



**Disabled children's evolving digital use practices to support formal learning. A missed opportunity for inclusion.**

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## Disabled children's evolving digital use practices to support formal learning. A missed opportunity for inclusion.

### Abstract

This article takes an interdisciplinary approach combining digital education with disability theory to investigate disabled children's digital use practices for formal learning. Evidence suggests that children's lives have been transformed through engagement with digital technologies, e.g. computers, laptops and mobile devices. Even so, empirical studies about disabled children's uses of technology remain limited, particularly studies that engage with disabled children's own views in context. In response, an exploratory, participatory research study was designed to gain up-to-date insights into how visually impaired children, as an illustrative case, experienced digital technologies for learning within the context of inclusive education policy. Disabled children and teachers were interviewed in mainstream schools in England; results were analysed using social practice theory to identify digital use practices characterised as digital learning and digital accessibility practices alongside children's experiences. Outcomes were mixed. Youngsters saw benefits to using digital technologies, particularly tablets, for learning. Nevertheless, digital accessibility practices were potentially stigmatising and carried an extra task load to overcome barriers that occurred when teachers had not developed inclusive digital pedagogy. The article discusses the implications of these findings and calls for further research to guide schools to use digital technologies to support inclusion.

### Keywords

Disabled children, inclusion, digital technologies, social practice theory; digital pedagogy.

### Practitioner Notes

What is already known about this topic

- There is limited research about how disabled children may be using technologies in the classroom within the context of inclusive education policy.
- The trend towards increased access to digital technologies in schools, particularly mobile devices, has the potential to support disabled children's learning.
- More research is needed to understand how digital technologies can enhance digitally inclusive pedagogy.

What this paper adds

- A small-scale exploratory, participatory study to investigate how disabled children with visual impairment experience digital technologies.
- A social practice approach to identifying the reproduction of inclusionary/exclusionary digital use practices in classrooms.
- An opportunity to engage with disabled children's views about digital technologies in situ.

Implications for policy and practice

- Disabled children perceive digital technologies to be beneficial for their learning.
- Subject teachers have a key role in developing inclusive digital pedagogy to prevent extra workload for disabled children and to prevent stigma.
- Subject teachers need guidance to develop further awareness, and skill to develop inclusive digital pedagogy, supported by further research.

### Introduction

It is essential that disabled children have access to the same opportunities to participate in society as their peers. A key aspect of this is how they are included in schooling to access the curriculum and learn to socialise. Importantly this includes their uses of digital technologies. Evidence has shown that digital technologies have transformed children's lives in the Global North, i.e. computers, laptops and mobile devices (Bond, 2014). These changes have impacted education and learning, social activities, friendships and the development of digital skills and competences needed to participate effectively and safely online (Ferrari, 2012). Nevertheless, little attention has been given to how disabled children

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3 have incorporated digital technologies into their everyday lives (European Schoolnet, 2014; Passey,  
4 2013; Söderström, 2009), particularly studies which engage with disabled children directly. In  
5 education, studies typically focus on specific interventions rather than seeking to understand the ‘state  
6 of the actual’ (Selwyn, 2011). The lack of research is hardly surprising given that research carried out  
7 with disabled children is underdeveloped generally (McLaughlin, Coleman-Fountain, & Clavering,  
8 2016). Moreover, research about generic children seldom makes reference to disability (Watson,  
9 2012). This is problematic given the need to ensure that disabled children can access and benefit from  
10 the potential opportunities of digital technologies alongside their peers. Education and learning play a  
11 key role in this. The main focus for this article therefore is on how digital technologies support  
12 disabled children’s formal learning in mainstream schools within the context of inclusive education  
13 policy. Formal learning is understood as relating to activities that directly support the curriculum  
14 whilst recognising the important broader debate around the relative relationships that exist between  
15 formal, informal and non-formal education (Sefton-Green, 2004, 2013) outside of the scope of this  
16 article.  
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19 The article draws on findings from an exploratory participatory research study designed to provide  
20 insights into disabled children’s experiences of using digital technologies for learning (removed to  
21 preserve anonymity). The project takes an interdisciplinary approach that combines approaches from  
22 both digital education and disability theory. Disabled children are not a homogenous group  
23 (Shakespeare & Watson, 2001). Therefore, it was decided to focus on visual impairment as an  
24 illustrative case to reach more depth in understanding. Visual impairment was selected because  
25 evidence has shown that visually impaired adults meet the most barriers online compared with those  
26 with other impairments (Disability Rights Commission, 2004).  
27

