Mobile technologies and

social applications are

nearly ubiquitous in the

lives of many of America's

youth. Mobile device ownership and social media use have been increasing over the past few years: 93 percent of US

teens go online, 73 percent use social networking sites,[1] 75 percent own a cell phone, and

66 percent use text messaging[2] (see Figure

1). Children under 12 are one of the fastest growing segments of mobile technology users,

and 93 percent of six-to-nine-year-olds live in

homes with a cell phone.[3] However, despite

students' strong connection

with the digital world and

media environments and these

systems' potential to improve

learning,[4,5] they're rarely used

in US schools, where students

spend a significant percentage of their time—

more than 1,200 hours annually.

In formal school settings, teachers, administrators, and other stakeholders must negotiate a complex set of issues when addressing

the use of mobile phones and other portable

networked devices. Efforts to integrate technology in schools include investment in curriculum

development and difficult purchase and installation decisions. In addition, numerous legal

and policy issues contribute to the risk/benefit assessment. These challenges have meant

that, to date, few educational applications using mobile phones have been developed for the

classroom.[6–8]

To explore mobile technology's potential

to facilitate learning, the community at large

must consider this technology's use in schools

as a complement to an understanding of its

impact outside schools. Specifically, schools'

acceptable-use policies represent the current

legal basis and historical precedents that define the climate of mobile phone and social

media use in classrooms. Understanding these

policies is an important first step toward creating a workable solution as a joint community of teachers, researchers, and designers.

Rather than holding teachers responsible for

adapting teaching practices to technologies,

or holding designers responsible for adapting

technologies to teaching practices, we explore

how to address these issues together.

This article speaks to a broad audience,

including

• developers, who have designed products

for the classroom but aren't seeing rapid

adoption;

• educators, who are both mobile-technology

practitioners and purveyors of knowledge

about their use; and

• researchers, whose future work in this area

will determine the nature of ubiquitous computing in school environments.

Barriers to greater ubiquity of pervasive computing systems in formal

educational contexts come in the form of legal policies, moral standards,

and institutional responsibilities.

Meg Cramer and Gillian R. Hayes

University of California, Irvine

Acceptable Use of

Technology in Schools:

Risks, Policies,

and Promises

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Our data and analysis are drawn primarily from literature and legal reviews. Where appropriate and necessary, we describe our own experiences

working in US public schools as both

practitioners and researchers during

the past several years. Our corpus of

data includes thousands of hours of

participant observation, direct observation, and interviews. These interviews focused on the design and

evaluation of netbooks and their applications in K–12 (elementary and

secondary) classrooms as well as the

design and evaluation of classroomspecific tools for special education.

Potential Benefits of

Mobile Technology in Schools

Many pundits and researchers argue

that mobile devices and social media

applications promise "anytime, anywhere learning" and support new

pedagogical approaches for an age of

connected learners.3,9 Schools must

continually adapt to the influx of technology and new societal demands, including the push for 21st-century skills

such as critical thinking and problem

solving, as well as student-centered

and project-based learning models.

Much like adults, students use their

mobile phones and social media for

both socializing and work-related activities. Students' work usage patterns

are "closely related to the daily tasks

and activities in their young lives,"10

including managing schoolwork and

scheduling activities. Outside school

hours, students have reported texting to coordinate school projects, researching on the Internet to prepare

for tests, sharing tips and shortcuts in

social networks, and participating in

online study groups.

Mobile technology can open up new

possibilities for on-the-go and just-intime learning.3 Research has shown

that mobile phones can address underserved, hard-to-reach children, especially those who can't attend school

regularly or don't have alternative

means of accessing digital resources.11

Mobile devices extend peer-based

learning to outside the classroom setting: social media has encouraged

peers to learn from each other instead

of drawing from adults' authoritative knowledge. Peer-based feedback

scaffolds learning by surrounding

individuals with others who are invested in similar outcomes. Computermediated communication could also

limit the dominance of certain peers,

as has been repeatedly shown with

adults.12

Furthermore, as the Digital Youth

Project shows, students create knowledge, establish identities, build relationships, and participate in other

activities that have important implications for social and cognitive development.13 According to the project's

researchers, "youth are picking up

basic social and technological skills

they need to fully participate in contemporary society." In fact, online activities are complex and often require

skills and confidence with technology

and communication strategies. Using

networked technologies in classroom

activities lets students interact with

devices and applications they use in

everyday life.14 The project's researchers assert that "youth can benefit from

educators being more open to forms of

experimentation and social exploration that are generally not characteristic of educational institutions."13

Of course, such experiments don't

guarantee success, and educators

should undertake interventions with

some caution. Mobile devices might

not find a place in the classroom.

