular techniques. The original conception of digital storytelling arose within an arts-based context, as a desire to capture, value and honour the oral traditions of Jewish and African cultures (Lambert 2010). More recently, digital storytelling has been defined by researchers using the method in broad, technically orientated terms, for example:

> . . . a technology application that . . . allows computer users to become creative storytellers through the traditional processes of selecting a topic, conducting some research, writing a script, and developing an interesting story. This material is then combined with various types of multimedia, including computer-based graphics, recorded audio, computer-generated text, video clips, and music so that it can be played on a computer, uploaded on a web site, or burned on a DVD. (Robin 2008, 222)

And:

> Digital stories are 3- to 5-min visual narratives that synthesize images, video, audio recordings of voice and music, and text to create compelling accounts of experience. (Gubrium 2009, 186)

In his most recent book, Lambert (2013) highlights the power of digital stories being rooted in the fact that they are natural vehicles for understanding and reflection and for creating meaning. Digital stories ensure that everyone feels they are 'somebody';

they give voice, enable agency and a sense of belonging. They are about valuing experiences as they arise in the *here and now* and are about reflecting on, reviewing and articulating what did and did not work. More specifically, Lambert (2010, 3, our emphasis) discusses the personal and individual in the development of the story:

> As you are putting together your raw material for your story, you are also working to build your narrative voice. *Everyone has a unique style of expressing him or herself* that can jump off the page or resonate in a storytelling presentation.

He contrasts the 'narrative voice' with the 'official voice', which is: ' . . . the voice of our expository writing class, our essays and term papers, or our formal memos and letters to our professional colleagues' (3). In other words, in the telling of stories it is a different, less formal, 'more organic and natural' (3) voice that we seek to show. Crucially, as part of the natural voice, Lambert (2010) also discusses the importance of emotional content in the stories and how the storyteller should reflect on, and seek to convey, their personal involvement in, and emotional connection with, the story. This aligns with Labov's (1972) narrative features in storytelling which, he argues, have two main functions: (1) a referential function in which the teller gives information by referring to the experience, or by recapitulating it, for example, the reporting what happened; and (2) an evaluative function where the teller communicates the meaning of the narrative by establishing some point of personal involvement, and the speaker's perspective on what it all means. In other words, the stories are developed from personal perspectives and should convey what the storyteller seeks to communicate.

As implied in Robin's (2008) and Gubrium's (2009) definitions, the particular value of the *digital* story compared to other kinds of stories is that the visual is combined with sound and, often (but not always), motion. The advent of Web 2.0 technologies and the ease, with which images, video and sounds can be captured, edited and disseminated, enable personal narratives and experiences to be documented and shared in relatively brief presentations. For example, Gubrium (2009) discusses the use of digital stories as a method in community-based participatory research about women's reproductive health experiences where they offer a grounded way to capture and document experiences that ' . . . inserts indigenous empirical material into research endeavors' [*sic*] (186). That is, there is a more direct insight into situated knowledge that can be gained through digital stories by being able to show specific contexts in visual and/or audio form (cf. Harrison, Sengers, and Tatar 2011).

Moreover, the process of creating a digital story can help individuals reflect on and 'own' their experiences and stories, and to receive validation through the story being 'screened' to others (Gubrium 2009, 189). In other words, the *process* of story creation and the production of a tangible artefact as an *outcome* that can be viewed and reflected upon by others are two of the key aspects of digital storytelling (Lambert 2010). These features make digital stories as a research method different from other forms of visual research methods, for example, photo-elicitation (Shohel 2012), stimulated recall (Vesterinen, Toom, and Patrikainen 2010) and video narratives (Taylor et al. 2011). In these examples, images and/or video were used as cues to aid recall and reflection on the specific context or practice example. That is, the videos and pictures are used as tools for prompting verbal responses and discussion in interviews and it is this dialogue that forms the main research data for analysis and dissemination. By contrast, in digital storytelling it is the stories themselves that are the main vehicle for constructing, presenting and disseminating knowledge: they are stand-alone objects that capture

and document practice, views and experiences from the perspective(s) of the storyteller(s).

Digital stories have been used widely in community activism, public health care, social services, international development, public broadcasting and in business (Lambert 2013). As a method, they have also been used to engage and empower marginalized young people (Lowenthal 2009). However, only recently has this method been applied in educational contexts (Robin 2008; Ohler 2013) and this has tended to take two main forms: (1) as constructivist teaching and learning activities for students to enhance digital media skills as well as topic-specific learning outcomes through deeper engagement with the material (Ohler 2013) and (2) as a means through which teachers can encourage discussion of topics by presenting information in a way that makes ' . . . abstract or conceptual content more understandable' (Robin 2008, 224). We argue that in the Shape project our use and discussion of digital stories as *evidential artefacts in research* is different from these methodological applications in that the Shape stories offer direct and grounded opportunities to capture, document and reflect upon emergent TEL-related practices in schools (cf. Gubrium 2009).

The 'Shape' project: shaping the future of educational technologies today – from prototypes to practice

Project overview

The objectives of the Shape project were to (i) draw upon four multi-disciplinary TEL projects to disseminate and explore creative ways in which children's social communication skills and understanding can be supported in schools and (ii) to create the foundations for the development of an effective online community whereby practitioners and researchers could address how to extend the use of TEL for this group of children. One of the main motivations for the project was to enable us to translate the findings of this research into further development of the technologies and of their applications, to make them more robust to withstand different school settings and real-world usage and to enable technology designs that are able to support teachers in being autonomously creative in their practices. We used a participatory approach where the project team worked with teachers and children in six special, specialist and mainstream schools. In this paper, we focus on digital story creation as a methodology for (i) identifying how teachers were using the technologies and (ii) disseminating their practice in using the technologies. We draw specifically on our experiences with one of the autism specialist schools – Radlett Lodge – and the paper is co-written with the school's lead Speech and Language specialist. Two main technology-based prototypes from previously funded TEL projects were used in the Shape project – ECHOES and COSPATIAL – and these are briefly described next before an explanation of how we developed the digital stories is given.