28 Research was carried out to answer the following:

- 29 • How do disabled children engage with digital use practices to support formal learning?
- 30 • How do disabled children experience digital use practices to support formal learning?
- 31 • What factors enable or constrain digital use practices to provide learning opportunities for  
32 disabled children?
- 33 • What are the implications of these findings for policy and practice in relation to inclusive  
34 education?  
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38 The term ‘digital use practices’ has been coined from the data to describe disabled children’s uses of  
39 digital technologies to support formal learning.  
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41 The original focus of the project was disabled children’s uses of so-called mainstream digital  
42 technologies only, setting aside specialist assistive technologies. However, the data showed a  
43 convergence between mainstream technologies (e.g. computers, laptops and mobile devices) and  
44 specialist assistive technologies (e.g. SuperNova magnification and screenreader software installed on  
45 computer; Braille Notetaker, a device for taking notes with built-in braille keyboard) due to the  
46 proficiency of in-built accessibility features making any clear distinction arbitrary. Therefore, the  
47 focus in this article has been widened to include assistive technologies as used by children and to  
48 describe complementary uses of whiteboards, present in many classrooms.  
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51 The term ‘disabled children’ will be used purposefully in this article rather than the apparently more  
52 child-centric ‘children with a disability’. The former emphasises the social model of disability  
53 established by disabled academics and activists which views ‘disability’ as the consequence of the  
54 social, economic and political systems that impact disabled people’s lives (Oliver, 1996). The social  
55 model has been instrumental in enabling disability to be linked to questions of ‘equity, social justice  
56 and human rights’ (Cameron & Moore, 2014). It differs from the medical model of ‘impairment’  
57 based on individual condition and instead views ‘disability’ as based on the ‘collective experience of  
58 disablement’ (Oliver, 2004, p. 8). Accordingly, the term ‘special educational needs’ (SEN) is rejected  
59 - except when describing policy or quoting verbatim - given its inherent alignment with individual  
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3 diagnostic models with expectations of being ‘special’ and having ‘need’ (Benson, 2014). The term  
4 reinforces a deficit understanding of impairment whereas the term ‘inclusive education’ is based on  
5 the assertion that all children should be enabled to access an equivalent education to that of their non-  
6 disabled peers (Corbett & Slee, 2000). In the article, ‘disabled children and young people’ will be  
7 referred to as ‘disabled children’ for simplicity.  
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10 The contribution of the article is to identify and explore the experiences of disabled children’s  
11 evolving digital use practices in mainstream secondary schools in England within the context of  
12 inclusive education policy. The aim is to provide up-to-date insights about how contemporary uses of  
13 digital technologies may or may not support inclusion and to consider the implications of these  
14 findings for policy and practice.  
15

### 16 **Inclusive education**

17 Inclusion has long been a major policy issue for governments globally, recently reaffirmed in Goal 4  
18 of the United Nations ‘Sustainable Development Goals’ in order to ‘Ensure inclusive and equitable  
19 quality education and promote lifelong learning opportunities for all’ (United Nations, 2015). Yet,  
20 inclusion is not easy to define. Conceptions tend to incorporate analysis of individual actions  
21 alongside structural framing. This emphasises the potential failures within society that impede  
22 opportunities for inclusion rather than emphasising individual differences. Inclusion, therefore, places  
23 the need for change onto society rather than individuals in order to contest the oppression that is  
24 potentially created and sustained by discriminatory social markers such as ableism, ageism, class,  
25 heterosexism, racism and sexism.  
26

27 Within education, the Salamanca statement (UNESCO, 1994) has been instrumental in strengthening  
28 the drive to deliver inclusion, recognised in policy in many different parts of the world. It adopted  
29 specific principles, policy and practice designed to address the need for education for all.  
30 Policy on inclusive education in the United Kingdom (UK) in 1978 preceded the Salamanca  
31 statement. It stipulated that disabled children should be educated ‘wherever possible’ within  
32 mainstream settings (Department of Education and Science (DES), 1978). The Special Educational  
33 Needs (SEN) Code of Practice reaffirmed this by stating that children with ‘SEN’ should have their  
34 requirements met in mainstream schools and provided with full access to the national curriculum  
35 (Department for Education and Skills (DfES), 2001). In 2014, the Children and Families Bill became  
36 legislation (Council for Disabled Children, 2014), again reasserting that disabled children attend  
37 mainstream schools. The Bill aspired to offer children improved life chances whilst allowing parents  
38 and children to have greater control in decision-making; identifying and supporting children’s needs  
39 earlier; and high quality provision to meet their requirements. The Bill was prompted by critique of  
40 how inclusion policies from government have previously been enacted. In 2010, for example, the  
41 Commission on Special Needs in Education set up by the Conservative Party said that inclusive  
42 education was an ideology that had ‘failed a generation of special needs children’ (Conservative  
43 Party, 2010). Disability activists and academics are similarly critical arguing that inclusive education  
44 in mainstream schools represents ‘integration’ not inclusion (Cameron, 2014). Disabled children  
45 should not simply be placed into mainstream schools and expected to change and adapt to them  
46 (Rieser, 2001). Inclusion policies and initiatives should instead require each school to: ‘...identify and  
47 address the barriers within its environment, teaching and learning strategies, attitudes, organisation  
48 and management that prevent the full participation of disabled children’ (Rieser, 2001, p. 175).  
49 Moreover, inclusive education should take account of the importance of how we educate all children,  
50 not rely on ‘special’ teachers meeting the needs of ‘special’ children (Ballard, 1999).  
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54 With these points in mind it is disappointing that the new Bill sets out a framework for meeting the  
55 needs of disabled children and improving attainment yet remains silent about the evaluation of  
56 schools in relation to admissions and exclusions of disabled children (Norwich & Eaton, 2015).  
57 Norwich and Eaton argue that this omission reflects the continued ambivalence in UK policy in  
58 relation to persistent adoption of a market-led system. Current policy on inclusion is undermined by  
59 the neoliberal values underpinning schools and the competitive individualism within wider society  
60 (Moore & Slee, 2012). They note how schools have become sites of performativity (Ball, 2008) using