Once-novel technologies such as the

television also held similar promises

to change the nature of schooling but

aren't particularly widespread means

of formal teaching and learning. Mobile phone use in education requires

pedagogical compatibility, including designing learning environments

with a focus on cultural responsiveness and situated learning. Even if

schools adopt mobile phones and associated pedagogies, developing content and effectively integrating it in

the curriculum might be a slow process. As previous technologies have

shown, the device can often be much

less important than the development

of content and practices to enable

learners to reach educational objectives in new ways.

The Tension between Present and Future Goals

When considering the use, misuse,

and control of mobile phones and

social media in schools, we must also

consider education's role in socializing

young people. Students' engagement

with educational materials, including

100

80

60

40

20

0

Go online Use social network sites Own a cell phone Use text messaging

Percentage

Mobile social patterns of teens aged 12–17

Figure 1. Teens' mobile phone and

social media use has risen in the past

few years. Teens are using these devices

and applications at school, though not

necessarily for school-related purposes.

Given the widespread nature of these

practices, it's important to understand

the impact in school settings.

systems, is an individually constructed

experience that helps them learn about

the world around them. The education

system has an enduring social structure comprising roles, responsibilities,

processes, and traditions that carry

social meaning. What's more, education is a moral institution that serves

society as a whole, focusing on what it

should do for its members and adding

a moral dimension to the activities that

happen in it. Specifically, schools have

a moral character in their rules, dress

codes, student governments, and so on.

Consequently, their policies on technology use both implicitly and explicitly

define what's normal and what's right

and wrong. So, schools are both places

for individual and collaborative sensemaking and places where students learn

about morality and society's expectations of them.

Education is more than learning a

prescribed curriculum. Children and

teens learn constantly, and formal education might simply be an attempt to

adjust what they would learn naturally

into what the adults of a society want

them to learn. Thus, educational systems can be seen both as descriptions of

what's currently important in society,

including social roles, and as prescriptions for what society wants for the future.15 The tension between representing today's standards and preparing

students for the future requires schools

to continually negotiate what is and

isn't suitable for the classroom.

These negotiations have left students

without access to many of the technologies that are familiar in other aspects

of their lives but not yet considered appropriate in the context of schooling. A

2002 Pew Internet Research report revealed that students find a "substantial

disconnect between how they use the

Internet for school and how they use

the Internet during the school day."10

Restrictions and bans don't keep

mobile devices off school premises or

eliminate their use. Students often hide

their use from teachers and administrators, whether or not it's for school

purposes, and teachers and other staff

often hide mobile device use from administrators and students. During our

fieldwork, teachers regularly noted that

they would like to employ novel uses

of networked devices in their curriculum but were restricted by policies that

prevented technology use for various

reasons, including lack of technical infrastructure, network security regulations, possible disruptions, and lack of

parent and staff support. In the schools

in which we conducted our work, responses from administrators about

whether they'd actually punish any

teachers caught violating these policies varied dramatically from school to

school and even—in the same school—

from teacher to teacher. Almost universally, when teachers used phones

in class for learning and other workrelated tasks, such as communicating

with parents, they hid these practices

from administrators.

US schools are at a delicate tension

point. There's the inherent desire to

maintain social propriety as defined

over the past several decades of formal education. However, many educators favor the development of a more

individual student-centered learning

model, often through the use of novel

technological solutions. As moral and

political institutions, schools will likely

play a significant role in developing and

transmitting societal rules about these

technologies, based on their potential

risks and benefits. For example, e-mail

and mobile phone etiquette, understanding of security and privacy risks,

and preparation for the workplace in

terms of online reputations and contributions are all issues schools will face

because of their inherent position as social learning environments.

Acceptable Use

In response to these myriad complex issues, most US schools have acceptableuse policies to regulate mobile phone

and social media use. Mobile phone

and pager bans were established in the

late 1980s and early 1990s in response

to fears that students would use these

devices to traffic drugs16 and that usage

would disrupt classrooms and control

structures.

