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ARTICLE

Teaching through the cloud: An ethnography of the role of cloud-based collaborative technologies in the formation of teachers' classroom practices

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Abstract

Through an examination of ethnographic fieldwork data, this paper explores the ways in which cloud-based collaborative technologies created by Google *mediate* (Latour 1994) teachers' discussions around, agreement of and enactments of their classroom practices. Bringing together concepts from actor-network theory and literacy studies, this paper argues for greater consideration of the role(s) of increasingly-used technologies in shaping teachers' practices and suggests a framework for exploring this issue further.

KEYWORDS

actor-network theory, collaborative technologies, Google Cloud Platform, teachers' professional practices

INTRODUCTION

We live in an increasingly connected world, with connectivity heightened and enabled through the rapid growth of Internet-based digital technologies over the past decade. These technologies have expanded in scope and scale in their presence in schools. However, events leading to their creation and their impact on social and cultural practices in schools are often obfuscated (Emejulu and McGregor, 2019; Williamson, 2019). This obfuscation tends to conceal from view potential ways that technologies shape, or are shaped by, the social situations in which they are created and used. In this article, through ethnographic data, I describe how one type of digital technology—cloud-based collaborative technologies created by Google—comes to influence the formation of teachers' classroom practices. To do so, I resituate these technologies as a "gathering" of functionalities, people, software, hardware, places, stuff, and things, which can be described and traced in the interactions

Keypoints

Cloud-based collaborative technologies mediate the formation and enactement of teachers' classroom practices.

Digital technologies modify relationships between teachers and students.

Online collaborative technologies reorganise teacher agency in a way which risks teacher burn-out.

An actor-network theory and literacy studies approach provides an analytic sensibility with which to examine the relationship between digital technologies and classroom practices.

between teachers and these technologies when they are planning, teaching, learning, and enacting their plans in the classroom. Drawing on a Latourian reading of how technical artifacts mediate the work of other actors in the production of the social (Latour, 1994), I describe how technologies used by teachers in a United Kingdom (UK) primary school shape the discussion and enactment of classroom practices. The contribution this article makes to the field of anthropology of education is twofold. I raise awareness of a growing need to explore the influence of cloud-based collaborative technologies on classroom practices while simultaneously offering a combined actor-network theory (ANT) and literacy studies (LS)—ANT(LS)—analytic approach with which to speak to this issue.

HOW CLOUD-BASED COLLABORATIVE TECHNOLOGIES CAME TO CLASSROOMS

The term *collaborative technologies* refers to a set of tools that enables multiple users to interact simultaneously to achieve similar goals (Neilson, 1997). A surge in the development of cloud technology in the early 2000s included rapid expansion and development of online versions of collaborative technologies, including cloud-based collaborative technologies.

The term *cloud* is believed to have grown out of John McCarthy's 1961 speech at MIT, as an idea for connecting computing resources as a public utility system similar to the telephone network (Garfinkel, 1999). Essentially, this idea involved the integration of computing resources—such as servers, storage systems, and applications—from across the globe, allowing multiple users to access and share these resources simultaneously (Surbiryala and Rong, 2019). Today, "the cloud" refers to computing resources on servers and software sites across multiple data centers owned and managed by private companies—physical sites of data storage and processing that remain unidentified by the user, who sees their data as "somewhere in the cloud."

As universities around the globe promoted cloud-based sharing of computing power and online resources (Sultan, 2010), major players in the world of technology such as Amazon, NASA, Intel, Dell, and Google all developed cloud-based user platforms. These platforms enable multiple simultaneous users throughout the world to work together in structured virtual environments (Surbiryala and Rong, 2019). One of these platforms is Google Cloud Platform (GCP). Launched in 2008, GCP provides users with infrastructure to use a set of related collaborative software applications. These include cloud-based storage (Google Drive), word processing (Google Docs), database processing (Google Sheets), presentation tools (Google Slides), and meetings (Google Meet). In 2014, Google developed a platform designed specifically for education organizations, Google Classroom, which brings together

Google's other applications in a system of virtual “classrooms” where teachers may assign and grade work, arrange students into working groups, and see their work develop in real time. GCP technologies share a key functional design feature: the ability for multiple users to simultaneously create and edit files on devices based in different geographical locations.

In UK schools, teachers' use of cloud-based collaborative technologies has become a major part of a burgeoning EdTech (technology designed and used for educational purposes) sector. This increase has been promoted by UK government funding, directed in the first instance specifically toward the teaching of computing (DfE, 2018) and later as an infrastructure for online learning and professional collaboration in response to prolonged periods of remote learning during the COVID-19 pandemic (DfE, 2020). The years 2020 and 2021 marked a sharp uptick in UK downloads of GCP and particularly of Google Classroom (Clark, 2022). This increase in usage has been posited as an opportunity, grasped by EdTech companies such as Google, to experiment with and expand a new form of technologically mediated and algorithmically controlled education (Williamson, 2021). However, the impact of deeply entwined usage of cloud-based collaborative technologies in the business of teaching and learning has yet to be fully explored. This article draws on ethnographic research from 2018—pre-pandemic and thus before enforced periods of remote learning intensified the usage of these technologies. This pre-pandemic view suggests that technologies establish different ways of being and knowing when used in a school. Changes I examine in this article may have been intensified by recent increases in the usage of online collaborative technologies. This article contributes to a growing body of anthropological research interrogating the impact of digital technologies and EdTech on teaching and learning by offering a view of some of the ways GCP impacts the formation of teachers' classroom practices.

