

Reassembling Home-work: Mixing “Newer” and “Older” Technologies in Home Learning Environments

Deborah Silvis, University of Washington, dsilvis@uw.edu

Katie Headrick Taylor, University of Washington, kht126@uw.edu

Reed Stevens, Northwestern University, reed-stevens@northwestern.edu

Abstract: Home is the original place for children’s learning and a vital site for studying new technological practices. Families’ uses of new technologies present questions and opportunities for research at the intersection of family life, learning, and technology. With so much to do, how do families make use of emerging technologies to accomplish everyday tasks? Drawing on an ethnography of families’ media engagement, this paper examines the nature of young people’s assigned tasks at home. Through analysis of interactions between children, parents, the home setting, and material resources, we develop a theory of learning that accounts for how newer and older technological forms are reassembled in everyday tasks like homework and chores. We discuss how, through mixing media, repurposing space, and remote assistance families make home “work” with technology. These reassembly processes collapse tools, nesting old and new media together in ways that are increasingly relevant for designing learning environments.

Introduction

Every day it seems there is a new gadget or app available that potentially changes the nature of “everyday” practice and learning. Still, while devices and services fall out of use and others come to take their place, there is often continued coordination between old and new technologies (Stevens, 2000), while new skills are being acquired or infrastructures accommodate new systems. As danah boyd (2014) concluded, this exchange of different media does not usher in all new practices as much as it provides new mediums for maintaining social practices over time. Technologies may disappear (or remain in play), but the social practices they reflect and enable are constantly re-worked. Thus, everyday sites of learning- like family life at home- are set pieces for studying how people arrange older (i.e. paper-based) media and newer (i.e. computer-based) tools and resources during collaborative activity (Stevens, 2000).

Home-work is a common site of such collaborative activity. Traditionally, “homework” was assigned in school. However, a wide variety of assigned tasks occupy children working at home, the original site of learning, where, historically, family routines have always entailed some version of children’s work contributing to collective endeavors (Rogoff, Najafi & Mejía-Arauz, 2014). What we are calling home-work includes: schoolwork assigned by a teacher; household chores; helping parents who are working from home; pet care; music practice; and tasks performed at home that are required for activities pursued during discretionary time (e.g. for clubs, sports teams, faith-based groups). Home-work, broadly defined as the routine tasks young people are assigned to do while at home, continues to occupy a sizable portion of out-of-school time (Kremer-Sadlik & Gutiérrez, 2013). While new forms of media have transformed how learners engage in sociotechnical practices, the amount of time young people spend on home-work has not shown similarly dramatic changes (Twenge, 2017).

This contradiction presents a number of questions about the relationship between home-work and media engagement or technology use. If children are doing as much home-work as ever and also using more- and more types- of media, then how (if at all) do they use these new media and emerging technologies to accomplish tasks at home? What types of materials and technologies are used during home-work? How are home-work routines re-mediated through new technological practices? This paper addresses these questions by analyzing how young people accomplish assigned tasks at home. We studied how changing technological practices reassemble families everyday home-work routines. In this paper, we describe three processes that were involved in this reassembly: *mixing media*, *repurposing space*, and *remote assistance*.

Framework

We take a situated and sociocultural approach (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991; Vygotsky, 1978) to learning and its on-going re-mediation (Cole & Griffin, 1983) through technology. Accordingly, in this study, we took a historically broad perspective on what counted as technologies; paper-based tools like worksheets, sheet music, pencils, markers, and clip boards continue to be part of everyday home-work alongside new tablet computers, mobile phones, laptops, and other screens. Today, screens

monopolize the attention of users and researchers of technology and new media (e.g. boyd, 2014; Twenge, 2017)). With this intense focus on emerging digital spaces for learning, one might ask what the implications are of studying home settings as sites of technological re-mediation. When so much of kids' media engagement today is digital and virtual, why bother examining physical spaces or material resources?

While one response to this is empirical- and we will address this in the current analysis- there is a real sense in which everyday activities are still very much mediated by "older" technologies. This is not only because these technologies are deeply embedded in sociotechnical practices (Star & Ruhleder, 1996), nor a simple consequence of persistent inequities in access to opportunities for learning with new media and technology (Ito et al., 2013; Rideout & Katz, 2016), but because *they are still serviceable for users* (Cole, 2017). Re-mediation involves less a replacement of one tool by another than a reorganization of the underlying activity that supports coarticulation of new technologies with old (Stevens, 2000). Coarticulation involves coordinating the use of different tools within interactions as people work together, divide their labor, and jointly perform a task (Stevens, 2000). In media environments where older and newer tools coexist, this process of coarticulation requires hybrid paper-digital practices and novel sociotechnical arrangements.