ECHOES was funded jointly by the Economic and Social Research Council (ESRC) and Engineering and Physical Sciences Research Council under the TLRP (teaching and learning research programme)-TEL (technology-enhanced learning) programme in the UK and had the aim to support typically developing children and children on the autism spectrum to explore, rehearse and acquire skills that are fundamental to social interaction, such as turn-taking, the ability to engage in joint activities with others and in reciprocal interactions. The ECHOES prototype is set in a 'magic garden', which is populated with a semi-autonomous virtual character and interactive

Figure 1. A child playing with ECHOES on a big multi-touch screen.

objects that are used as triggers for engaging the child in an interaction (with or without the virtual character). For example, the child might take turns with the virtual character to grow flowers by shaking a rain cloud or to stack flowerpots to build a tower out of them. The virtual character will encourage and support the child in completing the activity. The interactivity is therefore organized around discrete activities, each with a pre-defined pedagogic purpose relating to turn-taking skills, sharing attention with others as well as initiating and responding to bids for interaction. In the Shape project, ECHOES was used in dedicated spaces in schools and was presented on a large multi-touch screen, with the interactions between the technology and the children being facilitated through touch (see Figure 1).

COSPATIAL (Communication and Social Participation: Collaborative Technologies for Interaction And Learning) was funded by the European Commission's FP7 programme. The project's main aim was to develop and apply collaborative technologies to promote learning and understanding of collaboration and social conversation for children on the autism spectrum. Prototypes were designed with the close involvement of teachers and children (with and without autism) in both mainstream and special schools (Parsons et al. 2011; Parsons and Cobb 2014). The Shape project involved the

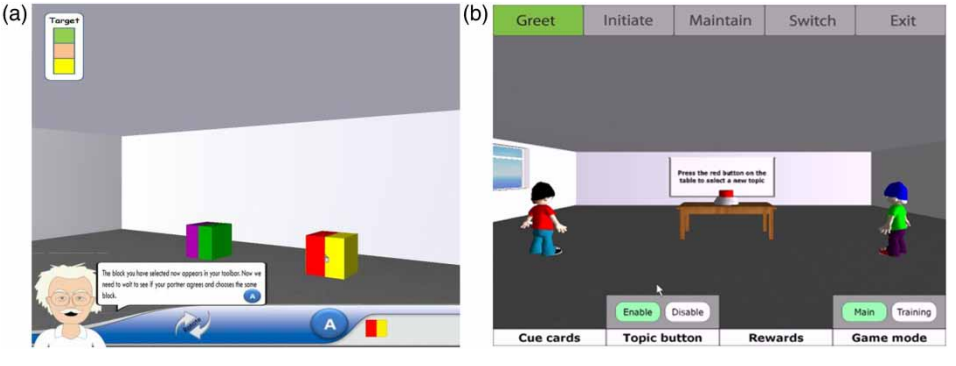

Figure 2. Screen shots from COSPATIAL's Block Challenge (left) and Talk2U (right).

COSPATIAL Collaborative Virtual Environments (CVEs) 'Block Challenge' and 'Talk2U' (see Figure 2). Block Challenge is a two-player game focusing on collaboration, turn-taking and perspective taking in which children have to co-operate and communicate to stack dual-coloured virtual blocks in a pattern that matches a target; each child has a different target and only specific blocks, oriented in a particular way, meet the target pattern. Talk2U focuses on social conversation and provides a structured, prompted framework in which children can practice different elements of social conversation (e.g. starting, maintaining, switching topic and ending) before engaging in a social conversation with the other player; both players, plus a teacher who facilitates and supports the conversation, are represented in the CVE as virtual characters, and rewards (virtual stars) are given by the teacher for good effort and performance.

Methodology

Development of the ingredients for the digital stories

We began the process of digital storytelling by running a series of half- or full-day workshops at the schools involved, first introducing narrative concepts, before covering more technical issues such as camera work, sound and editing. The workshops generated a great deal of discussion, and to some extent caused concern that the project would become onerous if the expertise in storytelling was perceived to be missing. Some members of teaching staff were unsure initially because they did not understand the term 'digital stories' and so this was perceived as a jargon phrase that felt somewhat alienating and complicated. However, we demonstrated practical methods for explaining how humans are natural storytellers and most of the teaching staff quickly grasped that this is something that they already do, particularly in relation to concepts already familiar in the Key Stages 1 and 2 curricula, such as the 'story mountain'. The story mountain builds from an opening through an event, or sequence of events, that present a problem, question or big event, before showing a solution (or resolution) and then an ending. The workshop then adopted the story mountain as a structure for helping staff develop example stories based on their experiences in the classroom. This emphasizes the need for researchers and practitioners to find a common language in order to be able to work together in a way that is comfortable, respectful and which enables both sides to cross boundaries (Rynes, Bartunek, and Daft 2001). The use of the 'story mountain' meant that we were using a concept that teachers were familiar with using, and therefore, demystifying the process of creating narrative through digital story creation.

