National Center on
INTENSIVE INTERVENTION
at American Institutes for Research ■

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U.S. Office of Special Education Programs

Intervention Taxonomy Brief: ROOTS Whole Number Foundations Level K

The goal of this brief is to provide educators with information they can use to evaluate the appropriateness of **ROOTS Whole Number Foundations Level K (WNFK)** for a specific student or group of students who require supplemental and intensive intervention. The brief also may be used to guide decisions about the selection or purchase of a new intervention. We envision that the brief may allow users to examine the extent to which the program aligns to the Taxonomy of Intervention Intensity, a framework used by educators to categorize interventions along key dimensions. The information included in this brief is organized along the seven dimensions of the Taxonomy of Intervention Intensity and can assist educators in answering the following questions:

- Does evidence suggest that this intervention is expected to lead to improved outcomes in the identified area of need (**strength**)?

- Will the group size, duration, structure, and frequency provide sufficient opportunities for students to respond and receive corrective feedback (**dosage**)?

- Does the intervention match the student's identified needs (**alignment**)?

- Does the intervention assist the student in generalizing target skills to general education or other tasks (**attention to transfer**)?

- Does the intervention include elements of explicit instruction (**comprehensiveness**)?

- Does the student have opportunities to develop the behavior skills necessary to be successful (**behavioral support**)?

- Can the intervention be individualized with a data-based process to meet student needs (**individualization**)?

To learn more about the Taxonomy of Intervention Intensity and find resources to support implementation, visit https://intensiveintervention.org/taxonomy-intervention-intensity.

Program Summary

ROOTS WNFK is a 50-lesson Kindergarten intervention program designed to develop procedural fluency with and conceptual understanding of whole number concepts. ROOTS WNFK is delivered by instructional assistants to small groups consisting of 4-5 students, 4 to 5 times per week, for 10-12 weeks during the second half of the school year. Each ROOTS WNFK lesson is approximately 20 minutes in duration and includes 4 to 5 brief math activities that center on whole number concepts and skills. ROOTS WNFK provides in-depth instruction in whole number concepts by linking the informal mathematics developed prior to kindergarten to the formal mathematics of kindergarten. Specifically, ROOTS WNFK focuses on three key areas of whole number understanding (a) Counting and Cardinality (b) Number Operations and (c) Base 10/Place Value.

Table 1. Program Information

Features of program implementation	Program recommendations
Grade level(s)	K
Group size	2–5 students
Intervention length	50 lessons
Frequency	Once per day
Session duration	20 minutes
Cost	$10–$399
Training	Two 4–6 hour training sessions (for Books 1 and 2)

Evidence of Taxonomy of Intervention Intensity Dimensions

The following section presents definitions for the Taxonomy of Intervention Intensity dimensions and a summary of intervention-specific evidence for each dimension. The evidence comes from the intervention's vendor or developer. It is accurate as reported to the National Center on Intensive Intervention (NCII); it was not independently verified by NCII. Additional program evidence can be found on the NCII Tools Chart and might appear on the What Works Clearinghouse. For specific questions about the content, contact the publisher at ctl@uoregon.edu.

Taxonomy Dimension: Strength

Strength tells us how well the program works for students with intensive intervention needs, expressed in terms of effect sizes. Effect sizes greater than 0.25 indicate an intervention has value in improving outcomes. Effect sizes of 0.35 to 0.40 are moderate; effect sizes of 0.50 or larger are strong (preferred).

Exhibit 2 provides the effect sizes for students in need of intensive intervention organized by domain and subdomain. These effect size data are calculated on low-achieving participants, those falling at or below the 20th percentile on pretest measures of achievement. If available, additional effect sizes for disaggregated data can be found on the NCII Tools Chart.

