Title
Agentic neglect: teachers as gatekeepers of England's national computing curriculum

Author
Laura R. Larke (University of Oxford)
Oxford Internet Institute, 1 St Giles, Oxford, OX1 3JS

Biography
Laura Larke is a researcher based at the University of Oxford in the Oxford Internet Institute. Her research is focused on critically evaluating British educational policies aimed at preparing young people for participation in an increasingly digitalised world and how these policies are experienced in practice.

Abstract

The addition of computing to England's National Curriculum was welcomed as a much-needed modernization of the country's digital skills curriculum, replacing a poorly-regarded ICT programme of study with an industry-supported scheme of computer science, robotics, and computational thinking. This paper will demonstrate how teachers have acted as gatekeepers to block a curriculum that they view as narrow, difficult to teach, and in conflict with their beliefs and practices as educational professionals. Extensive qualitative data was collected through classroom observations, teacher and student interviews, and student artefact creation in four state-maintained primary school classrooms to explore how teachers acted agentically to minimise or altogether reject a legally-mandated curriculum that clashed with their local, professional knowledge (Foucault, 1980). Analysis of this data was supported by official documents and personal accounts of the creation of the computing programme of study, which highlight a discourse of economic anxiety and post-imperialist nostalgia on the part of the curriculum's designers. This study will illuminate the significant influence that teachers wield as gatekeepers for subject content, with the ability to reject digital technology curricula even when it is supported by industry and mandated by law.

Context
Computing was added to England's National Curriculum in 2014 with the intent of providing young people with the skills, knowledge, and ways of thinking necessary to participate fully in an increasingly digitalised world, as citizens as well as potential tech entrepreneurs and computer scientists. What was not accounted for was how teachers would interpret this education policy and whether there might be a mismatch between the narratives reflected in the new programme of study and the professional beliefs and practices of classroom teachers.

Practitioner notes

What is already known about this topic

- Schools are increasingly being pressured to include elements of computer science in their curricula, including at the primary school level.

- Research shows that young people need a range of technical, psychological, and social skills and knowledges to engage safely and productively with modern digital technologies.
- Few studies have been conducted on how mandatory computing education policies are translated into classroom practice.

What this paper adds

- Confident teachers will teach content that meets their professional standards. The teachers in this study did not believe that the National Curriculum's computing programme of study did that and so largely neglected it in favour of other subject content.
- Teachers in this study viewed the content of the computing programme of study as developmentally inappropriate, too narrow, too difficult to teach without additional staff or technological resources, requiring more prerequisite knowledge than their students had or could be expected to acquire during the school year, or as a lower priority subject compared to other subjects.
- Teachers have significant influence over what curricular content reaches students, even in education systems that are highly regulated and surveilled through national assessments and school inspections.

Implications for practice and/or policy

- The introduction of new, digital technology-centric curricula requires additional investment in teacher training, staffing, and the maintenance of digital devices.
- Teachers' perspectives should be given due consideration during the development of any new curriculum in order to improve the likelihood of implementation.
- Further research is required to identify how England's National Curriculum computing standards could be modified to better meet teachers' beliefs, needs, and abilities.

There is a critical gap in the field's understanding of how best to teach modern digital skills on a nationwide scale. Research on nationwide computing education policy especially is limited (Crick, 2017; European Schoolnet, 2015; Passey, 2017) and it is difficult to transfer results from one country context to another (Hubwieser, 2013). Small-scale studies of computing education generally focus on the integration of technology into individual or small groupings of schools (Becta, 2006, 2008; Moss et al., 2007; Somekh et al., 2007), rather than on implementation of educational technology policy or the integration of computing skills into a multi-subject curriculum.

This study takes advantage of a unique opportunity to study a country-wide computing education policy in depth, examining the motivations and mechanics behind its translation into teachers' practice. Using the qualitatively rich data I gathered over the course of one academic year, I will demonstrate the significant influence teachers have over the implementation of educational policies around digital technology in the classroom and the importance of teachers' professional beliefs and practices to the adoption of such policies.

Background

England has a long history of innovation in computing, with contributions from individuals such as Charles Babbage, Ada Lovelace, Alan Turing, and Tim Berners-Lee – as well as heavy investment from government into research and development during World War II – leading to the creation of many world firsts in the 1940s and 50s (e.g. the Colossus, the world's first electronic digital programmable computer; the Manchester, the first electronic stored-programme computer). British strength in computing began to fade, however, in the late 1960s as British computing companies were forced to merge in an attempt to hold back the tide of American-made IBM computers entering the country. By the 1970s, the British government has ceased giving preferential treatment to British companies and openly bought American computers, and by the 1990s, the home-grown computing industry had all but disappeared (Computer Conservation Society, 2018; Lavington, 1980).

Seeing how far this country has come – from standing at the forefront of innovation up until the 1960s, to fading from view in the Silicon Valley's shadow – politicians and the public have become eager to return to Britain's "glory days" as a world leader of technological advancement. This interest in improving the country's tech industry has left many organisations open to advice from their more recently successful counterparts in the United States, both in terms of structural investment (e.g. government support for startups, improving computing education in schools) and cultural shifts (e.g. pro-technology, pro-entrepreneurship, pro-accelerationism, pro-"move fast and break things"). This Silicon Valley narrative – or "California ideology" (Watters, 2015) – combined with a post-imperialist nostalgia for Britain's former status as an industrial world leader, has fostered a variety of narratives around technology, the workplace, the workforce, and children, many of which conflict with the largely agreed upon mission of state-funded education and the values of the teaching profession.