These new arrangements are a consequence of complex processes of reassembling social life (Latour, 2005), yielding new configurations of people, materials, and their spatio-temporal dynamics (Leaner, Phillips, & Taylor, 2010). New media practices do not only bring about proliferating virtual contexts, they also bring heightened awareness to physical spaces for learning where people and material resources are co-present. Everyday tasks cut across physical and virtual contexts and are populated by heterogeneous technologies; not all sociotechnical practices converge around interactive screens (c.f. Jenkins, 2006). Boyd (2014) found that the social lives of networked teens are complicated by how computer mediated communication and web-based services *collapse contexts*, spreading activity out across more spaces. In contrast, we are analyzing children's work at home, because these learning contexts *collapse tools*, distributing learning across a range of technologies and reassembling domestic routines.

Reassembly disrupts what is taken for granted in sociotechnical practices, revealing the "invisible work" required to maintain everyday routines (Star, 1990). For example, when televisions became common fixtures in American living rooms in the 1950s, this domestic space (formerly used for formally entertaining guests) was repurposed for everyday family recreation, impacting the work of caring for children who could then congregate around TV screens (Spigel, 1992). Work processes that go unseen or unrecognized are associated with a gendered division of labor; child care and domestic work has historically been performed by women (Cowen, 1983), with the lion's share falling to women of color (Star & Strauss, 1999). In general, in our study, mothers were primarily responsible for caring for children while homework was done. And while the advent of domestic technologies- from the washing machine to personal home computers- promises to streamline family life, new technologies have paradoxically not eased the work load of women at home (Cowen, 1983). Less still is known about how *children's* work is impacted by technological change. This presents questions about the ways children's home-work is being reassembled and the nature of work processes that are involved in their learning at home.

Design and methods

In this analysis, we draw on data collected in an ethnographic study of family life at home as it is currently being transformed by new (especially mobile) forms of media and technology. Participants included eighteen focal children in twelve families from diverse racial, ethnic, geographic, and socioeconomic backgrounds. Participants were recruited from local youth-serving organizations, camps, and other places where young people between the ages of nine and thirteen years old spend time; this period of development is significant for media engagement because it is about the time when children get their own devices (Rideout & Katz, 2016).

Data collection in this ethnographic study of families "daily media rounds" (Taylor, Takeuchi & Stevens, 2017) took place over two years in two separate US cities, and methods included the following: semi-structured interviews with parents and children (48 total); video recorded observations conducted during home visits, some of which were recorded by children using point-of-view cameras (i.e. GoPros®) (approx. 100 hrs); experience sampling through nightly phone calls (90 total calls), and a novel research activity for digital mapping of participants' technology use (Silvis, Taylor & Stevens, in press), which was also video recorded (16 digital artifacts). To answer our research questions- how homework routines are re-mediated by newer and older technologies- we drew on ethnographic and interaction analysis (Hall & Stevens, 2016). We produced multi-modal transcription of the talk, gesture, gaze, coordination of body movements (or lack thereof), uptake of tools, use of space, and other aspects that played into moment-to-moment interactions (Tulbert & Goodwin, 2011).

Analytic findings

A wide variety of assigned tasks took place across families participating in the study. During the school year, many of these tasks centered around schoolwork assigned by teachers. During discretionary time and summer break, children's assigned tasks often took other forms, such as chores and housework, music or dance practice, or informal research projects (e.g. where to go on vacation). Because we were studying families' new media engagement and technology use, we looked specifically at times when various technologies were being used to accomplish tasks. We found three processes of reassembly of children's work that cut across these assigned tasks and reorganized the activities of home-work: *mixing media*, *repurposing spaces*, and *remote assistance*. In what follows, we focus on three instances of kids and parents working together during homework time. Each of these examples serves as a representative case of the three overarching processes of technological reassembly that happened in the course of assigned tasks.