Exhibit 2. ROOTS WNFK Effect Sizes for Students ≤20th Percentile by Domain and Subdomain

Domain	Subdomain	Outcome measures	Effect size[a]
Mathematics	▪ Early Numeracy ▪ Math Concepts	Oral Counting	0.1
Mathematics	▪ Early Numeracy ▪ Math Concepts	Assessing Student Proficiency in Early Number Sense (ASPENS)	0.49[*]
Mathematics	▪ Early Numeracy ▪ Math Concepts ▪ Math Computation	RAENS	0.91[*]
Mathematics	▪ Early Numeracy ▪ Math Concepts ▪ Math Computation	Number Sense Brief	0.49[*]

Mathematics	▪ Early Numeracy ▪ Math Concepts ▪ Math Computation	TEMA	0.42[*]
Mathematics	▪ Early Numeracy ▪ Math Concepts ▪ Math Computation	SESAT	Unavailable

[a] To ensure comparability of effect size across studies, NCII uses a standard formula to calculate effect sizes across all studies and outcome measures—Hedges g, corrected for small-sample bias.

[*]$p \leq .05$.

Taxonomy Dimension: Dosage

Dosage is the number of opportunities a student has to respond or practice and receive corrective feedback. Dosage may be impacted by the size of the instructional group, the number of minutes each session lasts, the number of student-teacher interactions built into lessons, and the number of sessions provided per week.

Assuming a group size of two students, each student in the group has an estimated 58 opportunities to respond and receive corrective feedback.

Assuming a group size of five students, each student in the group has an estimated 49 opportunities to respond and receive corrective feedback.

Taxonomy Dimension: Alignment

Alignment (Exhibit 3) focuses on how well the program (a) addresses the target student's full set of academic skill deficits, (b) does not address skills the target student has already mastered (extraneous skills for that student), and (c) incorporates a meaningful focus on grade appropriate curricular standards.

Exhibit 3. Alignment With Content Areas Addressed

Instructional grade level(s)	Content area addressed	Skill strands
Kindergarten	Mathematics	Counting and Cardinality ▪ Know number names and the count sequence. ▪ Count to tell the number of objects. ▪ Compare numbers.
Kindergarten	Mathematics	Operations and Algebraic Thinking: Understand addition and putting together and adding to and understand subtraction as taking apart and taking from.
Kindergarten	Mathematics	Number and Operations in Base 10: Work with numbers 11–19 to gain foundations for place value.

Taxonomy Dimension: Teaching to Promote Transfer

Attention to transfer is the extent to which an intervention is designed to help students (a) transfer the skills they learn to other formats and contexts and (b) realize connections between mastered and related skills.

For Composing and Decomposing Teen Numbers, three activities designed to explicitly teach for transfer are (a) using multiple mathematical models to represent teen numbers, (b) working with place value across contexts, and (c) systematic and cumulative review of previously introduced teen numbers.

Activity 1: Using Multiple Mathematical Models to Represent Teen Numbers. To develop place value understanding of teen numbers, students work with multiple mathematical models, including concrete, pictorial, and abstract models. These representations promote transfer by providing multiple representations that illustrate how teen numbers are composed of one 10 and some number of 1s.

Activity 2: Working with Place Value Across Contexts (Exhibit 4). Students practice sequencing teen number cards, identifying teen numerals, rational counting objects greater than 10, and writing teen numbers. These activities promote transfer by providing students with place value practice across various contexts.

Activity 3: Systematic and Cumulative Review of Previously Introduced Teen Numbers. After learning the name of a teen number, students review it in the daily Math Practice (Exhibit 5) wrap-up and daily lesson warm-up in the following lesson. These activities promote transfer by incorporating systematic practice and review throughout the lesson with multiple types of problems related to place value understanding.

Exhibit 4. Place Value Example

- As you lay cubes down 1 at a time in the ones column, the children should count. ("1, 2, 3, 4, 5, 6, 7, 8, 9...") As you lay down the 10th cube, the children should say, ("Ten-stick.")
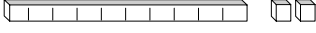
  ◦ "Right. We can trade the 10 _cubes_ in for a _ten-stick_."
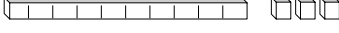- Remove the individual cubes, substituting them for a ten-stick in the tens column.

  ◦ "Right now, we have 1 group of 10 and zero _more_."
  ◦ "I still have 4 more _cubes_."
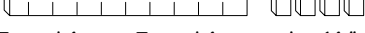- Put down a cube in the ones column.

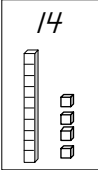 ◦ "That makes 11."
- Put down another cube.