Beyond the Ban

For many reasons, mobile phone and

social media bans in US schools have

become unrealistic and even undesirable.3 Parents and educators no longer

fear that student cell phones are primarily tools for drug deals and other

criminal activities. In addition, parents

and other stakeholders have pushed for

increased acceptance of these devices

for "emergency use" so that students

can coordinate relatively benign events,

such as rescheduling a carpool, and are

prepared in the case of true crises, such

as a school shooting.

Although complete bans are unrealistic, evidence exists to support

the formulation of appropriate rules

and regulations. Increased use of cell

phones and mobile devices for phone

calls and other purposes—for example, social networking, instant messaging, SMS (Short Message Service), and

blogging—has brought about new concerns for schools, parents, and regulatory bodies.

For example, mobile phones specifically have come under much scrutiny

regarding "sexting," the practice of

sending or receiving sexually suggestive

nude or nearly nude photos or videos.

Formal education might simply be an attempt

to adjust what teens would learn naturally into

what the adults of a society want them to learn.

40 PERVASIVE computing www.computer.org/pervasive

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Sexting isn't just a moral concern for

educators and parents; it's also punishable under child pornography laws. As

legislators and lawyers in some states

are attempting to change the offense

from a felony to a misdemeanor specifically for minors, laws are emerging to

deal with possession of such images on

mobile phones, "increasingly the locus

of teens' personal, and seemingly private communication."2

As a result of such challenges, most

states now place the authority to determine electronic communication's

role in the classroom in the hands of

local school boards. These boards consist of elected or appointed officials,

educators, and community members

who represent the school districts'

interest, determine policy, and lobby

for and allocate resources. State statutes now allow—and, in some cases,

require—local stakeholders to establish policies concerning the possession and use of mobile phones, social

media, and computational devices on

school property, including disciplinary measures.16 These policies reflect

the legal obligations and rights of

schools and the governments that support them, as well as address concern

for student and teacher well-being and

school reputation.

A safe school environment protects

students from physical harm and creates a space where they can focus on

learning. Students concerned for their

well-being or safety will unlikely make

substantial academic gains. Mobile

phones and social media can be avenues for "hate speech" or other illegal speech that's threatening and hurtful to students or faculty, undermines

institutional control, and puts schools

at risk for lawsuits. Consequently,

administrators generally develop

acceptable-use policies to protect

schools from these threats.

Defining What's Free Speech

Whereas safety is an overt goal of

acceptable-use policies, protection of

free speech is the dominant issue in relevant case law. Acceptable-use policies

are binding contracts that students and

parents enter into at the beginning of

each academic year. However, these

policies must adhere to the legal rights

that the federal government has guaranteed students, including the right to

free speech at school, secured in the

First Amendment of the US Constitution and confirmed in the 1969 seminal court case, Tinker v. Des Moines

School District.

Most legal cases we discuss here

center on the schools' rights to protect

students and faculty and the students'

rights to free speech. Not every form of

speech is protected. School administrators and teachers are obligated to discipline students for lewd, profane, or indecent speech; threats of violence; drug

trafficking; or other speech acts that interfere with others' rights at school or

during school-related activities (Bethel

School District v. Fraser, 1986; Lovell

v. Poway Unified School District,

1996; Morse v. Frederick, 2007; Tinker

v. Des Moines School District, 1969). If

a communication device is involved, it

needn't be school property for a student

to commit an offense; indeed, in many

court cases, the devices belonged to the

students or their parents.

In establishing whether a speech act

is protected or subject to disciplinary

action, schools struggle to define what's

on campus as opposed to off campus

in light of new technologies that blur

these lines. A school entity can be disrupted or threatened by speech acts that

originated away from school grounds,

and mobile phones and social media

can make certain speech acts more visible and persistent. Recent case law has

exposed incidents in which websites,

social networking profiles, and instant

messages created off campus were

thought to have compromised school

safety.

In some off-campus cases, courts

have ruled that disciplinary action

against students wasn't warranted.

