TODOS: MATHEMATICS FOR ALL

The mission of _TODOS:_ Mathematics for ALL is to advocate for equity and high-quality mathematics education for all students — in particular, Latina/o students.

Equity Considerations for Access, Design, and Use of Technologies for Teaching Mathematics

Abstract

In this paper, we add to the discussion on technology considerations for the teaching of mathematics in the coming school year. Technology is not a learning panacea. Nor does the right technology supplant instruction and professional knowledge for teaching. Given the scope of possible topics to discuss in relation to technology for teaching mathematics during the ongoing COVID-19 pandemic, we choose to highlight essential equity considerations rather than aim for a comprehensive discussion or a list of suggested online tools. We acknowledge the possibilities and challenges in distance teaching that relies on inequitably distributed technologies. We propose actions for educators organized through the lens of access, use, and design. Finally, we discuss accountability towards our commitments to equity and social justice when implementing technologies for teaching mathematics.

Acknowledging Possibilities and Challenges

As we continue to use technologies to limit interruptions to schooling in light of various events, we must preserve our commitments to equitable, just, and humane teaching pedagogies. Technological resources are not a replacement for teaching; rather they are tools to aid us in meeting our instructional goals and to help us foster relationships from afar.

We acknowledge that alongside the incredible power and potential of technology, there are also a number of issues in terms of access, design, and use. Some of these challenges include how access to broadband networks and online-capable devices is inequitable, with affluent, urban communities tending to have more access, and notable disparities by racial groups (National Telecommunications and Information Administration (NTIA), 2019). Many of the technological tools engineered for instruction and used most broadly were designed without input from or consideration for Black, Indigenous, and People of Color (BIPOC) communities or the neurodiversity of humanity. Students with particular needs may be disadvantaged by the design of learning activities that lack the necessary accommodations. Teachers have been tasked with using technologies with little preparation on how to do so in alignment with effective mathematics teaching practices. Without overcoming these challenges, issues of use do not even become part of the conversation.

Actions to Address Access, Design, and Use

Given the speed at which change to schooling conditions are occurring, it is impossible to anticipate all of the challenges that will arise during this new school year. In this section, we suggest actions that various stakeholders might enact as they work to address access, use, and design of technologies for learning that align with our mission at TODOS. We note this list is not comprehensive and hope that as we learn and know better that we continually strive to do better. In addition, though we have generated suggested actions, we know that this school year will require all of us to be flexible and fluid as we face changing circumstances.

Access

In utilizing technologies for instruction, we must first consider if families, students, teachers, and other education staff have access to what they need to make school work for everyone in distance and hybrid modes. Access can be considered in terms of both connectivity and use. In the spring of 2020, both educators and the general public alike became aware of the disparities in access to high-speed internet connectivity – necessary for students and teachers to successfully interact with many forms of digital instructional media (see, for example, this article in the Washington Post). Many people who relied upon public Wi-Fi access points at libraries, schools, churches, fast food restaurants, etc. lost those points of access due to the pandemic. In many rural areas without broadband access, schools had to quickly procure and distribute hot spots to allow students access to instruction. In May, EdWeek reported that 96% of teachers have access to high-speed internet at home and have relied on that for teaching, while few if any districts had stipends to offset their out-of-pocket costs. Moving forward, we must act to ensure students *and* teachers have access to high-speed internet and that families can do so without sacrificing other basic needs. This requires us to engage in conversations with students, families, and communities to understand the access available in schools, homes, and community spaces and then create plans to fill in any gaps.

Once connected, many students may lack devices to access learning activities. Again, teachers must work with students, families, and community organizations to understand which devices students utilize and, if needed, provide devices aligned with the instructional materials. For example, if students are regularly expected to write, those who utilize their learning activities from a smartphone may have greater difficulty completing assignments than those with laptops because it can be very difficult to write on a phone. Alternatively, teachers must also consider how they can align instruction with available technology. For example, in some households where the speed of connectivity is slow, downloading videos versus streaming them works better because streaming quality can be poor at slow speeds, whereas once a file is successfully downloaded it can playback properly. Moreover, teachers must consider the challenges that arise for families with multiple remote learners/workers who rely upon a single device. Teachers must learn to connect families to resources both within and outside of the schools.

Mechanisms must be put in place, so students, teachers, staff, and all those in the school community have ways to check their access to the internet and technology. This is becoming increasingly important as many states are renewing their requirements for schools to take attendance (which was suspended during the initial crisis in the spring), and many states tie school funding to attendance, creating the conditions for drops in school funding due to students' technological access issues. Teachers and staff must ensure they are checking on students and their families to ensure all have access to devices and networks. Through conversation, surveys, phone calls, etc. teachers can connect with families to ensure students have the tools they need to be successful. There are several ways teachers might approach this, including a weekly check-in with each student as well as follow up by administrators and others in the school community. These check-ins could also be facilitated by existing parent-school partnerships (see our commentary paper on Parents). In addition, there should be ways for teachers to talk with administrators regarding their concerns about their own and their students' access, especially once the school year is underway.

