KIPP Math Vision for Grades K-8

Overview

The creation of the KIPP Math Instructional Vision is the result of the work of teachers and instructional leaders in the KIPP network as well as members of the KIPP Foundation who compromised the Instructional Vision Team. The formation of the team was in direct response to the needs of the KIPP network. The combination of variability among schools and regions, the fact that 81% of teachers report developing their own unit plans, the needs of new teachers, and the adoption of the Common Core State Standards led the call to action. This vision was developed to help guide a partnership with third-party publishers to provide KIPP teachers in grades K-8 with access to robust curricular resources, associated professional development, and recommendations for school-wide structures and conditions that support achievement in math.

Partnership with a publisher could mean adoption of off-the shelf products, co-development of materials specifically for KIPP, or further development of existing resources such as the Featured Teacher curriculum. It's essential that the experiences and wisdom of KIPP teachers and leaders, current research, and clear alignment with the CCSS guide the curricular decisions we make for our kids. This high-level vision reflects the beliefs, experiences, and knowledge of KIPP teachers and leaders and will serve as the foundation for the Instructional Vision Team's decision making.

Beliefs

Conceptual understanding, procedural fluency, and application are deeply linked and effective math instruction reflects a balance of all three. Deep conceptual understanding leads to fluency, which is defined as students being fast, accurate, and flexible in their computation. When students are procedurally fluent in math they are able to tackle more challenging multi-step and application problems. Application is the ability to apply math concepts in context and across content areas. Over the last decade we have had success with a procedural and fluency focus which we must sustain. We now need to enrich our approach with conceptual understanding. In particular, in earlier grades, we need to build conceptual understanding of number sense and operations to promote fluency. This will support the development of fluency and flexibility with algorithms in later grades.

Mathematical reasoning is the backbone of conceptual understanding and algorithmic proficiency. Mathematical reasoning can be defined in two ways. First it is the ability to construct knowledge through inquiry (reasoning of inquiry). Secondly, it is the ability to justify and prove mathematical claims (reasoning of justification)[1]. It must be modeled, taught, and practiced, and students need

[1] Ball, D.L. & Bass, H. (2003). Making mathematics reasonable in school. In J. Kilpatrick, W.G. Martin, and D. Schifter (Eds.) A Research Companion to *Principles and Standards for Mathematics* (pg. 27 – 44). Reston, VA: National Council of Teachers of Mathematics.

consistent opportunities to make meaning of the math they are learning. This is done through the regular use of rigorous mathematical tasks that allow students time to grapple with ideas and refine them through writing, speaking, and listening to the ideas of others. The Standards for Mathematical Practice from the Common Core State Standards play a crucial role in fostering mathematical reasoning. Where content standards tell us what students are required to understand, know, and be able to do, the practice standards inform us of the student actions that we need to foster. Through the practices, students develop the ability to reason, understand why what they are doing works, and apply their thinking to real-world situations.

Teachers must wrestle with the content to equip students to wrestle with the content. To meet the demands of CCSS, teachers need a high level of content proficiency. To appropriately inform instruction, teachers must be well versed in the skills that students have acquired from previous mathematical courses. They must deeply understand the ways in which this prior knowledge will impact the content delivered in their instructional plan, and they must understand how their instruction will lay the foundation for future instruction and concept development. Teachers need to have a deep understanding of the mathematics that they are teaching, extreme clarity around what kids are being asked to understand, know, and do, and knowledge of how students learn best. In order to accomplish this, teachers must continuously seek deeper knowledge of mathematical content, and curricular materials and school structures must support this.

Student conceptual understanding and the ability to apply mathematics is enhanced when students have frequent opportunities to communicate about math. Specifically, providing students with opportunities to read, write, and talk about math enhances conceptual understanding and the ability for students to apply mathematics to novel situations. This requires students to have a rich mathematics vocabulary and ability to work with complex language structures that they can confidently use in written and oral communication, and that students are able to listen carefully to their peers and build on the ideas of others. Students need frequent opportunities to share their thinking and respond to the thoughts of others both verbally and in writing.

Deep understanding of mathematical concepts is the gateway to success in higher level mathematics in high school. Our goal in K-8 mathematics is to prepare students for success in Algebra I and beyond through a rigorous K – 8 mathematics program that allows students to gain a deep understanding of core mathematics principles inherent in the design of the CCSS. Strong algebraic thinking skills come from exposure to, experience with, and practice of algebraic concepts from an early grade. Adherence to the Common Core State Standards, which are designed coherently, will prepare our students for college-preparatory high school math classes.