Even though we ran workshops in the capturing and editing process, many teachers were already using digital cameras, phones and iPads. Nevertheless, the time available for capturing and creating stories was a concern raised by the teachers. We placed an emphasis on the stories being led by the school personnel, but which were co-created with the help of the research team; in other words, the creation of the digital stories was focused on the stories that schools wanted to tell and the experiences they wanted to share. We were very clear that the focus could be critical as well as positive and that we were interested in a range of experiences and views. We were also very clear that the focus of the project was not about taking a narrow view on 'effectiveness', that is, only concerned with whether the use of the technologies were supporting particular learning outcomes for children (as would be the focus in a more traditional research approach), but rather about the school's experiences with the technologies

in a much wider sense, including any challenges faced in implementing the technologies within the context of everyday school life.

ECHOES and COSPATIAL were left with school to explore and use as they wished, with the children they identified as potentially benefitting from their use. The research team provided some initial information about what the technologies had been designed to do and how they had been used previously, but made no other stipulations about when, where, for how long, in what ways and with whom the technologies should be used. Nevertheless, the use of prototype technologies, not yet commercially available and developed in previous projects by research team members, provided the *starting point* for the co-construction of knowledge within this project. That is, ECHOES and COSPATIAL represented the research team's initial contributions to knowledge that was shared with the school. The school was asked to work with these specific technologies in order to contribute their knowledge and experiences about where and how the technologies could be used in their lessons and classrooms. These processes, along with the perceived outcomes for the school, provided the focus for joint reflection between the teachers and the researchers, and for the co-creation of the digital stories (see the next section).

The school was provided with digital video cameras to record interactions of the children and staff with the project technologies as well as any reflections or perspectives on their experiences. The school worked with the technologies over a period of about four months, implementing their use during the school day and capturing this via video, with limited involvement from the research team. Seven children with autism, aged from 6 to 15 years, and around 10 members of staff were involved in the activities captured on video, but it was the Speech and Language Therapist (co-author, Rachael Lee) who was the driver of the project within the school. With the full backing of the senior management team of the school, she timetabled and organized lessons using the technologies, ensuring that sessions were videoed and that staff, and students (where possible), provided feedback and reflection on their experiences. This was managed explicitly for some teaching staff in the form of direct interviews to camera (with questions being asked by Rachael), and also more implicitly for students, for example, through designing one of the lessons as a 'focus group' so that feedback on views and experiences could be gathered (see 'Working Party' in Table 1). As well as filming lessons that involved the use of ECHOES and COSPATIAL by the students, 'staging' or potential 'cut-away' shots were also filmed and photographed, including the set-up of the technologies and the room(s) in which they would be used and images showing additional materials that teachers developed to support the lessons. These are good examples of where the capturing of material for the videos went beyond a straight forward exposition of 'what happened'; that is, video materials were planned, scripted and filmed so that they could be used as parts of a story that could be edited together.

Co-creation of the digital stories

In total, approximately 10 hours of video footage was taken over the four-month period. Having planned and collected the videos and photographs, the school personnel did not feel that they had the time or expertise to edit clips to form their stories and so chose to involve the project team in bringing the digital stories to fruition. Two members of the project team met with Rachael for a full day to watch some of the footage and discuss the stories that the school identified as wanting to be told. Crucially, it was Rachael who

Table 1. Summary of the four digital stories from Radlett Lodge with hyperlinks to the stories.

Story title with hyperlink	Participants	Main technology used	Story summary
Collaboration by stealth (see https://www.youtube.com/watch?feature=player_embedded&v=dMC63lMZNSk)	David (15), Ahmed (14) and Ciaran (13); Rachael (Speech and Language Therapist); Stephen (Teacher); Mary (Learning Support Assistant)	COSPATIAL	Presents how they worked on maintaining and exiting conversations appropriately. The boys were all very motivated by using the software and COSPATIAL gave them a way to work on these aspects in a novel manner. They have historically found learning social conversation skills difficult, hence the emphasis on 'learning by stealth' i.e. focusing on a challenging task without realizing they are learning!
Outside the box (see https://www.youtube.com/watch?feature=player_embedded&v=ApVlTUeeBFI)	As above	COSPATIAL	Presents how COSPATIAL became more than just a teaching tool and intervention but it also helped with assessment procedures. The technology supported the staff to become more aware of how to break down conversations into specific parts. It also helped staff identify the specific difficulties the boys had with conversation skills. In addition, pairs of students worked together and got out of their comfort zones in the process. These pairings had unexpected gains as it helped the staff think 'outside the box' about how to support the students

(*Continued*)

Table 1. (*Continued*).

Story title with hyperlink	Participants	Main technology used	Story summary
Working party (see https://www.youtube.com/watch?feature=player_embedded&v=mX_UnysuTSs)	As above	COSPATIAL	Presents the process of a focus group activity that Rachael conducted with the boys to feedback on their experiences and their thoughts about the software. The boys then watched themselves talking about, and using, the software. It was clear that the work with COSPATIAL enabled them to improve their communication skills with one another and to gain confidence. In this clip, the students also make suggestions about how to improve the technology
Playing with ECHOES (see https://www.youtube.com/watch?feature=player_embedded&v=2ZvSjbWz72I)	Hammad (7), Sabir (6), Aaron (9), Shivam (9) and various members of staff from Radlett Lodge School	ECHOES	Presents the way in which teachers used ECHOES with the individual children. ECHOES was used to engage in activities in collaboration with the child and to prompt them to act in particular ways. Teachers also used ECHOES to 'sabotage' some children's actions to see how they react and this has often provoked behaviours from the children that would provide teachers with a view on what the individual children may be capable of. Access to such children's capabilities is important in allowing the teachers to tailor the individual interventions appropriately

came with clear ideas about the main stories she – on behalf of colleagues and students – wanted to tell. Therefore, the stories from this school were very much driven by them and by the experiences of the different staff and children taking part. We first discussed the key messages that Rachael wanted to convey from the schools' experiences; for COSPATIAL there were three: (1) the use of COSPATIAL fired the children's imagination, (2) encouraged teamwork and (3) the technology is a tool not a teacher – support and good teaching are needed. For ECHOES, which in contrast with COSPATIAL, was used by a younger (4–6 years old) and predominantly non-verbal group of children, the key message also related to the technology as an enhancement of the existing practices rather than a replacement for the teachers. Specifically, teachers' observations related to the fact that ECHOES allowed them (1) to tailor their own interaction with the individual children, using the technology as a pre-text for collaboration, turn-taking and eliciting spontaneous responses from the children, for example, when the teachers sabotaged a routine activity such as bubble popping by turning it into a game between the teacher and the child, and (2) to gain insight into individual children's abilities, for example, their ability to focus on some aspects of the environment, which would have been difficult to observe in routine classroom environment.