Justification for abandoning ICT

The United Kingdom's four constituent countries – England, Scotland, Wales, and Northern Ireland – each have their own devolved national curriculum. Complaints regarding the timeliness, quality, and rigour of the information and communication technology (ICT) component of England's National Curriculum came from multiple outlets in the early 2010s. There were concerns that England was producing significantly fewer computer scientists and IT professionals than were needed by industry, and that school leavers had a dissatisfactory level of ICT skills for work in even non-technical jobs (BCS, 2011). Various tech-related industries across the country complained of a lack of home-grown talent, blaming this on a dated education system focused on office skills rather than innovation, creativity, and computer science (Livingstone & Hope, 2011). The Secretary of State for Education at the time, Michael Gove, called the ICT curriculum "harmful," "boring," and "irrelevant" (Department for Education & Gove, 2012), whilst England's Department for Education (DfE) confessed that the subject carried "strong negative connotations of a dated and unchallenging curriculum that does not serve the needs and ambitions of pupils" (Department for Education, 2013a). Overall, a narrative of ICT as academically weak and vocationally useless prevailed.

The international tech industry took hold of this narrative to put pressure on the British government to increase the use and study of digital technologies in British schools. Google's chairman and former-CEO Eric Schmidt (2011) made this cause the focus of his keynote speech at the annual Edinburgh International Television Festival, saying:

> In the 1980s, the BBC not only broadcast programming for kids about coding, but... shipped over a million BBC Micro computers into schools and homes... I was flabbergasted to learn that today, computer science isn't even taught as standard in UK schools. That is just throwing away your great computing heritage.

In response, then-Prime Minister David Cameron (2011) agreed that “we’re not doing enough to actually teach the next generation of programmers... and I think that’s a real wakeup call for us in terms of our education system, and we’re acting on that.” What action that would be exactly was clarified two months later in Gove’s (2012) speech at the British Educational Training and Technology (BETT) Show in London, with the announcement that the DfE was planning to withdraw ICT from England’s National Curriculum whilst a replacement programme of study was developed.

Gove’s speech was reinforced that same day by the release of The Royal Society’s (2012) seminal *Shut Down or Restart?* report on the state of computing education in UK schools. This report similarly acknowledged the limitations of the ICT programme of study in England and warned of a severe shortage of teachers with the training necessary to teach more than the most basic aspects of digital literacy. The Royal Society also admonished the lack of continuing professional development made available to teachers, and lack of school infrastructure necessary to offer effective ICT lessons. The DfE was urged to “remedy the current situation” (p. 45), for the current ICT offering was, in short, “highly unsatisfactory” (p. 8).

ICT, computing, or computer science?

Following the Royal Society’s report and Gove’s speech, the DfE signed a memorandum of understanding with two professional organisations, the British Computer Society (BCS) and the Royal Academy of Engineering (RAEng), granting them power to coordinate the drafting of the new ICT[1] programme of study for all years of compulsory schooling. The memorandum insisted that it was “essential that the Programme of Study is developed in association with and has ‘buy-in’ from key stakeholders across the sector,” suggesting that the draft curriculum would be developed with all of the relevant parties at the table (Twining, 2012, September 20th).

This consultation group was chaired by a computer scientist from Microsoft Research and consisted of representatives from BCS, RAEng, Vital (the Open University’s ICT professional development programme for teachers, now defunct), ITTE (the Association for Information Technology in Teacher Education), and Next Gen (a lobbying campaign to meet the skills needs of the UK’s video game and visual effects industries), as well as three computer science school teachers, two academics from university computer science departments, and three academics from university teacher education programmes. The group submitted a full draft of the curriculum to the DfE in September 2012 after their first meeting, focusing on three broad areas of ICT for school students: Implications, Application, and Foundation (Twining, 2012, September 20th). These three areas were redefined the following month during a closed consultation as Computer Science, Information Technology, and Digital Literacy (Twining, 2012, October 1st).

After a DfE and UK Department for Business, Innovation and Skills-led roundtable involving organisations such as Apple, IBM, Hewlett Packard, Microsoft, Toshiba, Cisco, Facebook, the British Educational Suppliers Association, BCS, and RAEng, an attendee reported concerns that there was “utter confusion in schools about ICT,” “that having the three strands of Digital Literacy, Information Technology and Computer Science within the ICT PoS

[1] Still called ICT initially as it was thought to be legislatively too difficult change the curriculum’s name. It later became clear that no special dispensation was needed for the DfE to change the name unilaterally.

[programme of study] was important," and that there was an "agreement that there would need to be extensive supplementary material [created and provided] to support teachers in implementing" the revised curriculum (Twining, 2012, October 23rd).

