VDOE Region 4 Training and Technical Assistance Center at George Mason University banner, https://ttac.gmu.edu/
**SDI Spotlight – Mathematics: Integer Operations**

**SDI Spotlight Purpose:** This spotlight was based on practices identified in VDOE’s [Evidence Based Specially Designed Instruction in Mathematics](https://vdoe.prod.govaccess.org/home/showdocument?id=3206), and focuses on specific strategies for whole number operations using the Concrete-Representational-Abstract (CRA) method, an evidence-based practice. Brief videos demonstrating how to teach whole number operations with CRA and lesson plans when available are shared.

**Considerations:** Dr. Sarah Powell, Assistant Professor discusses important considerations when teaching students with difficulties in mathematics (8:22 mins): [Considerations for teaching students with math difficulties video](https://youtu.be/dQX9Cl0s04I). To better understand the needs of students with mathematics disabilities, read: [VDOE Students with Disabilities in Mathematics Frequently Asked Questions](https://vdoe.prod.govaccess.org/home/showdocument?id=3204).

**Explicit Instruction (HLP 16):** Explicit instruction forms the foundation for delivering specially designed instruction. CEC created a checklist that walks teachers through phases of explicit instruction: [CEC HLP 16 Checklist](https://ttaconline.org/Resource/JWHaEa5BS74Th4roZsxqhg/Resource-hlp-16-checklist-explicit-instruction-high-leverage-practices-implementation-guide).

**Proper Mathematics Vocabulary:** It’s essential to use and encourage student dialogue with proper mathematical vocabulary. VDOE identified important mathematics vocabulary: [VDOE Word Wall Cards](https://www.doe.virginia.gov/teaching-learning-assessment/k-12-standards-instruction/mathematics/instructional-resources/mathematics-vocabulary-word-wall-cards). Scaffolds like [Frayer Models](https://iris.peabody.vanderbilt.edu/module/sec-rdng/cresource/q2/p07/) enhance students’ understanding of mathematics vocabulary. For students with decoding difficulties, decoding strategies and syllabication can integrate with vocabulary word instruction. This [video from Anita Archer](https://explicitinstruction.org/video-elementary/elementary-video-4/) demonstrates how to introduce new vocabulary words with decoding strategies.

**Progress Monitoring:** Monitoring student progress is an essential component of instruction. When students are not making meaningful progress, we gather data to analyze instructional practices and make necessary adjustments to improve student outcomes. Progress Monitoring Tools:

* National Center on Intensive Interventions [Student Progress Monitoring Tool for Data Collection and Graphing](https://intensiveintervention.org/resource/student-progress-monitoring-tool-data-collection-and-graphing-excel)
* Adapted Virginia Tech TTAC [CRA Mathematics Progress Monitoring Data Collection Form](https://gmuedu-my.sharepoint.com/:w:/g/personal/cmarti82_gmu_edu/Ecxfdxr7JUFAgaMk15BTo4IBoD5XLkj3WTuT-mqVf49xWA?e=LdjcXt)

**Learn:** How to interpret progress monitoring data: [Project Stair (4:29 mins.)](https://www.youtube.com/watch?v=O3IPT5fX6YY) and how to use error analysis in mathematics [IRIS Center (2015) Page 7 Error Analysis for Mathematics](https://iris.peabody.vanderbilt.edu/module/dbi2/cresource/q2/p07/).

## Integers & Integer Operations

Number lines help students conceptually understand integers. Below are several recommendations:

* Use a number line with positive numbers in one color, zero, and negative numbers in another color to help students visualize the number line and differentiate negative and positive numbers.
* Relate integers to real life applications (money, bank accounts).
* Give students their own number lines.
* Provide lots of practice.
  + Include the "Integer Number Line" as part of daily warm up until students have mastered integer operation skills.
* Use **brackets** around negative numbers when they are first introduced *example:* **(-5)**

### Adding and Subtracting Integers

Adding and Subtracting Integers are explained with:

* Number line
* Two Color Counters (the red and yellow counter dots) with concrete manipulatives