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3 league tables, international league tables, high-stakes testing and onerous inspection regimes in an  
4 increasingly market-led environment. It is within this environment that the current study of disabled  
5 children's digital use practices is set.  
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### 7 **Digital technologies for learning**

8 For over a decade, it has been recognised that the development of disabled children's uses of digital  
9 technologies could be advantageous for learning within the context of inclusive education. In 2004,  
10 Florian declared that digital technologies have the potential to be an effective leveller for disabled  
11 children noting that 'technology can help create the conditions for equal opportunity to learn and  
12 equal access to the curriculum for all.' (Florian, 2004, p. 10). Similar claims have continued, recently  
13 heightened by the arrival of mobile technologies in schools, particularly tablet computers. Tablets  
14 have become increasingly available combined with free or low-cost apps with potential for teaching  
15 and learning (European Schoolnet, 2014). Across Australia, Europe and the United States, there are  
16 many examples where children have one-to-one laptop or tablet computer access (Balanskat,  
17 Bannister, Hertz, Sigillò, & Vuorikari, 2013; Keane & Keane, 2018); provided through school  
18 purchasing policies or 'Bring Your Own Device' initiatives.  
19

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21 Between 2011 and 2014, the European Commission funded SENnet, a sustainable network of policy-  
22 makers and practitioners intended to support disabled children to use technology, led by European  
23 Schoolnet. The 2014 SENnet report identified the following potential benefits for disabled children  
24 using tablets: fast speed of operation; immediate feedback made possible by touchscreens;  
25 individualised use made possible by selection and organisation of apps; opportunities for more  
26 personalised instruction and learning; affordability and greater versatility when compared with  
27 assistive technologies; the possibility of greater differentiation in presenting and accessing knowledge  
28 with appeal for different learners; built in accessibility features such as voice over, voice control,  
29 ability to zoom, change fonts and colour schemes to suit preferences (with the possible replacement of  
30 assistive technologies for some children) (European Schoolnet, 2014). Other educators have noted the  
31 potential of tablet computers to reduce stigma for disabled children by helping them to fit in (Dwight,  
32 2012; Schaffhauser, 2013); particularly beneficial when disabled children are using the same devices  
33 and apps as their peers (European Schoolnet, 2014). For these reasons, tablets have become popular  
34 among practitioners who support disabled children (Pellerin, 2012; Terror-Perez, 2013).  
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37 Nevertheless, despite the apparent benefits, disabled children's uses of technology in context has  
38 received little attention by researchers (European Schoolnet, 2014; Passey, 2013; Robinson, 2014;  
39 Söderström, 2009). Where studies do exist, these typically focus on specific educational interventions  
40 and consequential benefits for disabled children rather than seeking to understand everyday  
41 experiences of using technology in classrooms. Previous studies have researched technology to  
42 enhance literacy learning (Hayhoe, 2012; Hutchison, Beschorner, & Schmidt-Crawford, 2012);  
43 communication, organisation and social skills (Sultana & Hayhoe, 2013); learning and independence  
44 (O'Malley, Lewis, & Donehower, 2013). Lidström and Hemmingsson (2014) reviewed literature  
45 across a range of physical disabilities (i.e. motor, speech, visual, hearing impairment) to explore how  
46 digital technologies could enhance participation in school activities. Their analysis showed that digital  
47 technologies were being used narrowly as assistive technologies in class by disabled children (E.g.  
48 magnification used on tablets to overcome visual impairment) rather than as 'powerful' educational  
49 tools. Moreover, disabled children described uses of digital technologies in schools as limited  
50 especially when compared with how they would like to use them. The review identified evidence that  
51 digital technologies could improve self-image and reactions from peers, alongside studies that showed  
52 benefits for writing, spelling and communication. Even so, there was little evidence that digital  
53 technologies were promoting inclusion more broadly to encourage equal opportunities in education,  
54 participation in tasks and social interactions. These results were similar to earlier studies carried out  
55 with parents of disabled children to explore how technology had enhanced children's schoolwork and  
56 equity more broadly (Brodin, 2010; Brodin & Lindstrand, 2008). Parents were disappointed by  
57 children's limited use of technology in school, lack of up-to-date software and hardware; teachers'  
58 apparent lack of knowledge about and training with technology; and slow development of uses  
59 generally. Brodin (2010) noted the key role that teachers play in the development of digital pedagogy.  
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3 She identified the need for effective educational tools alongside the willingness of teachers to change  
4 attitudes. Parents also blamed the head teacher for not providing further teacher training and  
5 knowledge updating. As Brodin notes, the head teacher's competence and readiness to resource  
6 technology is crucial. Further studies have similarly identified a need to increase teacher training and  
7 development in order to improve uses of digital technologies for learning (Brečko, Kampylis, &  
8 Punie, 2014; Dixon, 2011; Florian, 2004). Other barriers include the cost of hardware combined with  
9 security issues such as lost or stolen tablets (Johnson, 2013). Importantly, Dixon (2011) states that  
10 more research is needed to understand how best to match technology to disabled children's  
11 requirements and preferences. Finally, it is important not to overlook disabled children who are not  
12 interested in digital technologies (Robinson, 2014), an important challenge if they are to benefit from  
13 digital use practices.  
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16 These studies are useful for understanding the possible benefits and issues that frame disabled  
17 children's uses of digital technologies for education and learning. Nevertheless, empirical studies in  
18 the field remain limited, particularly those which engage directly with disabled children's perspectives  
19 within the context of inclusive education. This points to an urgent need for further research,  
20 particularly the case when compared with research about generic children's uses of digital  
21 technologies in the global North and emerging in the global South.  
22