A second draft of the programme of study was submitted to the DfE shortly after, where it sat for some months. The first sign of the Department's position on the draft was when it was declared that the new curriculum would be rebranded as "computing" rather than ICT:

> After building a consensus for the draft ICT programme of study, the project has hit controversy. The British Computer Society and the Royal Academy of Engineering have gone behind the backs of their education partners in the group producing the draft Programme of Study for the new ICT curriculum... and made a personal plea to Secretary of State for Education Michael Gove MP to change the name of the subject from ICT to Computing... According to the draft programme of study that the BCS and RAEng [-led working group] has just submitted to Michael Gove, Computing is just one strand in the much wider ranging subject of ICT... As one school leader involved quipped, "It's a bit like calling a car a steering wheel rather than a car. Computing is just a component of ICT"... *The secretary of state's decision to hand over development of the Programme of Study for the new ICT curriculum to the BCS and RAEng rather than the English education community was seen as unusual from the outset.* (John, 2012, emphasis mine)

The DfE released a final draft of the curriculum for public consultation, revealing a significant change in its focus from a broad interpretation of ICT to a narrower set of computer science skills and knowledge. The eleventh hour letter sent to the Education Secretary had been a success. Members of industry, rather than the mixed-profession working groups they had led, had been invited to write the final draft of the curriculum, resulting in digital literacy and the "dirty word" of ICT being removed entirely in favour of a computer science focus. As the director of Vital said at the time:

> I am dismayed. Even if you take the narrow view that our school system... is intended to prepare young people for the world of work, this proposed Computing Programme of Study is not fit for purpose. Most workers do not need to be able to program computers. They don't even need to have a deep understanding of how computers work... However, all members of our society need to be "digitally competent" - something that appears to be a minor consideration in this Computing Programme of Study. (Twining, 2013, February 12th)

In conversation with former members of the original consultation groups (who asked to remain anonymous), the sense was that teachers and their interests had been betrayed and that the democratic process through which the curriculum was developed had been compromised by the influence of industry. With no additional funds provided by the DfE to support teachers' training or the acquisition of new technological resources, and no official guidance beyond the short outline of computing skills listed in the National Curriculum, primary schools and their teachers – all subject generalists – were left to figure out the curriculum on their own.

Stages of education policy

Even if a good set of developmentally appropriate and societally desirable skills are written into policy, this does not necessarily mean that young people will receive an education in those skills and knowledges as expected. Education policy goes through several stages before it reaches teachers and students, and each one of these stages play host to a variety of potential filters and obstacles.

While national education policy is applied to a diversity of student bodies, school structures, and community cultures, it is also developed and written into law as if "one size fits all." The "all" that policy is developed for depends on the beliefs and knowledge of the policymakers involved in its creation, but typically it is a personification of a school ideally set for the perceived needed ideal change (Ball & Bowe, 1992). Assumptions are made regarding this ideal school's: material resources; staff training and experience; and the knowledge, experiences, and attitudes of the students. Education policy also assumes one of two things about teachers: either a) that their professional beliefs, knowledge, and experience aligns with the beliefs of policymakers about what's best for their classroom, or b) that they will comply with national educational policies regardless of their own professional beliefs, knowledge, or experience. If any of these assumptions are not met (and they often are not, given how much difference there is between schools, catchment areas, and teachers across any one country), then policy can be interpreted and experienced in unpredictable ways (Cuban, 2002).

A teacher's "professional responsibility does not begin and end with the National Curriculum" (Ball & Bowe, 1992, p. 109) and there is a tension as teachers balance the academic and assessment-oriented requirements set by national policies with the educational, socio-emotional, and organizational, and special needs of their particular classroom. As professionals they may choose to enact (or not enact) the curricular standards in a way that they believe will best benefit their students but which does not meet the expectations of the policymakers who created those standards (Biesta, 2012). This does not mean that teachers are failing to meet professional standards; rather, the National Curriculum standards cannot account for the various and unique needs of individual classes and their teachers, and therefore may not be strictly applied where seen (by teachers) as inappropriate. The ways in which teachers translate the policy into practice appropriate for their students and situation, rather than the intentions of those who created the policy, will be the deciding factor in what change is created in schools (Knip & van der Vegt, 1991).

In this way, education policies such as England's National Curriculum exist in three different states: the "intended policy," the "actual policy," and the "policy-in-use" (Ball & Bowe, 1992). The intended policy consists of various official and semi-official ideologies, such as those held by members of government and by private sector groups invited to play a role in the development of the curriculum. There is a tension between these oftentimes-competing ideologies as groups struggle for the power to influence change in education policy and, to the extent they believe possible, educational practice.

The actual policy is the official policy as written into law, which states that "pupils are expected to know, apply and understand the matters, skills and processes specified" for each subject (Department for Education, 2013b). This policy state includes legislative wording, policy documents, speeches by government ministers, and other official materials used to disseminate changes to schools, other government and Parliamentary organisations, industry, and the public. The actual policy also consists of what is omitted by the curricular standards as written. What isn't required to be taught – the "null curriculum" (Gehrke, Knapp, & Sirotnik, 1992, p. 53) – is just as powerful as what is required. The null curriculum may reflect a failure to translate the intended policy with fidelity into the language of actual policy, or may instead be a purposeful omittance reflecting the ideology of policy writers (i.e.

the intended policy), such as in the choice not to include some of the content of the old ICT curriculum in the replacement computing curriculum.