  ◦ "That makes 12."
- Put down another cube.

  ◦ "That makes 13."
- Put down the last cube.

  ◦ "That makes 14. Ten and 4 _more_. Ten and 4 _more_ makes 14."
- Show the numeral 14 card.

  ◦ "That's what the numeral 14 means. It means that we have 10 and 4 _more_."

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Taxonomy Dimension: Comprehensiveness

Comprehensiveness is the number of explicit instruction principles the intervention incorporates (e.g., providing explanations in simple, direct language; modeling efficient solution strategies instead of expecting students to discover strategies on their own; providing practice so that students use the strategies to generate many correct responses; and incorporating systematic cumulative review). Additional information can be found within the NCII Explicit Instruction course content materials.

Dimension: Prime Relevant Background Knowledge

Activity 1. ROOTS is systematically designed and structured so that instruction begins with the numerals 1, 2, and 3. Students receive teacher-guided practice opportunities to represent these numerals with objects, identify numerals, and rote and rational counting, prior to moving on to more challenging content

Exhibit 5. Math Practice Example 1

Math Practice 39

Name and trace each numeral below. Use the ten-stick and cube to describe each number.

Activity 2. Mathematics vocabulary is explicitly defined and reviewed within and across lessons. For example, students learn the name of representational tools (e.g., tally marks, number line, ten-stick, ten-frame), shapes and their characteristics (e.g., how a triangle is different from a rectangle), and ways of describing number relations and operations (e.g., greater than, less than, equal, add).
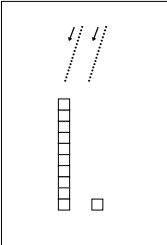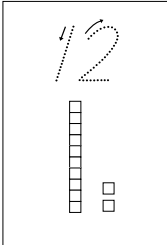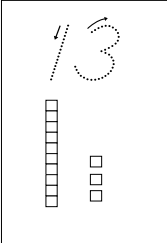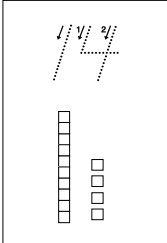
Dimension: Strategic Integration of Content in Ways That Connect New and Existing Knowledge

Activity 1. All opening routines include a counting activity that has students count to the current lesson number (e.g., counting 12 spaces for Lesson 12), using the "Nifty Fifty" number chart. In these routines, students also receive practice opportunities identifying numerals on flashcards, with counting starting with a number other than 1, counting objects, comparing quantities to determine which is more/less, and comparing number cards to determine which number is greater than/less than.

Activity 2. The daily Math Practice (Exhibit 6) wrap-up activities include additional independent practice opportunities for students to extend what they learned in the current lesson or in previous lessons. For example, students build fluency identifying numerals by engaging in a "race around the track" where students choose a space on a number racetrack and say each numeral around the track as fast as they can.

Exhibit 6. Math Practice Example 2

Math Practice 11

Race around the track: Choose one of the spaces to start and say each numeral around the track as fast as you can.

2	5	4	1	3	5
4					3
5					2
3					1
4					4
1	5	2	5	3	2

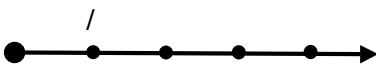**Dimension: Conspicuous Strategies That Make Steps of Learning Explicit**

Activity 1. Students help the teacher label a number line with numerals 1–4. The teacher scripting, which contains consistent and direct language, prompts students to label each subsequent dot on the number line (Exhibit 7).

Activity 2. To teach adding 1 to a number and patterns within the number list (Exhibit 8), the teacher scripting provides consistent language to instruct students to add 1 more teddy bear counter to the group. With each subsequent number, the teacher scripting provides clear and consistent summaries of each step (e.g., "1 plus 1 more equals 2"; "2 plus 1 more equals 3").
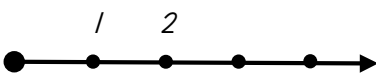
Exhibit 7. Number Line Counting Example

- o "We start on the big dot. What numeral goes on the _first_ smaller dot?" ("One.") "Yes, one."
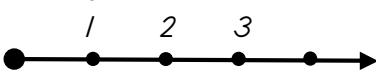- Place 1 on the first smaller dot.
- Continue with the next numeral.
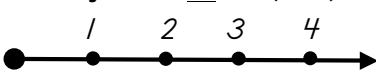   - o "What numeral goes on the _next_ dot?" ("Two.")
- Add numeral 2 to the number line. Continue with the next numeral.
    - o "What numeral goes on the _next_ dot?" ("Three.")
- Add numeral 3 to the number line. Continue with the next numeral.
    - o "What numeral goes on the _last_ dot?" ("Four.")
- Add numeral 4 to the number line.
    - o "Let's check to see if we put the numerals in the right place. Say the numerals when I touch them."

