BRIEF

DESIGNING FOR DIVERSITY PART 1

Where is Equity and Inclusion in Curriculum Design?

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D4D Designing for Diversity

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Introduction

Curriculum has been at the center of teaching and learning for the entire history of American public education (Joseph, 2011). It has been the vehicle for translating society's ideas and visions of what education should be and what children should learn into plans, prompts, and guidance for teachers and students (Apple, 2018). When we talk about a high-quality science, technology, engineering, mathematics, and computer science (STEM+CS) education, we include high-quality STEM+CS curricula, in addition to teaching and learning. High-quality STEM+CS curricula should not only incorporate our most current standards; they should also be equitable and inclusive. Curricula do not exist in a vacuum; teachers interpret curricula based on their own frameworks, and students experience curricula through their own lenses. This human interaction with curricula means that issues of equity and inclusion must be addressed; without doing so, some people will have greater access than others. But how well suited are established approaches to informing, designing, and implementing STEM+CS curricula to the diverse needs of diverse students?

High-quality STEM+CS curricula should not only incorporate our most current standards; they should also be equitable and inclusive.

Existing approaches to curriculum creation, selection, adoption, and/or modification are largely incompatible with equity goals to inspire and create learning experiences that are engaging and enriching for a wide range of students, including students from historically marginalized backgrounds. Research shows that changes to instructional materials, teaching practices, and student learning have an impact on student outcomes. For example, when teachers represent a diversity of racial and ethnic backgrounds, the drop-out rate of youth from economically disadvantaged backgrounds dramatically declines, the number of Black and Hispanic students in gifted programs increases, there are higher levels of students' feelings of happiness and support, test scores are higher, absenteeism decreases, and in general, there are long-term positive learning effects (Ouazad, 2014; Egalite et al., 2015; Grissom and Redding, 2015; Goldhaber et al., 2015; Lindsay and Hart, 2017; Grissom et al., 2017). Similarly, STEM+CS curriculum development, when designed with an equity lens, can contribute to STEM+CS proficiency and achievement. However, teachers need support in understanding how providing rigorous grade-level content that incorporates equity and inclusion is possible, otherwise, its potential will not be fully realized. For example, research into preparing urban science educators (Vora, 2006) found that new teachers often see a disconnect between subject matter knowledge and a commitment to social justice.

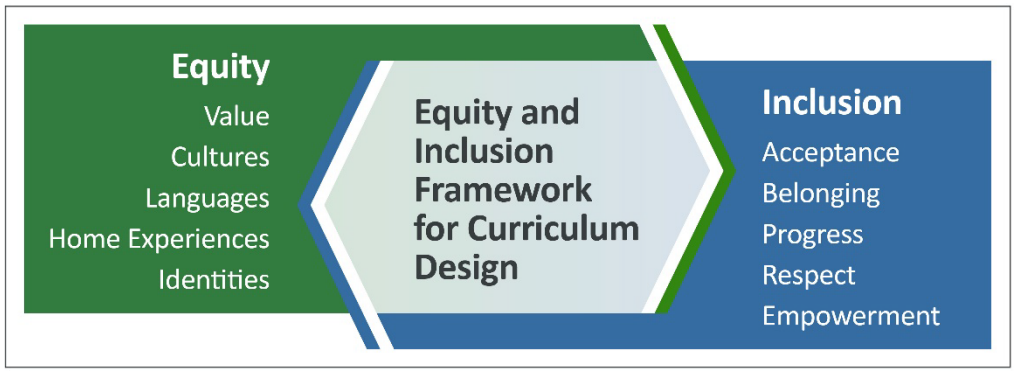
The voices of diverse students and the educators working with them are often missing from standardized curricula. Also missing are connections to students' diverse sociocultural and ethnic backgrounds and their communities and the flexibility to adapt instructional materials to these diverse contexts. Previous instructional materials have traditionally been developed on communities that are "convenient" or show proof of concept, then are transferred and modified for communities that have no connection to those resources (Hitchcock et al., 2002). Such retrofitted

modifications are often expensive, ill-fitting to the students, and have modest effects on student learning (King-Sears, 1997).

This whitepaper series proposes a novel approach to designing and/or modifying instructional materials that address diversity by purposefully and systemically integrating equity and inclusion principles at the onset of curriculum design.