Lastly, policy-in-use is the policy as understood and acted upon by educators. These practices emerge from teachers' internal struggle between balancing intended and actual policies with the realities of their classroom and their beliefs as professionals: "The distance between the idealized and the enacted is considerable; between the idealized and the experienced, even more" (Gehrke et al., 1992, p. 97). Given the largely subjective nature of policy-in-use, it will naturally differ from school to school given the needs and beliefs of individual teachers and students. Teachers, often through trial and error, "develop a repertoire of instructional skills and strategies" appropriate for their teaching context (Huberman, 1992, p. 136) and aligned with their professional beliefs. These highly contextualized practices cannot be replicated wholesale across classrooms and schools with differing needs and resources, or across teachers with differing experiences and beliefs. However, there can be similarities in policy-in-use across schools where they share similar contextual factors. Lessons learned observing policy-in-use at one school can be adapted and applied by teachers of similar philosophical leanings in other schools embedded in similar educational contexts.

This study examines whether the addition of computing to England's National Curriculum is successfully meeting its "intended" and "actual" goals while in its policy-in-practice state, before discussing what this means about past assumptions and future possibilities for the teaching of modern digital skills in England's state-funded primary schools

Methodology

In order to study how this new curriculum (Department for Education, 2013b) would be understood, implemented, and experienced in schools, an ethnographic case study method was selected, so as to "portray events, at least in part, from the points of view of the actors involved in the events" and to document the "local meaning" of this curriculum (Erickson, 1984, p. 52). Since individuals are often not aware of the decision-making processes behind their actions, exploring participants' perceptions while also documenting events as an outside observer was the ideal way to identify underlying understandings and dispositions that influenced how and why the curriculum was implemented in each classroom.

Participants

Primary schools (i.e. students age 5-11 years) were targeted for recruitment as this is the age at which many young people first leave the family home to be introduced to and trained in society-approved behaviours and knowledge. Only state schools were selected so that the study could focus on state-funded educational practices and the changes made to England's National Curriculum in particular (which private schools in England are not required to follow).

The two schools recruited for this study were both co-educational state primary schools located in the South of England. School 1 was situated in a rural village and served a largely white British, mixed-income demographic similar to the surrounding area. School 2 was in an ethnically diverse, expensive city centre and served a similarly diverse, middle- to upper-middle-income student population. Both schools' numbers of students with special educational needs or qualifying for low income-related support were below the national average; both were rated "Good" (the second highest rating out of four) in their most recent inspections; and both had performed close to the national average on the most recent annual National Curriculum assessments. These schools were selected as examples of governmentcertified “good” teaching with nationally average academic results taking place in representatively ethnically monocultural rural and ethnically diverse urban communities with relatively low student-specific challenges (i.e. special educational needs or severe economic disadvantage).

Classroom observations
I conducted a series of unstructured, naturalistic observations in four primary school classrooms in order to document what was occurring in children and teacher’s day-to-day lives, while also aiming to preserve the relationships, decision-making, and actions that would occur naturally without me being there (Omodei & McLennan, 1994). Each participating classroom was followed throughout the school day (i.e. typically from before morning drop-off to when children were picked up by their parents at the end of the day) for multiple days in a row, alternating with other participating classrooms as necessary (e.g. to avoid conducting observations during periods of standardised testing). This involved observing both computing lessons, as well as other subject lessons and schoolwide activities such as weekly school assemblies, an autumn harvest festival, and a summer sports day. I spent 230 hours across 49 days observing the four participating classrooms, with approximately the same amount of time spent at each school.

An unstructured field journal was kept, documenting participants’ words (Dore, 1985), actions, and physical affect (e.g. body posture, facial expressions, tone of voice) (Mehrabian, 1972; Scherer & Wallbott, 1985), as well as aspects of their physical environment (e.g. seating arrangements, location of classroom tablets, use of an interactive whiteboard). These field notes captured a “thick description” (Geertz, 1973) of the complex social interactions occurring within these spaces, including: examples of teachers enacting the computing education policy; beliefs and values expressed spontaneously by teachers and students regarding computing and digital technology; and the influence of outside forces (e.g. anticipation of schools inspections, preparation for national standardised testing, parental feedback, etc.) on what happened in the classroom.

Teacher interviews
The main teacher of each of the four observed classrooms was asked to participate in a retrospective interview at the end of their classroom’s period of scheduled observations. Retrospective interviews use verbal cues (such as reading out a description of an event that occurred in their classroom or a quote of what the teacher had said) to help “respondents recollect and report the thoughts they had in mind while performing a cognitive task, with some elaboration, description, or explanation” (Assiri, 2016, p. 106). These semi-structured interviews included questions developed in part by what I witnessed during classroom observations (e.g. a teacher might be asked to reflect upon a particular incident that had occurred in one of their lessons), as well as by themes that arose during interactions with students from their school. The creation of a unique set of starting questions for each teacher before their interview increased their salience and the comprehensiveness of the data I collected, while also allowing for new topics to arise naturally during our conversation (Patton, 2002).

These interviews were used to document the reasoning behind observed behaviour, as well as to capture data on events that occurred before or outside the scope of the study, to give a biography of the teacher, and to provide a “member’s account” of what was happening in the socio-cultural context of the school and the greater community (Denscombe, 1984).