We then watched together some of the video footage to identify particularly pertinent clips that could be used to illustrate the key messages and talked about how we could start to construct stories that showed these messages clearly. Having been present at all of the videoed sessions, and having a vision for the stories that she and the teachers at the school wanted to tell, Rachael was able to point us towards particular sessions with staff and students that showed interesting and relevant interactions and comments. This led to an initial drafting of the core elements of the stories by the project team members. For example, developing the idea about how COSPATIAL fired the children's imagination, we generated the following brief:

> This is a story that should emphasise the motivation, excitement, joy and focus that was observed in the sessions when the boys were working with COSPATIAL. There is a sense of exploration and freedom about some of the activity that was experienced very positively; as Rachael said: 'they were doing something that they did not want to do without realising it!' Include: clips of the boys working on COSPATIAL with Rachael to show: motivation, focus, excitement, exploration, and communication, via the co-construction/selection/creation of characters' attributes. Link these with something from Steven about the benefits and Rachael's prompting question about this. Could be structured around different stages: setting-up; finding out what's there; exploring? Note that Mary says 'these two don't really [normally] speak to each other'.

Working with this brief, one of the research team members then spent a further day independently collating and sequencing clips to build the story. This created a storyboard (one that listed in sequence the clips to be used rather than showing images), which was then shared with Rachael for checking. In this way, the stories were negotiated and ultimately co-created through the project team interpreting, from shared discussions and joint viewing of clips, how the story could be told. In other words, it was the responsibility of the project team to bring the school's anticipated stories to life.

Rachael was happy with the storyboards and also said that she could provide a voice-over for any of the stories if needed. The storyboards showing the timing, and start and end points, of each clip were then sent to a member of the project team who took responsibility for editing. The editing process for each digital story took approximately 48 hours. The draft-edited digital stories were then shared with

Rachael for initial approval, before being shared with the pupils, their parents and the staff for their agreement that the stories could be made public on the project website. Permissions and approvals were given and everyone felt happy with the stories without the need for voice-overs or the addition of music; it was felt strongly that the stories, emphasizing experiences and voices, were clear without the need for further embellishment or explanation. As Rachael explains:

> We all absolutely loved them [the stories]! The parents were also all really pleased with the outcomes and a couple of parents viewed the stories with their son as well which prompted a lot of interesting discussions! The video clips were fantastic and so well selected from a huge mass of film to back up the relevant points in a succinct and clear story.

Eventually, four stories of 22 minutes in total (around five minutes each) were created from the hours of video footage taken at Radlett Lodge (overall, the project created 27 digital stories with the six different school communities); the story brief included earlier became 'Collaboration by Stealth'. A summary of the stories is included in Table 1, which also provides hyperlinks to each story so that the digital stories form an integral part of this dissemination.

Analysis and conceptualization of the videos as digital stories, and digital stories as evidence

Space constraints preclude us from presenting and analysing each of the Radlett Lodge stories in detail, but we include one of the stories here for more explicit scrutiny and evaluation in relation to features of storytelling as distinct from narrative. Specifically, by using the teachers' concept and understanding of the story mountain, we developed structure in the stories with a clear beginning, middle and an end. A detailed discussion of the conceptual differences between narrative and story is beyond the scope of the present paper but we suggest that individual, digital stories were created in the project which were not simply exposition or narrative; the stories have referential *and* evaluative functions (Labov 1972), including emotional engagement, personal experiences and a natural rather than a formal voice (Lambert 2010). Moreover, Hagel (2013) argues that narratives are open ended and unfinished, while stories are closed ended; by following a story mountain structure our stories reached conclusions and were, *ipso facto*, closed ended. In agreement with Corman (2013), we argue that the Shape project produced, through subsequent analysis and reflection (as here), a 'local narrative' which is a ' . . . system of stories about events in the here-and-now . . . .[they] define a place where individuals can cast themselves in roles, aligning their personal narratives'. In other words, the synthesis that we bring to the stories in this paper is the *local narrative* that reflects the *system of stories* from Radlett Lodge. Table 2 presents a précis of one of the stories – 'Outside of the Box' – mapped to key elements of a story mountain structure; as well as the personal engagement with the story by the storyteller(s) (cf. Lambert 2010).

In addition, Table 2 summarizes a content analysis of the story using Schrum et al.'s (2005, 204) framework for a 'platinum standard' of acceptable evidence in the field of school-based TEL research, comprising: (1) teacher beliefs about technology, (2) teacher practice with technology and (3) student learning outcomes. Schrum and colleagues are editors of scholarly journals dedicated to TEL research, who argue for the reconsideration and improvement of the quality of evidence in the field, placing a particular emphasis on the need for *authentic research*. Authenticity in this respect

Table 2. Example of story analysis for structure, content and personal engagement of 'Outside the Box'.