### 23 **Social practice theory**

24 The article will use social practice theory to consider disabled children's experiences of digital use  
25 practices for formal learning. The approach draws on a range of theorists and researchers in order to  
26 take better account of both individual expressions of activities and context rather than previous  
27 research that has often focussed on individual uses without due consideration of the social  
28 environment that frames it. It draws on Schatzki's 'site ontologies' which argues that institutions,  
29 such as schools, are reproduced through social practices given that classrooms are social sites,  
30 comprised of 'a bundle of practices and material arrangements' (Schatzki, 2005, p. 474). For Schatzki,  
31 practices are the 'doings', 'sayings' and 'relatings' of the 'organised nexuses of activity' that occur in  
32 and constitute social life (Schatzki, 2001, p. 56). Kemmis and Heikkinen (2011) have defined these as  
33 the 'activities' (doings), 'characteristic arrangements of relevant ideas in discourses' (sayings) and  
34 'characteristic arrangements of relationships' (relatings) that 'hang[s] together' to form a practice, a  
35 'coherent and complex form of socially established cooperative human activity' (p. 5).  
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37  
38 Williams et al. (2017) and others have argued that social practice theory is particularly useful for  
39 research about disability given the parallels in intention, to remove the focus from individual 'deficits  
40 or skills of individuals' (p. 170) and instead to focus on the shaping and reproduction of social  
41 practices. Social practice theory has the potential to unpick and uncover exclusionary barriers and  
42 thereby facilitate the drive toward the social model of disability due to its focus on 'how social action  
43 itself becomes ordered via unconscious and invisible rules and patterns' (Oliver, 1996, p. 159).  
44 Analysis aims to disturb the taken-for-granted patterns of routine social practices and create social  
45 change (Giddens, 1988 in Williams et al., 2017). In the current study for example, social practice  
46 theory has the potential to reveal barriers to disabled children's inclusive digital use practices through  
47 analysis in situ in classrooms. Moreover, social practice theory can offer a useful lens for considering  
48 how new digital practices and routines emerge in educational settings, particularly given that  
49 technologies evolve to create new possibilities (Merchant, 2012). Merchant argues that some digital  
50 technologies, such as tablet computers, may become more easily embedded in schools than others  
51 '...because their affordances sit more comfortably in the "site ontologies" of educational settings' (p.  
52 780). Tablet computers, for instance, have become popular in some schools because their portability  
53 and versatility enables their seamless fit into the arrangements and practices of the classroom.  
54 The aim of using social practice theory in this article therefore is to consider how disabled children's  
55 digital use practices are evolving. This approach enables critical analysis of both individual  
56 expressions of activities alongside investigation of the environmental framing in order to consider  
57 digital uses practices in schools within the context of inclusive education policy.  
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### 60 **Methods**

