

Secondary Supplementary Intervention Mathematics Course

Teachers need to show students they believe in them, they need to give them opportunities to struggle and fail, they need to communicate that mistakes and struggle are good, and they need to stop deciding who can and who cannot do math.

-Jo Boaler

Introduction:

The secondary supplemental intervention mathematics course is designed to support students **during** the school day (for elective, not mathematics credit) who need additional instruction beyond their Core mathematics course. This course should be taught by a certified math teacher because it is intended to increase student understanding and achievement by increasing time and intensity on grade level core standards. Strategies that are used in the intervention course should be different than the strategies used in the core math course. It is inclusive of **all** student populations, including general education students, special education students, or English language learners. When done appropriately, this course will both build student confidence and reduce the likelihood of students repeating their core mathematics course.

Identifying students:

To determine which students would benefit from the intervention mathematics course, it is essential to look at several data points. Local education agencies (LEAs)/school site teams should establish guidelines that look at data trends, including state, district, and common formative assessments that monitor students progress over time, e.g., data trends over the past 3 years.

Data points may include:

- attendance
- overall GPA
- cumulative credits
- state, district, and school common formative assessments
- teacher recommendations
- performance in grade level core math class
- student interviews

Challenges:

- New student to LEA thus lack of data

References:

- Use diagnostic assessment such as ALEKS, Scholastic Mathematics Inventory (SMI), Think Through Math (TTM), Khan Academy

Course Guidelines:

Based on data and research from both local and national levels, the following guidelines have proven to be effective in an intervention mathematics course*:

- Collaboration
- Front loading
- Data driven instruction
- Standards based
- Effective class structure
- Positive classroom culture

*Specific examples for each guideline can be found in the appendix.

Collaboration

Consistent collaboration between core and intervention teachers is imperative for a successful intervention class. Common elements of Professional Learning Communities (PLC's) as described by DuFour include establishing common pacing, addressing standards and the big ideas, creating common assessments, and analyzing data. A brief description of the common elements are as follows:

- **Standards and Big Ideas:** Discuss intended learning outcomes of students as related to standards. Core and Intervention teachers should collaborate to unpack standards, build a progression, determine big ideas, discuss how to access background knowledge, and to identify appropriate interventions and activities.
- **Common Assessments:** Students having equal access to the curriculum occurs when all teachers work together to ensure student understanding of standards. Common assessments created by teachers promote effective practices, deepens understanding of standards, and reveals student learning. Common assessments may include, but are not limited to exit tickets, quizzes, class starters, etc.
- **Data:** Analysis of data assists teachers in improving instruction by sharing effective strategies. Sharing data over time allows for progress monitoring of student learning

and illuminates which standards may need re-teaching. Data is also used to determine when students are ready to exit the intervention course.

- **Pacing:** The intervention mathematics course is most effective when pacing is similar to the core course. Students in an intervention course may have different core teachers, thus common pacing among the core course and the intervention course is essential.
- **School Structure:** Core and intervention teachers should be allotted specific time for collaboration to support them in achieving the essential elements mentioned above.

Challenges:

- Teachers having too many preparations does not allow for effective collaboration. By reducing the numbers of preparations, teachers are able to focus time and effort on working collaboratively.
- Not having nor following a common pacing guide is a major obstacle. Establishing/following district/school pacing guides supports effective collaboration for all teachers.

References:

Briars, D. (n.d.). Common core mathematics in a PLC at work.

DuFour, R. (2010). *Learning by doing a handbook for professional learning communities at work* (2nd ed.). Bloomington, IN: Solution Tree Press.

www.allthingsplc.info

Data Driven Instruction

Data is an important piece for placing students in a mathematics intervention course and determining if the intervention is effective. Data also allows teachers to monitor student progress and to determine when a student may no longer need the math intervention.

Once initial placement has been made, some of the same data points can be use to track student progress and intervention effectiveness:

- state, district, and school common formative & summative assessments
- performance in grade level core math class
- data from math intervention software
- **Using formative & summative data to effectively collaborate:** The math site team (PLC) should collaborate regularly to create common assessments. These common assessments should be used to determine the mastery level of all students as well as those students targeted for intervention. The results of students targeted for

intervention should be compared to the overall class results. Core math teachers should gather formative and summative data in the core math class and then share that data with the math intervention teacher. A math intervention teacher may choose to repeat the summative assessments in the math class to assess progress.