Spreading homework across sheets of paper and screens

Children's home-work often required collaborating with parents, and their division of labor involved asymmetrically distributing media and materials (Stevens, 2000). One Saturday afternoon, Natalie an eleven-year-old who participated in the study in a Midwest city, helped her mom complete an Excel spreadsheet containing information from a survey her mom had distributed at work. Natalie's mom presented this to her as "work they needed to do together;" later, Mom told us she often enlisted Natalie in tasks for her job if technology was involved, in order to teach her daughter new technical skills. As they worked together on the couch in the living room, Natalie's mom held the paper surveys, while Natalie was responsible for computer data entry. Using her mom's laptop, Natalie created columns and rows and managed which information she placed in various fields. Her mom acquainted her with certain application functions, for example, by indicating the feature for expanding a row in order to view its contents. Natalie occasionally looked over at the sheets of paper surveys her mom held, however she primarily relied on her mom to verbally relay the information from the paper forms before transforming this into digital data.

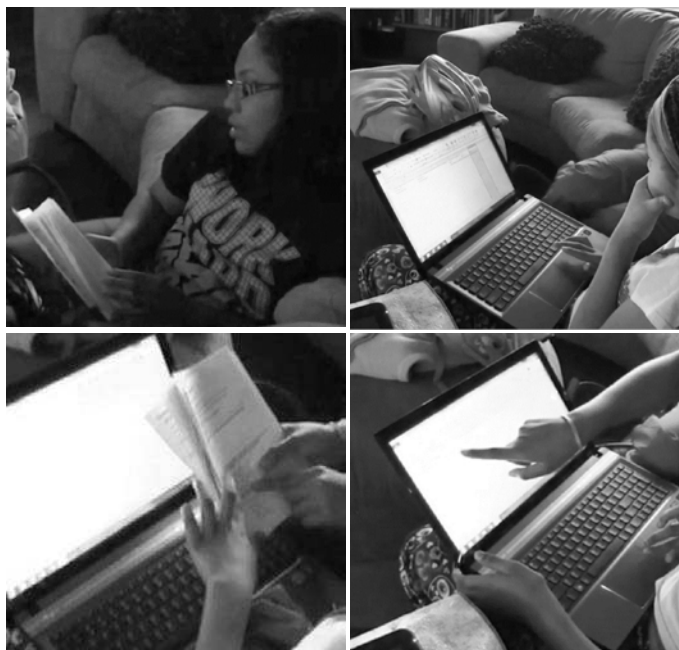


Figure 1. *Video stills of mixing media during homework.* Clockwise from upper left: Natalie's mom reports information from paper-based surveys (upper left), Natalie enters data into Excel spreadsheet (upper right), they collaborate over the screen (lower right), they collaborate over paper (lower left).

Natalie assisted her mom with her work, re-distributing their family's labor across people but also across forms of technology. For the most part, they maintained a strict division of labor: Natalie managed the computer-based work, and her mom handled the paper-based materials (See Figure 1). At times, the distribution of the task was more fluid, and they used either the screen or the papers as a substrate for joint activity (Goodwin, 2013). As they coordinated this joint activity, they stayed physically huddled together side-by-side

on the couch, their arms and hands repeatedly overlapping in activity. The task required that paper and digital forms be mixed together, similarly positioned side-by-side and interleaved in action. For Natalie, learning to manage data through Excel required coarticulation of computer-based and paper-based source of information through collaborative work with her mom (Stevens, 2000). This spreadsheet home-work activity literally spread the task out across sheets of paper, software, and screens, mixing together older and new forms of technology.

Doing homework at the scale of the house

Joint activity that involves mixing media is not always a stationary affair. As mobile technology becomes a ubiquitous aspect of family life, home-work can take place over more- and more distributed- spaces in the home. In the next instance of using technologies to accomplish assigned work, we turn to a more traditional version of homework, completing work after school that was assigned by a teacher. Oscar and Eddie, nine-year-old twins in a West Coast city, had been tasked with creating a paper book cover for their language arts class; the cover was to be based on a book they had read or wanted to read, so that they had some familiarity with the content. The instructions involved designing the cover, creating a synopsis for the front flap and researching the author or illustrator for the back flap. The twins, avid Pokémon fans, both decided to base their covers on their favorite book, *The Pokémon Deluxe Handbook*, an encyclopedia of over seven hundred Pokémon.