A participatory, in-depth qualitative case study approach was adopted to investigate practices within classrooms. Taking a participatory approach was important given the need to carry out research 'with' not 'on' disabled children (Mallett & Runswick-Cole, 2014); also to hear their voices given the dearth of research which takes account of the views of disabled children (McLaughlin et al., 2016). Consequently, discussion took place with children and subject teachers (STs)/qualified teachers of children with vision impairments (QTVIs)/teaching assistants (TAs) throughout to develop questions within appropriate data collection tools and methods, analyses and reporting to ensure that perspectives were well represented in the study. It was important to ensure that the methods used with children were inclusive; could meaningfully engage participants. Draft reports were shared with children and teachers who took part in the study and comments integrated before finalising.

Children aged 13-17 were recruited in three secondary schools via the Vi-forum (a UK Government Department for Education mailing list offering teachers of visually impaired students support <http://lists.education.gov.uk/mailman/listinfo/vi-forum>). Data was initially collected between 2014 - 2015. Three follow up interviews were carried out with teachers (two qualified teachers of children with vision impairments and one teaching assistant) in 2017 to understand how the situation in schools had changed.

Semi-structured interviews were carried out with seven children in three schools to gain accounts of their activities and experiences of digital use practices.

Table 1: Characteristics of the disabled children

Child	Age	Gender	School
Fern	14	Girl	A
Rachel	14	Girl	A
Nigel	13	Boy	B
Laura	16	Girl	B
Jem	17	Boy	B
Simon	17	Boy	B
Siobhan	14	Girl	C

Draft interview questions and observational data collection tools were based on previous research carried out with generic children about uses of digital technologies by the author. Questions were focussed on potential areas of learning in school, at home; out and about. Initial questions were further developed in dialogue with subject/specialist teachers to ensure they were appropriate for disabled children; would provide good coverage of uses of digital technologies. Discussions highlighted the emerging convergence between assistive and mainstream technologies, questions were added to take account of this. Sample questions included: 'What are the different digital technologies you use at school?'; 'What do you like/dislike about using these technologies?' During the interviews, disabled children were introduced to the areas to be covered in the interview; asked if there were issues arising. Immediately after the interview they were asked to reflect on the questions asked and whether the semi-structured interviews had enabled them to discuss what they considered important. They responded positively in all cases. Where possible, observation also took place of each young person in the classroom to gain authentic exemplar of digital use practices in situ. This resulted in five



observations. The author sat at the back of each class taking field notes by hand on a descriptive paper-based standard pro forma of digital use practices, enablers/constraints to using digital technologies and support available. Nine subject teachers (STs)/qualified teachers of children with vision impairments (QTVIs)/teaching assistants (TAs) who teach or otherwise closely support the children were identified and a further semi-structured interview carried out. This process of triangulation was useful to build up a detailed and comprehensive picture of the situation.

Recruitment to the project was a particular issue given the ‘additional layer’ of gatekeeping for disabled children (<http://ethicsguidebook.ac.uk/Research-with-children-105>). Within Disciplinary Studies research small numbers of participants for collection of rich data are more typical given the known difficulties of accessing disabled children. Visual impairment is known to be ‘low incidence, high distribution’ in mainstream schools adding additional time and budgetary challenges given that children are distributed across different schools. Recruitment challenges combined with the issue of withdrawing children from class were a concern during the project, nevertheless, this was outweighed by the urgent need to hear more disabled children’s voices in educational technology research. A pragmatic approach was adopted and data collected with the children and teachers alongside the observational data was combined to provide compensatory richness.

Data analysis was carried out in stages. Data was combined to provide concrete examples of digital use practices at school in order to set out disabled children’s activities; provide context for their experiences; identify factors enabling/constraining uses of digital technologies for learning and draw implications. Firstly, interviews were transcribed and all data scrutinised to identify occurrences of digital use practices for learning. Observational data provided authentic accounts to triangulate with the interview data thereby adding further detail and reliability to the analysis. Practices were collated on a spreadsheet; clustered into emergent categories. These represent common activities around which disabled children organise digital use practices at school (table 2) and provide concrete examples to consider in relation to their experiences. Activities were grouped into categories, then organised by platform i.e. hardware, for reporting purposes.

Secondly, interview transcripts were closely read to identify common themes in line with grounded approaches to qualitative data analysis (Charmaz, 2006). Codes were refined; coding framework developed then systematically used to code data into themes or categories. Results have been extracted from the full analyses in response to the research questions. The experiences, enablers/constraints that children talked about have been consolidated; illustrated by a short extract from the data (table 3). This approach has been taken to add to the trustworthiness of results through transparency in reporting within space constraints.