- **Using formative assessment effectively throughout the intervention course:** In addition to the data from the core math course, the math intervention teacher will need to use continual formative assessments in the intervention course to check for understanding. A variety of quick, informal assessments should be used frequently and may include: exit tickets, white boards, response cards, clickers, fist to five, turn-to-your neighbor, paraphrasing, think-pair-share, graphic organizers, jigsaw, gallery walk, four corners, and bell work.
- **Using data to exit a student from the intervention course:** The core class teacher, as well as the intervention teacher, should collaborate to determine whether a student is ready to exit an intervention course. Typically this is done at quarter or semester breaks. One important question to keep in mind when trying to determine if a student is ready to exit the intervention course is, “Is the intervention course the reason the student is successful and can he/she be successful without the intervention course?” Student input is sometimes helpful when trying to determine the reason for success and whether a student is ready to exit the intervention course.
- **Using data to place students during the school year:** As openings in the intervention class occur, it is likely that the math site team will recommend other students to enter the intervention class. Teacher recommendations and common assessments are great ways to determine the students with the greatest need. This should be done as part of PLC time at quarter or semester breaks.

Challenges:

- Gathering too much data can be a hindrance to using data to drive instruction. Deeply analyze data from a few key assessments rather than trying to analyze every piece of data collected.
- Not having common assessments and a common pacing guide can prevent the intervention teacher from gathering timely and accurate data. Creating and using common assessments is strongly encouraged among core math teachers.

References:

Bambrick-Santoyo, P. *Driven by Data*

Bambrick-Santoyo, P. *Leverage Leadership*

Standards Based

This course is intended to increase student understanding and achievement by increasing time and intensity on grade level core standards. This course may include time to front load (pre-teach) on grade level material before students learn the curriculum in the regular math class. Re-teaching (spiral) grade level curriculum using different teaching strategies should also be present. Both of these approaches can be blended into a class period and should include daily goals that are in the grade level core standards. There may be opportunities to design mini-lessons for prerequisite skills. These prerequisite skills should be directly related to the grade level core standard.

It is important to go beyond Depth of Knowledge (DOK) 1 questioning in the math intervention course. Students should be exposed to all levels of DOK in this course. Task based learning allows students to reach higher levels of DOK.

References:

Hess DOK cognitive rigor matrix

Front Loading

Another key structure/element, to the mathematics intervention course is front loading also known as pre-teaching.

Front loading helps students connect background knowledge to new learning and gives struggling learners a head start. Research indicates that students who receive front loading of core concepts and skills master the skills in significantly less time than students who receive the instruction for the first time. (<http://nycdoeit.airws.org/pdf/Preteaching.pdf>)

Front loading math concepts in an intervention mathematics course setting can provide struggling students the benefit of additional time actively engaged with concepts and build their confidence to participate in the core mathematics class.

Front loading instruction should be explicit and systematic. It is recommended that this instruction include:

- modeling of effective problem-solving

- a variety of teaching strategies including:
 - manipulatives and visual representations to connect concrete examples to abstract concepts (CRA)
 - verbalization of thought processes
 - guided practice with corrective feedback
- the use of appropriate grade level math technology software to build grade level fluency and efficiency (no more than 25% of class time)
- using multiple representations to make connections
- using a literacy strategy to introduce vocabulary

Reference:

- IES Practice Guide: What Works Clearinghouse: assisting students struggling with mathematics

Challenges:

- If effective collaboration is not present among teachers, the math intervention teacher will find it challenging to find common topics for front loading students. In this situation, the math intervention teacher will want to focus on predetermined important concepts rather than specific topics. Quarterly assessments in core math classes can help the math intervention teacher identify these important concepts.

