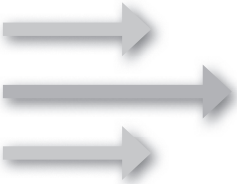


Chapter 2

HOW MIGHT TEACHERS RESPOND TO THE CHALLENGES?

I'm not excited about a world where students just use technology to click through materials on a screen. But I'm very excited about a world where learners use technology to design, create, explore and engage with their peers around the world. This use of technology is incredibly powerful, and it's an opportunity that should be available to everyone.

—Culatta, as quoted in Cortez, 2017

Although a large part of digital equity is access to devices and adequate bandwidth, as we saw in the previous chapter, it is not enough to simply buy devices and pre-packaged programs (such as the "drill-and-kill"). Forcing shiny new technology tools into adoption while the learning and purpose for the integration of the new tool lags behind is no longer an acceptable practice.

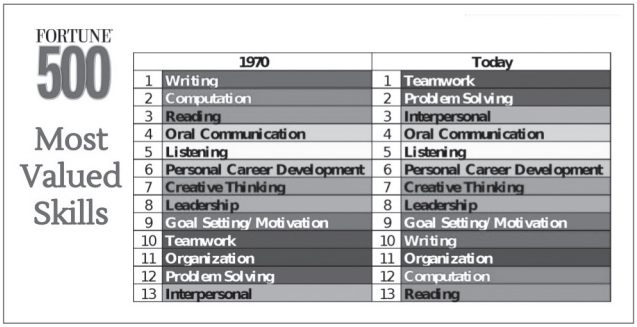
Many of us have heard these edtech urban legends, where schools invest tens of thousands of dollars in new devices and programs while leaving the most important part of the equation unsolved: the human factor.

Before rolling out new technology on a large scale, educators must know what to do with it and why the tool was adopted for use. As we mentioned in Chapter 1, the last phase of addressing your digital equity problem of practice is planning for teaching and learning. Proper planning includes professional learning on such topics as tool selection, digital citizenship, student-centered design, facilitation, and more; all of which are all supported by the ISTE Standards for Educators (International Society for Technology in Education [ISTE], 2017).

The ISTE Standards for Students (International Society for Technology in Education [ISTE], 2016) help prepare students for an unknown future, by addressing skills that are gaining importance over time. Shortly, we will discuss this more, but first we'd like to draw attention to the skills we are preparing students to acquire for the future. A good illustration of these, and how they've changed over the decades, can be see in Figure 2.1, which was shared by California educators Adam Juarez and Katherine Goyette in a 2018 presentation at CUE Nevada. As the baby boomers were entering the workforce in 1970, more academic subject-heavy topics were at the top of the list, such as reading, writing, and arithmetic. Nearly fifty years later, however, we see that soft skills have risen as millennials are coming of age. Soft skills will likely continue to play a role in the future workforce, although they often play second fiddle to the core content.

The key approach is to integrate these soft skills seamlessly within the content, as supported by the Standards for Students (ISTE, 2016). Doing so supports learning for all students regardless of learning styles and/or abilities. We are reminded of the work of an ISTE Digital Equity Network Leader, Valerie Lewis,

who is currently an assistant principal in Georgia. She recently shared her story with us about the integration of technology in special education (see the sidebar, "Technology in the High School Special Education Setting"). Valerie recognizes that students in special education classrooms are often overlooked, so her refreshing perspective is one we hope you will benefit from hearing.



	1970		Today
1	Writing	1	Teamwork
2	Computation	2	Problem Solving
3	Reading	3	Interpersonal
4	Oral Communication	4	Oral Communication
5	Listening	5	Listening
6	Personal Career Development	6	Personal Career Development
7	Creative Thinking	7	Creative Thinking
8	Leadership	8	Leadership
9	Goal Setting/Motivation	9	Goal Setting/Motivation
10	Teamwork	10	Writing
11	Organization	11	Organization
12	Problem Solving	12	Computation
13	Interpersonal	13	Reading

Figure 2.1 Compare the *Fortune 500* list of Most Valued Skills in 1970 and today. *(Image credit: Juarez & Goyette, 2018.)*

Educator Voices

Technology in the High School Special Education Setting

by Valerie Lewis, Assistant Principal

Learning in and of itself is difficult—not to mention when you are a student diagnosed with learning deficits or more simply, in need of some supports and accommodations.

According to the National Assessment of Educational Progress 12th grade report, 5% of students with disabilities scored at Proficient or beyond in 2011 (Figure 2.2). This

certainly does not help our case when pacing guides already send teachers into overdrive. So how does a teacher work around time constraints? What does effective instruction, assessment, and timely feedback look like for students with learning disabilities? After many years in a resource setting, I knew that I had to leverage technology in my classroom, specifically through the effective use of free applications that would complement my classroom instruction.

After you establish your goal, consider how to find the tools that will help you achieve it. Too often people decide that tech is good enough to use without a clear plan. It must serve a purpose. You want to get meaningful work done and not just busy work complete. Every assessment shouldn't just be on paper and pencil—or on a computer. Tech allows students to show what they know in a variety of ways, but more so—it allows access to things and places that may otherwise be considered a stretch. Isn't that what teaching and learning is all about?