## Results

As noted, digital use practices were clustered into categories to show the common activities around which disabled children organise activities at school using tablets, laptops and other hardware in response to the first research question. A distinction emerged in these examples between digital learning practices carried out for learning unrelated to disability and carried out by all the children in the class; and digital accessibility practices that enabled disabled children to access the curriculum. For example, when disabled children took part in learning tasks, their activities were often supplemented by what could be called ‘accessibility practices’ or ‘workarounds’ using technology. These accessibility practices emerged either through using the generic affordances of hardware in creative ways, e.g. taking and magnifying images to suit their preferences or were due to the inbuilt accessibility settings and options that enhanced learning, e.g. speech output.

Table 2. Examples of disabled children’s digital use practices.

Digital learning practices	Digital accessibility practices
<b>On tablets</b>	<b>On tablets</b>
<ul style="list-style-type: none"> <li>Constructing sentences in French to be spoken by puppets (Sock Puppets <a href="https://itunes.apple.com/gb/app/sock-">https://itunes.apple.com/gb/app/sock-</a></li> </ul>	<ul style="list-style-type: none"> <li>Accessing whiteboard content.</li> <li>Changing contrast to suit needs.</li> </ul>

<p>puppets/id394504903?mt=8 and Puppet Pals  <a href="https://itunes.apple.com/us/app/puppet-pals-hd/id342076546">https://itunes.apple.com/us/app/puppet-pals-hd/id342076546</a>).</p> <ul style="list-style-type: none"> <li>• Dictating on a speech programme to practise French pronunciation.</li> <li>• Reading textbooks.</li> <li>• Using moviemaker to make video of sporting activities for Physical Education.</li> </ul>	<ul style="list-style-type: none"> <li>• Photographing images to magnify them.</li> <li>• Reading textbooks.</li> <li>• Recording notes to speak text aloud.</li> <li>• Typing using enlarged letters on screen.</li> <li>• Zooming in.</li> <li>• Enlarging keyboard letters on touchscreen.</li> </ul>
<p><b>On laptops/computers</b></p> <ul style="list-style-type: none"> <li>• Producing film and editing in creative media lesson.</li> <li>• Searching on the internet for information about recreational drugs/alcohol in science lesson.</li> </ul>	<p><b>On laptops/computers</b></p> <ul style="list-style-type: none"> <li>• Editing video in premier pro using optical mouse to enlarge images.</li> <li>• Enlarging font sizes to carry out searches, read text.</li> <li>• Using magnification window.</li> </ul>
<p><b>On different devices</b></p> <ul style="list-style-type: none"> <li>• Accessing homework via a Virtual Learning Environment (VLE).</li> <li>• Accessing revision tasks via Twitter.</li> <li>• Recording speaking French on digital recorders to practise pronunciation.</li> <li>• Searching for information, independent research.</li> <li>• Using dropbox to collaborate in business studies.</li> <li>• Using prezi for collaborating on group presentations.</li> <li>• Using revision resources, e.g. <a href="http://www.tutor2u.net">www.tutor2u.net</a>.</li> <li>• Writing notes and essays (MS Word or Pages).</li> <li>• Discussing homework on social media (Facebook and Twitter).</li> </ul>	<p><b>On different devices</b></p> <ul style="list-style-type: none"> <li>• Accessing PowerPoint or Keynote presentations emailed in advance/USB.</li> </ul>
<p><b>On whiteboards</b></p> <ul style="list-style-type: none"> <li>• Animated food video shown in German lesson.</li> <li>• Revising for exam in science lesson using PowerPoint presentation.</li> <li>• Watching YouTube videos.</li> </ul>	<p><b>Specialist assistive technologies</b></p> <ul style="list-style-type: none"> <li>• Writing notes using braille note taker.</li> <li>• Speech and magnification software.</li> </ul>

The results showed a wide range of benefits to digital use practices intended to enhance learning generally or to provide disabled children with access to the curriculum. Nevertheless, analysis of the data showed that some uses were necessitated by subject teachers' lack of awareness about how to support disabled children. This led to disabled children having to carry out supplementary tasks to access the curriculum or to rely on teaching assistants to overcome problems that occurred in situ. For example, in one class (School A), it became clear during the observation that the teacher had forgotten that Fern (age 14) was unable to see the whiteboard, therefore excluding her from the learning activity. The teaching assistant stepped forward and used Fern's tablet to take a photo of the image on the board for Fern to magnify. Whilst outwardly the tablet provided a positive means through which Fern could access the activity, this intervention undermined Fern's independence and potentially stigmatised her. In another observed lesson (School B), the whiteboard did not sync with a tablet which meant that Nigel (age 13) was dependent on the teaching assistant reading out what was on the board to enable his participation. These issues could have been avoided with increased subject teacher awareness and adequate technical support.