While they worked on this assignment one day after school over at least two hours (they were not finished by the conclusion of our scheduled visit), their activities spanned the entire home floor plan (See Figure 2). Eddie centered his work at the kitchen table, sketching his front cover design there and also consulting the assignment instructions and encyclopedia while watching TV in the living room; the twins' mom had placed the instructions on a clipboard that traveled around the home, helping Oscar and Eddie remember the prompts and task structure. Oscar began his work at the table and then, having finished his cover design ahead of his brother, he opted to move to the living room couch, where he could research a Pokémon illustrator on his Mom's laptop. The couch also afforded a better vantage point to watch TV, which remained on in the background while they worked. And yet, the living room was ostensibly a space for "technology breaks" from homework, not for legitimate "work." Moving homework materials and mobile technologies into this area repurposed space in a way that reorganized the underlying activity (Spigel, 1992). Both mobile devices and paper-based resources were instrumental in re-establishing what a given space could legitimately be used for and what technologies would "work" there to accomplish the task.



Figure 2. Homework repurposes space in the home. A segment of the home floor plan used during homework, including available materials and technologies (left). Eddie uses the kitchen table primarily for paper-based work (top). Oscar moves to the couch to research illustrators on Mom's laptop and discovers Bulbapedia, Wikipedia for Pokémon (bottom).

Remote time-keeping during piano practice

Reassembling home-work is a temporal as well as a spatial enterprise. In a third instance of reassembling homework, ten-year-old Brittany, who lived in the study's Midwest city, practiced piano in the evening after

school, supported by different material resources across two separate days. On the first visit to the home, Brittany sat at the piano, reading sheet music and repeating several lines of music in one piece for approximately thirty minutes. Her mom, an accomplished piano instructor who assists her children’s piano practice, intermittently came to Brittany’s side, clapping out the beat and circling notes and bars on the paper sheets (See Table 1). Brittany’s mom encouraged her daughter’s repetition and constructively critiqued her technique. On a subsequent visit, after Brittany closed her sheet music, her Mom approached the bench and offered a new way to practice (See Table 2). She placed her cell phone on the piano’s music stand, and Brittany proceeded to use a mobile app to play “When the Saints Go Marching In;” Mom reported that her cousin, who also teaches piano lessons, had told her about this app. A virtual image of the keyboard on the screen indicated when to play each key, and a built-in metronome feature held the beat. As Brittany tried to keep tempo, her mom approached and indicated where the metronome feature was located on-screen and then told her to press “showtime” so they could hear the accompaniment.

Table 1: Practice session with paper-based time keeping







Time	Technologies	Talk
5:39		Mom: So we’ll circle that and say “two” so you remember it’s a C and not a D
12:30		Mom: It’s slow, quick, quick, slow. Do you hear how it (<i>snaps fingers twice</i>)?
22:28		Mom: I just want to make sure you know how to do it, so I don’t have sit with you when you practice it all week... three, two, one, three, two and three and...G

Table 2: Practice session with mobile app time keeping

Time	Technologies	Talk
14:14		Brittany: Is this middle C? Mom: Yes, it’s in practice mode, so it’ll wait for you. (<i>walks into kitchen</i>) Look at the metronome on the phone.
14:42		Brittany: (<i>finishes playing</i>) I did the wrong rhythm, totally. I did it way faster than the thing was going. That’s why I didn’t get too many points (<i>applause from app plays in background</i>).

17:22		Mom: I don't understand this timing. Hit the "showtime" button.
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Brittany's family imported a new form of technological assistance into piano practice that was remote, in the sense that technical help was not immediately contingent on Brittany's activity. While the device was co-located, it did not respond to Brittany's mistakes by actively adjusting its assistance based on her performance in real time (however it did score her at the end of the song and give her a round of enthusiastic applause if she played well). The mobile app nonetheless maintained familiar aspects of piano practice to which Brittany was accustomed. Her mom placed the phone in the same location and position on the piano stand used for traditional sheet music; and Mom was still available to offer support. However, rather than standing next to Brittany, counting the beat, tapping the music with her pencil, Mom left her phone to act as a remote mentor and metronome; when she did offer support, it was mostly aimed at helping Brittany use the app- not play the piano. This temporary exchange of traditional tools- like sheet music, pencil, and manually tapping out the beat- with a form of remote assistance, reassembled the task. While remote assistance in and of itself is not exactly new to learning technology designs, learners now often engage in such temporal toggling between remote and co-located resources for learning during home-work.