This paper, the first in a series of three, describes why current approaches to designing STEM+CS curricula are inadequate; defines diversity, equity, and inclusion in the context of curriculum design; and introduces the Equity and Inclusion Framework for Curriculum Design (EI-CD) approach for designing and adapting STEM+CS curriculum materials to meet the needs of diverse students (see Figure 1). A second paper will describe the EI-CD approach in detail, showing how the structure, coherence, and rigor of evidence-centered design is leveraged. The EI-CD approach emerged from recent work that used equity and inclusion design principles to inform the design of formative assessments (Alozie et al., 2018) and curriculum materials (Fujii et al., 2020). The third and final paper will explore how state and local education leaders can work with the EI-CD approach to make STEM+CS instruction more equitable and inclusive.

Figure 1. The Intersection of Equity and Inclusion and the Equity and Inclusion Framework for Curriculum Design (EI-CD) Approach



Defining Equity and Inclusion to Expand the Meaning of Diversity

Creating curriculum materials for a diverse student population requires clarifying the meanings of diversity, equity, and inclusion.

Diversity. For many, diversity refers to the presence or absence of students representing broad categories of race, ethnicity, age, gender, sexual orientation, disability, and locale (Williams et al., 2005; Yu et al., 2013). But the simple presence of people from diverse backgrounds does not address the persistence of systemic inequities for groups who have been and continue to be marginalized (Ahmed, 2007; Bell and Hartmann, 2007). In fact, sometimes invoking "diversity"

masks inequities by minimizing the presence of marginalized groups and maintaining existing values and beliefs to take the pressure off the need for change (Ahmed, 2007). For example, simply identifying the number of different racial groups represented in a school may falsely convey that individuals from historically marginalized groups are meaningfully included in the practices of the school. Understanding diversity requires understanding how different groups within different contexts experience the educational system. For example, schools with higher proportions of students of color are less likely to provide advanced STEM+CS courses, and in schools where they are offered, the courses are disproportionately populated with White students (Sawchuk, 2018). Responding to diversity includes (a) acknowledging the presence of individuals and/or groups that do not have social power, prestige, or institutionalized privilege; (b) developing an understanding of their marginalization; and (c) actively working towards creating equitable and inclusive experiences and opportunities for them.

Equity. Equitable educational approaches account for and respond to student diversity, including the social, cultural, and ethnic facets of their life experiences as well as the systemic barriers they encounter. When STEM+CS education is responsive to diversity and driven by equity, it (1) values and leverages the strengths of learners' backgrounds (including cultural and linguistic experiences) and abilities as rich resources; (2) connects learners' background knowledge and experiences to what they are learning in their STEM+CS classes; and (3) provides supports to address learners' needs to ensure that all students, particularly students from diverse cultural, ethnic, and racial groups, have meaningful access to STEM+CS learning (National Research Council (NRC), 2012; Lee and Buxton, 2008; Lipman, 2004).

Inclusion. Inclusion goes beyond providing access—it promotes feelings of acceptance and belonging (Williams et al., 2005) and welcomes and values students' diverse identities (Fahd and Venkatraman, 2019). Inclusive teaching practices and learning environments are purposeful, active, and attentive to every learner.

Creating STEM+CS curriculum materials using the EI-CD approach necessitates understanding how instructional practices in equity and inclusion emerge from frameworks on cultural relevance, sustainability, revitalization (Paris, 2012; Ladson-Billings, 2014), multicultural education (Banks, 1996), Universal Design for Learning (Hitchcock et al., 2002) and student assets (e.g., Garoutte et al., 2014). The goals of these frameworks are to transform education to include voices that have previously been misrepresented or excluded and promote social justice. It is important to refrain from being limited to surface level curricular changes, such as holiday observances or activities that may represent stereotypical characterizations of different groups of students. For example, assuming that a predominantly African American classroom will relate to the use of rap music more than Latinx students during a lesson is based on preconceived notions of race and identity and overlooks the sociocultural history and evolution of rap music in society.

The EI-CD framework is informed by previous frameworks to provide a structured and coherent approach for making equity and inclusion unique to the specific learning community that

curriculum materials are intended to serve. EI-CD accounts for the intellectual, social, emotional, and political contexts of a community, while also underscoring the value and needs of the individual student. District and school leaders aiming to achieve equitable and inclusive learning for diverse student populations can progress towards these goals by understanding how these ideas work within a larger system of teaching and learning. A focus on diversity by itself offers little benefit. Similarly, focusing on equity or inclusion separately is not enough when working to provide quality learning opportunities for diverse student populations. Curriculum materials for diverse audiences help develop an infrastructure that values and supports the uniqueness of students and demonstrates feelings of acceptance and belonging. Seeing diversity, equity, and inclusion as interconnected and essential elements for educational success and progress is critical for district and school leaders. We need to help these leaders shift the paradigm of thought from compliance to proactive engagement in changes that support teaching and learning in a pluralistic society—one that promotes student assets, culturally relevant and sustaining pedagogy, and universal design.