To add a further dimension to the analysis, disabled children's experiences of digital uses practices were summarised in relation to enablers/constraints in response to the second and third research questions (table 3). Themes generated relate to specific hardware, skills, technical support, built-in accessibility settings, assistive technology, teacher practices and technical issues.

Table 3. Disabled children's experiences of enablers and constraints.

<b>Enablers: key themes</b>	<b>Subthemes (child)</b>	<b>Exemplar</b>
<b>Digital learning practices</b>		
Tablets	Easy to use (Fern, Jem, Laura, Nigel, Rachel, Simon, Siobhan)	Rachel: I can do what I want to do, it's quite straightforward.
	Fast to operate, lighter, more portable, (Jem, Laura, Nigel, Simon);	Jem: It's quicker to use, less of a hassle to carry, easy to enlarge things. It's just generally better.
	Fun (Nigel)	Nigel: It's just more fun to turn pages.
	Good for taking notes (Jem, Simon)	Simon: Oh, it's just so much easier than, it seems daft but I'm rubbish at reading out of a textbook. The way I learn is, I have to take some notes
	Helps to fit in (Laura)	Laura: I like to be just like a normal girl sort of thing in the mix, which I quite like. Having an iPad and my friends have iPad as well, it just makes me feel like I'm one of them basically.
	Reliability (Laura)	Laura: No, it's very reliable, most of the time it's reliable.
	Supports creativity (Jem, Laura, Siobhan)	Jem: I do PE as a subject and part of that is coursework whereby you have to make a video of like your sport [...] I use the iPad for that because there's an app called moviemaker.
Laptop	Supports independence (Laura)	Laura: I do like the independent side and very much do it myself.
	Versatility including detachable keyboard (Jem, Nigel, Simon)	Simon: It's just, it's like a whole new world really, it's just crazy all the stuff you can do on it.
	Supports creativity (Laura)	Laura: I love creative media, it's my favourite subject ever, yeh. And then the other side of it is photography, so together it makes creative media. But in the TV side we have to actually go out filming, like scenes and then actually edit them in Premierpro.
Skills	Being able to touch type (Nigel, Laura, Simon)	Nigel: I've got my certificate for 30 words a minute.
Technical support	From the specialist IT teaching assistant (Jem, Laura)	Jem: So he sort of showed us what the different apps were for and I, because I already had a bit of experience of iPods and sort of learn pretty quickly I guess. So I was able to put the textbooks on and start writing stuff up, so it was good.
<b>Digital accessibility practices</b>		
Tablets with built-in accessibility settings	Ease of changing colour contrasts (Laura, Simon)	Laura: You can set the text to be like big, so you can make it like personalised to you and you can also have, change the contrast colours.

	Magnification (Fern, Rachel, Nigel, Jem, Laura, Simon)	Fern: Then on the camera it's like someone's wrote something, I can just like take a picture of it [to enlarge].
	Speech output (Nigel, Jem, Simon, Siobhan)	Simon: And then for revision I, there's this setting whereby you can listen to your notes back, so a lot of my revision consists of the i-pad reading notes to me that I've written up.
Assistive technology	Braille notetaker (Siobhan)	Siobhan: Ok, I use the Braille Note in every lesson, because it's basically like my pen and paper and in every lesson we need pen and paper.
	Printing out braille using an embosser (Siobhan)	Siobhan: If there's a passage in a book that I need printing in Braille, just so I can read-. Because it's different when you listen to something than when you read it yourself.
Teacher practices	Emailing PowerPoint presentations before the class (Laura, Nigel, Jem)	Nigel: The presentations that they're using on the board, the teachers email me either the night before or just before the lesson.

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### Constraints: key themes

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#### Digital learning practices

Laptop/tablet hybrid	Difficulty removing screen (Rachel)	Rachel: The only problem is when I take it off sometimes, I've accidentally shut down.
Laptop	Time lag when loading documents (Jem)	Jem: With a computer I guess it would be, just being impatient with regards to it like loading and things like that.
	Unreliability/error messages (Laura, Nigel, Simon)	Simon: When it crashes, when you get all the sort of can't do this error with this that and the other, you sort of don't understand why because you've done it over and over again and then just one time it doesn't work.
Skills generally	Difficulty adding textbooks (Jem, Simon)	Jem: I got all my text books on, I sort of emailed them to myself but some were too big so I had to put them on googledrive which was a bit, I'm not, you know [...] I don't really understand the sort of Cloud system but I don't think anyone does so.