Finally, needs must be reassessed as the year goes on. School districts, government, and community organizations need to establish the relationships and communication channels so solutions can be enacted quickly when barriers exist.

Potential **Access** Actions
Teachers can embed weekly check-ins around technology into instructional time or into family check-ins. Family circumstances can change quickly, and technology can crash for a variety of reasons. Revisiting technology needs as the year goes on will be important.
Teachers can have multiple methods for how to take attendance that accounts for the differences in access and possible issues with connectivity. Some examples include checking usage statistics on learning platforms, allowing students to keep journals of their progress, screenshots of Zoom calls, and (especially in earlier grades) checking in with parents to understand how students engaged with particular learning activities.
Teachers can ensure systems that maximize equitable access to mathematics instruction are in place. For example, if you are unsure if students have printers at home, do not ask for them to print out items necessary for engaging in class.
School administrators can develop strategies to assess and aid teachers and families with connectivity issues; initial needs assessments help get started, however establishing checkpoints to revisit needs and creating flexible budgets to adjust to teachers' and families' needs as the year continues will be important.
School site teams can collect and share data about attendance and participation as part of evaluating digital learning plans. Establish procedures to revisit these plans with input from families and students.

Design

As schools rush to approve and purchase curricular resources for distance and hybrid learning situations, we ask school communities to rate these resources with a critical eye towards design considerations, including whether the technology:

- Maintains or supports access to high-quality mathematics learning
- Has accommodations for students with different needs (visual, audio, learning differences, EL) integrated into the design
- Supports social and emotional development of students
- Aligns with a vision and mission of antiracist education

The final point may be harder to wrap our heads around. How could technology undermine an antiracist approach to teaching? As illustrated by authors like Cathy O'Neil in her best-selling book *Weapons of Math Destruction*, even machine-generated algorithms are riddled with bias from their human originators. Our suggestion is to take a critical eye to the damage that even seemingly innocent tools for teaching might inflict on students. For example, see this article on Classroom Dojo as indoctrinating children into a culture of surveillance. Technology and norms for the use of technology that reproduce the harmful policing aspects of schooling do not belong in an online antiracist classroom. For example, rather than the hard and fast rule of requiring students' cameras to be on during a live lesson, a teacher could instead remind students that they trust they can manage their own needs during a lesson and ask to the extent that they feel comfortable to have their cameras on.

Teachers should consider students and families as they set up learning management sites. For example, it can be difficult for middle and high school students to engage with distance learning when six teachers each use a different learning platform or designs of the learning sites differ dramatically. Further, collaboration among teachers is critical if one is to gain an understanding of students' remote learning experiences. Such collaborations among paraprofessionals, language acquisition teachers, special educators, etc. are essential to providing the necessary accommodations for students. Teachers who may be accustomed to providing necessary accommodations in face-to-face classrooms may not know how to do so remotely. All instructional personnel must hold one another accountable for the necessary services.

Finally, most educational technology developers have not been teachers or even in the world of education. However, social media and other platforms have created a third space for developer feedback. We must proactively convey feedback from teachers, students, and families to the software companies who are profiting from their products, from those designed for synchronous (i.e., "real-time") interactions, and those designed for asynchronous (i.e. "on your own time") mathematics practice. This allows those in the school community to hold developers accountable as they provide feedback.

Potential **Design** Actions
Teachers can communicate clearly with families about what technological platforms you will be working with and why. In particular, for working with newcomer families, consider communicating through short videos translated into more than one language for families who may not read target home languages.
Teachers can invite feedback from families. Collaboration with parent groups, site council, and family coordinators can be helpful here to get feedback from multilingual families.
Leaders in decision-making positions (such as administrators, site council groups, etc.) can bring the user group to the table when making decisions about technologies for teaching and learning. This may be teachers, students, and families, who are all involved in decision-making about technology adoptions and renewals.
All users can utilize third-space technologies (twitter, developer feedback forms, online forums, etc.) to provide feedback to developers on design needs for your communities. Teachers, parents, students, and administrators should all provide feedback to help shape the direction of educational technology.

Use

We must support students, teachers, and families in understanding the use of technologies, and we should not assign technologies that are misaligned with our core values. Schools and technology companies must provide the necessary educational opportunities for families and schools to use tools effectively for instruction and learning. Collaborations must occur within our schools and communities to make sure students and families are able to use the necessary technologies.

We must commit to critically examining our learning environments so that humane uses of technology are prioritized. This requires us to question whether it is feasible (or desirable) to require students of all ages to be tied to a computer screen for hours a day with little opportunity to engage in exploration, play, and conversation. For example, as states come out with guidelines for instructional minutes during distance learning, it is unlikely that all minutes should be spent in online learning environments. Therefore, teaching teams should strategize around how instructional minutes might be divided between synchronous time with teachers, independent online activities as developmentally appropriate for children, and learning time off-screen. Moving to remote instruction requires us to rethink the structure of the school day for faculty, staff, and students so that we are intentional in bounding the workday.

Moving to remote instruction must not dehumanize teaching; relationships must be fostered and preserved. Much as we take time to develop norms for navigating the physical classroom and developing community, so must we take time to do so in the digital classroom. Such norms must also take into account issues that are of particular concern in digital environments such as privacy and cyberbullying.