This includes cases involving a parody

profile of a school principal (Layshock

v. Hermitage School District, 2007)

and an e-mail of a top-10 list regarding a school's athletic director (Killion v. Franklin Regional School District, 2001). In other off-campus cases,

courts have upheld schools' disciplinary actions—for example, the cases of

a YouTube video depicting the killing of

a teacher (O.Z. v. Board of Trustees of

Long Beach Unified, 2008) and a hate

website directed at an algebra teacher

(J.S. v. Bethlehem Area School District, 2002). Given that technological

devices and networks are increasingly

used in a variety of physical locations,

a wide array of behaviors involving

mobile social technologies obscures

the boundaries between places such as

home and school.

Acceptable-use policies are already

changing in response to speech acts

occurring outside school property, a

trend we expect will continue. One

such change is the inclusion of "reasonable foreseeability," a test put forth

in Wisnieski v. Board of Education of

Weedsport Central School District

(2007). A report to the leadership of

schools in Southern California recommended policy changes that would

further delineate the nexus of acceptable off-campus use and the schools'

interest.17 If the speech act doesn't

Recent case law has exposed incidents in which

websites, social networking profiles, and instant

messages created off campus were thought to

have compromised school safety.

directly reach the school campus, such

as a website that wasn't accessed or

created at school, it's put to a test in

which an adult determines whether

the information would have eventually reached the school and caused

disruption. Reasonable foreseeability

gives schools the right to discipline

students for speech acts committed

off campus when a material disruption of and substantial interference

with others' rights exist. Designed to

alleviate the confusion surrounding

the school's authority to manage offcampus speech acts, this test should

result in more elaborate policies addressing both on- and off-campus use.

Risks for Schools and

Students

Schools' usage patterns and policies are

shaped not only by the desire to minimize liability but also by the risks of

social media and networked devices for

students as users.

Perceived Risks

A glance at any news website or parenting magazine exposes the vast array of

perceived risks of engaging with social

media and pervasive computing technologies. However, stories in the popular press can misrepresent research

and generate panic about issues such

as dangerous online solicitations. In

reality, online solicitation is incredibly

nuanced.

Findings from the Youth Internet

Safety Surveys, commissioned by the

Center for Missing and Exploited

Children, revealed that one in seven

youth has been sexually solicited online.18 These and similar reports have

prompted most schools to deploy Internet filters and blocks on websites,

instant messaging, and other social

media. But blocks meant to protect

students are much harder—if not

impossible—to enforce when mobile

devices are involved and students no

longer need the school network for access. Furthermore, it's unclear whether

the blocks prevent solicitation. A recent

literature review from the Berkman

Center for Internet and Society reiterates that Internet sex crimes haven't

contributed to a rise in sex crimes

against minors.18 This report establishes that the most frequent threats

online are from bullying by known

peers. However, sexual predation remains a concern, and more research is

necessary.

Most teens use social media and mobile phones to strengthen relationships

that they've established offline, not

with strangers. It's not uncommon for

adolescents to congregate in unmoderated spaces (physical or online).13

When students can access virtual

spaces anywhere, anytime, parents and

schools must consider a much broader

definition of unsupervised or unmediated peer interaction. Beyond students'

ability to interact with strangers, school

policies must consider time spent with

friends in unsupervised locations where

much of their activity is supposed to be

monitored.

Another recent study receiving attention from the popular press states that

one-third of teens with mobile phones

admitted to using them to cheat at

least once in school.19 Although these

numbers are alarming at first glance,

prompting reactions to "cybercheating," the report doesn't discuss the frequency or conditions under which the

cheating occurred. Furthermore, students reported ambiguity as to what

they considered cheating (for instance,

telling a student in a different class

about a surprise quiz).

Our fieldwork, although not quantitative and thus difficult to compare

directly to these results, indicates that

teachers are also unclear on the definition of cheating in modern learning

paradigms. New technologically mediated learning environments and curricula often sanction the use of other

materials (for example, online research

and building off other students' work

in online environments) that might

not have been allowed just a few years

ago. Researchers must examine how

students use mobile phones and social

media in situations of academic dishonesty. In particular, we must seek to

understand whether these devices do

in fact make cheating easier and, if so,

whether this ease makes cheating more

prevalent.

Observed Hazards

Many longtime school problems, such

as bullying, "at-risk" youth, and classroom disturbances, are facing new complications regarding mobile devices and

social media. In addition, one possible

new problem is student multitasking.

