COMMENTARY

There is no a Silver Bullet – Intentional Equity-Focused Technology Integration in Schools

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Abstract: With over 30 years in education and as an early adopter of emerging technologies, Professor Emerita Gomez (UCLA) emphasizes that technology integration must go beyond being an afterthought. She argues it should intentionally embed equity within education programs and implementation plans by focusing on pedagogical equity, addressing systemic challenges at classroom, school, and district levels, and engaging in actionable strategies. As Prof. Gomez notes, there is no "silver bullet" to technology integration—only deliberate, equity-centered practice. Follow her as she illustrates what this looks like in classrooms, schools, districts, and broader curricula.

Introduction

Recently, I attended a conference focused on learning which offered a special emphasis on technology use in K-12 contexts. As with many such settings, the meeting rooms were chock full of talented researchers, graduate students, and administrators all hoping to hear about how to make learning more interesting, engaging, and impactful for students, and more useful and usable for teachers. However, the majority of the conference content, that week, was less focused on technology as an integrative tool and partner with teachers and learning, and instead, the content was centered on AI largely as a "replacement tool" for students' learning. Unfortunately, far too often, we, in education, look for the silver bullet, embrace the bright and shiny new tool that will fix our educational woes.

Having spent more than 30 years in the field of education, and as an early adopter of new technologies, I hope in the next few paragraphs to join the perhaps much quieter but still persistent chorus of voices that encourage us, as a field, to integrate rather than replace and to intentionally center equity in the integration of technologies in classroom teaching and learning.

Rather than serving as an afterthought or an add-on, I believe technology integration must intentionally embed equity into technology education programs and broader instructional technology implementation plans. Ideally, this occurs through a focus on pedagogical equity, identifying and taking into account systemic challenges at the classroom, school, and district levels, and engaging in actionable strategies. What does this look like?

Intentional Design and Integrative Use

(Gomez et al., 2021), in describing the challenges associated with integrating computer supported collaborative work in and out of schools, urged educators to attend to the importance of moving DEI beyond simply giving everyone a device to instead restructuring collaborative interactions with people and tools towards equity. With attention to collaboration, educators can combine access with pedagogy ensuring that every student participates, belongs, and learns in tech-enabled classrooms. To this end, it is important to highlight the divide between surface level access to technology (e.g., all students have tablets) and the deep, equitable use of technologies in which all students have opportunities to meaningfully contribute to their learning. From the vantage point of tool designers and also school administrators and classroom teachers who select tools for their schools and students, such equitable opportunities can be facilitated through attention to what the tool can do, can support, and can help build.

Attention to the design of, and presence of interface scaffolds like structured roles, turn-taking prompts and sentence stems can be enormously useful in helping students who are less confident or familiar with tools. For classroom teachers, such interface scaffolds create opportunities to build and maintain, for future use, a suite of lessons and activities to support access for all. Accessibility features like font scaling, color contrast, and translation tools help to ensure that all students, regardless of ability or language differences, can do their work and collaborate with their classmates.

An important affordance of working with mindfully designed tools is that they may have embedded strategies that assist teachers in forming heterogeneous groups of students in the classroom. These tools can help teachers intentionally consider the diversity of ability, language background, experiences and other characteristics in building collaborative group activities. For example, teachers might want to rotate student collaborator roles or create prompts for multi-language expression to encourage more participation. When tools have participation strategies available, teachers can work with students to engage in agentive activities like building participation norms and task activities. Such support, for teachers, can help them embed inclusive pedagogy with more intentionality.

Tools that support the formation of groups can create heterogenous groups that can both be tied to student identities but also to create spaces for students to reflect on, and share, their experiences of community. In such groups, supported by teachers' use of technology, teachers can build content that supports community and social justice topics and which can encourage and support diverse perspectives.

Working with tools that are designed for equitable access, teachers can meaningfully infuse culturally-relevant content, not as an add-on or afterthought, but as an integral element of teaching and learning. For example, with tools that scaffold students' voices across languages and abilities teachers can create spaces for students to engage in reflections about their shared and different identities and to have spaces for cultural expressions. They can also provide students with opportunities to take up their rightful presence in classrooms and resist deficit stereotypes about their abilities (Ryoo et al., 2020; Ryoo & Blunt, 2024).

Tools that allow teachers to monitor the classroom can support teachers in understanding which students are participating in group collaboration and which voices remain silent or potentially marginalized. To that end, teachers can leverage technology to create and monitor participation patterns, detect dominant roles, and identify silenced voices – allowing the teacher to document the ways that collaborations are unfolding or fail to productively unfold. Such support helps teachers invite all students' voices, facilitate discussions, and support collaborative inquiry and project activities.

Equity Conjectures in Classroom Teaching and Learning

So far, I've focused this discussion on how tools can be leveraged to create opportunities for teaching and learning in classrooms. However, two issues present themselves that far too often impede classroom technology integration, in general, and meaningful and equity-focused integration in particular – teacher knowledge and skills and intentional equity-focused lesson design and implementation.

