Democracy's College

Episode 8: Equity-Minded Approaches to Mathematics Education

Welcome to the Democracy's College podcast series. This podcast focuses on educational equity, justice, and excellence for all students in P-20 educational pathways. This podcast is a product of the Office of Community College Research and Leadership, or OCCRL, at the University of Illinois at Urbana-Champaign. Learn more about OCCRL at occrl.illinois.edu.

In this episode, Dr. Heather Fox from OCCRL talks with Dr. Helen Burn, a mathematics professor and Director of the Curriculum Research Group at Highland College, about equity-minded approaches to mathematics education.

Dr. Heather Fox: The first question that I want to ask you is about mathematics education as a whole. Mathematics education plays a critical role in college students' trajectories and ultimately their chances of successfully completing. Can you provide an overview of the current thinking around mathematics education in the community college context that highlights some of critical challenges faced by mathematics faculty and administration?

Dr. Helen Burn: Mathematics and quantitative skills are more important than ever to more programs of study, largely due to the use of data in different careers. The current thinking is to examine entry level college math courses in a deeper way from the perspective of: What is the purpose of this class in terms of students' career or education goal[s]? How do we create content that is achieving those outcomes, keeping in mind the whole time the need for these courses to transfer to four-year colleges and universities? In achieving this, the considerations are: First, to determine the purpose and content we need to have math faculty on board who have the collective attitude, "Let's really work on this." Success depends on the full-time math faculty. Many colleges are relying on their adjunct teams for the daily work of the department, and adjunct team members generally don't have the resources to engage in this level of work and leadership. Lastly, in this type of deep curriculum work, the administrative support role changes from, mainly in the past, providing funding to do redesign work, now to helping math faculty navigate state-level policy and requirements around issues of course-level transfer to four-year colleges and universities and how these math courses apply towards degree requirements.

Dr. Heather Fox: Listeners might not automatically associate mathematics education with issues of equity. Can you illustrate some of the educational inequities within mathematics education?

Dr. Helen Burn: In the past, we used to think to think about equity in terms of access. The door has been opened and the access is now there. Now we see equity not in terms of being able to get in, but in terms of whether students leave having been successful. Success, that's not just about passing and completing, but includes whether students have learned mathematics that is meaningful and relevant to their programs of study. From the frame of reference of quality of outcomes, the good news is that there is less of a gender gap than there used to be. On the other hand, we still see different outcomes by other student characteristics such as age, race/ethnicity, socio-economic status, and whether or not students are first in their family to attend college. We refer to students with historically lower outcomes as underserved students. The data shows that students from historically underserved groups tend to place lower in the math sequence. As a result, they often have to take two, sometimes even more, preparatory pre-college math courses before they can enroll in their entry-level college math course.

These students have a long journey ahead of them to achieve their end outcome. We also need to talk about perception and attitudes toward math. In the United States math has become like a four-letter word. Because of this attitude, students tend to learn mathematics at a very superficial or surface level. Surface-level learning will not get students to the level they need to pass their entry-level college math course and as a result achieve their end outcome of college completion. Surface-level learning is even more insidious, because the outcome here is not just completing math courses, it's to learn meaningful mathematics, given what I alluded to before about the increase of quantitative skills required for more careers, professions, and jobs. Some of the curriculum work that is being done nationwide is an attempt to disrupt this perception that many students have about mathematics, [which is] about themselves as capable of learning mathematics, and about the role of faculty as partners supportive of and interested in developing their mathematical talent. Currently, I am working on a project called "Transitioning Learners to Calculus in Community Colleges." Calculus is a gateway to students interested in science, engineering, technology, [and] math careers. We call those the STEM fields. The project is fundamentally about equity, because increasing science outcomes in the United States requires that we increase the number of historically underserved students interested in science who enroll in community colleges. The research team for the project includes a mix of people who specialize in math education in the two-year setting; that would be me and Dr. Vilma Mesa, from the University of Michigan. We include people who specialize in community college student development, student transitions, [and] student psycho-social adjustment; that would be Dr. Eboni Zamani-Gallaher, from the University of Illinois at Urbana-Champaign, and Dr. Luke Wood, from San Diego State University. Within this project we are examining not only the types and the rigor of courses the students are required to take, but also the ways in which mathematics faculty use relationship-building strategies and promising instructional practices that promote equality of outcomes.

Dr. Heather Fox: Students who are assessed as not ready for entry-level college mathematics courses are often referred to or required to take pre-college mathematics courses. These students are sometimes referred to as underprepared students. Can you unpack that term for us? Who are these students, and what are the factors that contribute to students being underprepared for college-level mathematics?

Dr. Helen Burn: As we spoke about in the last question, we talk about equity not in terms of access, we have the access, we talk about equity in terms of outcome. Because of that, we recognize that students are coming in with all of these challenges from the past. There are numerous factors [that] can lead to students being labeled as underprepared, and we can't change the past. The current thinking about improving outcomes calls on colleges to shift away from blaming the students, their families, and their communities and instead for institutions to take responsibility for addressing what is true for our student population. In thinking about serving underprepared students, what we know is that if a student comes to us and only needs a single pre-college math class, that is they are initially placed one level below college-level math, those students, the data shows, are going to hit their end outcome of college completion at that same rate as students who come college ready. But, if students come in needing multiple pre-college math courses, or if they need prep courses in multiple areas, like writing and mathematics, those students are unlikely to reach their outcome. In part, because they have to do so much more, their outcome seems too far out of reach. Also, students can get demoralized when they come to college only to learn that they are not prepared for college courses. The data supports this as well.