LITERATURE RELATING CLOUD-BASED TECHNOLOGIES TO TEACHERS' CLASSROOM PRACTICES

Despite a sharp increase in teachers' usage of cloud-based collaborative technologies in their professional lives, there is a dearth of studies that explore how teacher-technology relationships change the shape of their practices. Rather, many studies of teachers' usage of cloud-based collaborative technologies tend toward a foregrounding of learner experience GCP as a pedagogical tool (Heggart and Yoo, 2018) or the challenges and opportunities presented by different learning formats offered by online collaborative technologies (Laurillard, 2009).

In the wider field of technology at work, a case has been made for exploring how workers and technologies relate through looking to the “constitutive entanglement of the material and the social” (Orlikowski, 2007, 1435). In this view, technologies, the hardware and software that enable them, and the people who use them relate to each other in ways that may influence one another. Part of this entanglement can be seen in studies that highlight the influence of technology on educational activity. For example, physical positioning and usage of hardware such as computer screens have been explored as influencing communication between teachers and students (Decuypere and Simons, 2016). Moments of strategic decision-making around practices between teams of teachers can also be seen as influenced by the design of the software being used (Baker, 2002). Software design has additionally been posited as engendering certain types of teacher behavior (Alvarez et al., 2009). In this way, technological devices can be seen to mediate teacher agency (Nespor, 2011), reorganizing teacher agency in professional activities around the ways these devices and software function. It seems important, then, to trace the role of different technologies in shaping the work of teachers.

However, to take the idea of entanglement further necessitates acknowledging that influence in the teacher-technology relationship is not one-sided (technologies influencing teachers), but rather a complex web of co-influential ways of existing within this relationship. In short, teachers may reciprocally influence technologies as they use (or choose not to use) them. Central to the influence of technology in teachers' practices may be teachers' technology-related utility beliefs (Backfisch et al., 2021) or norms and values about education that influence how teachers employ technologies in their professional lives (Johannesen et al., 2012). These beliefs, norms, and values may influence the ways technologies are used and the extent to which they are activated as influences in the formation of classroom practices. For example, teacher buy-in has been explored as key to continued usage of collaborative technologies post-pandemic (Bonk, 2020). In this sense, technologies can be seen to shape teachers' practices only while in partnership with the people that technologies rely on to function—along with hardware, Internet connections, and so on (Tummons et al., 2018).

The field of anthropology expands this view through situating explorations of digital technologies within the social and cultural worlds in which they circulate. Recent studies highlight the growth and dissemination of EdTech policy (Williamson, 2019). A strong argument emerges for "politically informed understandings of the digital… in which critical social relations with technology are made visible" (Emejulu and McGregor, 2019, 131). It seems prudent, then, to explore GCP's role in shaping teachers' classroom practices from a perspective of how technologies enter and become entangled in the social world of a school.

AN ANT-ISH APPROACH

Following this idea of entanglement, I take a sociomaterial approach to ethnographic data, employing ANT, extended through concepts from LS, as an approach to tracing the ways GCP and teachers co-influentially relate in-classroom, practice-based interactions.

Emerging from anthropological and ethnographic research in the field of science and technology studies, ANT started as a material-semiotic constructivist approach to understanding how authoritative knowledge is produced in the sciences (Gorur, 2011). From an ANT perspective, the reality we perceive around us—culture, society, and so on—is seen as an ongoing relational and associative achievement, a product of associations between constituting actors. ANT's notion of symmetry (Latour, 1987) affords human and nonhuman actors (people, material objects, ideas, beliefs, and so on) equal potential to act in the production of the social world. Symmetry contains within it the idea of entanglement (Fenwick and Edwards, 2012)—the dual notion that, on the one hand, interactions between people are routinely mediated by material objects (Michael, 2017), while on the other hand, things are "full of people" (Nespor, 2011, 19): they are created and used and given agency by people.

In ANT, actors are seen as forming collectives—actor-networks—that can be traced to explicate how certain aspects of reality have been established. The ANT researcher seeks to describe the associations of actors within an actor-network that produce aspects of our reality. For this reason, ANT has been dubbed "a sociology of associations" (Latour, 2005). Within these associations, actors may be seen as *intermediaries*, actors who carry meaning within an actor-network without exerting influence (these are considered to be uncommon), or *mediators*, actors who influence the work of other actors (Latour, 1994). As they move within the actor-network, mediators may alter its shape through associations that may exclude, include, alter, or merge parts of the existing actor-network.

In his 1994 essay, Latour writes about technical mediation, an approach to understanding how techniques—technologies in the wider sense—act within and upon the social world. In so doing, he describes four meanings of technical mediation, on which

I draw in this article. The first meaning is *translation*, in which the goal of one agent is translated into something new, modified by another actor. (In later iterations of the essay, "translation" is changed to "interference" [Latour, 1999, 178].) The second is *composition*, meaning that "action is simply not a property of humans but of an association of actants" (Latour, 1994, 35). In this meaning of technical mediation, the notion that "the teacher teaches" is a misunderstanding. Rather, teaching is a property of an assemblage of actors: teacher, students, texts, classrooms, timetables, resources, websites, pencils, computers, tables, and so on. The third meaning of technical mediation is *blackboxing*. Blackboxing is a process through which the associations that create an actor are hidden from view. Latour gives the example of a projector, present in lectures as a silent intermediary whose existence is taken for granted—until it breaks. We are reminded only then that the projector consists of many parts, assembled in specific ways. In an earlier version of his essay, Latour calls this *reversible blackboxing* (Latour, 1994)—one can trace the actors and their associations that produce the techniques' mediating influence. The fourth meaning of technical mediation is *delegation*, in which the meaning of one actor or assemblage of actors is displaced to another: a speed bump represents the meaning or action of the police officer, or a worksheet represents the key teaching points made by a teacher. Through displacement, techniques "modify the matter of our expression, not only its form" (Latour, 1994, 38).