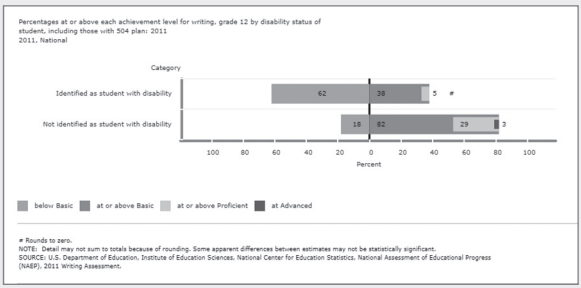


Figure 2.2 Fewer students with disabilities scored at Proficient or beyond *(Image credit: U.S. Dept. of Education, 2011.)*

Writing

For example, writing can be frustrating for students with disabilities because of motor dexterity challenges or because

articulating their thoughts through written communication is more difficult. Unfortunately, the curriculum and pacing guides do not often build in the time needed for teachers to model or practice writing. It is still very important for students to write and to recognize writing as not only a form of communication, but also as an important building block to help them develop the necessary skills (e.g., soft skills, motor skills) that will be beneficial beyond writing.

To help students, I integrated Google G Suite (especially Google Docs) into lessons. This tool allowed my students to pull up information and share documents that I could view and edit it in real-time. Chunking students' work or putting it into manageable parts is helpful and perhaps part of the supports or accommodations written in their Individualized Education Plan (IEP). By using Google Docs, my students and I and could easily work on a long essay in chunks, editing them as they were written. This approach not only eliminates the long wait for feedback, but also avoids student frustration and the letdown of having to redo everything after writing a long essay. Both my students and I could gain insight on what they are doing well and what changes would improve their work, as they went along. In the comments section, I could quickly give feedback on capitalization, grammar, sentence structure, word choice or even citing supporting evidence in a research paper. Students would become less anxious when they felt like they were getting individual support along the way and arriving at the end was a whole lot less daunting.

Teaching grammar in isolation is almost a thing of the past. Some teachers find ways to carve out time at the start of class (bell ringer) to complete Daily Grammar Practice (DGP) exercises. Although that approach helps to set a foundation of understanding, some find a less intimidating way to teach this skill through the Grammarly browser

extension (grammarly.com). Available for the Chrome, Edge, Firefox, and Safari browsers, this free tool is essentially a writing assistant that helps to spell check, define words, find synonyms, and make timely suggestions while you write. When students are writing, suggestions become visible and they can easily self-correct and then begin to recognize mistakes they often make. You can also have follow-up in conversations with them about their writing ethic and encourage them to goal set and build.

Speaking and Listening

Very rarely do you come across a teen that doesn't have an opinion of his or her own. Under the right context, you just may have a hard time getting them to sit still and quiet. This is where student choice comes in: Topics for discussion (school appropriate, of course) should sometimes come from the students. If they are interested in it, then chances are they are willing to engage and participate. This is half the battle. Too many times, we are dead set on checking off a list of our "must-dos" that we fail to meet the needs of our most important treasure—the students. Find ways in which to connect the units of study, themes, or topics to things that kids like. They may actually retain the understanding much better. Get creative on how you connect standards and skills.

In this age of tech, I don't spend time collecting phones and holding them hostage at the board or behind the door. Instead, I find ways to engage kids with the tech glued to the palm of their hands or other devices they brought to school with them. Through Snapchat, we build Snap Stories, which were reflective of their learning, as well as build #BookSnaps (tarammartin.com/booksnaps-snapping-for-learning).

To tie in the writing component, I also give students the opportunity to pick an area of interest to blog about through

Blogger; being a G Suite for Education school makes this easy. I found my students became most excited when they could get feedback from their peers within the class and those across district, state, and country lines—or out of the country. To push a step further, students also have had the experience of creating their own podcast show using Audacity (sourceforge.net/projects/audacity). Creating intro music, show notes, and a storyboard, as well as researching for evidence that supports their commentary, allows students to use multiple skills across platforms in an authentic way. Just wait until you see what content they can produce! Of course, these are additional ways to assess learning, understanding, or applying the skills you want to see in context.

Reading

Everything circles back to literacy, which is true across all subject areas. Students' Lexile levels are informative on how they can access and understand text. Websites like lexile.com will allow struggling readers more accessibility to information. Do not take for granted the idea that student choice in reading is key. If a student wants to pick up a book and develops a love in that manner, we should celebrate that daily. CommonLit (commonlit.org), Newsela (newsela.com), ReadTheory (readtheory.org), and other online content platforms can assist you in pairing nonfiction, poetry, and current events texts with instruction and standards. I most appreciate that these sites have assessment tools that show student progress in an easy-to-understand manner. This data is shareable with parents and makes having conversations during parent-teacher conferences easier. Working with your media specialists and having them label books, or sections of the library, by Lexile levels is helpful, as well. All of this will help you move the needle towards higher student achievement, while also enabling

you to embed such strategies as SOAPStone (speaker, occasion, audience, purpose, subject, tone), RACE (restate the question, answer the question, cite the source, and explain), OPTIC (overview, parts, title, interrelationships, conclusion), and annotating to help students increase meaning and understanding when interacting with text.

Give It a Try

Although this may seem like a lot of suggestions, remember that the new ideas you try will be seamless with practice and time. Find one or two tools to focus on and add to your practice; see how they help inform your understanding of your students' learning and mastery of skills. It is important to continue to grow as an educator and improve your effectiveness through professional knowledge, instruction, communication, assessment uses, and academic rigor. Use tech to leverage what you are doing, but always be clear it will not solve the education gap exclusively.

