THE EDUCATION FUND
FOR EXCELLENCE IN MIAMI-DADE PUBLIC SCHOOLS

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Ideas with IMPACT

ROBOTICS

Indi on the Move: Learning by Coding

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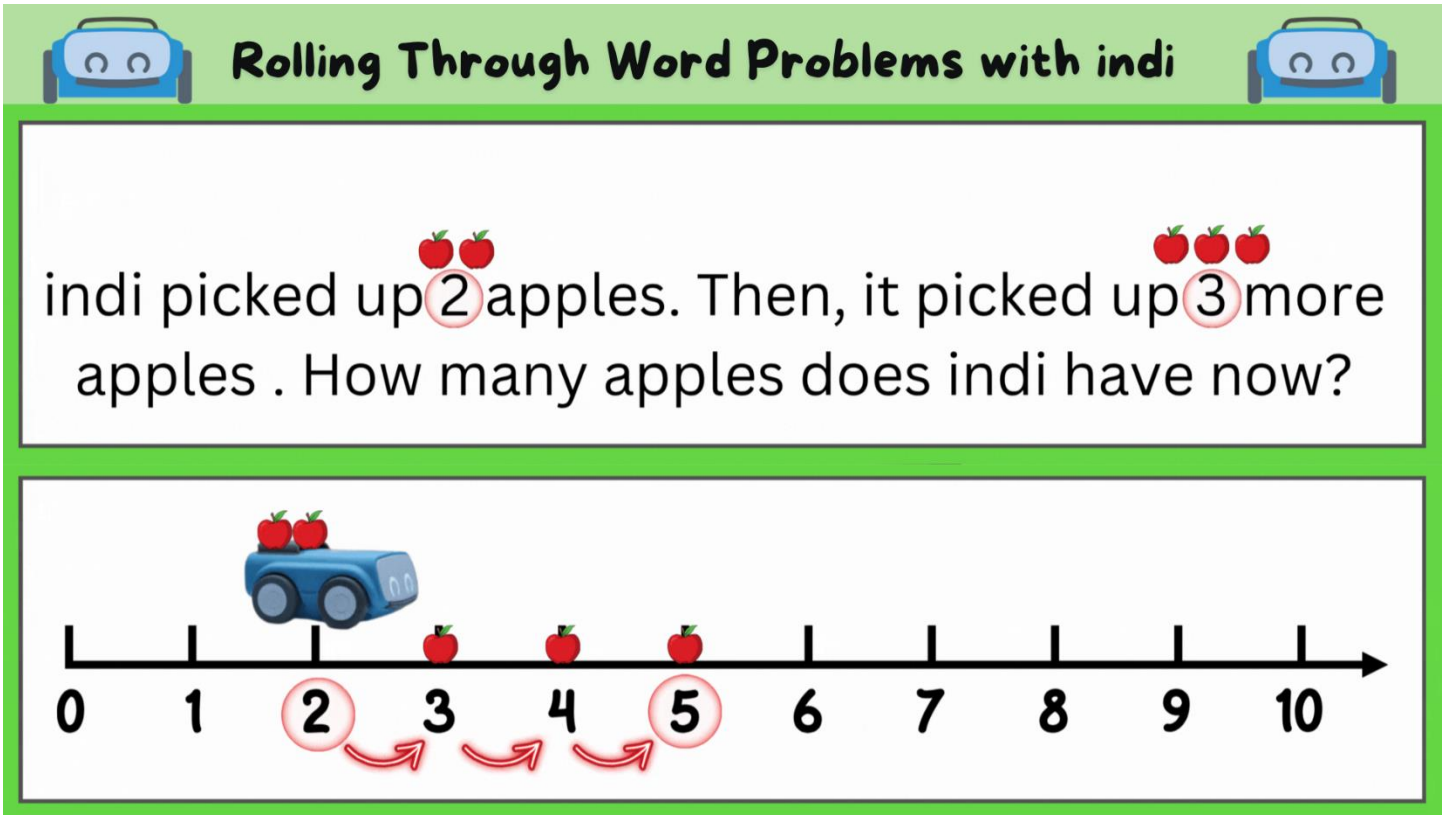
FPL