Latour's extended description of technical mediation offers potential to expand explorations of the ways collaborative technologies and teachers may influence each other: "all four meanings of mediation… can be traced and thereby brought more clearly into view and the extent of their influence considered" (Kamp, 2018, 783). In tracing technical mediation, ANT gives us tools to describe associations between actors that shape and characterize the actor-network, producing network effects of power and authoritative agency (Nespor, 2002). In this article, for example, I talk about how some actors come to dominate and shape the agency of other actors through the establishment of obligatory passage points (Law, 1994): an actor or actors with which all other actors in the network must associate at some point. I also use the idea of immutable mobiles (Latour, 2005)—actors that represent and carry meaning across geographic space while maintaining shape as a "stable network of associations" (Law and Singleton, 2005, 4)—to speak to how effects of authority are attributed to certain actors.

Unsworth and Tummons (2021) have spoken to limitations in the language and tools of ANT in describing how texts are used and created. We pointed out that many moments in the teachers' professional lives were centered around the creation and use of texts. In this article, I draw on the language of LS to extend the analytic potential of ANT in relation to moments of textuality in the actor-network of teachers' practices. LS, partly derived from insights in anthropology, shares many of the epistemological assumptions on which ANT rests (Clarke, 2002). As in ANT, in LS meaning is seen as "contingent and situated, shifting according to context, purpose and social relations" (Hamilton, 2011, 56). LS, like ANT, rejects overarching nominalization of causal frameworks such as literacy or culture; rather, it accepts that there may be many different practices and normative understandings of such terms as literacy and culture, and that they vary with social context (Heath, 1982). LS may thus be seen as a complementary conceptual framework to an ANT account.

In this article, I examine the actor-network of teachers' classroom practices as associatively performed during literacy events (Heath, 1982): moments of the everyday in which interactions center around the written word. For example, one literacy event might be teachers discussing texts together to draft a plan for the week's lessons. Also included within literacy events are teachers' literacy practices (Street, 1984): "ways of using literacy which are carried from one particular situation to another similar situation" (Barton, 2007, 37). I use ANT(LS) to extend the analytic potential of ANT, while also entering LS-based discussions

around the impact of digital technologies on the literacy practices of different social groups. These discussions highlight the ability of digital technologies to instigate sustained change in, for example, students' ways of communicating in the home (Marsh, 2006) or in the functioning of workplace, recreational, and community contexts (Mills, 2010). I argue that the suite of digital technologies offered by GCP reshapes literacy practices in the school in specific ways that effect fundamental changes in teaching and learning.

Using these ANT(LS) tools, I describe an actor-network that establishes teachers' classroom practices in a UK primary school. More accurately, I describe part of this actor-network. ANT affords the opportunity to act to any actor, be it a text, a person, a room, an idea; all people, stuff, and things carry equal potential to exert influence on the formation of classroom practices. While this expands the field of study exponentially, it also entails that the description of the network of actors will only ever be a partial description due to the impossibility of describing all constituting influences of all actors present in the actor-network (Latour, 2005). Here, then, I describe part of the network of teachers' classroom practices, offering insights specifically around the role(s) played by some of Google's collaborative technologies.

METHOD

The research reported in this article is part of a wider ethnography of the development of teachers' professional practices. The study took place in Highland School—a three-form entry primary school (teaching students aged 3 to 11) in the north of England, between April and July 2018. While not all ANT research is ethnographic, the corpus of ANT accounts makes use of ethnography to trace associations between actors. Ethnography's overarching approach of “deep hanging out” (Geertz, 1998) offers the ANT researcher opportunity to observe and follow the actors (Latour, 2005) as they circulate in an actor-network.

The period of fieldwork in this study (four months) was short in comparison to many ethnographic studies. However, this short-term ethnographic approach—also known as “micro-ethnography” (Pink and Morgan, 2013) or “focused ethnography” (Andreassen et al., 2020)—coincided with one complete term in the school's academic calendar. Short-term ethnography uses ethnographic principles and methods but tends toward focused exploration of elements of the subject culture (Pink and Morgan, 2013). It has long been employed in anthropological ethnography to explore small elements, or traits, of a society (Knoblauch, 2005). The approach suits a study of the formation of classroom practices, which, like medical practices, can be seen as multifaceted and episodic in their development (Andreassen et al., 2020), involving different themes and occurring in multiple places (a planning room and a classroom, for example). Speaking in depth to episodes in teachers' professional practices, such as the development and influence of GCP usage, lends rich descriptive insight into how aspects of teachers' practices are established. For example, short-term ANT-based ethnographies have been used to explicate how nursery teachers align their practices through material objects and physical actions (Plum, 2017) and how a teaching strategy comes to be part of teachers' classroom practices (Nichols, 2006). Short-term ethnography can thus be used to study episodes within the wider arc of development of teachers' classroom practices throughout their career.

Pursuing ethnographic research over a shorter timeframe entails careful attention to the ethics of field relations to avoid a “drive-by” approach and less answerable research. Connections to people and place are often already partly established as the researcher enters the field familiar with many of its organizational structures or common tenets (Andreassen et al., 2020). This sets up a very particular form of researcher positionality, in which the researcher enters the field of study as an insider (Crang and Cook, 2007). To

counteract increased potential for interpretative influence of the researchers' prior experiences, researcher perspective becomes one of making the familiar strange rather than making the strange familiar (Knoblauch, 2005). Examples include teachers swapping places to teach in each other's schools (Plum, 2017) or a researcher studying a familiar field in a new setting.