Teacher Knowledge and Skills- Leveraging Professional Development

Professional development opportunities to build, practice, and refine equity-focused technology adoption and integration in classroom teaching and learning is woefully limited.

Menske (2015) found important challenges in the design and content of professional development programs (PD) that center their instruction on supporting teachers' use of technology in classroom contexts. First, PD programs are often too limited in length to support meaningful opportunities for learning and long-term impact on knowledge and skills. Menske (2015) also found that the programs' content is often broad rather than deep offering essentially a scan of a broad swath of tools and aims of use. Teachers then, are exposed to a little bit about a lot, and the content is not likely to be directly connected to what they plan to teach or have taught in their classrooms.

Lacking more specific use and utility (Wei et al., *forthcoming*), teachers metaphorically put what they've learned "on the shelf" and are less likely to enact technology integration in their classrooms). In a review of K-12 computer science-focused professional development for teachers Ni et al. (2021) found that there is a broad range of content being offered to teachers with different aims and intents. Many professional development programs focus on standardized computer science curriculum. Others center their work on integrating computer science and computational thinking and learning into teachers' existing curricular content. Still others create unique programmatic content that may, or may not, be targeted specifically to the needs of the classroom teachers attending the course(s).

With respect to how to teach the content that teachers receive in technology-focused professional development courses, and with a learner-centered perspective, Ni et al. (2021) found that three pedagogical thrusts were evident in their review of programmatic pedagogical content - inquiry-based learning (Ryoo et. al., 2016), equity-based learning (Ryoo et al., 2016, Ketelhut et al., 2020), and problem-based learning pedagogies (Reding & Dorn, 2017). Yet, with few exceptions – e.g., the SPARCS program (Reding & Dorn, 2017) – teachers do not have access to ongoing support

as they encounter challenges in using and integrating technologies in their classroom context (Molina, 2021; Theodorio, 2024; Yadav et. al., 2017), so when they aim to engage in an equity-focus with technologies the problems can therefore seem insurmountable. The Strategic Problem-based Approach to Rouse Computer Science (SPARCS program) develops and supports middle school teachers' understanding, and confidence, in integrating computational thinking and learning and computing or programming solutions. Teachers attend a series of workshops and are also supported throughout the school year where needed by master teachers and university researchers. Rather than taking a "helicopter professional development approach where teachers are left to figure it out on their own, the SPARCS program encourages teachers, from the beginning, to consider how they will integrate technology into the existing STEM program. Such an approach is a model for other groups aiming to more comprehensively support technology integration.

Equity Conjectures and Lesson Design and Implementation

(Lee et al., 2021) introduced the concept of Equity Conjectures as a tool for supporting teachers in equity-focused technology integration in their classrooms. They described design-based research in which they, along with teacher practitioner colleagues, collaboratively designed lesson plans for classroom implementation. Equity conjectures are explicit statements that articulate how learning interventions aim to remedy social and historical injustices. Teachers can make explicit statements in their lesson plans about how the learning intervention aims to support equity in the classroom. Specifically, the equity conjecture statement in the lesson plan can indicate how the intended lesson is in support of equity in the classroom. It indicates where, how, and why the lesson supports for example, community cultural wealth and knowledge discussions (Yosso, 2005), group turn-taking to support all students, and related equity-focused activities. The teacher's equity becomes visible for themselves, their colleagues, administrators, and when relevant research collaborator partners. Lee et al. (2021) found that when these conjectures were made explicit and visible, teachers engaged in tangible changes in both their curriculum and teacher practice. Lessons became more inclusive and justice-oriented, where technology was a partner in support of equity-focused technology integration and lessons supported not only technical skills but also social purpose and cultural relevance.

What changed? The process of articulating equity conjectures in their lesson plan design and development engages teachers in deeply reflective practice moving beyond surface-level equity-intended technology integration towards a more principled stance on how and why technology integrated lessons serve equity goals. While the work described by (Lee et al., 2021) was facilitated by a university researcher-school practitioner partnership, local school administrators can support this work by encouraging the content and pedagogical focus of professional learning communities (PLCs), ongoing iterative development, sharing, and refining of equity-conjecture centered lesson plan design. Such ongoing collaborative and reflective conversations within the PLC community can serve as a form of embeded and long-term professional development.

Conclusion

Ultimately, whether referring to AI, Wi-Fi-enabled devices in the early 2000s, personal computers in the late 1990s, or handheld calculators in earlier decades, it is not the tools, themselves that are the silver bullet. It is how they are designed, how they are structured to support particular teaching and learning goals, and what and how they facilitate learning. The aim in technology integration should be, at base, to combine embedded opportunities for professional development, adopting, for classroom use, tools that have interfaces and other features that can provide useful support for teachers and students, as well as designs that support access will go a long way to ensuring that every student participates, belongs, and has the opportunity learn. When technology is meaningfully integrated into classroom teaching and learning and when used with a clear theory of how the tool supports inclusion it can help build collaborative teaching and learning environments where all voices matter.

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