As we develop these norms, understanding of students' perspectives on our learning environments is critical; we must talk to students in ways that show we value their perspectives and knowledge. Let us be honest: some students know more about online relationship dynamics than we teachers do! We must also ensure students understand ethical uses of technology while also protecting their privacy and prioritizing healthy relationships with teachers, staff, and peers.

Potential **Use** Actions
Teachers can provide families with resources for how to use the various technologies, keeping in mind the particular needs of your families (e.g., limited access to devices, unstable internet connections, etc.). Clarity of communication and attention to the communication preferences of families are especially important during distance learning.
Teachers and administrators should consult research regarding appropriate amounts of screen time for various grade levels (e.g., see these resources from We are Teachers, 2020).
Teachers can ensure they are routinely engaging in purposeful activities and discussions with students to build relationships both synchronously and asynchronously.
Teachers and students should work to build norms around safe and productive interactions and uses of technology.

Accountability

Accountability is difficult but crucial to ensuring that we continually engage in actions to develop and foster equitable, just, and humane learning environments. We note that delineating specific accountability systems and measures will take much time and thought, given the new challenges brought about by the pandemic. Therefore, in this section, rather than prescribing means of accountability we detail guiding principles we think critical to the success of such measures.

Quality Learning Environments

All of us education stakeholders, from the general public to the superintendent of public instruction, must hold schools accountable for the provision of high-quality learning experiences. Schools must put in place systems to ensure *access* (as described in the prior section) is regularly monitored and addressed. These systems must be shared with students and families so they can, in turn, hold schools accountable for the provision of safe, equitable, humane, and quality learning environments. Moreover, these systems must extend to teachers as they must have access to the knowledge and resources to teach effectively from a distance. Such systems must allow for and encourage open and safe dialogue.

Students should be accountable for and hold others accountable for the ethical use of technologies. Schools must work collaboratively with students to develop accountability systems for holding everyone accountable for ethical and humane uses of technology. This includes ensuring technology-related issues such as cyberbullying are addressed. Families can help to hold schools accountable for quality learning experiences by communicating concerns and engaging in public discourse via organizations, school board meetings, and elections. Communities can pool or pull resources in reaction to leaders' progress, or lack thereof, in fulfilling the promise of quality learning environments. Technology developers can be held accountable by the provision of feedback on what those in the school community need.

Multiple Stakeholders Involved in Digital Accountability

Accountability relies upon open and accessible dialogue among stakeholders. We must not only invite people to the table, but we must also bring the table to the people. It is insufficient to lament lack of involvement; we must instead look to the lack of engagement as a sign that our approach is insufficient. This accessibility means that people should be engaged in multiple platforms and at times and in spaces that do not cause unnecessary harm or difficulty. Information should be easily accessible in forms and languages(s) that are of use to those who are impacted.

Systems of accountability should also include mechanisms for change. If actions do not result in movement toward quality, humane learning environments, our accountability systems must change. Such provisions are included in some accountability systems. For example, elections allow us to vote out those who have not upheld their commitments.

In an era of distance and hybrid learning, we fully recognize that technology for teaching mathematics is no longer an afterthought. As we rethink technology for teaching mathematics, we have to keep the same student-centered, human-centered pedagogies that we teach within brick and mortar schools. While we have full confidence in teachers as professionals, many of the recommendations we make will require school districts to put their budgets where their commitments are, and invest in teachers' professional knowledge for technology use, access to equipment as well as tech support for families, and a range of other new expenses – but we can do it. Technology that allows for distance learning is what is going to keep teachers, children, and families alive through our viral pandemic, and help students keep learning mathematics.

(Re)sources

https://www.ntia.doc.gov/data/digital-nation-data-explorer#sel=internetUser&disp=map

On the distinctions between online teaching and emergency remote teaching, and why it's important to have a plan for ERT beyond our current COVID pandemic, higher ed focus

https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

We are Teachers. (2020). *Kids (and teachers) don't need to spend 8 hours a day on school work right now*. https://www.weareteachers.com/virtual-learning-schedule/?fbclid=IwAR0YdvSza5BhcfQY7WT4nme3Vgrh_ZOwkQxwKMywFYJtPmEJbIr5-X4BVIU

California Parent Poll: COVID 19 and School Closures. Education Trust West Parent Survey Data on early COVID school closures. The data here might be helpful to inform how school districts approach technology distribution and support, or designing surveys. https://west.edtrust.org/ca-parent-poll-covid-19-and-school-closures/

CoSN *(Consortium for School Networking)* has a free survey template originally designed in 2016, before COVID-19 when our internet concerns were more focused on a "homework gap". The survey questions are just as important today and can be used as a starting point. More free resources for digital equity at their website: https://cosn.org/

National Standards for Quality Online Learning can be a starting point for assessment of county/district plans for online learning.
https://www.nsqol.org/the-standards/

Turn to the next page for a TODOS handout summarizing the actions for access, design, and use of technology

Equity Considerations for Access, Design, and Use of Technologies for Teaching Mathematics
Read the full commentary at www.todos-math.org/statements

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