ISTE Standards

While leveraging technology for learning, be mindful of the role the ISTE Standards can play. They are aspirational, meaning that they are where we would like every student, educator, coach, and administrator to aim as goals on their learning journeys. As for other standards, and even models of technology integration such as SAMR (substitution, augmentation, modification, redefinition) and TPACK (technological pedagogical content knowledge), the point is that our learners should have the capacity to reach these benchmarks, even if they are not evident in every single lesson. Our end goal is certainly an application and a mastery of the ISTE Standards for Students, which can be facilitated

by a mastery of the Standards for Educators and Standards for Coaches (ISTE, 2011).

ISTE Standards for Students

The ISTE Standards for Students were first established in 1998, with a focus on learning to use technology. The second iteration in 2007 shifted the lens to using technology for learning. Although not explicitly stated, the ISTE Standards address the digital equity challenges students face today especially through the current version of the Standards, which are centered on transformative learning with technology. The seven standards, shown in Figure 2.3, support the philosophy that

> Today's students must be prepared to thrive in a constantly evolving technological landscape. The ISTE Standards for Students are designed to empower student voice and ensure that learning is a student-driven process. (ISTE, 2016)

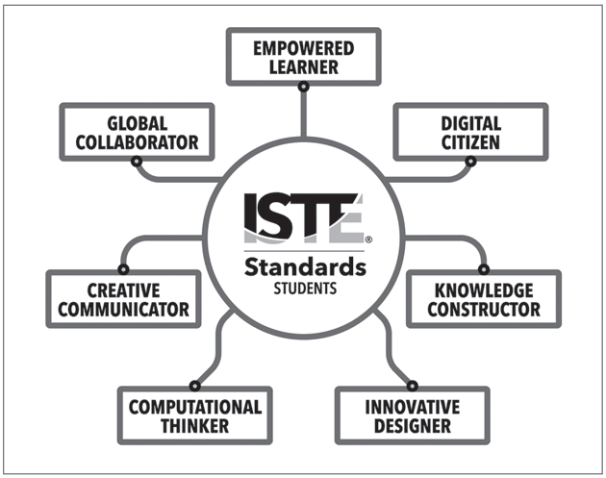


Figure 2.3 Prepare today's students to thrive in an evolving technological landscape.

One of our authors, Sarah, was a member of a 2017 ISTE Technical Working Group, and recalls the conversation around developing the Educator Standards in the context of the Student Standards. These two sets of standards interplay to transform learning to prepare students for their future, as well as the present day. By nature of the Standards for Educators and for Students, educators have a common benchmark against which to measure their own progress and that of their students, which promotes digital equity for all.

ISTE Standards for Educators

Another of our authors, Nicol, participated in rounds of evaluations during the ISTE Standards for Educators refresh. Students in her masters in education course engaged in rounds of discussion about how each of the seven ISTE Standards for Educators (Figure 2.4) serves to enhance digital equity in some way. The goal of the Standards themselves is to provide transformational learning opportunities for each student around the world. Arguably, any efforts toward building educator efficacy contribute to solving inequities as they help to enhance learning opportunities for students. As ISTE stated,

> The ISTE Standards for Educators are your road map to helping students become empowered learners. These standards will deepen your practice, promote collaboration with peers, challenge you to rethink traditional approaches and prepare students to drive their own learning. (ISTE, 2017)

We will discuss the ISTE Standards for Coaches later in Chapter 3; for now, let's take a closer look at certain themes that emerged from all of the Standards. These three themes promote digital equity; interestingly (and perhaps subconsciously), the themes emerged in the following order: lifelong learning, communication, and transforming learning.

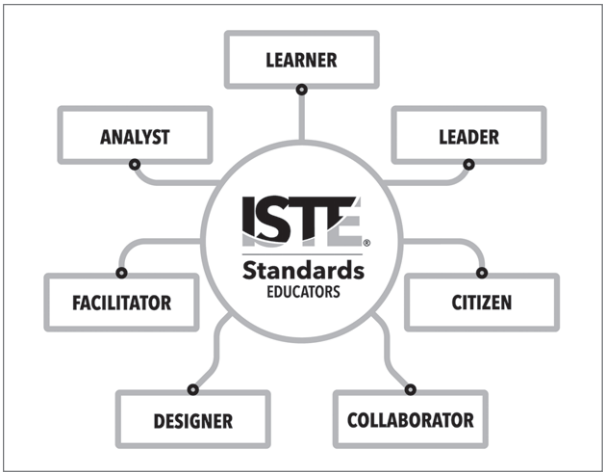


Figure 2.4 The ISTE Standards are an educator's road map for preparing today's students.

Lifelong Learning

Essentially, the goal of the first ISTE Standard for Educators, Learner, is to promote self-directed lifelong learning in order for learners to increase their capacity to deliver high-quality, transformational learning opportunities (ISTE, 2017). Much like the Empowered Learner from the Student Standards, educators are expected to set their own goals for learning, using the power of technology to enhance the experience (ISTE, 2016).

Think back to how you first became connected in your journey to professional learning. What was the spark? For many of us, it was through traditional face-to-face environments. A little over a decade ago, before the rise of social media, options for professional growth were limited, and educators were often at the mercy of whatever offerings were mandated to them. If they wanted choice over their learning to best support their students, their sole option was to connect during district professional development (PD) days or conferences.