State and District Roles in Standardized Curriculum Adoption

Under a largely decentralized U.S. education system, local school districts have primary responsibility for making decisions about the formal curriculum (the written and supported curriculum). To identify STEM+CS curriculum materials that will support improvement in instruction and higher student achievement, districts often prioritize curriculum materials aligned to state standards and thus to high-stakes assessments, which can limit the scope of the materials (Au, 2011) (see the Curriculum Design textbox below for various uses of the term curriculum). In recent years, several states have granted districts wider latitude in making curriculum decisions (Steiner et al., 2019). National teacher surveys highlight the importance of districts' role in curriculum design; for example, more than 60% of mathematics teachers say that district curriculum policy influences their choice of instructional materials more than any other factor (Opfer et al., 2016).

CURRICULUM DESIGN: DEFINING THE TERMS

The Latin root of the word curriculum means to run a course. In the modern United States, the word has taken on multiple meanings, some of which are hotly debated. Scholars have long noted multiple uses of the term curriculum:

1. The formal curricula are documented and approved by states and local school boards, and consist of frameworks, curriculum guides, and pacing guides
2. The supported curriculum reflects the instructional/curriculum materials, textbooks, and digital resources that may be purchased from commercial developers, curated on open education resource sites, or developed by individual teachers or districts and that include STEM+CS content, educative supports, and formative assessment
3. The enacted/taught curriculum uses instructional practices, pedagogical content knowledge, local school and community knowledge, and student knowledge to implement the instructional curriculum materials
4. The hidden curriculum communicates unspoken and often unintended messages to students about the school's values and beliefs (Goodlad, 1979). These implicit messages about race, class, social order, and roles shape curriculum development and implementation.

In these papers we consider the role of states and districts in the design of the formal curriculum, which may contribute to or emerge from the enacted and hidden curricula, but which we do not explicitly address.

States and districts contribute to the design of (1) the formal written curriculum that is represented in curriculum guides, frameworks, scope-and-sequence charts, and pacing

STEM+CS standards have prompted new attention to the quality of curriculum materials and the extent to which they align to new, more rigorous state standards. Widespread adoption of common learning standards in both mathematics and science,[1] coupled with some states' investment in the development of standards-aligned curriculum and open education resources, have created new incentives for a range of noncommercial entities to enter the curriculum marketplace (Hodge et al., 2019; Kaufman et al., 2016). At the same time, a growing body of rigorous research suggests that the adoption of high-quality, content-rich, learning standards-aligned curriculum materials can support gains in student achievement at a lower cost than can many other reform strategies (Boser et al., 2015; Steiner, 2017). This new attention to curriculum quality has created an audience for careful, independent vetting of curriculum materials for quality. For example, many districts now

[1] By 2020, 20 states and the District of Columbia had adopted the Next Generation Science Standards (National Science Teachers Association, 2020).

rely on reviews from EdReports.org[2] to guide curriculum decisions (Johns Hopkins Institute for Education Policy, 2018).

The Need for Equity and Inclusivity in Standardized Curriculum Materials

State adoption policies incentivize large publishers to target their materials to the largest number of states and the broadest possible demographic rather than to specific student or local needs. Although the selection and adoption of high-quality, content-rich curricula is an important step toward ensuring equitable educational opportunities for all students, it is not sufficient to ensure truly equitable and inclusive learning environments. As STEM+CS classrooms grow more diverse, the need to support students who belong to groups with less social power, prestige, and institutionalized privilege (Gutiérrez and Rogoff, 2003; NGSS Lead States, 2013) with relevant curriculum materials has become a national priority (NRC, 2012; K–12 Computer Science Framework Steering Committee, 2016). Standardized (not to be mistaken for standards-based curriculum materials) and widely disseminated curriculum materials, although sometimes promoted as democratizing access to learning, may undermine equity (Timberlake et al., 2017; Fitz and Nikolaidis, 2020) and leave achievement gaps unaddressed (Cramer et al., 2018). These materials are, by design, not adapted to the diversity students bring to the classroom. They are often developed based on assumptions originating in the dominant culture (Jackson et al., 2001); for example, knowledge is static and validated by authorities rather than emergent, contested, and multi-voiced (Barrett et al., 2017). Tensions can arise when some semblance of equal access to standardized curricula is provided without addressing the systemic inequities, including the need for diversification of curriculum, that are essential to make educational experiences more equitable (Hitchcock et al., 2005; Ravitch, 1983).