Bullying. Online bullying (also called

cyberbullying or online harassment)

is a substantial concern for educators.

According to the Internet Safety Technical Task Force, online bullying can

involve "direct (such as chat or text

messaging), semipublic (such as posting a harassing message on an e-mail

list), or public communications (such as

creating a website devoted to making

fun of the victim)."18 This can seriously

harm victims, who can experience depression, loneliness, lower grades, and

absenteeism. Online bullying becomes

a school concern when it's connected

to the student's well-being and a liability if it involves the school location or

school peers.

In some ways, cyberbullying differs

from in-person bullying. Cyberbullies

aren't restricted by distance, and their

Most teens use social media and mobile phones

to strengthen relationships that

they've established offline, not with strangers.

reach can be extended within the online

environment. They might not be bullies

in the "real" world; rather, they might

consider the Internet a place to exercise more dominance and aggression

than they would in person. (Interestingly, this effect mirrors the workplace,

wherein computer-mediated communication tends to flatten hierarchical

power interactions.12) Current school

policies consider bullying a serious offense, and schools must respond to the

new trends in student harassment.

At-risk students. Mobile technology's

possible effect on at-risk students—

those who are potential dropouts, failing academically, or performing below

grade level—is another area of concern

for schools. Studies show solicitation,

victimization, and online harassment

aren't correlated to a particular type of

social media (for example, Facebook)

or practice (for example, SMS-based

texting). Instead, risk online is statistically correlated with risk offline.18 Students struggling with a poor
home environment, physical abuse, depression,

and substance abuse tend to make poor

choices and might find themselves in

undesirable situations online.

Educators have long known that

these offline issues are tied to academic

performance; they must now address

online risks as well. We predict that

schools would fare better if they didn't

target any particular device or media

but rather focused on interventions for

at-risk youth that include education and resources addressing risky online practices.

Classroom disruption. A significant concern for teachers—and likely the one that comes to mind most readily when considering mobile phone use in schools—is the potential disruption to the classroom environment. Teaching is a challenge; teachers must manage students' diverse needs and behavior to meet an entire school year's worth of established goals in a timely manner. Mobile phones can undermine the classroom's paramount learning objectives, in which decorum, order, and control are valued.

Teachers and administrators have posted to blogs (for instance, www.commonsensemedia.org/cheatinggoes-hi-tech) with complaints about in-class student behavior involving mobile phone and social media use. These statements often describe mobile device use in classrooms no differently than passing notes or whispering between students. Like other disruptive activities, then, mobile phone use can be managed by teachers who engage their students and provide proper guidance. Teachers have always diverted student attention away from potential distractions and toward the task and material at hand—which is difficult but doable.

Multitasking. In 2006 and 2010, the

Kaiser Family Foundation produced

two reports on concerns about multitasking. The 2010 report stated that

"development of mobile media has

allowed—indeed encouraged—young

people to find even more opportunities

throughout the day for using media,"

with minority youth being the heaviest

consumers of media content via mobile phones.20 The 2006 report noted

that the brain structure and function

of people who engaged in substantial

multitasking as youth differed measurably from that of those who hadn't.21

It's unclear what these changes mean

in terms of long-term human cognitive

and emotional capabilities; researchers

are continuing work in this area.

Parents and teachers, both in these

reports and in our fieldwork, have been

less concerned about multitasking than

about productivity, etiquette, and rudeness or distraction. New rules and coping strategies should ensure that crossgenerational expectations regarding

these issues are met.

Discussion

As educators must begin to understand

pervasive computing technologies, researchers need a solid understanding of

classroom dynamics and management

strategies to develop technologies that

support the realities of formal K–12

learning environments. Experts in pervasive computing, educational technology, and teaching must work together

to establish best practices for integrating technology into classrooms, using mobile devices and applications to augment school tasks rather than distract from them.

We must continually ask ourselves where pervasive and mobile technologies fit in formal schooling and where educational technology's boundaries lie. Examining mobile devices' and applications' roles in teenagers' lives lets us think differently about educational technology and education itself.