Many conferences have a registration fee, therefore unless the school or district is willing to pay (and approve professional leave), this may present a barrier. As Sarah Thomas wrote,

> Creativity in schools should not be limited to the more affluent districts. All learners deserve high-quality teachers, who are motivated to grow professionally for the good of their students. (Thomas, 2017)

Additionally, such face-to-face events are usually held infrequently, and once sessions are over, attendees may not have support as they implement their new learning. However, we have come a long way in a very short time as we detailed in Chapters 2 and 3 of *Closing the Gap: Digital Equity Strategies for Teacher Prep Programs*, and now educators have a variety of options available.

Self-Directed Professional Learning

According to Dr. Randall Sampson, "Self-directed professional learning is what teachers want and need. Through self-directed professional development, teachers will be able to seamlessly reflect, align and implement best-practices; personalized growth is created and implemented by each teacher" (Sampson, 2015). Here are just a few ideas for teachers to take control of their professional learning journeys:

> **Twitter chats.** Twitter chats are "usually moderated and focused around a general topic. To filter all the chatter on Twitter into a single conversation a hashtag is used. A set time is also established so that the moderator...is available to engage in the conversation" (Cooper, 2013). These chats have proved invaluable to many educators around the world, and allow for multiple perspectives to be shared in a limited period of time. Furthermore, the conversation is then publicly archived on the hashtag itself. *You can find a list of Twitter chats at cybraryman.com/chats.html (Blumengarten, Hamilton, Murray, Evans, & Rochelle, n.d.).*

Voxer Groups. Voxer is what we call a freemium (free for the basics or pay for the premium) walkie-talkie application available on the web, iOS, and Android platforms. It allows large groups of up to 500 members to discuss topics and listen back asynchronously, facilitating global communication. *Although Voxer does not have the searchability of Twitter chats, you can find a crowdsourced list of groups at theedsquad.org/voxer (Corbell, Gauck, Pacheco, & Thomas, n.d.).*

Edcamps. Edcamp is a movement that began in 2010, which has expanded exponentially and globally. In essence, these events are spaces where educators come together for peer-to-peer learning. There are no presentations, only facilitated informal conversations; in fact, the daily schedule is decided by participants on the day of the event. While Edcamps are primarily based on geography, some online virtual Edcamps have emerged on platforms such as MIT Unhangout (unhangout.media.mit.edu) and even Voxer. *To find out more about Edcamp, please visit edcamp.org. For examples of virtual Edcamps, take a look at edcampedumatch.org and edcampvoice.com.*

Several other options exist on spaces such as Facebook, LinkedIn, YouTube, podcasting, and more. For anyone seeking to grow professionally, you have quite a selection!

Traditional PD Provides Benefits

Conferences and face-to-face meetups have benefits that the online world cannot replicate (and vice versa), and for many educators, they are an entry point into learning about more of the free and virtual options that can take their pedagogy to the next level. As the old saying goes, "you don't know what you don't know," and many of us have received our first exposure to the connected world by attending a conference.

According to research conducted Project Tomorrow (2018), conferences are still the second-most popular option for

self-directed learning with 40% of respondents having reported being an attendee. This slightly trails watching videos online (46%) and is far more popular than social networking (33%) or engaging on Twitter (23%). Also apparent in Project Tomorrow's results is the rise in popularity of online self-directed learning, showing an increase in usage of social media since 2010. However, not a single category reported had adoption rates by the majority of respondents. Thus, although we have come a long way as a profession, we still have room to grow.

Communication

The second emergent theme from the Standards for Educators is that of communication. While the Standards for Students note the role of "Creative Communicator" (ISTE, 2016), there is no similarly worded standard in the Educator Standards. Instead, we see this theme referenced in standards such as Leader, Citizen, and Collaborator (ISTE, 2017). As Sarah Thomas explained,

> Many of the new Standards focus on transparency, with the aspiration of partnering with parents and community members. There is also an increased focus in acknowledging the voices of the most important stakeholders of all, the learners themselves. (Thomas, 2017)

The Leader standard is unique in two ways: It is not mirrored in the Standards for Students, and it is the only one that explicitly mentions equity, stating "advocate for equitable access to educational technology, digital content and learning opportunities to meet the diverse needs of all students" (Indicator B). However, as mentioned before, the Standards as a whole help support equity by providing a universal set of standards for educators to cultivate deep and active learning. Furthermore, the theme of equity is also heavily implied in Indicator A, "empowered learning with technology by engaging with education stakeholders," which

suggests advocating for transformative learning experiences. This implication continues in Indicator C, "Model for colleagues the identification, exploration, evaluation, curation and adoption of new digital resources and tools for learning" (ISTE, 2017).

The Citizen standard (mirrored in the student standards as Digital Citizen) continues to gain importance, as it is easier than ever before to connect with other educators, schools, and stakeholders globally through social media. As Julia Freeland Fisher, director of education research at the Clayton Christensen Institute, pointed out,

> Social capital scholars have long pointed to the fact that opportunity flows through individuals' networks. In fact, according to some estimates, nearly 50 percent of jobs come through personal connections. In some cases, these come through strong ties, but they can also come through looser connections—what researchers call "weak ties"—which tend to offer up new information not necessarily contained in stronger-tie networks. (2018b)

The Organization for Economic Cooperation and Development (OECD) defines social capital as "networks together with shared norms, values and understandings that facilitate co-operation within or among groups," (Keeley, 2007, p. 103). OECD further delineates it into three categories:

> **Bonds:** "links to...'people like us'... such as *family, close friends and people who share our culture or ethnicity*" (italics added for emphasis)
>
> **Bridges:** "links that stretch beyond a shared sense of identity"
>
> **Linkages:** "links to people or groups further up or lower down the social ladder" (Keeley, 2007, p. 103)

All students bring to the table with them some form of social capital; however, not all capital is held in equal regard in the eyes of society, as demonstrated by injustice, discrimination, and bias.