I conducted my research in an unfamiliar school, but I am familiar with teaching in primary schools through my professional background as a teacher. On entering a familiar-yet-strange field, I knew how to "be" in a classroom and was able to "talk the talk" (Crang and Cook, 2007, 22) while remaining open to whatever might emerge as actor in relation to teachers' practices. The time needed to tune into field-specific language—references, acronyms, metaphors—was reduced (O'Reilly, 2012), and I was a readily accepted presence, quickly building a rapport with participants. Relationships with people and place lasted beyond fieldwork, and I presented my findings back to those in the field—to participants, school leaders, and governors.

Data gathering becomes an intensive process in short-term ethnography (Knoblauch, 2005). From an insider perspective, the researcher often takes the stance of observer-as-participant (Higginbottom et al., 2013). This is an alternative approach to the participant as observer positionalities often used in longer studies (Crang and Cook, 2007), but it is not seen as a replacement for participant observation or learning through doing. Rather, observation is shaped differently in that background knowledge of the field is drawn upon in making intensive observations (which are necessary over the shorter time span) from the sidelines, with light (rather than immersive) participation in the activities of the group (Pink and Morgan, 2013). During fieldwork for this article, I joined each teacher participant ($n = 10$) for one week, observing their practice from the time they arrived at school to the time they left, from between 8 and 9 a.m. to between 5 and 6 p.m. (see Table 1 for fieldwork schedule). Other participants ($n = 2$) included a senior leader and a professional development consultant, whom I joined as their schedules allowed.

I was present for all in-school activities of the teachers at Highland School every day. Although ethics and the scope of the study entailed that I could not join them for professional activities conducted at home, we discussed these informally and in semi-structured interviews. Following my conceptual framework, I paid particular attention to activity in literacy events, noting the people, materials, physical environment, and spoken words in the reading, writing, or discussion of texts. I was often in a corner of a room with my notebook, at a table with students, or in the staffroom. Teachers and students included me in their conversations and activities. For example, I would help sort resources with a teacher before a lesson while we chatted about their work, or I would join in briefly in a lesson activity that was being modeled, and I would write fieldnotes afterward. In ANT research, to gather data of a standard that can be deployed in magnifying aspects of the actor-network, the researcher needs data rich with the interactions and associations of actors, showing "energy, movement, and specificity" (Latour, 2005, 131). To achieve this, I focused on recording the behaviors and interactions of the teachers in as much detail as I could.

Semi-structured interviews ($n = 12$) gave further opportunity for me to gather teachers' perspectives on the activities of the group (O'Reilly, 2012). The number of interviews corresponded to the number of participants. Interviews expanded and clarified observations and fieldwork conversations, focusing on exploring daily professional practices through open questions such as "What guides you in your teaching?" or "Tell me about your practices." Interviews lasted between one and one-and-a-half hours and were conducted at the end of a week spent with each teacher, to maximize potential for a relaxed interviewee-interviewer relationship in which we might wander off topic to reveal incidental insights into practices (Heyl, 2001).

TABLE 1 Fieldwork schedule. Data collection periods drawn upon in this article are represented in bold font.

Participant	*Professional role*	*Observation and interview week*
N/A	N/A	April 2–April 23, 2018 (settling in period)
Charlie	Early career teacher Key stage 1 (ages five to seven)	Week beginning April 23, 2018
Alex	Experienced teacher Key stage 1 (ages five to seven)	**Week beginning April 30, 2018**
Frances	Mid-career teacher and year group leader Key stage 1 (ages five to seven)	**Week beginning May 7, 2018**
Benny	Student teacher Key stage 1 (ages five to seven)	**Week beginning May 14, 2018**
Rowan	Mid-career teacher and year group leader Upper key stage 2 (ages nine to 11)	**Week beginning May 21, 2018**
Laurie	Mid-career teacher and math subject leader Lower key stage 2 (ages seven to nine)	**Week beginning June 4, 2018**
Sam	Experienced teacher and senior leader Lower key stage 2 (ages seven to nine)	Week beginning June 11, 2018
Jamie	Mid-career teacher and year group leader Early years (ages three to five)	**Week beginning June 18, 2018**
Wallace	Experienced senior leader	Week beginning June 25, 2018
Toni	External professional development consultant for mathematics teaching	Week beginning June 25, 2018
Joss	Experienced teacher and senior leader Early years (ages three to five)	**Week beginning July 2, 2018**
Meri	Early career teacher and year group leader Early years (ages three to five)	**Week beginning July 9, 2018**

Documentary data provided a third data source for the tracing of the actor-network. As textual artifacts of social cultures, texts are seen as embedded in the practices of the social group (Barton, 2007). They may represent and carry meaning across geographical boundaries of the group (Law, 1994) and become woven into the establishment of the "way of being" in the group through their usage (when people read or discuss them) and creation (when people draft and edit them). Documents may hold information about the social group being studied (Marsh, 2006) or reveal something about how the group is organized, confirming or challenging information gained from observation or conversation (Pahl and Rowsell, 2005). Documents ($n = 86$) were collected that formed part of the participants' actions, ranging from online versions of policy documents saved on Google Drive to lesson slide decks, lesson plans, printed resources, and copies of textbook pages. I observed documents during their creation and usage, enabling a view of trends in how they were positioned in the school's literacy practices and of the network effects these trends produced.

Data analysis began in the early stages of fieldwork, in which I used an iterative-inductive process of thematic coding to ascertain which actors to "follow." This process began with open coding of actors observed or talked about in documents, rather than according to predetermined themes (Emerson et al., 2011). ANT research often produces a large code set initially, which researchers sort into themes by reading data, noticing patterns, and finding more information on a pattern of associations (Wright, 2016). To preserve the flat ontology of ANT, which resists generalization into abstracted conceptual themes during the analysis

process (Latour, 2005), codes were streamlined into groups of prominent actors or associations such as GCP usage.