Student interviews and artefact creation
Stimulated recall interviews – in which the interviewee is presented with something during the interview meant to stimulate their memories of a particular event – were used to explore the motivations and cognitive and emotional processes of the observed children (Dempsey, 2010; O'Reilly & Dogra, 2016). In this study, students (age 7-9 years old) in observed classroom were asked to create some of the objects of reflection themselves, to be used alongside field notes taken during classroom observations as a tool to build rapport and facilitate the interviews in a developmentally appropriate way (Driessnack, 2006; Hill, Laybourn, & Borland, 1996).

Forty-four primary school students (approximately a third of those observed) consented to creating developmentally appropriate artefacts (i.e. a piece of writing and a drawing) in response to prompts designed to start them thinking about their perception of the classroom generally, computing in the classroom, and life outside of the classroom (including any computing done there). These artefacts were then used in conjunction with observation field notes to start a conversation (i.e. a qualitative, semi-structured interview) regarding these same students' uses of digital technologies inside and outside of the classroom, their affinity or disposition towards it, and their understanding or perception of the potential uses for computing skills and digital devices.

Findings: the gate is closed
Given that all of the teachers observed had been teaching the new computing curriculum for three years, it would not be unreasonable to expect to see computing lessons fully integrated into the classroom schedule and school-owned digital devices being made use of regularly in both computing and non-computing lessons. However, the use of digital devices observed in participating classrooms and identified by teachers and students in their interviews demonstrates that technology use is highly constrained and computing-specific instruction is rare in these schools.

In order "to understand why the enacted curriculum is so slow to change, we must [first] gain a better understanding of the reasoning of teachers and the circumstances surrounding their choices" (Gehrke et al., 1992, p. 101); that is, how and why teachers are translating the actual computing education policy into such an unexpected policy-in-practice.

Rare computing instruction
During the 49 days spent in participating classrooms, only eight computing lessons were observed, each lasting between 20-50 minutes. Five of these lessons took place in one class (whose teacher also acted as the school's head of computing), while another class had zero computing lessons (neither during the observation period or – as reported by the students – during the 2/3rds of the school year which took place before the start of observations). Of the eight lessons observed, two were offline (one a lecture on e-safety, the other on computation thinking), three involved programming floor robots to complete an obstacle course or maze, and two involved using the Scratch block-based programming language (one to build a science quiz, the other following a guide to create a simple game). Most of these lessons did not build conceptually off of previous lessons or they involved working on the same project infrequently over a long period of time, with students' prior work sometimes being lost between sessions.

Given the infrequency of computing lessons, the same devices were often used for the same task multiple times over the course of several weeks and months. In interviews, students expressed boredom at this repetition and teachers expressed a wish for more resources or time to delve more deeply into technology-based activities for sustained periods of time. Ultimately though, there were limiting factors that impacted how technology could be incorporated into lessons, and significant justifications for why the computing curriculum was deprioritised.

ICT: weaker than ever

With such a low uptake of the new computing curriculum, it would not be surprising to see the old ICT programme of study in its place. Since the causes for complaint against the ICT curriculum had not been rectified by the introduction of computing, however, as no additional resources or training had been provided, teachers continued to be left to squeeze aspects of a weak, under-resourced subject into a busy school schedule.

At the participating schools, digital devices such as desktop and laptop computers, interactive whiteboards, and tablet computers were predominantly used by teachers. These uses – administrative, utilitarian but not innovative, and replicating many non-digital processes – are not new, nor are they a part of the computing programme of study. Given that field work for this study took place in the third year of the curriculum's implementation, one might expect to see more computer science, more diversity of tasks, and more sophistication of use. However, the constrained uses witnessed in the classroom were not due to malice, ignorance, naiveté, or professional malfeasance on the part of teachers. Rather, they were a logical result of teachers – situated in the local *dispositif* (Foucault, 1980) of their profession, school, and community – translating an inapposite policy into their teaching practice.

Findings: the role of the gatekeeper

The impact of education policy is not unidirectional; policy changes schools just as schools change policy by uniquely interpreting it through their local, contextual worldview (Ball, Maguire, Braun, & Hoskins, 2011). Teachers play a critical role in the creation of this policy-in-practice, filtering education policy through their professional experiences and values.

Missing external influences

In the case of England's computing education policy, there has been limited external motivation – either positive or negative – to remain faithful to the National Curriculum or to teach the subject with any great frequency. The curriculum itself is light on guidance – "Yes, the computing, I mean, it is very slim compared to everything else [in the National Curriculum]" (School 1, Year 2/3 [ages 6-8 years], teacher interview) – and the usual processes that regulate the translation of policy into practice (e.g. standardised testing, school inspections) are either not present or weakened compared to the accountability measures of other National Curriculum subjects. This has given teachers more leeway to use their professional judgement when producing policy-in-practice.

In the case of School 2's Year 2 (ages 6-7 years) classroom, this meant that some components of the computing curriculum were integrated into her teaching throughout the week. However, she also said that, "as a separate subject, I'm not overly keen on it in primary school," given the difficulty in getting teachers to translate the subject into more nuanced lessons:

> Really, our whole world is full of algorithms, and just making sure we're aware of that, but actually to formalise that into computing in the way that I think most

> teachers understand it to be is not particularly healthy at primary school. Because I think then they just rigidly stick to things like programming stuff.

