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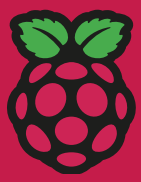

Equity-focused teaching in K-12 CS: strategies for teachers, teacher educators, and districts

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Abstract

In this chapter, we aim to support practitioners in understanding what equity-focused teaching and learning can look like within K-12 computer science learning settings. We unpack key constructs, such as equity and minoritized learners, to offer context for how we identify learners and how we define equity. In providing an overview of a justice-oriented approach to computer science education, along with our rationale for how and why prioritizing asset- or strengths-based approaches are essential in this work, we demonstrate how practitioners can shift the focus in computer science learning further towards justice-oriented approaches. After explaining what it means to use a justice-oriented equity lens in computer science teaching and learning, we offer key considerations when integrating computer science and share how to engage families and communities. In sharing, we hope to provide practical insights and guidance to practitioners for engaging in equity-focused teaching in Key Stage 1-4 and K-12 computer science education. Resources for further learning are also included.

Introduction

We write this chapter amid the COVID-19 pandemic, which continues to impact learners of all ages, families, and our educational systems in more ways than we could have ever imagined. As such, we begin by giving gratitude to all educators and the learners and families these educators work with across learning settings globally. Teaching and learning in the COVID-19 era have (hopefully) increased our awareness of and attention to educational inequities; using equity-focused pedagogical strategies is one way we can respond to these inequities to meet the needs of all learners—especially minoritized learners. Much educational research has focused on equity-focused teaching and learning in general or across specific content areas (e.g., Martell & Stevens, 2017; Titu et al., 2018), and there is a growing body of research focused on equitable computer science (CS) education (e.g., Fields et al., 2018; Ryoo et al., 2015). In our previous work, we have provided an overview of the distinctions between common approaches to equity-focused teaching and learning, as well as specific suggestions for STEM teacher educators (e.g., Madkins et al., 2020; Madkins & Morton, 2021). Here, we focus on how educators, teacher educators, and school district personnel (e.g., instructional coaches, CS instructional coordinators, research associates, etc.) can engage in equity-focused CS teaching and learning. We aim to support our readers in understanding what equity-focused teaching and learning can look like within CS learning settings. We also share why stakeholders should use these strategies with learners in Key Stage 1-4 in classrooms in the United Kingdom or similar systems globally and K-12 classrooms in the United States.

To this end, we share our expertise as U.S.-based researchers and former classroom educators related to engaging in equity-focused work in CS learning environments with attention to minoritized learners, knowing that this work is important for *all* learners. We recognize that many educators work with learners who are multiply-marginalized and cannot provide expertise related to working with learners with disabilities (see Israel in this volume for supporting learners with disabilities). First, we define key constructs in preparation for a discussion about justice-oriented approaches to computer science education. We provide a brief overview of using equity pedagogies, key considerations for integrating CS with an equity lens, and how to engage families and communities. In doing so, we hope to provide practical insights and guidance to practitioners for engaging in equity-focused teaching in K-12 computer science.

Constructs defined

We are former elementary school teachers (Key Stage 1-2; K-5 in the U.S.) and have worked with children of all ages in both formal and informal learning settings (e.g., classrooms, schools, after-school programs, summer enrichment programs). We are also both researchers and university-based teacher educators who focus on supporting pre-service and in-service teachers to engage equity-focused teaching strategies and design inclusive STEM classrooms (i.e., classrooms where learners' multiple identities are honoured). As such, the terms we use to identify learners and how we define equity are grounded in these experiences and our asset-based beliefs about the communities we have worked with over time.

Minoritized learners

Rather than referring to students as Students of Colour, which is a commonly used phrase to refer to children who are from racial and ethnic minority groups, we use the term *minoritized learners*. By using this term, we highlight the power dynamics and racial hierarchies influencing communities who are of the global majority (Lim, 2020), yet in dominant narratives are minoritized (e.g., *minority students, racial minorities*). Our use of *learners* rather than *students* pushes back against traditional narratives about how we define students using white middle class norms and signals that all children are learning no matter where they are—in or out of schools (Adair & Sánchez-Suzuki Colegrove, 2021; Madkins & Morton, 2021).

Equity

As evidenced in our seminar session, educators, researchers, and other stakeholders define the term, *equity*, in varied ways. Individuals typically understand *equity* in ways that reflect equal access and achievement, which are important ideas and practices if we are to achieve equity within CS education. This includes, but is not limited to, meeting all learners' needs with resources (programming software, laptops, etc.), providing all learners with access to high-quality CS instruction, or finding ways to remedy disparate academic achievement outcomes based on race, ethnicity, social class, or other identity markers. These definitions align more with *equality*, which is common not only within our society (A. E. Casey Foundation, 2020), but is prominent in educational research and practice (O. Espinoza, 2007; Gutiérrez & Jaramillo, 2006). However, we "*advocate for the use of equity-focused teaching and learning as an essential practice within computer science classrooms*" and use a social justice equity lens (Madkins et al., 2020, p. 1). Thus, we now turn our attention to operationalizing equity-focused teaching as we

discuss a justice-oriented approach to computer science education.