In relation to the scope of data concerning GCP usage, I observed all participants who were using Google Drive, Google Slides, Google Search, and Google Docs as part of professional discussions about classroom practices or as part of their practices in the classroom. Some teachers ($n=4$) used Google Classroom in addition to other elements of GCP. Other elements of GCP that I observed and reported being used in the school included Google Mail ($n=11$ participants) and Google Sheets ($n=8$ participants). In fieldwork conversations and interviews, all participants talked about GCP, often without being prompted to. In this article, I draw on data from eight of the 12 participants observed in the study. This data pertains to weekly teaching team planning sessions and to the classroom, in which nonhuman and human actors associated with GCP usage are traced.

FINDINGS

GCP is a significant actor in the network of classroom practices at Highland School

Leaders at Highland School began introducing cloud-based collaborative technologies in 2012. The main technologies they introduced belong to the Google suite of technologies, although the school used other platforms for safeguarding records and for parent communication. Sam, a key stage two teacher and senior leader at the school, described the suite of GCP software used at Highland School:

> We have a shared Google drive, where we store school policies, lesson plans, resources, etc. Each year group has their own folder within the drive and there are others for different subjects, school events, and so on. And you can create documents—Google Docs and Google Slides and their versions of Microsoft Excel and the like—directly on the online platform so everyone can access them wherever they are. Over the last couple of years we've started using Google Classroom with pupils—we put learning tasks and resources in the classroom, and they work directly in the virtual room.
>
> (Sam, interview with author, June 2018)

Sam described a usage of GCP based largely in the reading and writing of texts. When GCP was introduced to the school, teachers were already using a wide range of documents in the planning and teaching of their lessons: lesson plans, lesson resources, textbooks, teacher subject guides, and curriculum documents.

Joss, another senior leader at the school, told me that the introduction of GCP had two deliberate intentions: to support teachers' collaboration in designing lesson plans and to enable consistency of teaching in a school where there are three classes per year group:

> It used to be tricky to work together. We talked together with year group leaders to make everything consistent.… Technology was brought in to help with this. Everyone can capture their ideas on the same platform, see the same resources, and then teach using lesson slides they have created together.
>
> (Joss, interview with author, June 2018)

Here, Joss highlights a form of collaboration the school aimed for, which is based in working together to teach the same way—a standardization of practices for which GCP was introduced

as a supporting tool. After a period of school-wide training in the use of GCP, teachers were expected to conduct most professional activity involving document usage through GCP software. This included an expectation that they create weekly teaching plans on Google Docs and set out the structure and content of each lesson on Google Slides. Documents were created weekly in team planning meetings, and the same documents were then used by all teachers in the year group to teach lessons in the classroom.

In ANT(LS) terms, GCP is positioned as an obligatory passage point in the literacy practices through which the network's shape and structure are agreed on and sustained. Actors involved in the generation of lesson plans and the enactment of lessons must associate with GCP. This position was intensified in many schools worldwide during pandemic-induced periods of remote teaching and learning, and in continued heavy usage of online collaborative technologies in many schools post-pandemic (Bonk, 2020). In Highland School, the senior leaders' intended impact of GCP as a facilitator of standardization was performed through GCP's significant position within the network of practices. The remainder of this article examines this narrative of standardization and highlights perhaps unintentional side effects for collaboration and knowing.

A subtle translation: Interference in the goals of the network

School leaders' positioning of GCP as an obligatory passage point in the network effected a subtle translation of network goals. In planning and delivering lessons, teachers continued to agree on and enact approaches to teaching and learning. However, planning discussions and lessons inadvertently shifted focus to establishing teaching and learning through the medium of GCP documents. This seemingly subtle interference exacted significant network changes in actors' physical relationships.

The school's focus on the use of GCP entailed a certain physical positioning of teachers and technological artifacts in planning meetings, and teachers, technologies, and students in lessons. Planning conversations centered around the simultaneous evolution of GCP-based texts to be used in lessons (lesson slides, lesson resources, lesson plans) or the reading of other texts through GCP that informed discussions about approaches to teaching and learning. In these meetings, teachers ignored the round table with chairs around it in each of the school's planning rooms; instead, they sat at different computers arranged on long desks in the room, with the same slide deck and files (stored and accessed through Google Drive) open at each. They faced their computer screens as they talked, using GCP's simultaneous editing functionality to suggest, represent, and edit ideas while they came to an agreement on the approach to the lesson. Frances, an experienced year group leader, and Benny, a student teacher, planned a mathematics lesson together on Google Slides:

> Frances, on one computer in the room, clicks through the slides that Benny has prepared as Benny continues to work on them. Frances says, “Shall we?” (Frances adds photos of fruit to one of the lesson slides [see Figure 1] and suggests a teaching activity using real fruit.) Benny says, “Who will… ?” (Benny adds “children to cut the fruit” to the slide.) Frances responds, “I think…” (Frances changes “children” to “teacher.”)
>
> (Fieldnote, May 2018)

In their discussion, Frances and Benny talked through the medium of the slides, using the visual tools of the software—images, text—to represent and agree on ideas: “It's great for bouncing ideas around as you can show people what you mean—we now use a lot of clipart, photos, and text as we talk. We use that in the classroom, too. We talk in pictures” (Frances, interview with