In this way, teachers were understanding computing as either 1) a more philosophical or conceptual way of understanding the world that could be integrated into other subjects and did not necessarily require the doing of computer programming or robotics, despite the more prescriptive wording of the programme of study, or 2) a skills-based subject that required practicing a narrow range of activities which were not as broadly applicable as subjects like maths, English, or science.

The DfE, in turn, does not mandate any particular frequency or variety of use, further leaving teachers without guidance on the appropriate "dosage" of computing instruction. Computing is not included in England's Key Stage 1 (Year 2) or Key Stage 2 (Year 6, ages 10-11 years) annual national tests ("SATs"), either as a stand-alone test or as the subject of teachers' more inductive student assessments. The national school inspection agency, Ofsted, have also been clear that, while they do want to see e-safety taught and technology integrated well into lessons when it is used, they are not looking for any particular use of digital technology or method of teaching overall (Nixon, 2018). Additionally, hundreds of schools are long overdue for their regular Ofsted inspections (Ofsted, 2016) – as was the case with both schools participating in this study – meaning that even e-safety and pedagogically-appropriate use of technology in other subject lessons is not being officially evaluated in many schools for years at a time.

The teachers interviewed for this study did express worry about their students doing well on the SATs and often pointed out that they were adjusting the focus of their lessons to meet those goals. Additionally, they said that they felt they were under a great deal of pressure to be ready for long-awaited school inspections: "Ofsted is a huge, huge constraint... You are constantly on edge, thinking they are going to come in" (School 2, Year 4 teacher). While the DfE gave teachers the "freedom" to teach computing as they wished by not directing these instruments of surveillance at the subject (Department for Education & Gove, 2012), that did not the remove the pressures teacher felt regarding those subjects that did still fall under such surveillance. As a result, teachers in this study not only felt that they did not have the resources necessary to teach computing to their professional standards, but they also found themselves without the same external motivation to teach it.

Discussion

Without the usual external motivators, teachers looked inward to the needs of their school, classroom, and individual students, and taught accordingly. Today's primary-age children are not digital natives (Helsper & Eynon, 2010; Selwyn, 2009) and so cannot be expected to have gleaned or absorbed the attributes necessary to easily use digital devices or learn computing simply from having grown up in the "digital age." They need explicit instruction (Garcia, 2013) and, as evidenced by this study, for many that will not come from the home environment. Expecting teachers to have 1) successfully taught all of the preliminary digital skills needed before learning the computing science elements that make up most of the computing curriculum, 2) received a class of students who have all already been sufficiently educated before the start of the school year, or 3) provide the one-to-one handholding necessary to teach these skills at the same time as they are trying to teach another subject using digital devices (with infrequent or no support from teaching assistants due to budget constraints) are impractical, if not wholly unreasonable.

Various other obstacles were also observed in classrooms, such as unattended devices going to "sleep" and a child-unfriendly logging-in process needing to be repeated, or students struggled to drag and drop blocks of code using a laptop's miniscule touchpad, as well as small groups struggling to keep track of the execution of their algorithm by a robot that had worn its batteries out mid-exercise. With students required to be able to accomplish so many small steps before being able to exercise the skills and knowledge covered by the National Curriculum computing standards, teachers hampered by a lack of in-class support staff to guide students through these steps, and bare-bones technical support meaning that devices often malfunction or never worked in the first place, can teachers be expected to provide regular, rigorous computing lessons to their oftentimes large, mixed-ability classes?

For many teachers, the answer is "no." "Neglecting" the computing curriculum is not a matter of ignoring student needs; rather, for many teachers, it is a choice made in service of those needs. Participating teachers acknowledged that the underlying skills and knowledge needed by their students to engage with computing, as described in the actual policy, are largely not present. Given their local context – ageing devices, limited technical and pedagogical support or training, and fewer teaching assistants than needed on the best of days – teachers are making logical, pedagogically-sound choices to largely neglect the narrow set of skills addressed by the National Curriculum.

Conclusion

While minimal research has been conducted so far on the outcomes of England's change in policy, a new nationwide study by The Royal Society (2017) has shown that, so far, the implementation of "computing education across the UK is [still] patchy and fragile" (p. 6). This has especially been the case for England's secondary schools, which are facing a severe shortage of computing specialist teachers, but is also an issue in primary schools where current teachers have been asked to teach a subject that they are unfamiliar with. Across both secondary and primary schools in England, nearly half (48%) of teachers ranked themselves as having low confidence in their ability to teach the computing curriculum, with respondents commonly reporting "that they were lacking sufficient theoretical and technical knowledge of computing" (p. 54) to teach the subject well. This will likely be a result of the low number of hours spent in computing-related CPD, with a third of teachers (34%) spending between one-to-nine hours and close to another third of teachers (29%) spending zero hours in computing-related CPD. These teachers were most confident teaching the earlier stages of the computing curriculum, when the content was more likely to overlap with what had previously been covered by the ICT curriculum (e.g. e-safety, creating and managing digital content), reflecting how a lack of sufficient CPD (due to a series of budget cuts for state-funded schools and the lack of additional funds provided to support the new curriculum's roll-out) has left teachers to rely on their prior experiences instead.