Clip description	'Story mountain' structure	Storyteller's personal engagement with the story	Story content mapped to Schrum et al.'s (2005) platinum standard for evidence in TEL research (beliefs, practice, outcomes)
The story starts by Rachael talking directly to the camera, describing how the COSPATIAL technology has enabled her to understand more about how to teach conversation skills. She explains how one of the students she worked with was able to learn how to switch conversations and how the technology can support this continued focus	*Opening* – sets the scene about storyteller's own learning through the project and the value of the technologies for the students	We hear how Rachael's knowledge about teaching conversation skills has been enhanced. Rachael's own learning through the project is articulated: 'enabled me . . . not just for the children but for myself . . . '	*Practices*: Technology can provide a tool to help with the assessment of difficulties and a particular example is described *Beliefs*: Rachael is surprised about the insights provided through using the technology; her existing beliefs are challenged *Outcomes*: topic-switching in conversations is specifically identified as a challenge for one of the students, and subsequent support provided for them to work on this

(*Continued*)

Table 2. (*Continued*).

Clip description	'Story mountain' structure	Storyteller's personal engagement with the story	Story content mapped to Schrum et al.'s (2005) platinum standard for evidence in TEL research (beliefs, practice, outcomes)
The continued focus is illustrated in the next clip which shows David and Ahmed in a room using the software with Rachael's support. The clip shows how she supports the students to learn how to switch topic whilst using the software to support this process. This clip also shows the boys engaging positively in the learning experience and focusing on what is being asked of them. Additional (non-technology-based) materials (pictorial jigs) are also shown being used to support understanding and engagement	*Event (initial)* – illustrating the specific skills that are being taught using the technologies and which Rachael has found most useful	The story starts to show Rachael taking control of what they were doing at the school and how their own expertise was used in deciding where to go with this work	*Practices*: scaffolding of student engagement within and around the technology is shown; re-purposing of the technology compared to original intended use *Outcomes*: positive engagement of students with the technology and each other
The story switches to Mary talking about how it is interesting how pairs of children have worked together, and how these pairings have enabled them to mix with different people and develop their social skills. Mary says that using COSPATIAL has challenged them to go out of their comfort zone and do something a little bit different	*Event (build)* – raises the idea of the value of thinking differently about the students and how to constructively challenge them: 'you wouldn't have imagined them going out to the playground together, or sitting next to each other in class'	We hear Mary's surprise about the use of COSPATIAL and how the children responded: 'I think it's quite interesting . . . ' 'It's quite fascinating . . . '	*Beliefs*: challenging expectations and assumptions about who 'usually' works together, and children's individual skills and abilities. Risk-taking shown in pairing different children to work together *Outcomes*: positive experiences reported for the students involved

Rachael then talks to camera: she is interested in the students' reactions to Block Challenge. Rachael outlines how it is interesting how one of the students had to get over the initial hurdle of thinking from another person's perspective. Once he had done that, he could apply it. For his next step, she would like to see his next step as increasing the difficulty for him	*Posing the main question* – the extent to which different skills and abilities are revealed or uncovered in the use of COSPATIAL, and how progress can be made by students	Rachael's surprise at how one of the students responded is revealed: 'I was very interested in his reaction . . . to get over that initial hurdle'	*Beliefs*: Rachael's assumed knowledge about an individual student is challenged when the student finds some aspects of the task surprisingly difficult *Practices*: articulating how this new awareness about the student will influence planning for future sessions; illustrating the individualization of approach taken
The story moves to shots of the student using the software and showing how the difficulty was increased for him. It shows the student asking questions of the other student to understand his perspective	*Solution (answering the main question)* – showing how the student is working on the particular skill that is difficult for him, and how progress is being made through using the technology	We see Rachael's personal involvement in supporting the student to work on this challenging aspect. He is shown working constructively with another student on the task: 'Let's figure this out first right . . . ok . . . so here we go . . . '	*Practices*: shows how the technology is being used with and by the students to support their understanding *Outcomes*: demonstrates learning in action and shows that the initial difficulties described by Rachael could be overcome with support
The story ends with excerpts from an interview with Steven, a teacher at the school, where Rachael asks directly whether skills used in COSPATIAL are transferable. Steven says they are absolutely transferable but that this is very dependent on the teacher ensuring that they consider how to transfer the skills outside the technology. Then he talks about how he might work to transfer those skills using the software as a framework but without having the software there	*Ending/conclusions* – looking to the future i.e. further progress is possible through the exploration of similar skills outside of using the technology: ' . . . there is plenty of scope for teaching material there which I could use in a much more generalised manner'	We see Rachael interviewing Steven to help her to reflect on the value of the project from the perspective of a professional colleague. The implicit message is that Rachael – as the main storyteller – agrees with the views expressed by Steven. The explicit message is that Steven is very positive about the project and can see how the work so far can be extended: 'It's up to me as to how much they could be questioned . . . and how much we could experiment with the same idea'	*Beliefs*: tacit knowledge between colleagues is made explicit in this exchange; Steven's views about the benefits of COSPATIAL for his students are expressed. Suggests the potential for generalization of skills and understanding *Practices*: ideas are generated for extending the work to support generalization of skills; planning for the future

examines '. . . connections between beliefs, practices and learning outcomes' carried out in the context of real schools and classrooms, and demonstrating evidence of use via (for example) video case studies (Schrum et al. 2005, 206). Thus, our analysis focuses on highlighting the beliefs and practices of teachers, as well as the learning outcomes for students, illustrated in the digital stories.