Dr. Heather Fox: There is some controversy around how students are assessed as underprepared, as well as a fair amount of variation among colleges and even programs of study at the level of mathematics preparation that is required. Would you share your perspective on the necessity, the validity, and the impact of these processes?

Dr. Helen Burn: The validity of mathematics placement tests has been of concern for years. Only relatively recently has the field responded. The recent response was mainly because one of the major commercially available tests went away. This was an external shock and really caused institutions to have to scramble for a replacement. In the process, the issue of equity in placement, which had always been around, really took hold. So colleges have recognized that initial placement in mathematics has a significant impact on whether students reach their outcome. Going back to the previous question about equity, because our students have diverse educational backgrounds, the trend is toward placing students in their initial math course using multiple measures to assess their mathematical knowledge. For example, in addition to standardized mathematics tests, institutions, more often than in the past, honor high school transcripts or prior college math courses. Overall, using multiple measures reduces the percentage of students who are required to take the standardized placement test. But, for those who do, institutions are taking much more responsibility now for creating placement tests that are valid, which means their test items align with actual content of their courses, and for ensuring that the cut scores that they set have predictive validity, which means that students should perform well in the class in which they are placed. Much more frequently now than in the past, institutions are disaggregating institutional placement data along the student demographic variables I mentioned previously, including age, gender, and race/ethnicity. Here again, the focus is on equality of outcomes, because student outcomes decrease when the outcome is farther away. As I mentioned previously, placing into pre-college math courses can really demoralize students and shape their belief that they don't belong in college, which research shows is a fairly common belief among the underserved students I described. Placement is particularly important for students interested in science and math at community colleges. This is one reason we examine this within our transitioning learners to calculus grant. When students enter community colleges interested in science and math, their journey through college math is already long. It can include one to two pre-calculus courses, Calculus I, maybe Calculus II, and maybe even more advanced math courses, like differential equations or linear algebra. Institutions, who want to bolster the success of students from this population, need to insure that if they are requiring them to take additional pre-college math courses that those courses are truly needed.

Dr. Heather Fox: Individual colleges and some statewide college systems are implementing numerous strategies to reform their mathematics curriculum with varying levels of success: strategies like acceleration, contextualization, and learning communities. Are there strategies that you feel, that if successfully implemented, could contribute significantly to better serving students?

Dr. Helen Burn: We spoke previously about the trend toward examining entry-level college math courses in a deeper way. From the perspective of: What is the most appropriate entry-level course for students based on their stated career or educational goal? This is referred to as creating math pathways. There are three major considerations. First, students need clear advising information about which entry-level college math course they need for their program of study, so advising is really important. Second, reviewing the content of entry-level college math courses in order to ensure that the courses are rigorous and relevant to students' program of study [is important]. Lastly, for students who are deemed not college ready in math, colleges are developing more effective and efficient ways to prepare students

in order to shorten the journey to college math by making the outcomes of the preparatory courses align with the needs of the entry-level math courses. This strategy related to math pathways is promising, because it simultaneously addresses two needs that I mentioned. First, math is increasingly important to more programs of study, and this strategy has the potential to raise the quality of mathematics learning. Second, student outcomes increase when [students] perceive that their goal is within reach. In addition to math pathways, we know that math faculty care deeply about students and student learning. We also know that mathematics faculty want help integrating the research and data on how to build the bridge between the students who are coming in and the faculty [who] generally have not had similar life experiences. Another promising strategy involves professional development around areas like relationship building, positive classroom interactions, and creating community support for students within the classroom. This is one very important piece of our transitioning learners to calculus grant, where we have brought together specialists in math education and specialists in student development to help make relationship building and other promising instructional strategies more accessible to faculty teaching mathematics in the two-year setting, particularly faculty who teach students interested in science and math careers.

Dr. Heather Fox: What call to action would you like to issue for those listening today who want to take an equity-minded approach to mathematics education?

Dr. Helen Burn: As a first step, look at your local data and disaggregate along the demographic variables that I mentioned, such as gender, age, and race/ethnicity. Explore those in combination, like age crossed with race/ethnicity. Patterns will emerge. This is an important first step, because once you know it you can't not know it. Second, appreciate that the open door that we give to students means our institutions have a responsibility to take care of them now that they're here. Taking care of them is going to involve more than just rearranging the furniture. Here the call to action is to learn about different promising strategies, to understand what these strategies are intended to solve and what resources are required for these strategies. Third, take the first step and connect with team members at your institution and start the dialogue using the data as a springboard. If you're already there, maybe you've already identified a strategy that you're going to try. In this case, if the strategy involves deep curriculum work, you're going to likely need to move beyond your campus to engage transfer institutions and other state-level policies and structures. If you're particularly interested in improving outcomes for your students interested in math and science, I hope you would consider joining our networked community for the transitioning learners to calculus project. You can do that by contacting me directly or finding us through our project website.

For more information about equity-minded approaches to mathematics education, we recommend that you visit Dr. Helen Burn's website at Highland College and the Curriculum Research Group website for publications and additional readings. For more podcasts, links to today's recommended resources, or to share your comments and suggestions, visit occrl.illinois.edu/democracy or send them via Twitter @occrl. Tune in next month when Marci Rockey from OCCRL talks with Leslie Daugherty, transfer coordinator at Southern Illinois University Edwardsville, about the potential for reverse transfer initiatives to address inequity in higher education. Background music for this podcast is provided by DubLab. Thank you for listening and for your contributions to educational equity, justice, and excellence for all students.