Policymakers and others directly involved in the creation of this curriculum did not adequately account for how state schools and their teachers would interpret this new policy, the impact it might realistically have on young people's relationship with modern digital technologies, and whether there might be a mismatch between the pro-technology narratives represented in this curriculum and the everyday beliefs and experiences of today's teachers. The teachers in this study were using their professional judgement to modify or reject outright England's National Curriculum computing standards by minimizing or ignoring subject content that they saw as redundant or less than critical to their students' success, or that they felt they did not have the training, experience, resources, or time necessary to teach. These factors which resulted in the neglect of computing are not uncommon across England's state-funded primary schools and so teachers with similar professional values and experiences are likely to push back against this problematic curriculum in similar ways. Neglect of the computing curriculum – though perhaps not seen as ideal by participating teachers – was selected as the best choice of a bad set of options to meet their students' needs.

Acknowledgements

I would like to thank Dr Rebecca Eynon and Dr Niall Winters for their guidance and support over the course of this study.

Statement on open data, ethics and conflict of interest

Given the sensitive nature of the data and the ease with which participants might be identified, the full dataset from this study is not publicly available. Please contact the author directly if you have a specific access request. Ethical approval for this research was granted by the University of Oxford's Social Sciences and Humanities Inter-divisional Research Ethics Committee (IDREC), Ref No: R45046/RE001. No conflicts of interest arose during the execution of this research.

References

Assiri, M. S. (2016). Integration of stimulated recall, self-observation, and retrospective interview in the collection of strategy data in computer-assisted language testing. *Studies in English Language Teaching, 4*(1), 104-122.

Ball, S. J., & Bowe, R. (1992). Subject departments and the 'implementation' of National Curriculum policy: an overview of the issues. *Journal of Curriculum Studies, 24*(2), 97-115.

Ball, S. J., Maguire, M., Braun, A., & Hoskins, K. (2011). Policy actors: doing policy work in schools. *Discourse: Studies in the Cultural Politics of Education, 32*(4), 625-639. doi:10.1080/01596306.2011.601565

BCS. (2011). *Fact sheet, why computing education is important to the UK*. Retrieved from http://www.computingatschool.org.uk

Becta. (2006). *The Becta review 2006: evidence on the progress of ICT in education*. Retrieved from Coventry: http://dera.ioe.ac.uk/1427/1/becta_2006_bectareview_report.pdf

Becta. (2008). *Harnessing technology: next generation learning*. Retrieved from Coventry: http://dera.ioe.ac.uk/8287/2/A9R3172_Redacted.pdf

Biesta, G. J. J. (2012). Giving teaching back to education: responding to the disappearance of the teacher. *Phenomenology & Practice, 6*(2), 35-49.

Cameron, D. (2011, 10 November) *Tech City could be a challenge to Silicon Valley, say PM/Interviewer: R. Cellan-Jones*. The BBC. Retrieved from https://www.bbc.co.uk/news/av/technology-15682850/tech-city-could-be-a-challenge-to-silicon-valley-says-pm.

Computer Conservation Society. (2018). *Our computer heritage project*. Retrieved from http://www.ourcomputerheritage.org/

Crick, T. (2017). Computing education: an overview of research in the field. In *After the reboot - computing education in UK schools*. London: The Royal Society.

Cuban, L. (2002). *Oversold and underused: computers in the classroom*. Cambridge, Massachusetts: Harvard University Press.

Dempsey, N. P. (2010). Stimulated recall interviews in ethnography. *Qualitative Sociology, 33*, 349-367.
Denscombe, M. (1984). Interviews, accounts and ethnographic research on teachers. In M. Hammersley (Ed.), *The ethnography of schooling* (2nd ed.). Chester: The Bemrose Press.
Department for Education. (2013a). *Consultation report: changing ICT to computing in the National Curriculum*. Retrieved from https://www.gov.uk
Department for Education. (2013b). *National curriculum in England: computing programmes of study*. Retrieved from https://www.gov.uk
Department for Education, & Gove, M. (2012). *Michael Gove speaks about computing and education technology at the BETT Conference*. London: Department for Education. Retrieved from https://www.gov.uk/government/speeches/michael-gove-speaks-about-computing-and-education-technology
Dore, J. (1985). Children's conversations. In T. A. Van Dijk (Ed.), *Handbook of discourse analysis* (Vol. 3: Discourse and dialogue, pp. 47-77). London: Academic Press.
Driessnack, M. (2006). Draw-and-tell conversations with children about fear. *Qualitative Health Research, 16*(10), 1414-1435.
Erickson, F. (1984). What makes school ethnography 'ethnographic'? *Anthropology & Education Quarterly, 15*(1), 51-66.
European Schoolnet. (2015). *Computing our future. Computer programming and coding: priorities, school curricula and initiatives across Europe*. Retrieved from Brussels: http://fcl.eun.org/documents/10180/14689/Computing+our+future_final.pdf/746e36b1-e1a6-4bf1-8105-ea27c0d2bbe0
Foucault, M. (1980). *Power/knowledge: selected interviews and other writings by Michel Foucault* (C. Gordon Ed.). New York: Pantheon Books.
Garcia, A. (2013). The importance of still teaching the iGeneration: new technologies and the centrality of pedagogy. *Harvard Educational Review, 83*(2), 300-319.
Geertz, C. (1973). Thick description: toward an interpretive theory of culture. In C. Geertz (Ed.), *The interpretation of cultures: selected essays* (pp. 3-30). New York: Basic Books.
Gehrke, N. J., Knapp, M. S., & Sirotnik, K. A. (1992). In search of the school curriculum. *Review of Research in Education, 18*(51-110).
Helsper, E. J., & Eynon, R. (2010). Digital natives: where is the evidence. *British Educational Research Journal, 36*(3), 503-520. doi:10.1080/01411920902989227
Hill, M., Laybourn, A., & Borland, M. (1996). Engaging with primary-aged children about their emotions and well-being: methodological considerations. *Children & Society, 10*, 129-144.
Huberman, M. (1992). Teacher development and instructional mastery. In A. Hargreaves & M. G. Fullan (Eds.), *Understanding teacher development* (pp. 122-142). London: Teachers College Press.
Hubwieser, P. (2013). The Darmstadt Model: a first step towards a research framework for computer science education in schools. In I. Diethelm & R. T. Mittermeir (Eds.), *Informatics in schools: sustainable informatics education for pupils of all ages*. Berlin: Springer.
John, M. (2012, December 5th). Computational thinkers use Gove back door for ICT. *Agent4change.net*. Retrieved from