Findings

Insights into e-inclusion practices

The process of creating the digital stories offered teachers an opportunity not only to revisit and scrutinize the interactions between themselves and the children, and between children and the technology, but also for debating what aspects of those interactions were essential elements for the stories that they wanted to tell. In the use of COSPATIAL and ECHOES, teachers acknowledged their surprise at how children had engaged with the technologies, with some of this only becoming apparent through the creation of the digital stories and the representations of use captured therein. We suggest that, by revealing the beliefs and practices of teachers, as well as the learning outcomes of students (Schrum et al. 2005), the digital stories provided insights into e-inclusion practices, which '. . . emphasizes the interaction between digital tools, contexts and people, and focuses attention on the activity of the use of digital technologies' (Abbott 2007, 6).

Regarding *teachers' beliefs*, the Shape project took the approach that educational practice is more than the application of specific strategies to meet pre-determined ends and it addressed the particular contexts in which problems needed to be tackled. The digital story creation process enhanced practitioners' abilities to interpret and make sense of what they were doing. It contributed to giving them new understandings regarding their practice and helped them see and imagine their practice differently. For example, the speech and language specialist highlighted that the process helped her to reflect more carefully about how she taught communication skills to children with autism. It pushed her to encourage children who did not normally collaborate, to do so. Teachers took risks in their application of the technologies by pairing different children with each other and being creative in how the technologies were used. The process of reviewing the digital stories also provided insights into how children had developed their understandings through the use of the technologies, enabling staff members to engage with the responses of the pupils, to gauge whether the work was making sense to them and to check children's understanding through careful questioning and listening. For some practitioners, viewing and reviewing the digital stories also enabled them to identify new and nuanced information about children (see hyperlinked stories in Table 1).

Moreover, Rachael Lee also reflected on how she, and colleagues at the school, felt that they were able to contribute to knowledge as collaborators in, rather than recipients of, research due to the flexible and approachable ethos of the project:

> It was very refreshing and different to not have to be so constrained by a preordained clinical format and stringent participant selection systems etc . . . a flexible approach is crucial and all too often I have seen potentially important research projects fall through due to the amount of constraints stopping our pupils accessing a study. I felt really empowered by the researchers and not just [being] someone carrying out protocols to generate results to be taken away and analysed elsewhere. I feel this has been the most appropriately targeted project I have been involved in.

Such creativity and daring suggests that teachers experienced agency and empowerment in how the technologies were used, and in the creation of the digital stories. Gubrium (2009, 190) notes that 'The digital story process featured the agency of participants in ways a prestructured [*sic*] research agenda could not', and this accords with our experiences too. The knowledge co-creation on which we embarked with the school staff was about respecting their independence and genuine desire to understand their contexts, challenges and ways of using the technologies in their settings, in order to inform further development of the technologies as well as reflection on teaching practices and pupil progress. This is very different from the dominant rhetoric that is focused on critiquing the teaching profession's perceived weaknesses in drawing on EBPs (Biesta 2007). It is also quite different from much of TEL research, which often fails to reach beyond the life-times of specific projects to examine how the technologies developed actually become appropriated by teachers, the extent to which they can be appropriated without researchers' involvement and what, if anything, makes teachers feel at ease with using the technologies in their daily practices.

Regarding *teachers' practices*, the process of knowledge co-creation through the digital stories highlighted key features for making TEL interventions work in schools and revealed new insights about TEL teaching and learning practices. Teachers regularly re-purposed the technologies, scaffolding children's engagement in different ways than intended by the original TEL projects. Specifically, teachers responded to the individual needs of the pupils using their pedagogical content knowledge (Mishra and Koehler 2006). For example, with the COSPATIAL technology, the lead professional utilized pictorial 'jigs' from the structured teaching approaches of TEACCH (Mesibov, Shea, and Schopler 2004), alongside the structure and prompts that had been programmed into the technology. In the ECHOES sessions, teachers encouraged children to interact with the technology by physically supporting their engagement, demonstrating in the process a clear sharing of space and attention. Thus, the affordances of the technologies supported collaboration in different ways, which the teachers explored and extended in their sessions.

The motivation and enjoyment of the pupils in using the technologies highlighted the need for schools to be flexible in when and how the technologies were used. For example, some of the younger children wanted to use the ECHOES environment on days when it was not a part of their timetable. Accommodating this motivation and enjoyment was challenging for the school because space was very limited and the technologies had to be set-up each time they were to be used. Nevertheless, the teachers were willing to support and schedule children's engagement in a flexible way. Flexibility and patience were also required by the schools due to the technical difficulties experienced with the COSPATIAL and ECHOES technologies (both prototypes rather than commercial programmes). This underscores the level of interest and support that is needed by schools to be able to work with new technologies in spaces and contexts that are not tailored for their use, and when the technologies themselves are not yet as robust as they need to be to allow their systematic and independent use by teachers. A school with less patience and vision about how the technologies could be used would very likely have withdrawn or become frustrated with the project quite quickly. Nevertheless, this also highlights what can be done even in less than ideal circumstances when there are enthusiastic and positive staff members who are willing to commit time and effort to the project, with the full support of the school's management team. Indeed, the school leadership was vital in the success of this process; their strength of vision translated into support for staff time and technical assistance.

In terms of *learning outcomes* for the students, one of the main motivating factors for school personnel was seeing the pupils' clear enjoyment when using the technologies and how much they learned with apparent minimal effort. These positive, quality interactions also helped school staff to learn more about the pupils than in previous assessment sessions, as illustrated in the analysis of 'Outside the Box' in Table 2. The children showed their excitement and enthusiasm for using the technologies, through verbal reports and reflections, and also as captured in their verbal and non-verbal responses during the videoed sessions. The teachers, and older students, made design recommendations for improving the technologies; indeed, this session ('Working Party' – see Table 1) is a good example of where the creation of the digital stories facilitated the sharing of critical and constructive feedback, thereby supporting ideas for further development of TEL environments. The staff could see that the project was real and making a clear difference; not least because three of the participating children also had specific targets in their Individual Education Plans (IEPs) relating to social conversation, which they all achieved.

