RESEARCHING THE MATHEMATICAL HORIZON:

TWO COMPLEMENTARY PERSPECTIVES

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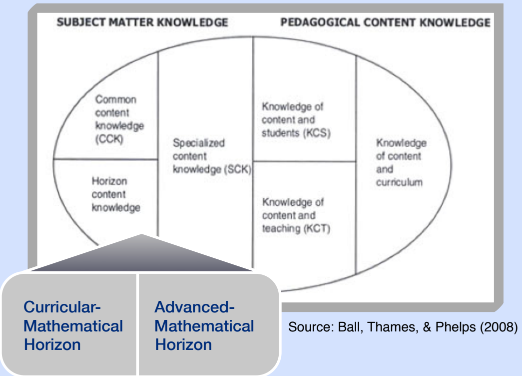
Background

Mathematical Knowledge for Teaching (MKT)



Source: Ball, Thames, & Phelps (2008)

Horizon knowledge is an awareness of how mathematical topics are related over the span of mathematics included in the curriculum. First-grade teachers, for example, may need to know how the mathematics they teach is related to the mathematics students will learn in third grade to be able to set the mathematical foundation for what will come later. It also includes the vision useful in seeing connections to much later mathematics ideas. (Ball, Thames, & Phelps, 2008)

Horizon Content Knowledge (HCK) is an orientation to and familiarity with the discipline (or disciplines) that contribute to the teaching of the school subject at hand, providing teachers with a sense for how the content being taught is situated in and connected to the broader disciplinary territory. HCK includes explicit knowledge of the ways of and tools for knowing in the discipline, the kinds of knowledge and their warrants, and where ideas come from and how "truth" or validity is established… HCK enables teachers to "hear" students, to make judgments about the importance of particular ideas or questions, and to treat the discipline with integrity, all resources for balancing the fundamental task of connecting learners to a vast and highly developed field. (Jakobsen, Thames, Ribeiro, & Delaney, 2012)

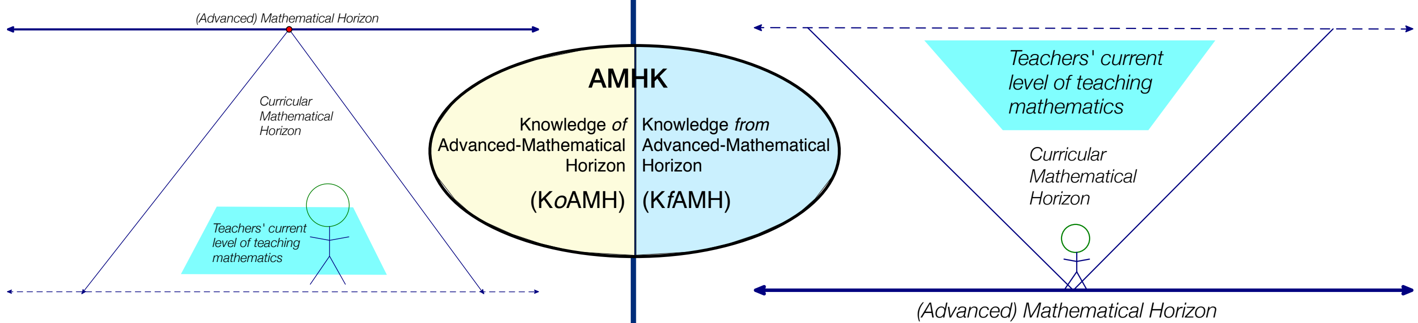
GOAL: To specify *content knowledge* that impacts the work of teaching, and to better-inform content requirements for teacher education and PD

Advanced-Mathematical Horizon Knowledge (AMHK):

Knowledge of advanced mathematics (where 'advanced' refers to mathematics that is more sophisticated than what is typically taught in K-12 mathematics education), including fundamental disciplinary ideas, structures, values and practices, that has a notable and direct impact on the teaching, both planned and in-action practices, of K-12 mathematics teachers

Source: Wasserman & Stockton, under review

Looking toward the Mathematical Horizon | Looking backwards from the Mathematical Horizon



"Advanced mathematics from an elementary standpoint"

"Elementary mathematics from an advanced standpoint"

Potential Impact on In-Action Teaching Practices:

Jakobsen, Thames, Ribeiro, & Delaney (2012) discuss a student who provided an unconventional split of a rectangle into four equal parts; the student claimed that while her picture was not quite accurate, she could still move the lines such that the pieces were equal. In this case, the authors contend that a teachers' response to the student's (correct) claim could draw on a flexible understanding of continuity and an intuitive feel for the intermediate value theorem (AMHK) in the context of a shifting line segment.

Research Methodology Implications

- Document evidence of impact of AMHK on in-action practices based on classroom observations
- Record student questions and identify how teacher responses could utilize AMHK
- Specify how elementary (K-12) ideas can be treated with mathematical integrity; record teacher mis-statements during observed explanations
- Interview teachers about their decision-making processes of enacted lessons to identify conscious connections to AMHK
- Specify any other ways AMHK can enhance flexibility in in-action practices

Potential Impact on Planned Teaching Practices:

Wasserman (under review) discusses knowledge of set properties, particularly as they relate to numbers sets. For example, N is well-ordered but Q+ is not, and both N and Q+ have equivalence classes. Implications for planned teaching practices stem from advanced knowledge about the properties and distinctions of sets: before discussing how to order fractions, teachers could make sure students' conceptions of ordering numbers is related to magnitude, not just to a naturally well-ordered set; and before introducing equivalent fractions, teachers might discuss the infinitely many equivalent representations for natural numbers in order to alleviate some of the difficulties transitioning to properties of rational numbers.

Research Methodology Implications

- Document evidence of impact of AMHK on planned practices based on lesson plans and interviews with teachers
- Record mathematical foundations, structures, and norms and how these may inform the teaching of K-12 mathematics
- Specify how advanced ideas impact presentation and discussion of K-12 ideas; link possible AMHK to K-12 standards
- Interview teachers about their lesson-planning process and influential content (i.e., possible AMHK) during the development process that impacted their choices
- Specify any ways that delivery of AMHK for teachers is linked to their planned practices