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Equitable and inclusive curricula in STEM+CS are essential to providing high-quality learning experiences to students who come from historically marginalized backgrounds. STEM+CS instruction that empowers these students and leverages their skills, languages, and values can lead to higher achievement (Dupuis et al., 2006; Alquraini and Gut, 2012) and improved student communication and social skills. For example, in addition to supporting the adoption of new rigorous curriculum, districts like Baltimore City, Palm Beach County, and Philadelphia have worked to improve the cultural relevance of curriculum materials. These districts hold that

[2] EdReports.org is an independent nonprofit organization designed to improve K–12 education. EdReports.org increases the capacity of teachers, administrators, and leaders to seek, identify, and demand the highest quality instructional materials. Drawing on expert educators, EdReports' reviews of instructional materials and support of smart adoption processes are designed to equip teachers with high-quality materials.

curricula should enable teachers to understand and honor the diverse backgrounds of students in their classrooms and promote learning environments that are more relevant and effective for students (Chiefs for Change, 2019). Moreover, these districts have developed rubrics and processes for assessing the cultural relevance of curriculum materials to ensure that instructional materials provide "mirrors and windows… reflect[ing] students' own histories and giv[ing] them opportunities to connect their experiences to other people's histories and the larger world" (Bishop, 1990).

Despite the role states and districts play in curriculum selection and adoption, individual teachers exercise enormous discretion over what is actually taught in classrooms. A 2017 survey found that teachers spend approximately 12 hours a week looking for or creating their own instructional materials (Partelow and Shapiro, 2018). Another national survey found that teachers regularly consult a wide range of informal sources for instructional materials, including Pinterest (77% of teachers) and Teacherspayteachers.com (73% of teachers) (Kaufman et al., 2016). These sites may or may not contain high-quality instructional materials, but they are go-to places for teachers seeking curriculum and curriculum ideas. These findings suggest that most teachers enjoy wide latitude in the selection, adoption, and creation of curriculum materials to reflect the perspectives and experiences of their students.

As teachers work to modify and adapt curriculum materials to their students, retrospective adaptations or edits to standardized materials may not fully reframe the curriculum to acknowledge the complexity of diversity, equity, and inclusivity, and instead maintain assumptions that all students are essentially the same (e.g., Santibañez and Fagioli, 2016). Such assumptions of equality may result in the proliferation of social and racial inequities (McLaren, 1999; Willis, 1977) and socialize students with implicit, inaccurate messages and expectations that portray race, class, social order, and roles as separate from equity and inclusion in classroom learning environments (Giroux and Penna, 1983; Wren, 1999; Gatto, 2002; Apple, 2018). For example, adaptations to STEM+CS curriculum materials that highlight White male figures in STEM+CS fields implicitly teach that STEM+CS does not include people of color or women. Furthermore, retrofitted curriculum materials often tack on activities or teaching practices that are deemed equitable without proper research into the social and learning context and/or student needs and strengths. Because such activities and practices tend to be disjointed from the design elements of the curriculum, they are often omitted from instruction. As Hitchcock et al. (2002, p. 8) noted, "Even when publishers explicitly include techniques for diverse learners, the writers seem to consider those diverse learners as outliers and exceptions." These approaches reflect the view that the diverse needs of students, rather than the curriculum materials, are problematic (King-Sears, 1997; Wahlström, 2014) and position students as contrary to the norm, afterthoughts, or deficient. Providing teachers with the tools and supports needed to undertake the work of creating truly equitable and inclusive adaptations is greatly needed. This work is not fast, and it is not easy; it needs to be part of systemic change that includes educators at all levels so that teachers are supported in this important and challenging task.