Critical reflections on the process and outcomes

Through the process of digital story creation, we developed a respectful and safe space for all in which different 'ways of knowing' could be produced and shared (Hall 2014). We concur with Hall, who argues that by taking a more radical shift away from conventional research paradigms and towards more dialogic forms of knowledge – via storytelling – the tendency for dominant cultures to impose epistemological assumptions is reduced, thereby allowing indigenous views and experiences to be expressed in more authentic and meaningful ways. Crucially, Hall (2014) emphasizes the value and importance of *stories as evidence* in their own right, rather than simply as a vehicle to support the expression of views in different ways (though this can also be a powerful method). Such a position is also well represented in the wealth of biographical and narrative research that illuminates experiences and perspectives from different groups and individuals (Denzin and Lincoln 2011; Andrews, Squire, and Tamboukou 2013).

Similarly, Grove (2013) makes a case for the structural similarities between the creation of stories and the creation of evidence through research. She argues that both stories and research have directionality that contextualizes, prompts and discusses specific questions or issues. Both stories and research have themes or topics that they focus on – they come from a particular genre (or paradigm) – and are presented in particular ways, usually with a beginning, middle and an end. In addition, both storytelling and research are influenced and/or underpinned by theories, especially theories about the positioning of the storyteller in relation to the audience. For example, in the same way that participants in research are positioned in different ways depending on the underlying epistemological position of the research, so too do storytellers occupy different positions in relation to their audience: as conveyors of information, as sharers of information and as collaborators in the creation of information.

We suggest that there is an equivalence between these positions of the storyteller with the concepts of knowledge transfer, knowledge exchange and knowledge co-creation, respectively. Specifically, *knowledge transfer* suggests a one-way application of knowledge *from* the researchers *to* the practitioners (ESRC, n.d.-a), whilst *knowledge exchange* suggests a more reciprocal relationship *between* researchers and practitioners, namely, 'a two-way process where social scientists and individuals or organisations

share learning, ideas and experiences' (ESRC, n.d.-b). However, as also suggested implicitly by the ESRC (n.d.-b), the power and direction of influence in knowledge exchange still lies very much with the researchers rather than the wider stakeholders (our emphasis):

> By creating a dialogue between these communities, knowledge exchange helps *research to influence policy and practice* … Collaborative activity can lead to a better understanding of the ways in which academic research can add value and offer insights to key issues of concern for policy and practice.

By contrast, we argue that *knowledge co-creation* represents a more innovative attempt to shift away from these traditional conceptions of knowledge transfer and knowledge exchange towards a much more shared (and shareable) endeavour, which is 'genuinely collective' and 'synergistic' (Leibowitz, Ndebele, and Winberg 2014, 3). Such a shift is in line with participatory (or inclusive; Walmsley 2004; Nind 2014) approaches to research which focus:

> … on a process of sequential reflection and action, carried out with and by local people rather than on them. Local knowledge and perspectives are not only acknowledged but form the basis for research and planning. (Cornwall and Jewkes 1995, 1667)

In a similar way that the voices of indigenous peoples are silenced or re-purposed by dominant cultures (Hall 2014), the prevailing research culture of knowledge transfer in evidence-based teaching diminishes the potential contributions of teachers and children by prioritising particular 'ways of knowing' through positivistic research paradigms (Rynes, Bartunek, and Daft 2001). Such paradigms fail to take into account the situated nature of the experiences and expectations of teachers and children in schools (Parsons et al. 2013), and the complex nature of schools where it is often difficult to implement more rigid, experimental research designs requiring strict adherence to planned protocols (Kasari and Smith 2013). Thus, in the Shape project, we worked with the idea that digital stories could provide a way of placing teachers' and children's worldviews at the centre of the research (cf. Hall 2014) such that schools would be empowered to create and share their own authentic stories and to build case examples of creative teaching and learning. In reflecting on the process for the school, Rachael suggests that this was achieved in the Shape project:

> … the stories were based on the salient experiences we felt needed to be told and recorded … [they] were a perfect way to document our experiences. However the best thing about them is that the research results were accessible to parents, professionals and the participants alike – something very few projects can achieve.

The aim of such empowerment is to create a means not only for research and practice to be aware of one another, but crucially, to be mutually informing, co-influencing and co-evolving. This meant finding ways to truly value the craft and personal knowledge of teachers (Thomas and Pring 2004), to take on board their tacit knowledge and skills and to value professional experience as research evidence in its own right. Our focus on the value of what practitioners were doing, rather than focusing on particular ends prescribed by us via a priori research designs, meant that professionals were themselves making judgements about the most appropriate course of action. The process of digital story creation elicited knowledge from practitioners. For example, the video recordings were used to identify key episodes in children's progress and learning

and how teachers could offer support. Practitioners could then reflect on how support was selected in the moment, such that meaningful links could be made between observable aspects of a given learning situation, teachers' interpretations of the situation and their subsequent pedagogic decisions. These links, created and presented via the digital stories, provide evidence of e-inclusion practices (Abbott 2007) by making explicit the tacit knowledge and experiences of practitioners and, thus, available for inspection and sharing. In this way, the digital stories show how teachers implementing TEL can respond to learner differences in a way that enables learners to be included in the daily life of the classroom (cf. Black-Hawkins, Florian, and Rouse 2007).