Effective Class Structure

To ensure the math intervention time is used effectively, a structured protocol based on student needs should be put in place by each LEA. This protocol should be based upon characteristics of effective intervention programs:

- Small class size (less than 20): because this is a targeted math intervention class, it should be for a small percentage of students who need additional math instruction in conjunction with the core mathematics class.
- Grade-level: in order for effective frontloading to occur, the intervention course must contain students on the same grade-level.
- Consistency: Institute of Education Sciences (IES) What Works Clearinghouse recommends that interventions are provided for 40 minutes, 4 to 5 times each week, during the school day. Interventions provided through a “homeroom” period that meets for only 10 - 15 minutes do not meet long enough in order for the intervention to be effective.
- Goal setting: student should set realistic goals and progress monitor themselves. These goals should lead them to exiting the intervention course.
- Groupings: a variety of grouping strategies should be used in order to provide multiple learning opportunities for students. This includes individual, small group, and whole group instruction.
- Targeted group instruction: during class time, the intervention teacher should pull small groups of students to work on targeted mathematical proficiencies.

References:

IES, What Works Clearinghouse: Assisting Students Struggling with Mathematics

Effect of Group Size on Students Mathematics Achievement in Small Group Settings
Justice Enu¹ Lydia Asominiwa² Philomina Obeng³ et al.

Hattie, j (2009), Visible Learning: A synthesis of over 800 meta-analyses relating to achievement

*A list of protocols in use by different schools can be found in the Appendix.

Positive Classroom Culture

Intervention class environments should have the following characteristics in order to make them productive complements to core classes:

- Growth Mindset (teacher): *“Teachers need to show students they believe in them, they need to give them opportunities to struggle and fail, they need to communicate that mistakes and struggle are good, and they need to stop deciding who can and who cannot do math.” Jo Boaler*
- Growth Mindset (student): build student confidence, provide opportunities for students to engage in productive struggle, provide opportunities for students to use the standards for mathematical practice, promote discourse to explain reasoning, and encourage students. Students should know “no one is born knowing math, and no one is born lacking the ability to learn math.” Jo Boaler
- Positive: Students in intervention classes benefit from a positive, non-threatening classroom environment. Mistakes should be encouraged and treated as a learning opportunity.
- Technology: Use of technology is a way to provide differentiated support for different student populations or to illustrate/explore mathematics and should only be used when it enhances learning, not for the sake of using technology.
- Variety of Approaches: Intervention classes should be taught using a variety of different instructional approaches to support different learners.
- Rigor: Intervention classes should be based around grade level content as well as the supporting content that allows students to grasp the core content. The mathematical practices should be taught both explicitly and implicitly. (USCC)

Challenges:

- Many students have not been engaged in classrooms arranged like this in the past and may be initially hesitant to this approach. Teachers must embrace these changes in order for students to be comfortable with them.
- This requires a shift in thinking for some instructors. This shift is time-intensive and requires perseverance.

References:

Dweck, Carol *Mindset*

Boaler, Jo *Mathematical Mindsets*

Leinwand, Steve *Principles to Actions*

Smith, Margaret *5 Practices for Orchestrating Productive Mathematics Discussions*

Formative Assessments:

- exit tickets: A short activity/task that is done at the end of a class period. It is usually done on small pieces of paper or index cards and handed to the teacher as students exit the class much like a movie theater ticket. It could be a writing assignment to summarize learning for the day, a short quiz, or a background check for tomorrow's lesson.
 - Resources
 - <https://www.nwea.org/blog/2012/classroom-techniques-formative-assessment-idea-number-two/>
 - <http://teachlikeachampionjordan.weebly.com/exit-ticket.html>
 - <http://www.brown.edu/about/administration/sheridan-center/teaching-learning/effective-classroom-practices/entrance-exit-tickets/sample>
 - <http://www.edutopia.org/blog/formative-assessment-exit-slip-rebecca-alber>
- white boards: Teachers pose questions or tasks and then ask students to provide answers on white boards. Students reveal their answers simultaneously. This quickly helps teachers to see which students are on the right track and which students may still be struggling with a concept. The differences in answers can be used to launch a discussion about the problem or task which will deepen the understanding of all students.
 - Resources:
 - <http://lizslessons.blogspot.com/2012/06/8-great-ways-to-use-white-boards-in.html>
 - <https://www.nwea.org/blog/2012/classroom-techniques-formative-assessment-idea-number-three/>
 - <https://www.teachingchannel.org/questions/131>
- response cards: They are similar to whiteboards, but are typically used to communicate a student's level of understanding. It can be done in several ways: index cards with "yes" on one side and "no" on the other side, colored index cards with red representing "I don't understand," yellow representing "not sure," and green representing "I understand," etc.

