

## The Timeliness of Inclusion Efforts in Biology Education

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Research in teaching and learning in higher education is only recently beginning to fully unpack the psychosocial bases of classroom inequities. This process has highlighted that inequity in higher education is in reality a reflection of broader social issues which we can no longer ignore if we are to effectively address campus and classroom diversity, equity, and inclusion problems. By examining the interplay of both theory and praxis, articles in this special issue collectively make the point that to truly address persistent inequitable STEM education outcomes, solutions must transcend the “checkbox” approach that very often characterizes the classroom response. Authentic changes in individual behavior are only maximally effective if they are contextualized within a system that communicates the value of equity through its incentive, evaluative, and support structures. There is national momentum building around fostering inclusion in biology classrooms, and consequentially there are several opportunities for practitioners to try out inclusion strategies for the first time, take the next step forward in broadening the use of inclusion strategies, or engage in inclusion scholarship that advances the field of biology education toward greater equity. Regardless of the current state of your inclusion efforts, we hope this special issue provides ideas that push those efforts deeper. The articles here chart a vision for both STEM classrooms and the ways in which institutions of higher education can enhance and support diversity, equity, and inclusion.

In her classic work *Teaching to Transgress* (1), bell hooks states that “the classroom remains the most radical space of possibility in the academy.” This seemingly innocuous phrase builds on earlier conceptualizations of pedagogies espoused by Freire (2), and Dewey (3), among others, that seek to transform classroom instruction to transcend the mere delivery of content and develop critical consciousness

within students. To do this effectively, practitioners require an appropriate combination of specific tools for classroom use and an understanding of the theoretical frameworks upon which those practices are based. In this special issue, we examine both theory and practice by highlighting examples from the field where the implementation of inclusive practice has yielded promising results. For biology educators, some of the theories underlying the articles are new territory and may serve as an introduction to some important frameworks that inform inclusive practices, with suggestions for how they can be operationalized individually, in a classroom, or at the institutional level. In this issue, inclusion is defined in each article and its unpacking depends on the specific context in which it is described. The overall spirit of inclusion in this issue fits Bensimon’s cognitive frame model (5), which envisions a truly inclusive campus as one that facilitates equity. In this environment, all stakeholders in the education process possess significant abilities to shape and direct the power structures of the institution. For this to be a reality, the STEM community needs to fully understand and embrace dialogic models of educational practice.

### DIALOGIC PEDAGOGIES IN STEM

In conventional didactic pedagogical models, the instructor is primarily responsible for covering a certain volume of content (“banking” in Freirean terms). Freire (2) views dialogue as the empathetic, active listening that allows for more intentional internalization of who students are as citizens. Therefore, dialogic pedagogies can be considered inclusive practices with the clear intention of fostering equitable outcomes. Under this framework, authentically “knowing” students is a critical aspect of inclusive practices. It is simply not sufficient to only increase access for historically disenfranchised students. How these students thrive and are given the space to shape and enrich society is what will ultimately make their inclusion authentic. This demands that equal attention be paid to the content expertise of the instructor and understanding the psychosocial contexts of students. An important focus for us in this issue was to

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emphasize inclusion over deficit theories of equity. In so doing we continue the steady march away from the paradigm of “fixing” incoming students to match arbitrary institution norms, toward a critical examination of institutional practices and individual behaviors that better align with authentic equity frameworks.

This special issue presents various theoretical, conceptual, and logistical models needed for both individuals and institutions to better understand those contexts and ultimately consider the potential impact on campus practices. The full actualization of dialogue also involves what Freire terms “conscientização,” or the development of a unique awareness of one’s own social reality, a concept that is only beginning to make its way into critically conscious teaching. When fully actualized, dialogic approaches can unleash an inclusive and equitable experience, where all stakeholders in the education process engage in a space where they freely cultivate their sense of meaning and purpose. Each submission highlights various and unique aspects of the dialogue process.

## **MANUSCRIPT HIGHLIGHTS AND FUTURE GOALS FOR THE STEM HIGHER EDUCATION COMMUNITY**

As we considered underlying themes of inclusive practice, several key ideas emerged, including an understanding that inclusion is the foundation for the future of higher education, the need for radical changes in the support structures for faculty who engage in the intense, often emotionally fraught work of inclusion, and the removal of barriers for collaboration and understanding pertaining to broader social issues and the higher education experience. Here we highlight articles that support these key themes particularly well.