A justice-oriented approach to computer science education

A justice-oriented approach requires three components: 1) prioritizing asset- or strengths-based approaches that centre learners, families, and communities; 2) using an equity lens that moves beyond access and achievement frames and instead centres social justice; and 3) empowering learners to use CS knowledge for transformation. Ultimately, a justice-oriented approach is one where learners can use their CS knowledge in ways learners themselves see fit to transform their communities and make connections to other content areas, particularly other STEM concepts. Simply put, this means we cannot define success in one way or emphasize the potential learners have for their professional futures (i.e., becoming the next big tech industry professional or only highlighting lucrative careers in CS). Rather, we allow learners to determine how they want to use the CS and STEM knowledge they develop across learning contexts *and* allow them to define what success means to them, their families, and their communities. Though it is important to make clear the multiple academic and career pathways learners might pursue and position all young people we work with as capable of engaging in CS, we must also allow them to determine their best pathways. To achieve this transformation and truly engage in equity-focused computer science teaching and learning, it is essential that we prioritize asset-based approaches and use an equity lens centring social justice.

Asset-based approaches

To engage a justice-oriented approach, an individual must identify, confront, and reject deficit thinking or narratives that are palpable within our society, schools, and classrooms (see Patton Davis & Museus, 2019 for a detailed explanation of deficit thinking). Deficit thinking means viewing learners, as well as their families and communities, as deficient or in need of repair, especially those learners who are racially, ethnically, culturally different from the individual educator, teacher educator, or other stakeholder. Examples of this include: "Black students have a hard time learning computer science, so it is best not to give them too much challenging work." Or: "The families of my students who do not speak English do not care about them doing well in school." These ideas are not only unfounded and not true—but are grounded in racist stereotypes and assumptions about the inferiority of racially, ethnically, gendered, or classed minoritized communities (Madkins & Morton, 2021; McGee, 2020). When we hear them, or think about them implicitly, we must acknowledge these ideas and reject them no matter who we are. Instead of viewing learners as deficient individuals who we need to "fix" in our classrooms, we use strengths-based approaches where we as educators learn to recognize, draw, and build upon learners' strengths. Ways we can do this include drawing upon learners' linguistic strengths (i.e., attending to their linguistic practices and better understanding their thinking and ideas) or finding ways to build upon learners' lived experiences and connect them to course content. This might include inviting learners to share their personal connections to CS content and how they use CS in their daily lives. It takes time to develop a mindset that centres asset-based approaches, but it is necessary to do so since it influences instructional decision-making (i.e., curricular choices, teaching practices, and how we interact with learners).

Justice-oriented equity lens

Using a justice orientation to equitable CS teaching and learning requires us to move beyond what we normally see in terms of an

equity lens in education, which is really about equality. As we mentioned earlier, this means equal access to CS course offerings within a school (i.e., not only offering CS courses to "high-performing" learners), technology tools (which we need to teach CS!), or high-quality teachers. Similarly, it means thinking beyond solving disparate outcomes related to achievement in CS, such as learners' test scores or grades, and other outcome measures, like interest in CS or pursuing postsecondary degrees in computer science. A justice-oriented approach to CS means supporting learners to have dignity-cultivating learning experiences where social justice and the development of learners' agentic selves and critical consciousness development are centred (E. Espinoza et al., 2020; Madkins et al., 2020).

This can be accomplished by using equity pedagogies (C. Banks & J. Banks, 1995). For many years, scholars who conduct research within and outside of STEM education (e.g., literacy, social studies, etc.) have shown that using equity pedagogies with minoritized learners can positively influence student learning outcomes. Equity-focused teaching practices can support learners' identity development, achievement, and conceptual knowledge development (Allen-Handy et al., 2020; Madkins & McKinney de Royston, 2019; Souto-Manning & Martell, 2017). Within CS education specifically, scholars have shown how engaging equity pedagogies in CS classrooms supports learners in increasing their interest in CS, feelings of belonging in CS classrooms and potentially as professionals, and achievement (A. Martin et al., 2017; Ryoo et al., 2013; K. Scott & White, 2013; Vakil, 2014). This body of research demonstrates how using equity-focused teaching practices can not only support learning outcomes but also further develops learners' critical consciousness. Yet, we know these practices are not commonplace. Researchers posit this is because teachers can more easily make connections between social justice issues and literacy or social studies curricula and content than they can to CS curricula and course content. (Sleeter, 2012; Young, 2010). Though it can be difficult to do this work, it is necessary. To support our readers in this area of professional development, we end by providing suggestions for how we can engage in this equity-focused work in both classrooms and in our work with families and communities. This is followed by a short resources list at the end of this chapter to support further learning.