Some students might be fortunate to access bonds that will provide them with advantages established through family connections, culture, or even ethnicity. Other students who are members of groups that have been traditionally marginalized often find themselves pushed further to the sidelines. Through the power of social media, however, individuals are now beginning to disrupt this perpetual system of inequity. As Julia Freeland Fisher (2018a) argued, schools are in position to assist students in creating inclusive networks through bridges: "Schools looking to prepare students for the workforce and open doors for their students are pursuing models designed around the critical role that social capital plays in expanding access to opportunity." Likewise, schools can help prepare students through emerging technology platforms that cultivate relationships, both on and offline. To address this need, the Institute has created whoyouknow.org, which helps pair students "with coaches, experts, mentors, and peers—otherwise out of reach" (Christensen Institute, n.d.).

In an interview with Getting Smart (Ryerse & Berkeley, 2018), Fisher stated that schools can also help students access these bridge connections in the following ways:

- Focus on the network of care.
- See the school system in terms of "slots" in which a student can learn.
- Incorporate project-based learning.
- Expand students' access through advisory systems.
- Explore opportunities for change in school design.

Creative Communicators Transforming the World

Not only are educators in position to help students build networks—they can also support them in transforming the world. In Chapter 3 of *Closing the Gap: Digital Equity Strategies for Teacher Prep Programs*, we discussed how social media has played a significant role in today's society, as well as how it has impacted digital equity in that youth (and others) are now using various platforms, such as Twitter and YouTube, to advocate for themselves and organize at grassroots levels. We touched upon how movements that utilize hashtags have gained momentum through social networks. Another example of students using social media to positively impact the world is that of students at Marjory Stoneman Douglas High School in Parkland, Florida, who, after the shooting at their school, leveraged the power of social media to launch the Never Again movement and fight for change to prevent school shootings. As Sarah Stoeckl eloquently stated,

> When advocates of education technology talk about the ISTE Standards and digital tools used to change teaching and learning, we often give examples built within traditional subject areas and focused on feel-good activities by students. The "Never Again" students exhibit the ISTE Standards for Students in action, but in a way that reminds us we are not only preparing students for academic or career achievement, but also for life in a complicated, messy, often brutal world. (2018)

As more and more students begin to leverage social media for advocacy, educators must be prepared to support them in their acquisition of knowledge around digital citizenship without eliminating the platforms that allow students' voices to be heard (Howard, 2015). We view digital citizenship as a key component in the pursuit of digital equity. Promoting looking beyond traditional definitions of digital citizenship, where emphasis is placed on safety, and instead encouraging educators to look into more meaningful implications, Marie K. Heath stated,

> The findings and discussion of this question suggest that uncritical usage of the term *digital citizenship* limits citizenship development in schools. Further, it hampers practitioners and scholars from imagining opportunities to use educational technology to develop pedagogies of engaged citizenship for social justice. These gaps lead to the fair critique of educational technology that technologists offer platitudes that technology can address issues of equity, but technologists have yet to develop strong pedagogies of liberation that leverage affordances of technology. (Heath, 2018, p. 5)

In her 2018 article, Heath identified three models of digital citizenship: *personally responsible citizen*, focusing on responsibility and character; *participatory citizen*, addressing organizing for social change; and *justice-oriented citizen*, using social media to "use technology to help interrogate established and oppressive norms" (p. 5). One key point identified regarding her study of justice-oriented citizenship models is that "several articles made general nods toward global citizenship or equity, often conflating access and equity or displaying a paternalistic and colonial attitude toward global citizenship" (p. 11), a sentiment echoed by Thomas (2018), who noted "... we tend to see a common theme: someone centering him/herself as the hero and saving the day, regardless of whether their 'saving' is welcomed and solicited, or not." This is an important, yet often overlooked, aspect to both digital citizenship and equity, as global communication and interaction is more available than ever before. We, as educators, need to model and embrace the entire continuum of digital citizenship in order to help our students navigate virtual spaces.

Digital Citizenship Resources

The need for good digital citizenship continues to grow as we move more of our interaction online. Furthermore, Howard (2015) said "as students grow older, they spend more time using

digital devices and online networks. The use of these tools opens lines of communication globally, so now is the time more than ever to support our students." The following resources offer a few ways that you and your students can learn with the world.