### **Inclusion as the foundation for higher education**

Scientists approach education with an eagerness to share their enthusiasm, curiosity, and disciplinary wisdom, but in the absence of inclusive practices, the impact of teaching is potentially limited. As reviewed by Moore and colleagues, the effectiveness of active group-based approaches is based on self-determination theory, or the ability of an individual to feel internal motivation. Self-determination theory can be coupled with optimal distinctiveness theory and perspective from the field of industrial psychology to include “meeting the needs of belonging while being able to display one’s unique characteristics” (6), suggesting that educators and administrators must design educational processes such that they acknowledge the personal development of students. We envision a future in which inclusive practice leads to transformation of higher education by prioritizing strategies to eliminate systemic inequalities and empower students.

Indeed, as is highlighted by many of the articles in this special issue, long-term, sustainable change in science edu-

cation is developed by moving away from interventions as part of a deficit model toward an environment in which the interventions are unnecessary. Ramirez and Gordy describe how to use frameworks for universal design for learning, constructivism, and 3D modeling to build a course that intentionally creates learning materials that make accommodations less necessary, in contrast to standard approaches, where faculty design “a course with able students in mind and [retroactively create] accommodations for students with disabilities” (7). Similarly, Johnson and Elliot adopt Gloria Ladson-Billings’s model on culturally relevant pedagogy and encourage faculty to develop critical consciousness for institutional change to be effective. Recruiting underrepresented students without trying to eliminate biases that they may face will not lead to “departments where all kinds of students feel they belong” (8). Their charge for faculty is to think about how psychological, social, economic, and cultural norms affect a student’s educational experience as central to transformational change in higher education. They highlight that this approach likely leads to departmental benefits as well. When one of their departments adopted a “No Criticism approach,” they “attracted more students, which allowed the department to petition successfully for more faculty lines” (8). In turn, they were able to build a more inclusive department by hiring like-minded faculty.

### **Radical changes needed in support structures for inclusive faculty**

Reform in the STEM higher education community must be guided by research that refocuses attention on the personal development of students as equal and valid contributors to the educational process. It’s rare that students are as one-dimensional as many of our research methods. We need more than individual techniques for helping students who have one aspect of identity. Rather, what is needed are structures and tools to assist faculty in interrogating the entire system of education and challenging the status quo. While science faculty are only one element of the educational process, they have significant potential and power within an educational system. In a world of competing priorities, faculty are faced with balancing their professional responsibilities while attempting to carve out time for radical self-inquiry. This is the reflection that is required to challenge biases, interrogate teaching practices, investigate institutional policies, and embody the courage to enact change.

Faculty also need collaborative networks, research that supports the use of inclusive practice, tools to demonstrate the efficacy of their approaches at their institutions, and appropriate incentives. Some collaborators for inclusion work may be found in social-behavioral science fields. Scholars from these backgrounds do not necessarily share all the same conceptualizations of inclusion, and their fields are very much areas of active research. Furthermore, context matters very much to inclusion work: what may be

an effective practice or strategy in a large classroom with primarily white students may or may not be as effective in other contexts. Social science scholars are great resources when reflecting on inclusive practices within the contexts specific to each institution. Approaching them with humility and respect for their discipline, experiences, and perspective will be important to build bridges that will ultimately enhance biology teaching and research.

### **Collaboration and understanding pertaining to broader social issues and the higher education experience**

Ramirez and Gordy highlight a particularly accessible way to create faculty networks, share ideas, and make faculty work visible for the purposes of tenure and promotion through their STEM BUILD online community (7). STEM faculty in higher education also need the opportunity to collaborate with more experienced practitioners in the social sciences and K–12 sphere. Spowls questions the effectiveness of “science outreach models in which scientist ‘experts’ judge school science projects” (9). Their alternative collaboration tools provide a framework for mutually beneficial dialogue between mentor and student, in which the mentors have just as much to gain, as they develop into inclusive practitioners, as do students.

### **Final thoughts from the editors**

As practitioners, we need to remember the words spoken by Dr. Kamau Bobb at the last National Science Foundation Scholarships in STEM Symposium. “The science that gets done is dictated by those that do it.” If we fail to prioritize diversity, equity, and inclusion in our undergraduate science courses, we limit the power of the collective to solve global problems, and we endanger the success of the scientific endeavor. We believe the articles in this issue

will support you in your goals to enact systematic change, and we encourage you to use them as a basis upon which to build your research and to hold them up as evidence to restructure your classes, departments, and institutions.

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