indi on the Move: Learning by Coding



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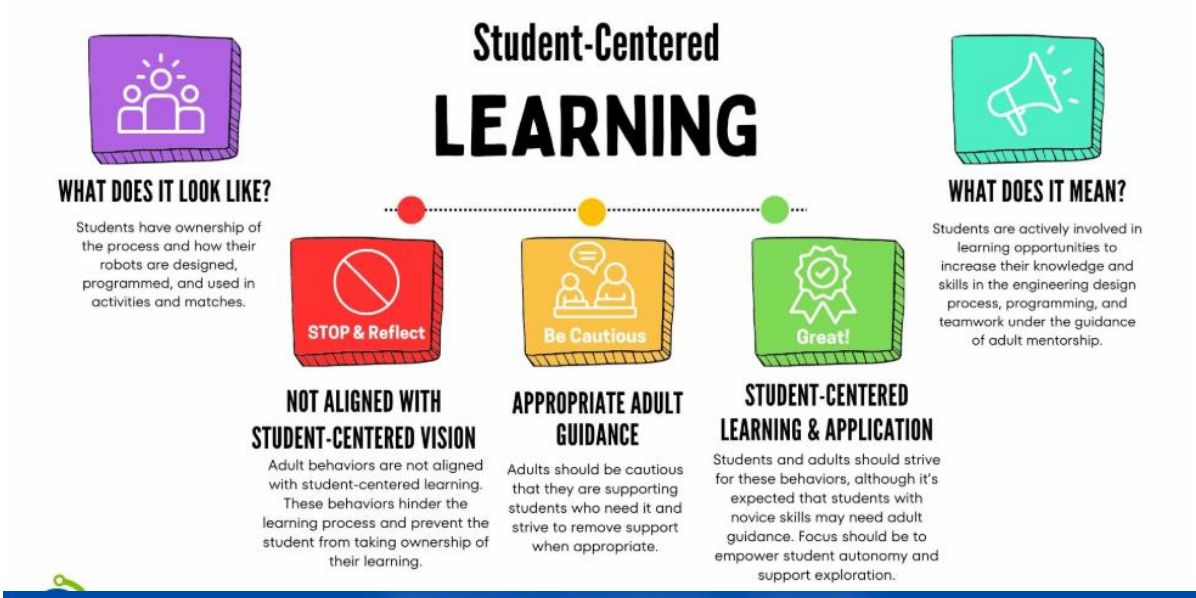
GOALS AND OBJECTIVES

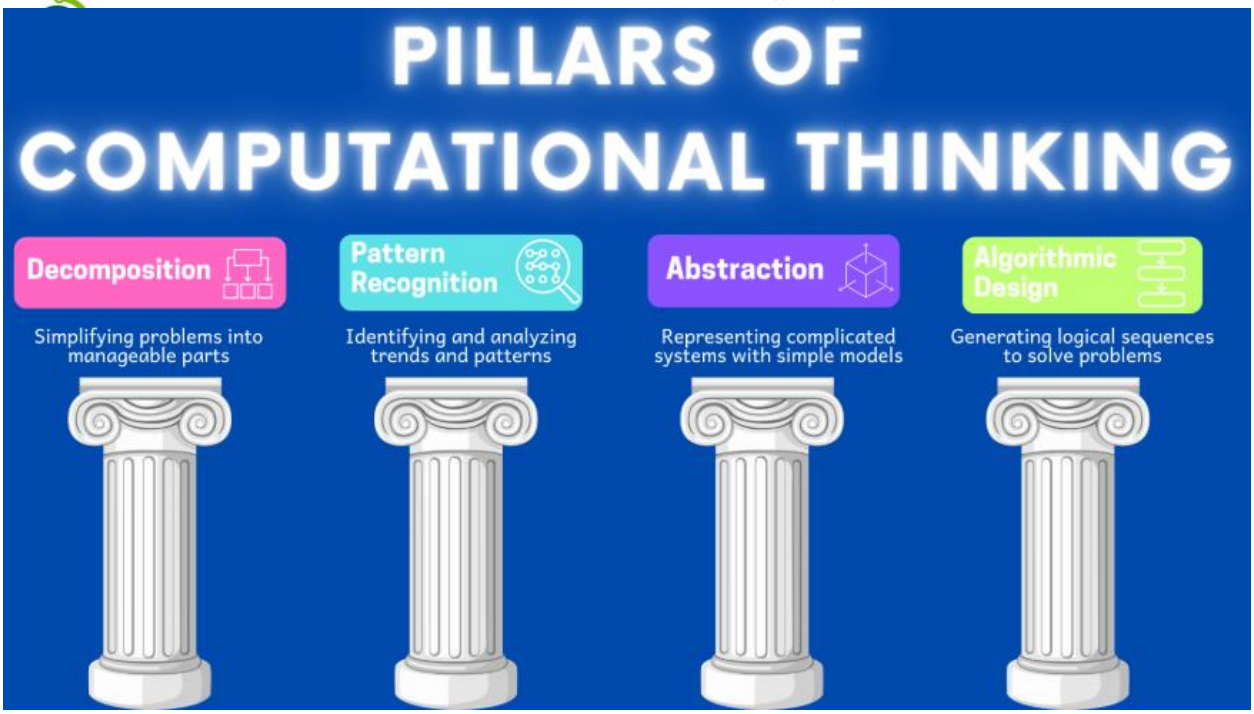
The primary goal of this project is to spark creativity and teach foundational coding and problem-solving skills to young learners (K-2) through engaging, screen-free, hands-on adventures using Sphero Indi robots.

