

Curricular Coherence and Open Educational Resources

A Position of the National Council of Teachers of Mathematics

Question: What are the responsibilities of teachers, administrators, and publishers in the age of open education resources?

NCTM Position

A coherent, well-articulated curriculum is an essential tool for guiding teacher collaboration, goal-setting, analysis of student thinking, and implementation. In a time when open educational resources are increasingly available, it is imperative that teachers be provided with curricular materials that clearly lay out well-reasoned organizations of student learning progressions with regard to mathematical content and reasoning.

NCTM has long recognized the importance of coherence in a well-developed mathematics curriculum. Broadly stated, coherence means that connections are made from one year to the next, from one idea to another, from one representation to another, and from one statement to many others that are implied by that statement. There is coherence pedagogically, logically, conceptually, in terms of learning science, and with the real world.

Although districts, schools, and teachers have greater access than ever to tools and resources for developing their instructional materials, the skill required to develop high-quality curriculum materials is both vast and complex, but neither widely understood nor appreciated. The risks of open education resources can include:

- Teachers who are provided with little or no support for setting mathematical goals and organizing resources into a coherent learning progression,
- Resources students have access to will vary widely from teacher to teacher and school to school, reinforcing inequities in situations where students who struggle are more likely to have inexperienced teachers, and
- School communities will abandon the process of vetting and adopting agreed-upon curriculum resources, creating a lack of transparency and accountability.

However, open education resources have clear advantages as well as risks. Today, some of the most vibrant discussions about mathematics teaching and learning currently take place within online communities that are built around sharing instructional resources and ideas. Sharing open resources online allows teachers to form virtual professional learning communities (PLCs) to compare implementation and share student work on the tasks and engage in forms of lesson-study with teachers and even researchers, in ways they may not be able to do in their own school setting. It is important that they know a) how to make the task feel valuable and coherent to the students, and b) how to engage with other teachers around the shared task to question how it is implemented, anticipate student work, and plan to support student learning toward clear goals.

In an ideal situation, teachers have access to a high-quality curriculum that supports them to make informed choices about adapting and implementing tasks, and ample time for well-facilitated work with colleagues so that all students have access to the same high-quality tasks. Open education resources have an important role in this ideal situation, providing teachers with

resources to, for example, engage students in interesting or topical problems or applications, use technology in innovative ways, or bring in mathematics relating to students' lived experiences.

Clearly, having a well-articulated, high-quality, coherent curriculum at the school and district level is even more important in the age of open education resources because it is the curriculum that establishes the learning goals in a coherent progression and helps teachers to see and understand the multiple pathways that students take through the progression.

The Curriculum Principle in *Principles and Standards for School Mathematics* (NCTM, 2000 p. 14-16) states, "A curriculum is more than a collection of activities." It further describes a well-articulated curriculum as both making clear the most important mathematics of the grade level, when concepts and skills are introduced and when they should be mastered, and how student conceptual understanding of big ideas develops across units and across multiple grade levels.

High-quality coherent mathematics programs help students make sense of mathematics by situating the mathematics in problem solving contexts, so that students learn the mathematics in order to answer meaningful questions in real-world or mathematical contexts. Explicit attention is paid to promoting students' conceptual understanding of mathematical content as well as mathematical thinking and reasoning practices so that the mathematics itself makes sense to students. By linking mathematical topics within and among mathematical domains, mathematics appears as a unified discipline rather than as a collection of topics.

Schools, districts, and publishers who provide high-quality curriculum and ample time and resources for teachers to collaborate with colleagues in well-facilitated professional learning communities (PLCs) help teachers implement consistent approaches in the use of tools (technological and other), instructional strategies, assessment, and accessibility, as well as pay careful attention to lesson design to create a program that seamlessly integrates a wide array of components into a coherent whole that will help facilitate the development and maintenance of a classroom culture with consistent student expectations.

References

National Council of Teachers of Mathematics. (2014). *Principles to actions: ensuring mathematical success for all*. Reston, VA: Author.

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