DigCit Institute, DigCit Summit, DigCit Kids. "The Digital Citizenship Institute is an inclusive innovation network promoting a positive digital citizenship message of social good...[and provides] a community-driven approach to educating and empowering digital citizens to create solutions in local, global and digital communities" (DigCit Institute, n.d.). Founded and run by Dr. Marialice Curran, the DigCit Institute holds conferences around the world to help educate stakeholders on this crucial topic. Additionally, Dr. Curran's son, Curran Dee, is the Chief Kid Officer of DigCit Kids, which features "kids solving real problems in local, global & digital communities" (DigCit Kids, n.d.). *Find them at digcitinstitute.com, digcitinstitute.com/digcitsummit, and digcitkids.com.*

Our Global Classroom. Established by Bronwyn Joyce, Our Global Classroom is a "space to share ideas and thoughts with your learning community" using the FlipGrid platform. At the time of this writing, there have been over 200,000 views and 13,000 responses to various prompts from students around the world about real-world problems. Talk about authentic learning! *Find this project at flipgrid.com/whatif, using password "whatif."*

EduMatch. Founded by one of the authors in 2014, EduMatch is a global community of educators connecting and learning together, using various forms of social media. The organization has a global reach of over 30,000 educators, who come together on platforms such as Twitter, Voxer, Instagram, and others to discuss educational topics. EduMatch also hosts a podcast, which was featured by ISTE as one of the top

podcasts of 2017; publishes crowdsourced and solo books; and, at the time of this writing, is preparing to launch a nonprofit arm to support grassroots projects of educators and students. *Find them at edumatch.org.*

Communication and Collaboration

Digital equity and digital citizenship go hand in hand. Students are increasingly utilizing their online networks, and as Collaborators, educators can use the power of their own networks to provide high-quality authentic learning experiences, to prepare students for an increasingly global world (ISTE Standards for Educators, 4: Collaborator, 2017). A key component of the Collaborator standard (paralleled in the Student Standards as Global Collaborator) focuses on transparency; engaging all stakeholders in the learning process. Collaboration as a form of communication tends to be overlooked, however, Collaborator calls it to the forefront. Within the standard, educators must communicate with colleagues, students, community members, and parents. Notably, Indicator D under the Collaborator standard speaks to the need to "demonstrate cultural competency when communicating with students, parents and colleagues and interact with them as co-collaborators in student learning." This brings to mind the notion of *culturally relevant*, *responsive*, and *sustaining* pedagogies, as explained in our first book (Howard et al., 2018). Digital equity cannot be separated from culturally relevant pedagogies. Doug Havard, a STEM Teacher on Special Assignment (TOSA) and Physics/Robotics Instructor from Southern California, agrees and recognizes the importance of building a social culture that is human-centered, rigorous, and includes place-based learning experiences for all students in the midst of digital equity challenges. He shares his thoughts in the "Culturally Responsive Computing" sidebar.

Educator Voices

Culturally Responsive Computing

By Doug Havard, STEM TOSA and Physics/Robotics Instructor

Not so long ago, pedagogical approaches to teaching and learning in our educational system were deeply contextualized by local living conditions and educative experiences: dominated by the interrelationships between the home, school, and community. Incongruencies on the means and ends of education, largely dominated by historical narratives and technological advancements throughout the mid-20th century, have led the school to become more institutionalized today (Greenwood, 2011). Along the way, accountability measures and standards-based teaching methods have attempted to stratify the educational ethos, a departure from the early form of education centered on experience (Spring, 2018). As a result of these standard-based approaches and the changing social and cultural nature of the American school, the emergent form of education over the last decade has led to a widening of the digital divide (van Dijk & Hacker, 2003). Contemporary research has revealed significant gaps in access, use, support networks, and skill in technoliteracies, particularly within underrepresented populations of students (Kahn & Kellner, 2005; Warschauer, Knobel, & Stone, 2004). In response to these philosophical stances, educational researchers have sought ways of bridging the access gap through *culturally responsive computing* (CRC) practices (Lachney, 2017; Lee, 2017; Scott, Sheridan, & Clark, 2015) and *place-based education* (Greenwood, 2011; Gruenewald, 2014) as counter-narrative pedagogical approaches which promote inclusion, digital equity, and self-efficacy.

Applying these perspectives, Scott and White (2013) sought to understand how unique STEM learning contexts employing CRC practices affected girls' pre- and post- programmatic engagement. Their research study, conducted on a sample of forty-one high school students participating in COMPUGIRLS, a National Science Foundation–sponsored program teaching technoliteracies to girls in digital media, game development, and virtual worlds, contended that girls are interested in technological fields despite a lack of culturally relevant opportunities to pursue such disciplines. They discovered the more complicated the technology and the higher the expectations, the more COMPUGIRLS participants expressed enjoyment. Moreover, Scott and White (2013) observed that the power of manipulation (e.g., to design and build an artifact that performs a task) not only intrigued participants, but also empowered them to perform individual research on specific technological topics in innovative ways—encouraging social change. This example of spiraling back to a time of connecting students, technology, and the world through educative experiences proposes an opportunity for reconnection between the means and ends of education today and our role as teacher educators.

My experiences as a K–12 STEM educator, STEM TOSA, and STEM program developer within a public high school have revealed the value and importance of building a social-culture that is human-centered, rigorous, place-based (has a positive role in the community), and connective to the discrete, individual experiences of students. These foci are not only reflected in the research presented above but emerged out of a number of experiences with my students while building a STEM-based program, namely through rigorous competition (e.g., US FIRST Robotics, NASA Student Launch, and Lemelson-MIT InvenTeam), but also through student-designed opportunities (TeenHacks Hackathon)

and curricular endeavors (mechatronics colloquia) centered around instilling inventive practices through an interdisciplinary, human-centered engineering curriculum. The unstated challenge facing STEM educators in the K–12 setting is how to provide CRC experiences to students that afford access to computers with the ability to run industry-level software, an institutional knowledge base and practices to access technical content, financial support to enter into competitions and sustain future entries, and an equitable CRC curriculum to strengthen positive interactions between students' lives and technology. By maintaining a program focus on building community leaders, my colleagues and I centered our work around a methodology seeking to directly support and involve the community. The return on this place-based educational approach was a spiraling up of interconnected factors including opportunities for students to engage in solving problems in their community, technical experts reaching out in support of building an institutional knowledge-base, in-kind financial and material support from local industry, and a rise in program participation of our underrepresented female student population.