Specific objectives include:

- **Introducing Foundational Coding Concepts:** To enable students to grasp basic coding logic, sequencing, and cause-and-effect relationships through playful, color-based programming with Sphero Indi, without requiring reading or screens.
- **Developing Critical Thinking and Problem-Solving Skills:** To improve students' ability to design and navigate mazes, recognize patterns, and optimize strategies by experimenting with color tile sequences and collaborative challenges.
- **Fostering Creativity and Collaboration:** To encourage imaginative thinking, storytelling, and teamwork as students design mazes, create art with Indi, and work together on coding challenges.
- **Connecting Learning to Real-World Applications:** To help students understand directions, angles, and the practical applications of coding in various careers, fostering curiosity about STEM fields.
- **Promoting Engagement and Motivation:** To transform early childhood classrooms into dynamic, hands-on learning environments that cultivate a love for STEM and prepare students for future academic success.

This project originated from the desire to provide an innovative, accessible, and engaging way for young learners to explore STEM and develop essential 21st-century skills.


Student-Centered
LEARNING
WHAT DOES IT LOOK LIKE?
Students have ownership of the process and how their robots are designed, programmed, and used in activities and matches.
WHAT DOES IT MEAN?
Students are actively involved in learning opportunities to increase their knowledge and skills in the engineering design process, programming, and teamwork under the guidance of adult mentorship.
STOP & Reflect
Be Cautious
Great!
NOT ALIGNED WITH STUDENT-CENTERED VISION
Adult behaviors are not aligned with student-centered learning. These behaviors hinder the learning process and prevent the student from taking ownership of their learning.
APPROPRIATE ADULT GUIDANCE
Adults should be cautious that they are supporting students who need it and strive to remove support when appropriate.
STUDENT-CENTERED LEARNING & APPLICATION
Students and adults should strive for these behaviors, although it's expected that students with novice skills may need adult guidance. Focus should be to empower student autonomy and support exploration.


PILLARS OF
COMPUTATIONAL THINKING
Decomposition
Simplifying problems into manageable parts
Pattern Recognition
Identifying and analyzing trends and patterns
Abstraction
Representing complicated systems with simple models
Algorithmic Design
Generating logical sequences to solve problems

PILLARS OF COMPUTATIONAL THINKING

Decomposition
Simplifying problems into manageable parts

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Representing complicated systems with simple models

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Generating logical sequences to solve problems

How did you use Computational Thinking while exploring indi?

FLORIDA STANDARDS

ELEMENTARY SCHOOL STANDARDS

The Florida Standards, established by the Florida Department of Education, define what students should know and be able to do at each grade level. Designed to prepare students for college and careers, these benchmarks, including the B.E.S.T. Standards for ELA and Math, and the Next Generation Sunshine State Standards for Science and Social Studies, emphasize critical thinking and the application of skills. The standards provide a clear, coded framework for a consistent and high-quality education across the state.

English Language Arts

ELA.K.F.4.4 Read emergent-reader texts with purpose and understanding.

ELA.K.F.1.2 Demonstrate phonological awareness.

ELA.K.R.3.2 Retell a text orally to enhance comprehension.

ELA.K.F.1.1 Demonstrate knowledge of the basic concepts of print.

ELA.K.R.1.1 Describe the main character(s), setting, and important events in a story.

Math

MA.K.NSO.1.1 Given a group of up to 20 objects, count the number of objects in that group and represent the number of objects with a written numeral.

MA.K.NSO.1.2: Given a number from 0 to 20, count out that many objects.

MA.K.NSO.2.1: Recite the number names to 100 by ones and by tens. Starting at a given number, count forward within 100 and backward within 20.