Students and teachers must have a growth mindset. In order for students to show greater persistence in learning mathematics, they need to believe that their efforts

make them 'smarter'. There are no 'math people'. All students can master mathematics at a deep level with the support of a strategic and skillful teacher.

We believe in high expectations and strong support for all students. All students can master complex mathematics and rigorous content from Pre-K onward. Because students learn at different paces, we believe that differentiation and personalization are necessary for students in all quartiles. Any adopted curriculum must be flexible to allow for teachers to adapt it to the needs of their students.

We believe in the potential of technology to help us meet the individual needs of our students. While we don't believe that technology will ever take the place of a skilled teacher, we believe that student technology can provide opportunities to practice and deepen understanding with a student's zone of proximal development. Additionally, technology can be a valuable resource for assessments and data analysis. Easily accessible data helps teachers strategically reteach and group students**.** Knowing where students are in terms of their understanding of mathematics is vital to getting them to where they need to be.

Student Habits

In order for our beliefs to be a reality in the classroom, we must foster specific habits in KIPP students. Our definition of habit is that it is a tendency or disposition. Students develop habits through explicit teaching and need frequent opportunities to practice with positive reinforcement, feedback, and support. These habits, which reflect many of the Standards for Mathematical Practice as well as highly predictive character strengths, support students in becoming college and career ready.

To prepare students for college-preparatory mathematics, students need to develop the following mathematical habits in K-8:

KIPP students possess the disposition to engage in discourse around mathematical concepts.

- Students actively listen to the ideas of others
- Students ask questions of others to deepen understanding
- Students build on the ideas of others

KIPP students successfully demonstrate understanding of mathematical concepts through oral and written communication.

- Students provide reasonable justifications and explanations for ideas and answers
- Students "show their work"
- Students use mathematical language and vocabulary to explain their thinking

KIPP students are comfortable being generative and making conjectures.

- Students are eager to explore new problems

- Students take risks
- Students apply previously learned strategies and prior knowledge to novel situations
- Students select and use appropriate mathematical tools to support problem-solving efforts (calculators, manipulatives, etc.)

KIPP students show perseverance in problem-solving.

- Students know there is more than one way to approach a problem and are willing to try multiple ways
- Students try very hard even after experiencing failure
- Students admit confusion and ask for help
- Students finish what they begin

KIPP students demonstrate a growth mindset.

- Students demonstrate comfort with making mistakes
- Students explain individual growth goals
- Students regularly track progress towards their goals
- Students demonstrate a belief that effort will improve progress towards goals

KIPP students attend to computational and procedural precision.

- Students are careful when performing mathematical procedures
- Students double-check their work, notice when an answer doesn't make sense, and take initiative to fix mistakes
- Student perform mathematical procedures in an organized manner to avoid careless errors
- Students know the grade-level fluencies demanded by the CCSS and seek opportunities for practice until achieving mastery

Teacher Habits

We believe teacher actions impact student actions. For students to develop the mathematical habits necessary for success in college-preparatory math classes, teachers must explicitly support students in developing these habits through their teaching.

KIPP teachers regularly provide students with opportunities for mathematical discourse.

- Teachers explicitly teach and reinforce discourse skills, including active listening, questioning, and how to build on the ideas of others.
- Teachers create regular opportunities for students to practice mathematical discourse skills
- Teachers provide immediate and affirming and adjusting feedback to students on their discourse skills

- Teachers explicitly teach mathematical vocabulary and expect students to use it when engaging in mathematical discourse

KIPP teachers deeply understand their content, allowing them to lead students to deep conceptual understanding.

- Teachers can explain with absolute clarity what the standards for their grade-level expect students to understand, know, and do by the end of the year
- Teachers can explain how concepts relate to those that were previously taught and those that are still to come
- Teachers identify which standards require conceptual understanding and identify or design tasks for those standards that reflect the progression from concrete to semi-abstract to abstract
- Teachers regularly grapple with the content they are teaching, coherence between topics, and problem and task types by seeking resources and support

KIPP teachers are careful and resourceful planners.

- Teachers leverage the resources available to them and build upon and internalize them as often as possible rather than reinventing the wheel
- Teachers consistently include the following components in math lesson plans: objective(s), criteria for success, sample assessment items, student misconceptions, QTIDWTFTA, INM, GP, IP, vocabulary practice, fluency practice, and questions that promote mathematical reasoning and student discourse
- Teachers can explain the difference between conceptual understanding, procedural fluency, and application and match instructional strategies accordingly
- Teachers spend the majority of the school year on the major work of the grade and devote longer chunks of time to standards that require understanding
- Teachers plan to explicitly teach mathematical habits required for student success in college-preparatory math classes

KIPP teachers use problem-solving to teach concepts that require understanding and application.