Matching curricular experiences which are culturally responsive and rigorous with community problem-solving has the opportunity to empower a generation of fledgling underrepresented scientists, technologists, engineers, and mathematicians. Although building social culture within your school and community can be initially slow, and often arduous, the power it places in the hands of students is transformative. Place-based educational practices which bridge the school and community will yield more real-world, problem-solving opportunities for students, access to digital resources, and supports for running difficult to maintain, albeit influential and inspiring, competitions such as US FIRST Robotics.

Transforming Learning

The final three standards, Designer, Facilitator, and Analyst, speak directly to the role of the teacher in the instructional process (ISTE, 2017). While the Designer standard speaks to the educator's ability to create learner-centric lessons, its counterpart in the ISTE Standards for Students (Innovative Designer) also deals with problem-solving and thinking outside the box (ISTE, 2016).

Facilitator speaks to the innovative learning environments and computational thinking as often seen in makerspaces, STEM/STEAM programs, and coding initiatives (see Computational Thinker and Knowledge Constructor in Standards for Students). Also overlapping with the aforementioned Student Standards is Analyst in the Standards for Educators, where data informs instruction to "support students in achieving their learning goals." Facilitator and Analyst intersect in that the former supports students in implementing a design process, while the latter has educators engaging in such a process themselves (ISTE, 2017). When considering these standards, it's important to keep in mind that

> Relevance and authenticity are two things that our learners crave. Many of our students aspire to create content, as opposed to passively consuming. Several ISTE standards promote student choice and voice in the classroom. (Thomas, 2017)

Models for Technology Integration

There are several popular models for technology integration that educators can use to self-evaluate where they stand, regarding their capacity to provide transformational learning opportunities for their students. Remember, not every lesson has to hit the

highest levels of the rubric; instead, the goal is to build capacity so that each educator has the capability to reach the highest levels when appropriate. Simmons (in Thomas, 2017) wrote about three models in particular. Shown in Figure 2.5, the first model is SAMR.

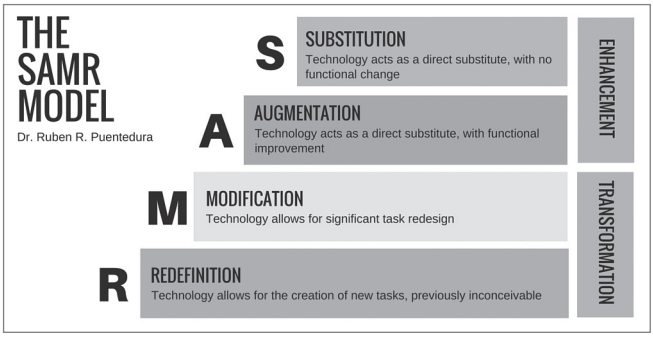


Figure 2.5 The SAMR model provides a practical guide for edtech integration. *(Image credit: Wikimedia Commons.)*

Originally developed by Dr. Ruben Puentedura, SAMR stands for substitution, augmentation, modification, and redefinition. You can learn more about SAMR at hippasus.com/rrpweblog.

Shown in Figure 2.6, the TPACK model focuses on technical knowledge, content knowledge, and pedagogical knowledge. These three forms of knowledge intersect in varying ways to create up to seven components. The highest level of mastery is TPACK, the sweet spot where each component intersects. If you're interested in learning more about this model, visit tpack.org.

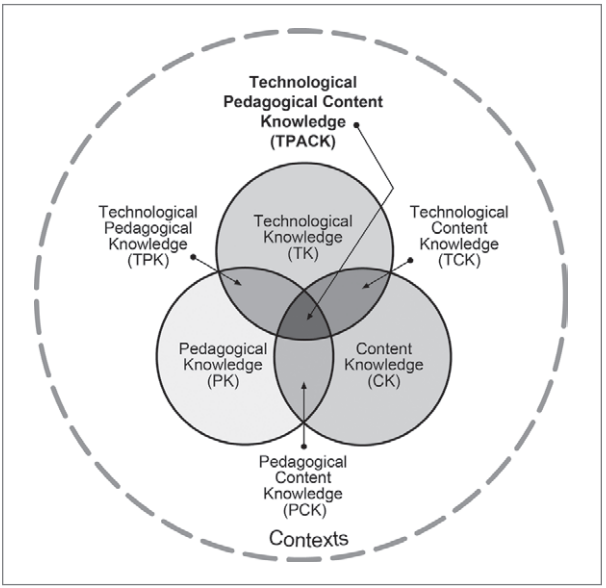


Figure 2.6 The TPACK model supports using digital tools for teaching and learning. *(Image credit: tpack.org.)*

The third model, Royce Kimmons' PIC-RAT (Figure 2.7) explores technology use and integration through the behaviors of both students and educators. On the student side, their relationship to technology may be passive, interactive, or creative, while educators may use the technology for replacement, amplification, or transformation. For more information on PIC-RAT, consult roycekimmons.com/tools/picrat.

Think about your last technology-infused lesson. Where does it stack up on each framework?