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| **Integers** | **Concept Explained - Concrete** | **Virtual Options** |
| Adding Integers | Project Stair [Number Line Video](https://youtu.be/eFrsMzyPI3w)  Project Stair [Two Color Counter](https://youtu.be/Wd0K_Kf-vS8) Video  Project Stair [Integer Mat Video](https://youtu.be/Qi1_UZz2O2g) with Concrete Manipulatives | Project Stair [Virtual Number Line Video](https://youtu.be/ZYuzQ3IOdYs)    Project Stair [Two Color Counter Virtual Manipulatives Video](https://youtu.be/NBkRCT1V-AY)  Project Stair [Integer Mat Video](https://youtu.be/KMEU9VMPfuc) with Virtual Manipulatives |
| Subtracting Integers | Project [Stair Number Line Video](https://youtu.be/ypHgqFte_q4)  Project Stair [Two Color Counters Video](https://youtu.be/wB38IYmhgso) Concrete Manipulatives  Project Stair [Integer Mat Subtraction Video](https://youtu.be/44h8RH6BxN4) | Project Stair [Two Color Counters](https://youtu.be/41QKZ5iWRFQ) Video Virtual Manipulatives  Project Stair [Integer Mat Subtraction Video](https://youtu.be/KIwJ9oS56KU) |

### Multiplying and Dividing Integers

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| **Integers** | **Concept Explained - Concrete** | **Virtual Options** |
| Multiplying Integers | Algeblocks are concrete manipulatives that help students understand algebraic concepts. | Project Stair [Multiply Integers with Algeblocks](https://youtu.be/iXBt10v0RDQ) |
| Dividing Integers | Algeblocks are concrete manipulatives that help students understand algebraic concepts. | Project Stair [Divide Integers with Algeblocks](https://youtu.be/vnBSongicQ4) |
| Order of Operations | The following videos demonstrate how to use mnemonics to help students remember the Order of Operations, | Cognitive Strategy Instruction: Mnemonics: PEMDAS & GERMDAS  Khan Academy – [Order of Operations Video](https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-arithmetic-operations/cc-6th-order-of-operations/v/introduction-to-order-of-operations)  MathAntics [Order of Operations Video](https://youtu.be/dAgfnK528RA) |

#### Additional Resources

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| [Intensive Interventions and Lesson Plans](https://intensiveintervention.org/implementation-intervention/math-lessons)The National Center on Intensive Intervention identified several strategies and interventions that enhance the skills of students with math difficulties in number system and counting, place value computation, basic facts, fractions as numbers, place value concepts, and computation of fractions.  The IRIS Center. (2017). High-quality mathematics instruction: What teachers should know. Retrieved from <https://iris.peabody.vanderbilt.edu/module/math/>  [Learning Mathematics through Representations](https://sites.google.com/view/lmrberkeleyedu)  “Learning Mathematics through Representations (LMR) is a research-based curriculum unit for the teaching and learning of integers and fractions in the elementary grades (26 lessons).  **Henrico County, VA** [Mathematics Courses – Activities and links that are aligned to grade level SOL](https://sites.google.com/henrico.k12.va.us/hcpsmathematics/courses?authuser=0)  **University of Texas**  Researchers at the University of Texascreated Instructional Routines for Mathematics Intervention documents that have pre-created resources and materials for mathematics for 23 interventions, which focus on different mathematical content. Each of the 23 interventions include vocabulary cards and problem sets to use during instruction. The interventions all require explicit instruction. Though the interventions align with standards from the Texas Essential Knowledge and Skills (TEKS), the resources and materials apply to teaching mathematics skills identified in the Virginia Standards of Learning.   * [Instructional Routines for Mathematics Intervention User Guide (31 pages)](https://4.files.edl.io/4749/04/23/21/225643-19d9c345-7899-42c2-a04a-85319467e96e.pdf) * [All of the Instructional Routines Files (2951 pages)](https://4.files.edl.io/797d/04/23/21/225638-0e72f842-7c82-4a19-be6c-28551e785665.pdf) * [Texas Instructional Routines for Mathematics Interventions Modules](https://www.inclusionintexas.org/apps/pages/index.jsp?uREC_ID=2155039&type=d&pREC_ID=2169859) |

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#### References

The IRIS Center. (2015). Intensive intervention (part 2): Collecting and analyzing data for data-based individualization. Retrieved from <https://iris.peabody.vanderbilt.edu/module/dbi2/>

The IRIS Center. (2017). High-quality mathematics instruction: What teachers should know. Retrieved from <https://iris.peabody.vanderbilt.edu/module/math/>