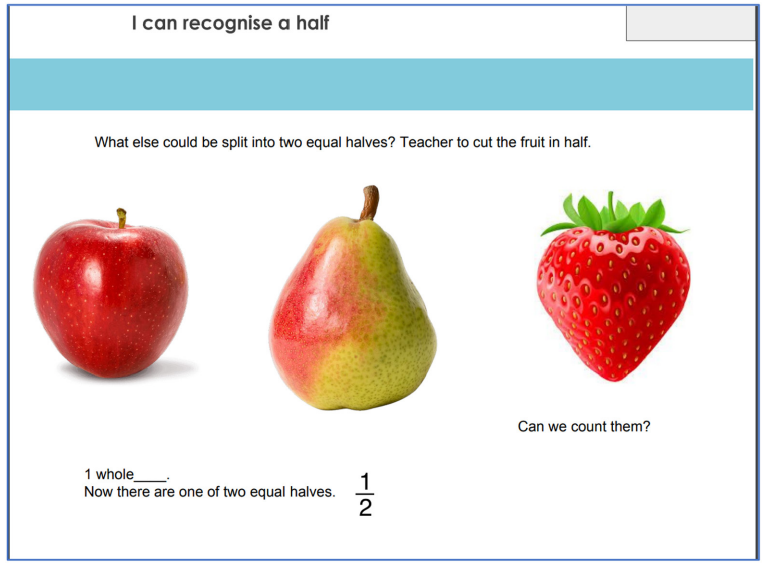

FIGURE 1 Part of a deck of lesson slides. *Source:* Created by Benny and Frances.

author, June 2018). The teachers physically face the computer and talk through the medium of documents generated in GCP software.

Physical centering of GCP software—and computing hardware that allows GCP documents to enter the physical space—was repeated in the classroom. Teachers sat at the front of each class, next to an interactive whiteboard displaying the lesson slides created in teaching team planning meetings. Students sat on the carpet or at tables (for older year groups), facing the screen. Classroom discussion, as in planning meetings, was directed toward the screen and the slides it showed. For example, Laurie, a midcareer teacher, began a lesson:

> Students sat at tables facing the classroom's large interactive whiteboard, on which the teaching team's lesson slides are displayed. Students are asked to talk about a discussion point on the lesson slide: "Consider this question with your partner and justify your answer in different ways," Laurie asks the class.
>
> (Fieldnote, July 2018)

The impact of interference (Latour, 1994) on the composite goals of the network is subtle yet significant. Foregrounding the use of GCP made technological artifacts the physical focus of GCP-based interactions. Not all teaching and learning at the school were directed through the medium of GCP; however, during fieldwork, all teaching team planning discussions were conducted through GCP documents, and most lessons began and ended in (and often were entirely conducted through) discussions and tasks centered around GCP-based documents. The usage of GCP as a focus for discussions determined the spatiotemporal constellation of network activity (Decuypere and Simons, 2016)—students directed answers to the whiteboard or interacted with GCP documents on the whiteboard (or on Google Classroom) while they sat at individual computers. Teachers conversed while facing screens in planning meetings.

This shift in literacy practices lends a certain irony to the term often used to describe GCP: "collaborative technologies." The idea of collaboration inherently speaks to a sense of connection between actors. However, GCP-based collaboration exacted spatially disconnected forms

of collaboration between human actors who were either physically individualized (in planning meetings) or physically directed toward a technological artifact and thereby physically decentered. The full potential or drawbacks of this form of collaboration warrant further research, contributing to discourses of digital literacy practices in raising possibilities of new forms of social interaction exacted through online technology usage (Marsh, 2006; Mills, 2010).

Further network disconnects: blackboxed actors increase standardization of practice

In moments in the network when GCP was positioned as a basis for professional dialogue, agreement of classroom practices became rooted in blackboxed actors (Latour, 1999)—a process through which the associations that create an actor are hidden from view. GCP is itself a black box. "The cloud" is an abstraction. Users do not know (or do not tend to ask) how software is coded and where data is stored. Teachers do not see physical servers or mechanics of technologies, but they use them all the same. At Highland School, GCP had become an accepted tool, often used simply as a necessary way of accessing and processing information. This was evident in many literacy events in which teachers planned lessons: "Joss asks Jamie about a resource for a topic they will be teaching. Jamie says, 'I can't remember. Let me check the drive'" (Unsworth fieldnotes, June 2018). Incorporated usage of GCP imbued the technologies with the potential to exert influence with unproblematized authority, reifying the technologies' network significance. From this privileged position, the cloud-based design of GCP also extended the reach of other blackboxed actors. As a virtual space, the technology connected teachers instantly to vast online information:

> Jamie searches (using Google Search Engine) for phonics teaching resources. She downloads activities from three different resources sites. After discussion with the team, viewing the lesson from their own computer screens, parts of these resources enter the lesson slide deck which is under construction.
>
> (Unsworth fieldnotes, June 2018)

The online resources can be seen as immutable mobiles in the sense that they represented and carried ideas for teaching, maintaining a stable form as they circulated in the network—here, from online space to planning room. Teachers were instantly connected to policies and teaching ideas from around the globe; these policies and ideas were blackboxed in the sense that a veil of anonymity is cast over entities available online. The story behind the creation of a resource did not accompany its presence in literacy events in which teachers agreed on their practices.

The usage of blackboxed online actors as providers of ideas for the planning of classroom practices was extended by school leaders, who used Google Drive to gather online textual actors they deemed important. They stored these in online folders: "Where documents themselves are not stored in the folder, a Google Docs text provides hyperlinks to where they may be found" (Unsworth fieldnotes, June 2018). In this way, school leaders provided black box repositories that simultaneously encouraged and channeled teachers' accessing of online texts. The blackboxed nature of these online textual immutable mobiles was significant in the agreement of teachers' classroom practices. It is not that teachers blindly used the online resources they were guided to, but rather that the circumstances of these texts' creation was obfuscated. This lack of transparency rendered texts more concrete, so that they were accepted as options, rather like available items on a supermarket shelf: "Laurie and his teaching team look for ideas for teaching spelling on the Internet. They compare resources from different websites: 'X does

this,' says Laurie. 'What does Y do?' The team choose between the available online options" (Unsworth fieldnotes, June 2018).