Exhibit 8. Numbers and Patterns Example

- o "How many teddy bears are lined up on your desk?" ("One.") "Yes, one."
- o "Now, you're going to _add_ or _plus_ 1 _more_. Do it. Put 1 _more_ teddy bear on your desk." Check.

- o "Everybody, how many teddy bears are lined up on your desk now?" ("Two.")
- o "Yes, there are 2 teddy bears lined up on your desk. 1 _plus_ 1 _more_ _equals_ 2."
- o "Now, we're going to _add_ or _plus_ 1 more. Do it. Put 1 more teddy bear in the line." Check.

- o "Everybody, how many teddy bears are lined up on your desk now?" ("3.")
- o "Yes, there are 3 teddy bears lined up on your desk. 2 _plus_ 1 _more_ _equals_ 3."
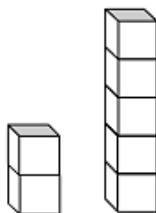
Dimension: Mediated Scaffolding
Activity 1. To help students transition from comparing different quantities to comparing numerals, students first work with concrete models (e.g., a tower of two and a tower of five) and identify the tower that has more or is bigger. Then students are asked which number is more or bigger (e.g., "Which number is more or bigger, 2 or 5?") using the same examples (Exhibit 9).

Exhibit 9. Counting Example

Teacher Note: This activity is designed to help the children transition from comparing objects (linking cube towers) to comparing numerals and determining which is bigger or more. Have the children answer with the numeral rather than point to the tower, but they can use the tower for reference.

- Have the children select the tower of 2 and the tower of 5 and place them in front of themselves.

  o "Touch the tower that has *more* or is *bigger*." Confirm or correct.
  o "Which number is *more* or *bigger*, 2 or 5?" ("Five.") "Yes, 5 is *more* or *bigger* than 2."

- Provide individual turns on the preceding 2 steps. Then have the children set the 2 towers aside.
- Repeat by having the children select the tower of 1 and the tower of 4.

Activity 2. Teachers lead students to practice counting along the number line to 5. The teacher provides a model (e.g., "My turn, I'll start at the big dot and say the name of each numeral as I loop under it"), then students join the teacher (e.g., "Do it with me, count to 5 as I loop under each numeral"). Lastly, the students count independently as the teacher signals the group by looping under each numeral.

Dimension: Judicious Review
Activity 1. In all daily opening routines, students practice identifying previously learned numerals on flashcards.

Activity 2. Students practice representing teen numbers that are introduced systematically across the Math Practice wrap-up activities. For example, using base 10 blocks, students practice representing the numerals 11 and 12 in Lesson 33; Lesson 36 reviews 12 and introduces 13; Lesson 38 reviews 13 and introduces 14 (Exhibit 10).

Exhibit 10. Math Practice Example 3

Math Practice 33

Place 11 cubes in the space below. Trade in 10 cubes for a ten-stick to show that 11 is ten and 1 more. Pick up the ten-stick and cube and your teacher will draw them in the box.

Place 12 cubes in the space below. Trade in 10 cubes for a ten-stick to show that 12 is ten and 2 more. Pick up the ten-stick and cubes and your teacher will draw them in the box.

//   *12*

Taxonomy Dimension: Behavioral Support
Behavioral support addresses the extent to which the program incorporates (a) self-regulation and executive function components and (b) behavioral principles to minimize undesired behavior. Additional information can be found within the [NCII behavioral support course content](#).

Activity 1. The ROOTS Teacher's Guide provides guidelines for teaching group expectations (Exhibit 11) and reinforcing students for following them. For example, group expectations are to be reviewed quickly at the beginning of each lesson until students have a firm understanding of them and reviewed when introducing new routines, such as using new mathematics manipulatives.