Conclusions and implications

This paper has described three sociotechnical processes that reassemble families' ordinary home-work routines: *mixing media*, *repurposing space*, and *remote assistance*. In the case of Natalie and her mom completing an Excel spreadsheet, the mixing of "older" and "newer" technologies was required for a task, supporting Natalie to develop technological fluency with a new software program. In the case of Oscar and Eddie, doing a homework assignment involved moving a variety of technologies from room to room, repurposing domestic spaces as a way of reassembling routines at the scale of the home. In the case of Brittany, practicing piano using the remote assistance of a smartphone app introduced a new way of keeping time where "collaboration" was out-of-sync compared to more proximal assistance her mother provided in prior practice sessions. These examples of young people accomplishing routine tasks at home show some common ways in which technology is re-mediating everyday learning and give specificity to how transformations in the mediational means of learning reorganize activities. We suggest that the reorganization of home-work involves less a replacement of paper materials by digital technologies than a reassembly and reordering of family life. This reassembly collapses tools, mixing technologies together over space and time in order to accomplish tasks.

There are several implications of these findings for understandings of how learning with technology and new media are changing in a digital age. For one, *home-work represents an important site for studying how technology is transforming family life*. Because so much of children's time in and out of school is spent doing work assigned by other people, it is important to continue to ask how these tasks get accomplished and what children learn through participating in them. The tools and technologies children have available not only reorganize such tasks, they also make new learning possible and potentially change what counts as home-work, making visible how children's contributions help stabilize sociotechnical systems (Star, 1990). Giving children credit for all the work they do and all the things they know is an important contribution of scholarship that re-centers informal sites like family life as valuable resources for learning (Rogoff, Topping, Baker-Sennett & Lacasa, 2002). Knowing more about how technology is involved in these unique and idiosyncratic funds of knowledge (Gonzales, Moll, Amanti, 2003) will be important as more technologies are incorporated into homes and families' routines. The challenge that faces us now is how we will connect these important sites of learning, such as homework, to culturally valued technical opportunities beyond children's homes (Ito et al., 2013) and throughout their "learning lives" (Erstad, 2012).

Our analyses of young people's work at home also suggest that *reassembling domestic routines through technology use is a collaborative endeavor*. This finding is important for understanding how joint media engagement (JME) supports learning (Takeuchi & Stevens, 2011). Children often seek assistance from others to complete their homework (Kremer-Sadlick & Gutiérrez, 2013), and the increased prevalence of digital media at home presents opportunities for new forms of JME that bring people together over valued (and not so

valued) tasks like homework assignments from school, household chores, music rehearsal, pet care, sports practice, and other activities. Even parents' work lives can bleed into children's assigned tasks, as was the case for many of the families who participated in our study. These emerging configurations of people, tasks, resources, and space that constitute JME are continually reshaped as new technologies co-articulate in novel ways with older ones (Stevens, 2000).

A third and related implication follows from this: it is simply not the case that digital technologies remove young people from their family networks and isolate them from larger family routines (c.f. Turkle, 2010; Twenge, 2017). In fact, what these analyses have shown is that the presence of *media and technology in the home present new opportunities for intergenerational teaching and learning in the family context*, and what some of the configurations of families' resources for learning can look like. This builds on prior studies of parents' supports of children's uses of technology (Barron, Martin, Takeuchi & Fithian, 2009) and families' unique patterns of media engagement (Levinson, Siyahhan, Pressey & Taylor, 2015) and extends it in an important way. While digital technologies may be the natural focus of much of our work because of critical questions regarding learning technology design (Roschelle, Martin, Ahn & Schank, 2017), there are still many older tools and technologies we need to account for in studying families' shifting sociotechnical practices.

Therefore, a final implication is that we should take an expansive perspective on what counts as innovation in learning designs. In the current moment, when so much of our work still relies on older technological forms whose utility and relevance are not diminished by digital tools, we ought to consider hybrid designs (Stevens, 2000; Ma, 2017) that draw on domestic processes we have described here. Repositioning families as generating novel forms of technological work, as we have done in this analysis, is not or not only a matter of making it possible for them to participate in activities we design. It is equally important to shift our view to the many ways families are already adept at using a variety of technologies to reassemble daily routines (Levinson et al., 2015). These vital sites for learning and living continue to situate heterogeneous tools and technologies together in ways that will require on-going study.

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