There was concreteness in the repeated conviction in planning discussions that a choice would be made from among available online options, rather than from previous teaching experiences or from ideas in texts that were available in hard copy at the school. Online texts/repositories of texts were thus positioned in the network in a way that reduced the influence of experientially gained professional knowledge on teaching and learning (Eraut, 1994) in favor of a wider social trend toward finding what works (Biesta, 2015). In so doing, teachers' attention was diverted away from the lived experiences circulating within the actor-network—whose actors pertain to students' lives, languages, and cultural practices—into a wider narrative of standardization of professional knowledge. This may be seen to support critiques of a "what works" approach to teaching as closing spaces for professional judgment based on knowledge of community (Biesta, 2015). In a "what works" approach, teaching and learning are diverted away from cultural assets; in this case, they are diverted through a digitized, cloud-based terrain.

GCP-based texts as a basis for classroom discussion

GCP-based texts created in planning meetings became new immutable mobiles in the actor-network, representing and carrying teachers' agreements of practice across spatial and temporal boundaries within the school—from a planning room one week to classrooms the next week. Teachers used these documents as a blueprint for their in-classroom practices. In July 2018, I joined an early years group (teaching students aged 3 to 5):

> Moving back to her computer, Jamie (a year group leader) clicks on the computer mouse and a new slide appears on the class screen. She begins a series of activities based on a numbered line displayed on different Google Slides.
>
> (Unsworth fieldnotes, July 2018)

In this sense, GCP documents delegated (in Latour's sense of the term) teachers' agreement of classroom practices (Latour, 2005). The GCP documents represented—within the classroom space—associations of actors that occurred outside the classroom: "Every morning at 8:30, the whole team meet to run through the day and to explain to each other lesson slides. We all use the same" (Jamie, interview with author, July 2018). All teachers in the same year group used the same slide deck as the framework for their lessons. This was most easily visible in the early years groups, whose three classrooms were connected by archways without doors, allowing me to tune in to activity in all three classrooms from my vantage point in the middle classroom: "From the adjoining classroom, I hear Meri (an early career teacher) conducting the same lesson, using the same language, although the lessons are now at slightly different points" (Unsworth fieldnotes, July 2018). While the pace at which the classes worked differed slightly, the slide deck acted to delineate teachers' practices to the approaches agreed on in planning conversations.

Delineation to a standardized version of practices was increased by teaching and learning caught up in visual elements of GCP text: classroom discussions were grounded largely in images and short bursts of text on slides.

For example, in Figure 2, text introduces a think point task, reminding students of the task during discussions, while images remind students of methods for segmenting a number. Teachers and students annotated slide decks in lessons as they talked. The virtual documents became a common reference space through which ideas were made corporeal, pointed at, and referenced (Decuypere and Simons, 2016), holding ideas under discussion

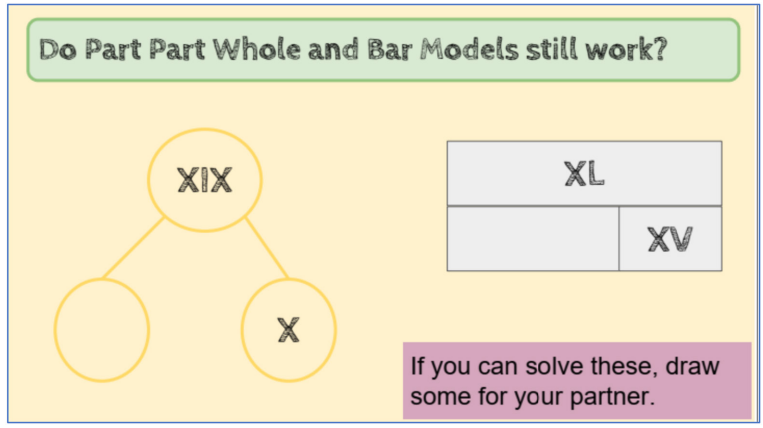

FIGURE 2 Example lesson planning slide. *Source:* Unsworth Fieldnote.

and representing them back to discussants in images and text. Classroom interaction remained focused on the slide deck.

This focus was intensified in teaching and learning of students aged 7 to 11 through the use of Google Classroom. In this collaborative learning space, teaching and learning took place through the reading and editing of shared online documents:

> Pupils access the slides on Google Classroom. Google Classroom is connected to Laurie's PC and he has sight of the work going on at each student laptop. He drafts comments on the work in progress directly into the online classroom and displays some student work on the classroom screen for discussion.
>
> (Unsworth fieldnotes, July 2018)

Classroom literacy practices in Google Classroom were formulated in a manner that backgrounded spoken communication and foregrounded typed communication; the students' thoughts, ideas, and actions were largely typed into documents in Google Classroom. With this manner of communication, every student had a say in relation to every area of "discussion." However, simultaneously, communication became delegated to virtual documents, with minimal verbal interaction outside of these spaces. This finding echoes studies highlighting how technology use in education simultaneously offers opportunities for "open, free and unbounded" teaching and learning while effecting situations in which "students were also managed and guided by the human and non-human elements with which they were networked" (Colton, 2019, 432). All students at Highland School were able to participate in online discussions; however, the parameters of these discussions were set by the GCP documents they were typing in. Agency in the classroom was balanced in favor of pre-planned GCP-based visuals (which set the parameters for student agency).

In foregrounding the use of Google Classroom in teaching and learning, teachers were continually "consolidating the network they form" (Johannesen et al., 2012, 790)—continuous deployment of GCP-based texts simultaneously reified the standardizing of practices and sculpted literacy practices in the classroom. Classroom practices were constituted by a pattern of interaction centered around, and sometimes in, digital documents. As Frances, a year group leader, put it in an interview, GCP documents were used for "bouncing ideas" off of in discussions. This resonates with discussions around the formation of multiliteracies in a digital age (see for example Selber, 2004), highlighting a need to consider how collaborative technologies are

generating different forms of classroom literacy practices, and, in turn, different constructions of teacher/student/technological agency.