MA.K.GR.1.2: Compare two-dimensional figures based on their similarities, differences, and positions.

MA.K.AR.1.3: Solve addition and subtraction real-world problems using objects, drawings, or equations to represent the problem.

Science

SC.K.L.14.3 Observe plants and animals, describe how they are alike and how they are different in the way they look and in the things they do.

SC.K.L.14.2 Recognize that some books and other media portray animals and plants with characteristics and behaviors they do not have in real life.

Social Studies

SS.K.G.1.1 Describe the relative location of people, places, and things by using positional words.

SS.K.G.1.2: Explain that maps and globes help to locate different places and that globes are a model of the Earth.

SS.K.A.3.2: Explain that calendars represent days of the week and months of the year.

SS.K.C.1.1: Identify the purpose of rules and laws in the home and school.

COURSE OUTLINE AND OVERVIEW

This project sparks creativity as Sphero indi teaches coding and problem-solving through colorful, screen-free, hands-on adventures. It highlights how Sphero Indi, a screenless and programmable robot, transforms early childhood classrooms into engaging, hands-on learning environments. Designed for preschool through 2nd grade, indi introduces foundational coding concepts through playful, color-based programming—no reading or screens required. Using color tiles, students guide indi through custom mazes and problem-solving challenges that build creativity, critical thinking, and computational thinking skills. indi's simple, intuitive design makes it easy for educators to integrate into lessons with minimal setup. For students ready to take the next step, the Sphero Edu Jr. app offers additional programming options using drag-and-drop blocks. With its fun approach and durable design, Sphero indi offers young learners an exciting way to explore STEM and develop essential 21st-century skills.

Target Grade Levels: K-2

Overall Value and Contributions to Student Achievement:

Sphero indi is an innovative, screen-free robot that makes coding accessible and fun for young learners. Through hands-on exploration with color tiles, students develop essential skills like problem-solving, critical thinking, and computational reasoning while engaging in creative, play-based learning. indi's intuitive design fosters independent learning and collaboration, making it ideal for preschool through 2nd-grade classrooms. This project not only strengthens cognitive skills like pattern recognition and sequencing but also nurtures social-emotional growth through teamwork and communication. By incorporating Sphero Indi into

their lessons, educators will provide a dynamic learning experience that cultivates a love for STEM and prepares students for future academic success.

Foundational Concepts and Core Activities

Introduction to Sphero Indi and Screen-Free Learning:

Sphero indi is designed to introduce coding concepts to the youngest learners without the need for screens or complex interfaces. Its reliance on physical color tiles allows for a tactile and intuitive learning experience, making abstract coding principles concrete and engaging for K-2 students. This approach minimizes screen time while maximizing hands-on exploration and discovery.

Key Learning Areas: This project focuses on developing foundational skills across several key areas:

- **Coding Logic:** Understanding how instructions are given and executed sequentially.
- **Problem-Solving:** Devising strategies to achieve a desired outcome and troubleshooting when things don't go as planned.
- **Critical Thinking:** Analyzing situations, identifying patterns, and making informed decisions.
- **Creativity:** Designing unique solutions and expressing ideas through robotic movement.
- **Collaboration:** Working effectively with peers to achieve shared goals.
- **Computational Thinking:** Breaking down problems, recognizing patterns, and developing algorithms.

Detailed Breakdown of Core Classroom Activities:

1. **Color Tile Programming:**
    - **Activity Description:** Students learn the fundamental language of indi by using physical color tiles. Each color corresponds to a specific action (e.g., green for moving forward, pink for turning left, red for stopping). Students arrange these tiles in sequences to program Indi to move along desired paths.
    - **Learning Outcome:** Students grasp the basic concepts of coding logic, sequencing, and cause-and-effect relationships in programming. They learn that a specific input (color tile) leads to a predictable output (Indi's movement).
2. **Maze Creation and Navigation:**
    - **Activity Description:** Students unleash their creativity by designing their mazes directly on the classroom floor using color tiles. They then program Indi to navigate through these custom-built mazes, requiring them to think ahead and strategically place tiles to guide the robot successfully.
    - **Learning Outcome:** This activity significantly develops problem-solving skills, spatial awareness, and creativity. Students learn to plan, execute, and debug their code as they build and solve increasingly complex navigational challenges.