- Teachers regularly present students with high-quality problems and tasks when developing lessons that require conceptual understanding and application
- Teachers explicitly teach students to approach problems and tasks in a variety of ways and gradually release responsibility for choosing strategies to students.
- Teachers provide students with sufficient time to take risks, explore solutions, and engage in discourse independent of the teacher

KIPP teachers explicitly teach students to reason mathematically.

- Teachers explicitly teach mathematical reasoning skills by modeling their own thinking and instructing students in the habits of discourse that promote reasoning.
- Teachers make visible when reasoning is being used for the purposes of inquiry versus as a means of proof or justification.
- Teachers create opportunities for students to apply mathematical reasoning skills
- Teachers provide immediate affirming and adjusting feedback on students math reasoning skills
- Teachers employ economy of language so reasoning is done by students

KIPP teachers use assessments to track student progress and inform grouping and differentiation.

- Teachers identify or design assessments that require variability in what students are asked to produce (i.e. answers, explanations, models, etc.)
- Teachers administer trimester or quarterly benchmark assessments that are aligned to the CCSS and reflect the rigor of the next generation assessments (PARCC, SBAC), including variability in item types
- Teachers administer weekly or bi-weekly assessments that are aligned to the rigor of quarterly or trimester benchmarks
- Teachers use a variety of strategies to assess student progress towards daily objectives, including CFUs, exit tickets, etc.
- Teachers use data from all of the above to regularly inform re-teaching, grouping, and other interventions.
- Teachers provide students with immediate, frequent, and meaningful feedback on all assessments.
- Teachers track student progress towards standards mastery and make the tracking visible, including progress towards grade-level fluencies.
- Teachers share individual college-ready growth goals with students and their families

KIPP teachers approach their work with a growth mindset about their students and about themselves.

- Teachers relentlessly follow-up with all students to re-teach, assess, and repeat until all students meet goals
- Teachers recognize what they do not know related to specific math content and student learning and proactively seek out resources to deepen understanding

KIPP teachers leverage technology to enhance instruction and save time.

- Teachers use appropriate technology to support math instruction, assessment, and data analysis.
- Teachers provide students with opportunities to use technology as a way to enhance skills and understanding at their individual levels

Enabling Conditions

In order for beliefs, student habits, and teacher habits to thrive, there are enabling conditions that must be present in a school setting.

Content-specific professional development is prioritized by the school's leadership. School and regional professional development, coaching, and professional learning communities are content focused and prioritize mathematical content knowledge, pedagogical content knowledge related to how students learn, and curriculum development and implementation. Teachers have time for regular collaboration and sharing of strategies, examination of student work, unpacking standards and unit plans, RTI practices, and data analysis. Structures are in place to support this ongoing PD.

Teachers have access to exemplary curricular resources that reflect alignment to the Common Core State Standards and the instructional shifts. Teachers are able to provide students with high-quality tasks, learning experiences, and assessments and they are able to save time because they are not charged with inventing these resources themselves. Teachers are supported in unpacking and internalizing these resources collaboratively and individually through professional development.

Instructional technology that supports individualized student learning, progress monitoring, and data analysis is readily available to teachers. Teachers receive training and support so they can use these resources efficiently and effectively, and they are held accountable for doing so. Tech support is provided by the school or region to minimize time teachers spend trouble-shooting.

School schedules are conducive to high-quality math instruction. Students have the time to grapple with concepts, make conjectures, and search for solutions before an algorithm is introduced. There is also time built in for small group or individualized learning for students in all quartiles, whether this time is built into the math block, another time in the school day, or both. Teachers have adequate planning time that allows for them to plan strong math lessons and to analyze assessment data to address re-teaching and grouping There is also time and space for teacher collaboration with colleagues both in the same school and in different schools.

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This paper is grounded in the mathematical expertise of Deborah Loewenberg Ball, Hyman Bass, Whitney Grese Hanna, Rob Park, the National Council of Teachers of Mathematics, and US Department of Education Mathematics Advisory Panel. In addition, this work represents a collaborative effort with some of our exceptional KIPP teachers and leaders: Lauren Abramson, Jacob Boesch, Michelle Bruce, Liz Coughenour, Margarita Florez, Mary Gardener, Marie Huxley, Jen Keyte, Meghan Little, Nancy Livingston, Andhra Lutz, Noel Mullen, Kinnari Patel-Smyth, Christine Rowland, Linda Theret, Jennifer Wells, Kimberly Underwood, and Lauren Vance.