Technology-teacher entanglement

In Latour's idea of mediation as composition (Latour, 1999) lies the notion that the perceivable stabilized actor-network is an achievement of "an association of actants" (Latour, 1994, 35). At Highland School, GCP's influence relied upon the school leaders and teachers who enrolled (Callon, 1986) it in literacy practices. School leaders took a central role; they made GCP a significant actor in the network by tying its usage to the access to school policies and to the writing of key documents such as school reports:

> On Google Drive, there is a team drive and individual drives, as well as a whole school drive. Reports are in the "school team drive" with a folder for every year group and within those folders, folders for each class.
>
> (Alex, interview with author, June 2018)

In this way, the influence of technologies relied on the influence of key spokespersons (Callon, 1986) and on teacher "buy-in" to the use of the software. This finding supports arguments that technologies can shape practices, but only in partnership with other actors (Tummons et al., 2018).

When usage of GCP was threatened—in moments of network resistance forged by human actors—the potential impact of GCP on teachers' attitudes toward their role was made visible:

> All teachers and leaders have access to all reports, so teachers can go in and read each other's, which many tell me they do. Alex, an experienced teacher, comments on this: "I'm not sure about it. I suppose I don't mind. I'm worried that anyone can edit them. I might do them separately, offline."
>
> (Unsworth fieldnotes, June 2018)

Alex's anxieties around the simultaneous view and edit functionality of GCP software reduce Alex's buy-in to its usage. Further resistance was also evident in teachers' feeling constantly connected to their work through GCP's accessibility from any Internet-connected device:

> I don't know whether to use it on my phone or not.… For me, if I'm sitting chilling out at home and I get an email at eight o'clock, I have to read that.… But if you don't keep up, you're just going to drown.
>
> (Jamie, interview with author, June 2018)

GCP intensified how teachers' work exceeded the four walls of the classroom, escalating the "onlife" conditions of living and learning in a hyperconnected era (Floridi, 2015). In terms of the effects of such hyperconnectivity, there are studies that point to the advantages of online technologies in reducing teacher workload (Ming, 2005). Teachers feel more productive in their role, partly due to greater access to technologies at home (Selwood and Pilkington, 2005). However, fewer studies speak to the narrative of professional pressure and burnout—pressure to "keep up" or "drown"—in relation to hyperconnectivity told by some teachers at Highland School. This narrative offers a potentially rich source of further research.

CONCLUSION

This article offers the anthropology of education a specific ethnographic encounter—a technologically mediated part of a network of classroom practices—through which to raise awareness of the relationship between cloud-based collaborative technologies and classroom practices. While I conducted my field research pre-pandemic, the ways GCP was established as a significant actor in this network highlight an identified need to explore how a pandemic-bolstered online technologies industry shapes education (Williamson, 2021). This need arises not only from a surge in usage, but also from the often automatic deployment of digital technologies in our daily lives, which obfuscates the social relations producing and sustaining technological actors (Emejulu and McGregor, 2019). This article offers insights into how GCP enters into these social relations, specifically, how GCP mediates literacy practices underpinning a network of classroom practices. These insights reveal a narrative of standardization that is facilitated and mediated by GCP.

The usage of GCP-based documents to standardize practices has evident effects on classroom literacy practices. Resonating with discourses of multiliteracies in a digital age (Selber, 2004), literacy practices in the classroom at Highland School became characterized by a physically disconnected form of collaboration between human actors. Agency was structured in favor of GCP documents, with student agency in classroom interactions tailored to the parameters of these documents. Sometimes students communicated largely within GCP programs, a method of communication that simultaneously offered scope for all students to engage with (online) discussions while also changing ways of being and knowing in relation to texts to a typed, online form. This tailoring of student agency is aligned with anthropological research into how digital technologies modify "our relationship to ourselves, to others and to the world" (Floridi, 2015, 2). Perhaps this tailoring of student agency also speaks to how digital technologies may fall short of idealized purposes (Sims, 2017): ironically, the collaboration effected by this suite of online "collaborative technologies" physically distances human collaborators.

A further side effect of the positioning of GCP as a significant actor in the network appeared to be a perceivable risk of *hyper*connectivity burnout among teachers at the school. This burnout echoes a wider argument in anthropological research "to redefine public and private spaces" whose boundaries are dissolved through hyperconnectivity (Thorseth, 2015, 38). This article thus also supports notions of technology as holding potential to reorganize agency in organizational activities (Decuypere and Simons, 2016; Nespor, 2011)—in this case, intensifying the presence of working patterns/responsibilities into life beyond the school gates.

ANT(LS) offers an analytic approach to ethnographic data with which to speak to the impact of GCP (and other technologies) in a network of classroom practices. The analytic perspective of ANT moves the locus of agency away from human-centricity to sociomaterial relationships in which human and nonhuman actors are entangled with each other (Latour, 2005). From this perspective, we may trace composite networks of associations between technologies, people, and any material, metaphysical, or human actor that technologies come into contact with or are created by. Extending ANT with LS expands ANT's analytic potential, offering a way of speaking to how cultural practices of reading, writing, and conversing using online technologies influence the production and continuity of networks of classroom practices (Clarke, 2002). An ANT(LS) analytic framework may be valuable in examining the rapidly developing world of online collaborative technologies, with possible areas of future research including school usage of platforms such as Zoom or Discord. Additionally, an ANT(LS) approach has great potential for the study of the growth of new technologies and their impact on educational practices. I wonder, for example, how literacy practices in education are influenced by OpenAI's ChatGPT.

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