3. **Pattern Recognition:**
    - **Activity Description:** Children are challenged to create and follow patterns using color tiles to program indi's movements. For instance, they might be asked to program Indi to move in a repeating sequence like "red, blue, green, red, blue, green" to create a specific loop or design.
    - **Learning Outcome:** This activity strengthens pattern recognition, a critical skill in computational thinking and a foundational element for understanding more complex algorithms in the future.
4. **Exploring Cause and Effect:**
    - **Activity Description:** Students actively experiment by arranging color tiles in various sequences to observe how indi reacts to different combinations. For example, they might place a series of tiles that make indi move forward, then turn, and then repeat the process, observing the precise outcome of each tile placement.
    - **Learning Outcome:** Students develop a deeper understanding of logical progression and how specific actions (placing a tile) lead to predictable results (indi's movement), reinforcing the core concept of cause and effect in programming.

Advanced Activities and Skill Development

As students master the foundational concepts, the Sphero indi project offers opportunities to expand their learning into more complex and creative applications, fostering deeper skill development.

Building on Foundational Skills:

1. **Storytelling with Indi:**
    - **Activity Description:** Students use indi as a character to "tell a story." They program indi to move through a series of pre-planned actions that reflect characters, events, or scenes from a narrative. This can involve simple movements to represent a character walking, turning to look, or stopping at a specific point in the story.
    - **Learning Outcome:** This activity encourages imaginative thinking, strengthens sequencing skills, and helps students understand narrative structure in a tangible, interactive way. It bridges literacy with computational thinking.
2. **Group Collaboration Projects:**
    - **Activity Description:** Students work in small groups to tackle more complex challenges. They collaborate to design intricate mazes or solve multi-step problems, sharing color tiles and ideas. They might work together to guide Indi through a large, shared maze or race against a timer to complete a collaborative challenge.
    - **Learning Outcome:** This fosters essential teamwork, communication, and collaborative problem-solving skills. Students learn to negotiate, share responsibilities, and combine their programming efforts for a collective goal.

3. **Advanced Programming with Sphero Edu Jr. App (Optional):**
    - **Activity Description:** For students who demonstrate readiness, the Sphero Edu Jr. app can be introduced. This app allows students to transition from physical tiles to a drag-and-drop block-based coding interface. They can program indi for more intricate tasks, such as creating loops, conditional statements, or repeating actions.
    - **Learning Outcome:** Students build upon their basic coding skills and begin exploring more complex programming concepts, preparing them for future coding languages and computational thinking challenges.
4. **Exploration of Directions and Angles:**
    - **Activity Description:** Students deepen their understanding of spatial reasoning by programming Indi to move in specific patterns that involve precise turns and straight lines. Activities might include programming Indi to turn 90 degrees, make specific right or left turns, or move in geometric shapes.
    - **Learning Outcome:** This teaches students about angles, directionality, and basic geometry, linking abstract mathematical concepts to real-world movements and coding applications.
5. **Timed Challenges:**
    - **Activity Description:** To introduce an element of efficiency and optimization, students are given challenges where they must program Indi to navigate a maze or complete a pattern in the shortest amount of time. They are encouraged to

experiment with different color tile sequences to improve their timing and efficiency.

- **Learning Outcome:** Students learn how to optimize their problem-solving strategies, think critically under pressure, and measure time as a valuable resource in achieving a goal.

Application, Extension, and Workshop Highlights

The "indi on the Move" project extends beyond basic coding, encouraging students to apply their skills in creative and practical contexts, and provides teachers with actionable strategies for implementation.

Application and Extension Activities:

1. **Collaborative Coding Challenges:**
    - **Activity Description:** In pairs or small groups, students work together to create a series of actions that lead Indi through a specific task or problem. This could involve programming Indi to navigate around obstacles, follow a complex maze while avoiding errors, or complete a multi-step mission.
    - **Learning Outcome:** These challenges significantly enhance communication, planning, and shared problem-solving skills, as students must articulate their ideas and coordinate their efforts.

2. **Creating Art with Indi:**
    - **Activity Description:** Students can use indi as a mobile drawing tool. By carefully placing color tiles, they direct indi's movements to create geometric shapes, abstract patterns, or even "trace" out letters and numbers on a large surface (e.g., paper or a whiteboard with washable markers attached to indi).
    - **Learning Outcome:** This activity strengthens spatial reasoning and allows students to see how coding can intersect with artistic expression and design, fostering interdisciplinary thinking.
3. **Coding with Themes:**
    - **Activity Description:** Students create coding sequences based on engaging themes. For example, they might direct indi through a maze of "obstacles" (like toy blocks) to "save a lost toy," or guide indi through a "winter wonderland" maze using specific movements related to the theme.
    - **Learning Outcome:** Theme-based activities make coding more engaging and help students relate their learning to real-life situations, fostering imaginative play and contextual understanding.
4. **Building and Testing Prototypes:**
    - **Activity Description:** Students work in teams designing a maze or obstacle course, then program indi and test their code to see if the robot completes the task. They are encouraged to make changes to the color tile sequence as needed to refine their design and improve Indi's performance.

