

## **Elements of an Effective Math Lesson:**

***Effective math instruction engages students in tackling problems through application of logical strategies and in explaining how and why math works.***

### **Students engage in the struggle.**

- We reject I-we-you teaching in which students watch a teacher solve a problem and then imitate the teacher's approach. Instead, good math lessons require students to use what they know to struggle with and logically attack a new problem that is more challenging than anything they have seen before.
- The struggle should be within the students' zone of proximal development – attacking a problem one step beyond what they have ever done before, but achievable through struggle.
- Students must be pushed to articulate their process, even when that articulation is a struggle. It is insufficient for students to be able to get the right answer – they must also be able to explain how they got it and why that is correct.

### **Students think logically and use flexible strategies.**

- Problems must be crafted to encourage logical thinking and ideally to allow for a number of strategies. Effective problems are open ended.
- Our instruction must encourage logic and flexibility. The goal is to develop deep content knowledge in our students. Any lesson that teaches students a list of steps instead of lasting and transferable math understanding is a missed opportunity.
- Teachers plan lessons by considering all the strategies that students can use to attack a problem. While anticipating correct strategies to reach a solution, teachers consider how to explicitly draw connections between those strategies.

### **Discussions progress logically, following a plan that demonstrates deep content knowledge and emphasizes connections between strategies / approaches and connections between content topics.**

- Teachers know how each student attacked the problem and how successful he/she was (did the student start strong and go astray later? Did the student have logical thinking but computational errors? Did the student get the right answer by chance or by a clear and generally applicable strategy?). This is necessary for the teacher to make intentional choices about what work to show and who to call on or speak with throughout the discussion.
- The discussion is focused on students explaining their work. This does not mean that a student needs to explain every part of their work; most effective discussions will focus on one element of the problem or of a strategy at a time.
- Teachers are intentional in structuring their discussions and adjust their structure based on student work.

- It should be clear to students why a piece of student work was shown to the class and what everyone was expected to learn from this segment of the discussion.
- Connections between strategies are essential. Connections should help students move from more concrete or inefficient strategies to more sophisticated strategies.
- Connections between content topics must be made transparent. It is essential for students to know how a lesson connects to content taught before. Making connections transparent helps students see how they can use prior knowledge to attack new problems.

**Misconceptions are anticipated, addressed, and corrected.**

- Teachers need to know what misconceptions each student has. This enables teachers to ensure that each student has corrected his/her misconceptions.
- Common misconceptions are addressed whole class, usually during the discussion. Less common misconceptions can be addressed during independent problem solving or group work time.
- Most lessons will include practicing and solidifying understanding/content during the class time (in groups, with partners, or independently). The teacher should vary levels of support during this time to maximize student learning and clarify misconceptions as effectively and efficiently as possible.

**All students are engaged throughout the lesson; they are engaged in the work, engaged in learning from others, and engaged in monitoring, articulating, and refining their own thinking.**

- Engagement doesn't mean every hand is up but it does mean every student is tracking the conversation and able to contribute at any moment. Students should be participating meaningfully at many times throughout the lesson; this could be achieved through cold calling, partner or group talks, quick writes, or other means.

**By the end of the lesson, students are aware of what they should have mastered (what the point of the lesson was) and whether they mastered it; the teacher knows who did and who didn't master it. The teacher addresses the lingering misconceptions of students, either during class or at a later time.**

- At the end of effective lessons, everyone knows what the point of the lesson was. Lessons end with a summary; the teacher or a student should summarize what was learned from the lesson and reinforce connections between strategies and content.
- The teacher can assess mastery with exit tickets (on paper or on slates) or listening in or another method.
- Determining mastery is not achieved by assessing whether they can do the same problem again, but whether they can apply that knowledge to another (and significantly different) problem.