Indeed, providing direct, context-specific examples of practice has been emphasized as crucial in developing EBP in TEL research (Schrum et al. 2005). In this respect, TEL research is no different from other areas of educational research, where the emphasis is on the importance of considering not only 'what works', but in what contexts something might work and for whom. However, one of the particular dangers with TEL research lies in its tendency to focus on a 'technologically determinist perspective . . . which takes insufficient account of the social and cultural contexts which support the technology use' (Abbott 2007, 7). Consequently, there is often a focus on the wonder of the widget without evaluating the pedagogical context within and around the use of the technology (Crook 1991). Fisher, Higgins, and Loveless (2006) discuss the power of direct illustrations of practice through using ' . . . digital video for capturing, observing and reviewing critical moments' (25). Their focus is on the affordances of digital technologies for *knowledge building* in the context of teacher learning, but their analysis is central to our argument about the potential value of digital stories as part of a co-constructed evidence base.

In particular, if teachers are to become active agents in their own research, then they need to build their knowledge about what works with *their* learners, in *their* own learning environment. As we have argued earlier, digital technologies provide a way to capture and reflect on practices, and learning, in a way that brings tacit or informal knowledge to the fore (Fisher, Higgins, and Loveless 2006). Regarding knowledge creation (rather than knowledge exchange or transfer), McFadyen and Cannella (2004) argue that ' . . . knowledge creation . . . is more dependent on the combination and sharing of tacit knowledge' (737). If we accept that knowledge creation is central to the building of an authentic evidence base, then methods to support the elicitation of tacit knowledge that convert 'intuitions or images . . . into tangible statements . . . ' (Rynes, Bartunek, and Daft 2001, 348) can be powerful tools for making knowledge (evidence) explicit and implementable, including in TEL environments.

Increasingly, the implementation of knowledge constitutes a key prerequisite of TEL, especially of environments relying on Artificial Intelligence (Porayska-Pomsta et al. 2013), as is the case in ECHOES. Therefore, methods for supporting knowledge creation can play a valuable role in helping practitioners to acquire a different understanding of their practice, to see and imagine their practice differently (De Vries 1990; Biesta 2007), and can inform the new and pedagogically more robust generations of TEL. Digital technologies can provide both the stimulus for developing and enhancing teaching and learning practices as well as the means through which those practices can be made manifest for further learning and reflection. Both features were incorporated into the Shape project.

Nevertheless, our experiences also show that not all teachers and schools may be ready for knowledge co-creation; whilst Radlett Lodge were engaged and enthusiastic from the start, and supported staff and pupil engagement with the project, they were still

unsure initially about the creation of the digital stories due to space and logistical constraints, as well as concerns about fulfilling the research team's expectations about producing digital stories. Some of the other schools involved in the project preferred a more typical role in the research, that is, with members of the research team taking the lead in organizing, implementing and recording TEL sessions, and in developing the content of the digital stories. One of the key objectives of the project was to enable teacher autonomy and judgement, yet teachers themselves were often reluctant to see themselves as knowledge creators. Some were keen to look at the EBPs for research and then to look at how to transfer this evidence to their own practice. This indicates that although teachers and school staff want to grapple with how to deal with knowledge transfer, they may find knowledge co-creation much more complex and difficult. McFadyen and Cannella (2004) note that

> In knowledge creation, information exchange is frequently emergent, in that partners to the exchange are often unable to articulate, a priori, the specific knowledge that they need. (737)

We suggest that this emergent property of knowledge co-creation can offer creativity, support risk taking and can develop agency and empowerment, but it can also be felt as uncomfortable, unsure and perhaps too risky in an environment where pressure on schools and teachers to meet standards is substantial. As researchers, we need to recognize that a more democratic participatory research space may offer important epistemological opportunities, with a positive impact on the quality of evidence created (Groundwater-Smith and Mockler 2007). However, such a collaborative space may not be appropriate for all and we need to accept that there is a continuum of 'readiness' for participation along which both researchers and schools need to travel in order to negotiate different roles and expectations (Seale, Nind, and Parsons 2014).

Conclusions

Overall, the process of engagement with the school, via the development of digital stories, was powerful, informative and challenging. Teachers were enabled to share their experiences and views and they supported children's learning in creative and flexible ways; the digital stories fostered reflection and critique of the teaching and learning opportunities for pupils who were afforded through the use of the new TEL environments. As argued throughout the paper, the stories themselves can be viewed as evidential artefacts, reflecting 'indigenous' local contexts and practices of TEL use, which are central features of demonstrating e-inclusion practices (Abbott 2007), and they can be used to generate authentic evidence in the field of TEL (Schrum et al. 2005). However, the final creation of the stories was also labour intensive (for the research team), necessitating considerable investment in time and resources not initially envisaged when setting up the project. This was because we had assumed that teachers and schools would want to take more control over the generation of the stories, but their own time constraints, as well as uncertainty about their own roles in knowledge creation, meant that the story-editing and production were more the responsibility of the research team than we had planned.

In addition, by focusing on the importance and relevance of the development of research strategies that are more participatory and endorsed by both researchers and community providers, Kasari and Smith (2013) caution that the learning outcomes

for children might become less of a focus than the process itself. This aligns with Schrum et al.'s (2005, 204) argument for a 'platinum standard' in school-based TEL research focusing on beliefs, practices and learning outcomes. The Shape digital stories enabled us to provide insights into the first two, and some indicators about the third. However, in order also to be able to demonstrate reliably particular learning outcomes for individual students, there is a need to triangulate the evidence from the stories with independent data about progress, preferably mapped to the pupil's IEP. This additional step would not necessarily be difficult to achieve given that schools gather such data all of the time. Crucially, in the context of developing authentic participatory research approaches with schools, this would not require formal research constraints on timing, frequency or the pedagogy of classroom-based TEL, thereby reflecting and respecting the complexity of real schools and classrooms (Rudduck and Hopkins 1985; Schrum et al. 2005).

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