Activity 2. In the Teacher's Guide, teachers are encouraged to provide specific praise to students when they are following the group expectations. Praise statements should be specific to student behaviors (e.g., "Great job following my directions right away") and should be aligned with the expectations for the group.

Exhibit 11. Group Expectations

Group Expectations
Be Safe
Keep hands, feet, and objects to self.
Be Respectful
Sit in "Get Ready" position.
Eyes on teacher.
Hands on table.
Four on the floor.
Be Responsible
Follow teacher directions the first time.
Do your best work.

Activity 3. Teachers are provided with guidelines for effectively using clear signals to elicit "choral" group responses to ensure that all students are engaged, on task, and have an opportunity to learn. For example, the Teacher's Guide includes a diagram with the five steps of an effective signal (Exhibit 12), including Focus (e.g., a question or task), Think Time, Cue (e.g., "Get ready"), Interval, and the Signal (e.g., snap or clap).

Activity 4. The Teacher's Guide includes suggestions for pacing. This includes how to adjust pacing based on required student think time and how to keep a lively pace to ensure that students are academically engaged and have frequent opportunities to respond.

Activity 5. Throughout lessons, specific confirmatory academic feedback is written into the teacher script. For example, following a correct student response, the teacher script includes a statement such as "Yes, two"; "Right, we have four tally marks"; "That's right, three!"; "Yes, your train has *more* cubes than mine."

Exhibit 12. Effective Signals
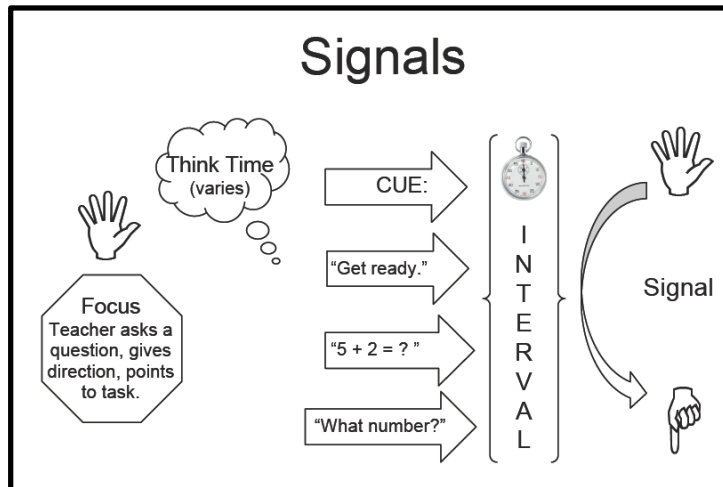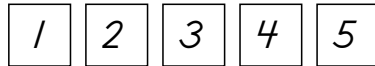
Activity 6. The Teacher's Guide provides general recommendations for correcting common errors made by students as well as ones that involve more complex student mistakes. For example, if a student makes an error when ordering a set of numeral cards (Exhibit 13), the teacher would then model a counting strategy to help the student correctly order the numeral cards.

Exhibit 13. Error Correction

> - Give each child a set of numeral cards 1-5. Tell children that they will arrange their cards in order from 1-5.
>
>   - **"I'm giving each of you a set of numeral cards 1-5 to put in order just like the number line."**
>
> - Be sure the children start at the left with numeral 1. If children start at the right, show them where to begin. You may wish to place a small circle at the left to prompt the children.
>
> > Teacher Note: If an error occurs, for example a child places numeral 5 immediately after numeral 2, correct with a counting strategy. Say, **"Listen to me count. One. Two. What comes next? Three. Your turn. One. Two. What comes next?"** ("Three.") **"Yes, three comes next. Fix your number line so numeral 3 comes after numeral 2."**
>
> $$1 \quad 2 \quad 3 \quad 4 \quad 5$$

Additional Information About ROOTS WNFK

ROOTS WNFK includes progress monitoring assessments embedded within the curriculum. These are brief, untimed assessments that include skills that students have recently learned in the program. These are designed for use by teachers to assess what students have learned and areas where students might need additional practice. They also can be used to help teachers determine where students should be placed in the program.