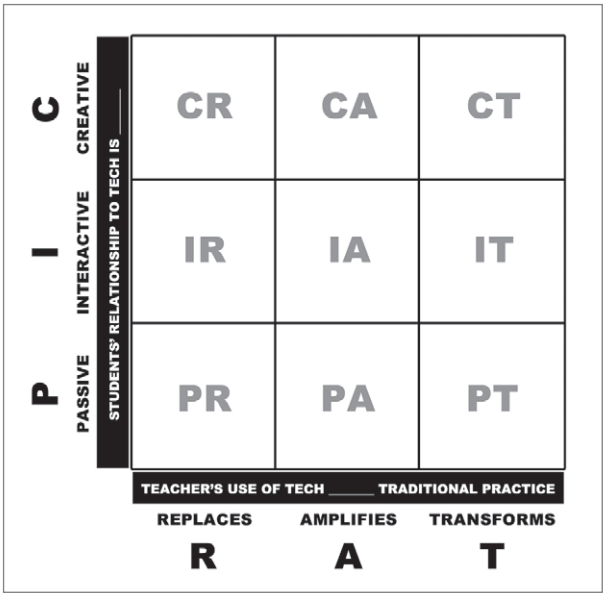


Figure 2.7 Evaluate your use of edtech using this matrix *(Image credit: roycekimmons.com.)*

The ISTE Standards for Educators help promote equity by ensuring that each learner can receive access to high-quality teaching opportunities, regardless of their zip code. Cicely Day, an elementary teacher in Oakland Unified School District, understands the need for ensuring equity for her students and has faced her own challenges related to access. On a limited budget, Cicely has overcome barriers and continues to address digital inequities while making moves on a tight budget. She shares her story in the sidebar "Ballin' on a Budget."

Educator Voices

Ballin' on a Budget

by Cicely Day, Teacher, Data and Tech Lead

If you are reading this, you want to do all of the great things you see other schools and libraries doing with making and a makerspace, but may think you need a host of expensive tools, which are beyond your limited or nonexistent budget.

Well, let me tell you that you can have a makerspace in your classroom on a budget. There is no wrong or right way of making or even having a makerspace. The most important thing is to get started and try some things! Your makerspace can be in bags or tubs on your bookshelf. You can store things in your closet and take materials out when you need them. If you don't have space in your classroom, think about the hallway or a room that is not in use all of the time. A makerspace can be wherever you and a group are making. I started off with what I already had in my classroom: paint, crayons, markers, and paper. Cardboard will become your new best friend, so will felt and glue guns. My school had a treasure trove of construction paper, so I would think of projects I could use with that.

Now, I also have some Chromebooks, a Kindle, and an iPad. When Chromebooks were introduced at my school, however, we didn't have a class set, so I would set up four or five as a station for coding projects with Code.org and then later Scratch (scratch.mit.edu).

I started small and added things little by little. For example, I bought some inexpensive Ozobots (ozobot.com) to help my students learn about coding and have fun with robotics. Later, I added more programmable robots that would work

with my Chromebooks and Kindle: a Sphero (sphero.com/education), a Dash, and a Dot (makewonder.com).

Many inexpensive options that work on a variety of devices are now available. Micro:bit (microbit.org), Makey-Makey (makeymakey.com), and Circuit Playground Express (adafruit.com) are great microcontrollers whose developers offer lots of support for students and teachers. If you are adventurous, you can get a Raspberry Pi (raspberrypi.org), which is also very affordable, if you have a monitor, keyboard, and mouse.

I am not saying that you have to buy all of your things like I did, but I am impatient and don't like waiting. If you can wait, plan out a budget, and think about the things you would like for your students to work on. Check to see if your colleagues have some of the things you are looking for. Share your resources with your colleagues. It helps expose more students to different materials and helps with your budget. Go to Michaels, Barnes & Noble, and JOANN, and sign up for their teacher discount programs, which help save you dollars when you are on a small budget. Sign up for DonorsChoose.org, and look for any organizations in your state and local area that offer matching funds programs. Some have a requirement for STEM/STEAM, math, or English language arts.

Having 3D printers, laser cutters, and other high-end equipment is nice, but that is not the only way to make or to have a makerspace. Thinking outside of the box, failing a bunch of times, and trying out different things will take you on a fun (and, at times, frustrating) journey. More importantly, it will help your students and you see how making can be a great way to think, create, heal, and build community.

DE Wisdom

A tasty cupcake and a sweet Twinkie are analogous to technology use and technology integration. Both are delicious and will serve a sweet tooth; however, the cream in the middle is the important part. The cream on the top of a cupcake can be easily removed without too much structural change to the dessert, much like what happens when technology is *used* in the classroom. If technology is simply used in the classroom—sometimes as an afterthought or quick addition to a lesson—it likely presents no structural change to a lesson. A Twinkie, on the other hand, has its cream in the center. If the cream were removed, the Twinkie would fall apart and make it difficult to eat. This is comparable to what we may observe when technology is *integrated* into a lesson. In the case of technology integration, technology serves a purpose that may not otherwise be realized if not integrated in a purposeful, impactful way into a lesson or activity. This simple use of technology makes building connections easy and is just a beginning to inciting students' curiosity and critical thinking.

—*Kim Roberson, Educator/Instructional Specialist from Maryland*

Join the conversation on Twitter using #DigEquityBook, and share your analogies with us.