Many researchers argue that pervasive computing systems, including mobile and networked devices and the mobile social applications running on them, could support sociality and learning in schoolwork and overcome some known barriers to learning by influencing pedagogical change. Schools can be sites for building interest in and understanding of social media. However, as we discussed earlier, substantial barriers to adoption and use still exist, with only preliminary evidence of educational outcomes from the use of

Experts in pervasive computing, educational technology, and teaching must work together to establish best practices for integrating technology into classrooms.

these technologies, often in university settings. We should seek scalable positive educational outcomes for K–12 education.

For mobile devices to become truly

pervasive in learning environments,

designers and researchers must also

acknowledge current and transitioning acceptable-use policies as keys to

understanding the school environment

and administrators' and parents' legal

duties. The design implications drawn

from this analysis wouldn't force pervasive technologies to fit perfectly in the

tight contextual box that these policies

create. Instead, acceptable-use policies regulate speech and expose how

speech and technology can be conflated. So, the challenge of developing

mobile technologies for learning is determining how to enable free speech in

a way that makes sense in the schooling

environment.

On the basis of our initial survey

of the landscape, we offer the following thought experiments about pervasive technology design for classrooms.

These aren't prototypical recommendations or even suggested designs for future systems. Rather, they're meant to

provoke critical thought.

First, rather than ban text-based

chatting in classrooms, educators

could capture and share these conversations. This solution is analogous to

encouraging students who are having

side conversations in pairs or small

groups to share their discussion with

the class. What would be the result of

such an intervention? Almost certainly,

some students would "game" the system, intentionally using it as a stage on

which to perform. Others might avoid

using the technologies altogether, and

still others might use the system to ask

public questions on the lecture anonymously. Regardless of the specific result, it's interesting to think about how

educators can use communication

technologies to foster discussion—and

yes, perhaps a little mayhem—in the

classroom.

Second, rather than block participation on social networking sites during

school hours, schools might build lessons into the curriculum about appropriate behavior in online environments

and encourage students to use wikis,

social networking sites, and mobile

communication technologies. To address concerns about online solicitation, bullying, and excessive burden to

at-risk youth, these environments could

be limited to only those affiliated with

a particular school or school district—

in much the same way Facebook was

initially limited to Harvard students—

and moderated by educators.

Again, this design concept prompts

us to wonder what might happen as a

result of such a system's implementation. Would the new environments be

virtual "ghost towns" like so many corporate intranet communities, or would

students engage in this new sandbox?

Does critical mass take on different

meaning when most of your social network is in one organization? Would

students reject systems limited to only

their schools? These online environments could transition from risk-laden

enterprises to safe places for experimentation and learning. These systems

might even destroy data when students

graduate to protect their reputations.

These concepts can be a starting

point for thinking about appropriate

mobile-technology design in school

environments.

Mobile phone bans have

been in schools for

more than two decades,

and local control and

acceptable-use policies are becoming

commonplace in US public schools.

However, these policies are often more

like "unacceptable-use" policies, focusing on how students shouldn't use

mobile phones and the consequences

for breaking the rules. These stringent

guidelines leave little room or desire for

innovation in teaching or learning. The

technological landscape has changed

dramatically, and researchers have begun to demonstrate benefits to learning

through these novel technological solutions.4,5 The next step toward a truly

connected youth is bridging the gap between in-school and out-of-school technology use, both in policy and practice.

Relevant stakeholders must ensure

that school guidelines are flexible

enough to protect students and faculty

while supporting innovative practices.

Whereas the contracts must retain their

legal base, schools can benefit from exploring possible additions that outline

practices that aren't just acceptable but

encouraged in the school environment.

For example, policies could let students

engage with mobile phone services and

social media to manage the school day

and organize homework, tests, and

activities. In addition, policies could

let teachers exercise discretion when

experimenting with mobile devices in

lesson plans. Mobile phones' potential

in schools lies in their features and services that can be leveraged for not only

socializing and play but also learning

objectives. Policies should remind students and parents of the ongoing negotiation between the desire to use technologies and school objectives, as well

as perceived versus actual risks.

The future depends on educators,

designers, and researchers working

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use, both in policy and practice.

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together to build adaptable systems

and construct usage policies that make

sense in formal learning environments.

Technologists, policymakers, and researchers must all understand formal

schooling's unique environment and

how pervasive technology practices

are being carried out there—not just

in students' afterschool and home life,

on which most research currently focuses. To predict how students will be

workers in the future, we must learn

how they're using technology for their

work today.