Moving Towards Equity and Inclusion in Curriculum Design

The work teachers do in their classrooms involves far more complexity than what is written in curriculum materials (Ball and Cohen 1996; Boaler and Brodie, 2004), but teachers have little support for integrating equitable inclusive pedagogies aimed at enhancing student learning (Mensah and Larson, 2017). As a result, teachers have started to move away from highly prescribed and widely disseminated curriculum materials and toward finding other sources of curriculum materials that allow for shaping their instruction to address the unique needs of their students (Steiner, 2017). The integration of equity and inclusion into curriculum design through the EI-CD approach guides the design and adaptation of STEM+CS curriculum materials for diverse student populations.

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The EI-CD approach combines evidence-centered design, equity, and inclusion into one design approach to intentionally attend to systems of inequity in STEM+CS education. The evidence-centered design process (Mislevy et al., 2017) proposes assessment tasks that are designed using principles of evidentiary reasoning (Mislevy et al., 2003), in which information about student learning is gathered and interpreted in a way that is aligned with the knowledge that the assessments are intended to address. The EI-CD approach uses the refined structure of evidence-centered design to integrate relevant contextual information about the students and the communities in which they live and learn into the design process. It leverages culturally relevant contexts to connect with underrepresented students' identities to support learning (e.g., Eglash et al., 2006; McLoughlin, 2007). The process ties STEM+CS content and practices in school with issues of personal and social significance to students' lives outside of school (Mallya et al., 2012). Whether students attend urban schools in California or rural schools in North Carolina, they can have robust and meaningful science experiences that feel relevant and meaningful to them. As a result, students are more likely to be agents of change and contributors in their communities, promoting practical utility and connectedness with societal events (Aikenhead, 2006).

Another important aspect of the EI-CD approach is involving various stakeholders in the design process to align the content of the curriculum with students' expectations and cultural and social needs in the classroom (e.g., Alsubaie, 2016). When STEM+CS learning is grounded in personally and socially relevant contexts, students use what they learn in ways that are meaningful to them (Mallya et al., 2012). This calls for breaking down silos and cultivating relationships with community members who know and care about school communities and culture and are committed to equity and inclusion in STEM+CS (Margolis et al., 2015). The process involves students working with experts in the field to understand the connections between what they are learning in their STEM+CS classes to real-world issues, needs, and events (Miles et al., 2015). For instance, using justice-centered science pedagogy, curriculum designers, educators, and community advocates can

collaborate on situating science learning in the contexts of community-based social and environmental justice issues as a way to promote higher academic achievement and transformative intellectualism among students (e.g., Morales-Doyle, 2017).

The increasing scrutiny paid to curriculum quality over the last decade and a renewed focus on the cultural relevance of instructional materials offer an important opportunity for states and districts to assess the STEM+CS curriculum, consider whether it supports student diversity, and actively work towards changes and modifications to ensure equitable and inclusive learning opportunities for all students. The EI-CD approach promotes a collaborative effort between schools, districts, educators, and local and state leaders to ensure that student learning focuses on building subject matter proficiency through a lens of contextually relevant learning experiences that build on student strengths and experiences.

Conclusions and Looking Ahead

A continuing disconnect exists between what states, districts, and schools deem important in STEM+CS education and what students find meaningful and relevant. This disconnect fuels inequities for marginalized students and their STEM+CS learning experiences and career pathways. Much work remains in changing mental models about diversity, equity, and inclusion. Given the lack of connection between diversity in education research and product design, the mental models, implicit biases, and power structures will inevitably favor dominant ideas.

This paper series addresses the challenges of moving diversity, equity, and inclusion from abstract ideas to actions that demonstrate the transformation of traditional thinking and practices in education. Understanding the ethnic, social, and economic context of a community will facilitate the design and development of curriculum materials that can reflect the needs of all students and allow progress toward educational equity.

This approach requires dismantling the silos in the STEM+CS learning community and building bridges and networks among curriculum developers through a process that includes stakeholders at various positions at the school, district, and state levels. The effort required to design equitable and inclusive curriculum materials cannot be accomplished by any one person, team, or school, nor will it look the same everywhere. Achieving these high goals and standards will require educational stakeholders in all roles to collaborate toward maintaining ongoing and systemic awareness of the state of teaching and learning and the extent to which high-quality STEM+CS curriculum supports equity and inclusion. Acceptance and engagement among the stakeholders will require an active process of understanding and a deep agreement that truly equitable education is greatly enhanced by and requires the diversity and inclusion of all students.

Paper 2, *A Systematic Curriculum Design Approach for Equity and Inclusion - The EI-CD Approach*, provides details for each component of this design approach and its application in STEM+CS.

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