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#### Digital accessibility practices

Laptop/tablet hybrid	Not fitting in (Fern)	Fern: Sometimes, because like I feel like everyone's looking at me, because I have it.
Technical	Whiteboard to tablet sync not working (Nigel)	I: Did it bother you that it wasn't working? Nigel: I'm used to it.
Teacher practices	Manually enlarging worksheets instead of digital methods (Laura)	Laura: I don't really use it in that many lessons now because everyone's so used to enlarging sheets and stuff like that.
	Sending PowerPoint presentations (need to be reformatted into Word before turning into braille (Siobhan)	Siobhan: It's just so complicated with all the different slides and because Braille's linear, you can't have things side by side. So say if I was in English and you'd have like poems, you'd have one next to the other and you'd just read them and compare them. What they'd have to do is they'd have to copy it, so one's underneath the other.
	Sharing work on memory stick rather	Laura: In chemistry my teacher's very old fashioned way sort of thing. She likes me to use my laptop. [...] She just prefers using

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3 than emailing to a memory stick instead of relying on email [...], but I find my  
4 tablet (Laura) iPad definitely much easier to use.  
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8 In relation to enablers, the analysis showed children's enthusiasm for digital use practices - both  
9 learning and accessibility - in terms of the attributes of technology complemented by their own skills;  
10 technical support provided by the school. In terms of constraints, children spoke of issues related to  
11 ongoing unreliability of technologies; occasional gaps in their own skills. There were also examples  
12 of subject teachers not meeting children's expectations through continuation of outmoded practices;  
13 creation of stigma and added work load. The next section will discuss the implications of these  
14 findings.  
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## 16 Discussion

17 This study has used social practice theory to analyse the complex manifestation of digital use  
18 practices by disabled children in schools within the context of inclusive education policy. Social  
19 practice theory is useful in this context to identify how inclusionary/exclusionary processes are  
20 reproduced in schools, manifested through technology use. The study identified a diversity of digital  
21 use practices – digital learning and discrete digital accessibility practices – together with disabled  
22 children's perspectives of these. The disabled children in the study perceived benefits to using tablets  
23 as previously anticipated by SENnet (European Schoolnet, 2014). Even so, there were examples of  
24 digital accessibility practices that could have been avoided through the provision of more inclusive  
25 pedagogy. This was of particular concern given they added an extra task load for disabled children  
26 alongside reliance on teaching assistants that undermined independence and created stigma. Technical  
27 issues were seen to further undermine disabled children's experiences. The former suggest that  
28 despite inclusive education policy, disabled children often continue to be required to fit in and learn  
29 within mainstream schools rather than schools adapting to them through the development of  
30 widespread inclusive pedagogy. Moreover, technical issues can have important consequences for  
31 disabled children's participation.  
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34 It was also clear from the current study that schools and particularly subject teachers have a crucial  
35 role to play in bringing about change to improve the situation for disabled children in line with  
36 previous studies (Brodin, 2010). Digital technologies have been incorporated into existing 'practices  
37 and material arrangements' (Schatzki, 2005, p. 474). This means that rather than digital technologies  
38 becoming a comprehensive leveller for disabled children (Florian, 2004), they are often implicated in  
39 the reproduction of exclusionary practices compounded by technical issues/occasional skills deficits.  
40 There is a need then to close the gap and instead to develop inclusive digital pedagogy. Not to do so  
41 would be to miss an important opportunity for digital technologies to support disabled children within  
42 the context of inclusive education.  
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45 It is important not to underestimate the challenge that this presents given that it encompasses a need to  
46 overcome two distinct but enduring issues. Firstly, it has been established that digital pedagogy is not  
47 yet well developed in schools: teacher use of technology remains limited in extent and variety  
48 (Blikstad-Balas & Davies, 2017; Merchant, 2012; OECD, 2015). Secondly, there is a notable failing  
49 in how inclusive education policies are being implemented (Ballard, 1999; Cameron, 2014; Moore &  
50 Slee, 2012; Rieser, 2001). In future policy and practice, these issues need to be combined and tackled  
51 together in order to develop effective inclusive digital pedagogy. In the short term, teachers need to  
52 be given dedicated time to work more closely with teaching assistants when planning rather than  
53 relying on teaching assistants to develop workarounds in situ. Schools need to improve technical  
54 provision and provide further opportunities for children to improve their skills. In the longer term,  
55 schools need to enable teachers to increase awareness, knowledge and skill to develop inclusive  
56 digital pedagogy. Researchers have a crucial role in this, to carry out research and development with  
57 schools to provide teachers with guidance that effectively takes account of the  
58 opportunities/challenges they face. Digital technology can never be a panacea. Within the schools  
59 visited, there were small numbers of disabled children who did not like using technology and it is  
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possible that they will never be convinced otherwise. Even so, it may be that if technologies were mainstreamed inclusively in classrooms with the opportunity for children to develop their digital skills further, rather than being used in potentially stigmatising ways, then these youngsters too would be motivated to participate.

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