Integrating computer science with an equity lens

Equity-focused work is important and not to be taken lightly. Educators all come to this work through different entry points on this journey; therefore, we think it is important to learn who you are and who you're in partnership with daily. Therefore, educators should prioritize deep thinking about the following when developing instruction for CS classrooms: 1) personal beliefs; 2) learners' beliefs; and 3) purpose for the lesson. Personal beliefs of educators and learners impact the learning experiences. An educator considering equity-focused CS teaching should have an awareness of how these various beliefs, and ways of knowing or thinking, impact the learning in their CS classrooms. Their own cultural lens affects their views of learners, which in turn impacts their instructional practices. To that end, it is imperative that educators know their purpose for a particular lesson. For example, is their goal to prioritize the learner's self-expression or is the focus on preparing learners for future CS courses and careers? Does the lesson enforce an arbitrary compliance to standards instead of building capacity and

autonomy? Are all learners held to the same standard and expected to perform at their best? If an educator determines their purpose for a lesson is to limit self-expression and adhere to standards only, they should unpack their "why" to ensure this decision was not based upon assumptions or stereotypes about their learners. Recalibration and an assessment of how their beliefs impact their learners' access to advanced learning and opportunities for self-expression should be a regular practice (see Madkins et al., 2021 seminar video[2] for examples and further explanation).

Equity-focused CS teaching also calls for educators to support the CS identity development of learners. It is imperative that they have an awareness that power dynamics, intersectional identities, and even stereotypes can impact the learning experience in different ways. Equity-focused CS teaching also calls for educators to address the personal and sociopolitical context of CS education (Vakil, 2018). In addition to offering their own critique of technological inequities, they should provide opportunities for learners to do the same. This leads to the notion of positioning learners as change agents, whereby they become creative innovators who question the world around them and push back against fake news. To position learners as change agents, educators can begin by legitimizing learners' expertise. Designing lessons that provide opportunities for learners to share their work with the broader community is one example of how educators can legitimize their learners' expertise. For some learners, especially younger learners, it will be important for them to receive support sharing beyond the classroom. Providing avenues for them to share with parents and families is a good first step, before they share with the broader community.

Family and community engagement

Parents without backgrounds and insights into the changing landscape of technology may struggle to negotiate what roles they can play in supporting and finding learning opportunities for their children (DiSalvo et al., 2014; Roque, 2013, 2016). This does not necessarily apply to all families and parents. Remember, equity-focused CS teaching calls for an awareness of stereotypes, so it will be important for educators to check any biases and pay attention to the strengths and outside knowledge families bring to the CS learning environment. We encourage educators to connect with learners' cultural practices and lived experiences and to foster and maintain relationships with learners, families, and communities. Educators can work together with parents and the community, with purpose, to achieve a common goal: facilitating an equitable (justice-oriented) experience for learners.

Conclusion

In conclusion, we emphasize that equity-focused work is important because we cannot continue to invite learners (and in turn, their families and communities) into CS education by *only* focusing on increasing access to CS courses, development of CS knowledge, and working towards CS integration. If we, instead, engage in CS teaching and learning with a justice-oriented approach, we are more likely to invite them into a field and learning experience that they will welcome and appreciate. There is work to do within each grade level and across each key stage or grade level band within primary/elementary and secondary schools (e.g., upper primary/elementary students, middle grades, etc.). We need to have primary/elementary

[2] https://www.raspberrypi.org/computing-education-research-online-seminars/previous-seminars/#equity-focused-teaching

secondary teachers. What is most important to remember is that we as stakeholders, including classroom-based or informal educators, teacher educators, district personnel, families, and community members, are *all working together* with common goals and with purpose—supporting all learners to be successful in computer science education. We know that content and context matter, so the ways we implement equity-focused teaching practices will look different wherever learning occurs. But, we have to hold each other accountable to *actually* engage equity-focused teaching as we get better at it over time. We will be kind to each other and extend grace to ourselves and colleagues as we become more adept at this, *but we have to hold each other accountable* to do the difficult work.

Resources for further learning

Readings

Benjamin, R. (2019). Race to Technology: Abolitionist Tools for the New Jim Code. Polity. (See discussion guide available for download on website.)

Cheney-Lippold, J. (2017). We Are Data: Algorithms and the making of our digital selves. New York University Press.

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Additional resources

AI, Ain't I a Woman?[3] by Joy Buolamwini

Resources for understanding structural racism and other equity issues in our society: Comprehensive List Curated by Tia C. Madkins, Ph.D[4].

Toolkit[5] for making connections between secondary CS content and social justice issues

[3] https://www.youtube.com/watch?v=QxuyfWoVV98
[4] https://docs.google.com/document/d/1msBqreACDpFVynqA54L408tKyOepT-pXhdaL8bTtVNc/edit?usp=sharing
[5] https://docs.google.com/document/d/1x0Kgn_LHnJhzrSXU3lutGcyjooZQNgvPSXlLnmeJJDk/edit

developed by Dr. Tia C. Madkins, Nijae Jones and the Mitigating the Double Bind in CS: A Culturally Relevant Approach Research Team

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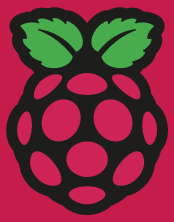

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