http://www.agent4change.net/policy/curriculum/1904-computational-thinkers-use-gove-back-door-for-ict.html
Knip, H., & van der Vegt, R. (1991). Differentiated responses to a central renewal policy: school management of implementation. *Journal of Education Policy, 6*(2), 123-131.
Lavington, S. (1980). *Early British computers.* Manchester: Manchester University Press.
Livingstone, I., & Hope, A. (2011). *Next gen: transforming the UK into the world's leading talent hub for the video games and visual effects industries*. London: Nesta. Retrieved from https://media.nesta.org.uk/documents/next_gen_wv.pdf.
Mehrabian, A. (1972). *Nonverbal communication*. Atherton, California: Aldine.
Moss, G., Jewitt, C., Levačić, R., Armstrong, V., Cardini, A., & Castle, F. (2007). *The interactive whiteboards, pedagogy and pupil performance evaluation: an evaluation of the Schools Whiteboard Expansion (SWE) Project: London Challenge*. Retrieved from Nottingham: http://discovery.ucl.ac.uk/10000905/1/Moss2007whiteboardsRR816.pdf
Nixon, J. (2018). *Inspecting the computing curriculum*. Retrieved from Ofsted: https://community.computingatschool.org.uk/resources/5398/single
O'Reilly, M., & Dogra, N. (2016). *Interviewing children and young people for research*. London: Sage.
Ofsted. (2016). *Developments in education inspection*. Retrieved from https://educationinspection.blog.gov.uk/2016/02/08/inspection-timescales/
Omodei, M., & McLennan, J. (1994). Studying complex decision making in natural settings: using a head mounted video camera to study competitive orienteering. *Perceptual and Motor Skills, 99*, 1411-1425.
Passey, D. (2017). Computer science (CS) in the compulsory education curriculum: implications for future research. *Education and Information Technologies, 22*(2), 421-443.
Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.
Scherer, K. R., & Wallbott, H. G. (1985). Analysis of nonverbal behavior. In T. A. Van Dijk (Ed.), *Handbook of discourse analysis* (Vol. 2: Dimensions of discourse, pp. 199-230). London: Academic Press.
Schmidt, E. (2011). Eric Schmidt's McTaggart Lecture - Full Text. *The Guardian*. Retrieved from https:// www.theguardian.com/media/interactive/2011/aug/26/eric-schmidt-mactaggart-lecture-full-text
Selwyn, N. (2009). The digital native - myth and reality. *Aslib Proceedings, 61*(4), 364-379. doi:10.1108/00012530910973776
Somekh, B., Haldane, M., Jones, K., Lewin, C., Steadman, S., Scrimshaw, P., . . . Woodrow, D. (2007). *Evaluation of the Primary Schools Whiteboard Expansion Project: report to the Department for Children, Schools and Families*. Retrieved from http://dera.ioe.ac.uk/21564/1/whiteboards_expansion.pdf
The Royal Society. (2012). *Shut down or restart? The way forward for computing in UK schools.* Retrieved from https://royalsociety.org/topics-policy/projects/computing-in-schools/report/
The Royal Society. (2017). *After the reboot: computing education in UK schools*. Retrieved from https://royalsociety.org/topics-policy/projects/computing-education/
Twining, P. (2012). PeterT's bliki. *EdFutures.* Retrieved from http://edfutures.net/PeterT's_bliki

Twining, P. (2013). PeterT's bliki. *EdFutures.* Retrieved from http://edfutures.net/PeterT's_bliki

Watters, A. (2015). Ed-tech and the Californian ideology. *Hack Education.* Retrieved from http://hackeducation.com/2015/05/17/ed-tech-ideology