- clickers: You can purchase clickers or you can utilize free software that allows students to use their own device (cell phone, tablet, or computer). Teachers can immediately see which students answered correctly and incorrectly. Results can be displayed for the whole class in real time.
 - Resources
 - <http://socrative.com/>
 - <https://getkahoot.com/>
 - <https://www.polleverywhere.com/classroom-response-system>
- fist to five: Students can use a scale of 0 (fist) to 5 (all 5 fingers) to indicate their level of agreement, readiness for tasks, or comfort with a concept or skill they are learning. Teachers should specify what each level represents to meet their specific needs in the classroom. An example would be: 0= not ready, 1-2=struggling, 3=on my way, 4=ready to go, 5=ready to go and highly motivated.
- turn-to-your neighbor: After students have been asked to work on a problem or task individually, they can turn to their neighbor and compare answers or ideas. Teachers usually ask students to explain their thinking and come to an agreement with their neighbor if there is a discrepancy in answers or ideas.
- paraphrasing: Having students use their own words to describe what they learned or heard during a lesson.
- think-pair-share: Assigning students a task to complete individually for a few minutes. After some time, allowing students to work with a partner to compare similarities and differences in their process and answers. Then having students share with the entire class how they approached the task.
 - Resources
 - <http://serc.carleton.edu/introgeo/interactive/tpshare.html>
 - <http://www.colorincolorado.org/article/increase-student-interaction-think-pair-shares-and-circle-chats>
 - <https://www.teachingchannel.org/videos/think-pair-share-lesson-idea>
 - <http://www.wcer.wisc.edu/archive/cl1/CL/doingcl/thinkps.htm>
 - <http://www.theteachertoolkit.com/index.php/tool/think-pair-share>
- graphic organizers: A way for students to organize information in a visual representation.
 - Resources
 - <https://www.eduplace.com/graphicorganizer/>
 - <https://www.teachervision.com/graphic-organizers/printable/6293.html>

- <http://eduscapes.com/tap/topic73.htm>
- **jigsaw:** Students are assigned to two different groups. The first group is their “expert” group. In this group they will become an expert at a skill, a concept, or a reading passage. Once students have become experts, they move into their second group where each member has become an expert in a different skill or concept. The team members share their expertise with each other.
 - Resources
 - <https://www.teachingchannel.org/videos/middle-school-lesson-idea>
 - <http://info.marygrove.edu/MATblog/bid/81941/Three-Cooperative-Learning-Strategies-in-Middle-School-Math>
 - <http://www.theteachertoolkit.com/index.php/tool/jigsaw>
 - <http://edtech2.boisestate.edu/tracismith/502/Jigsaw.html>
- **gallery walk:** In small groups, students create a poster or chart to demonstrate their knowledge about a concept. When the groups are done they hang the posters or charts on the walls and the class walks around looking at all of the different posters or charts. You can run this like a jigsaw activity and have one student from each poster group form a group and as they walk around looking at the posters, the student who helped create the poster can explain it.
 - Resources:
 - <http://www.theteachertoolkit.com/index.php/tool/gallery-walk>
 - <http://illuminations.nctm.org/Lesson.aspx?id=1475>
 - <http://www.sfusdmath.org/gallery-walk.html>
 -
- **four corners:** Teachers pose a question to students and then have them stand in one corner of the room based on their answer. While students are in their designated corners they can discuss why they chose the answer they did and then share that thinking with the rest of the class.
 - Resources
 - <https://wvde.state.wv.us/teach21/FourCorners.html>
 - <http://www.gottoteach.com/2014/08/four-corners-cooperative-learning.html>
 - <https://www.teachingchannel.org/blog/2015/03/04/formative-assessment-resources>
- **bell work:** A short task given to students to work on as they enter the classroom. It could be a short quiz, a writing assignment, or a couple of problems to see if they have

sufficient background knowledge or have mastered the previous day's concept. Once students have completed the task, the teacher and students should discuss it.