- **Learning Outcome:** This activity introduces students to the engineering design process: plan, test, refine, and repeat, teaching them iterative problem-solving.

5. **Connecting Programming with Real-World Jobs:**
    - **Activity Description:** Educators facilitate discussions about various jobs where coding is used in the real world (e.g., robotics engineers, game designers, software developers). Students then explore how the skills they are developing with Sphero indi (logic, problem-solving, sequencing) are essential in these careers.
    - **Learning Outcome:** Students see the practical applications of coding, fostering curiosity about STEM careers, and understanding the relevance of their learning.
6. **Mini Coding Competitions:**
    - **Activity Description:** Organize fun, low-stakes competitions where students race to program Indi through an obstacle course or a timed challenge. This encourages them to think quickly, creatively, and efficiently.
    - **Learning Outcome:** Encourages healthy competition, quick thinking, and the ability to adjust strategies on the fly to optimize performance.

What Teachers Will Learn in the Expo Workshop:

Teachers attending the "indi on the Move: Learning by Coding" workshop will gain practical knowledge and strategies to implement this project effectively in their classrooms:

- **Introduction to Sphero Indi:** Learn how to use color tiles to teach young students basic coding concepts without screens.
- **Hands-on Classroom Activities:** Explore interactive, screen-free activities that engage students in problem-solving, pattern recognition, and sequencing.
- **Simple Setup and Execution:** Discover how easy it is to integrate Sphero Indi into everyday lessons with minimal preparation and resources.
- **Differentiation Strategies:** Learn how to tailor activities to meet the diverse learning needs of students, from beginners to more advanced learners.
- **Building Collaborative Skills:** Gain strategies for promoting teamwork and communication through group coding challenges and cooperative learning experiences.

Materials and Resources Needed for Teachers to Implement the Project:

- Sphero Indi robots (one per group or pair of students)
- Color tiles for programming (including with Sphero indi)
- Challenge Cards for figuring out programs
- Large floor space for arranging color tiles and creating mazes

- Sphero Edu Jr. app (optional for advanced programming)
- Printed activity guides or lesson plans with step-by-step instructions
- Markers or tape for outlining mazes or activity areas on the floor
- Timer for timed challenges (optional)
- Carrying case for easy storage and transportation of robots and accessories

SAMPLE MATH LESSON AND STEP-BY-STEP IMPLEMENTATION GUIDE

indi on the Move: Solving Word Problems

This lesson plan integrates with the Sphero indi robot to provide a hands-on, engaging way for kindergarten students to understand and solve basic word problems, aligning with the Florida Math BEST Standards.

Grade Level: Kindergarten

Florida Math BEST Standard: MA.K.AR.1.2 - Given a number from 0 to 10, find the different ways it can be represented as the sum of two numbers. (This standard aligns with solving simple addition/subtraction word problems within 10).

Materials Needed:

- Sphero indi robots (one per small group or pair of students)
- Sphero indi color tiles (included with Indi)
- Large open floor space
- Picture cards representing objects for word problems (e.g., 3 apples, 2 birds, 5 flowers)
- Whiteboard or chart paper (optional)
- Markers
- **Optional:** Sphero Edu Jr. app (for advanced learners)
- **Optional:** Small blocks or counters for students to manipulate

Lesson Introduction (10-15 minutes)

1. **Engage:** Begin by asking students if they like stories. Today, we're going to tell stories with numbers, and our friend indi is going to help us.

2. **Introduce indi:** Bring out the Sphero indi robot. This is indi. indi loves to move and follow our directions. We can tell indi what to do by using these special color tiles.
3. **Basic Indi Movement Review**: Quickly demonstrate how indi moves on different color tiles (e.g., green for forward, pink for turn left, purple to celebrate). Have students practice placing a few tiles and watching indi move.
4. **Connect to Word Problems**: Sometimes, stories have numbers in them, like "I had 3 apples, and then I got 2 more." Those are called *word problems*! Today, we're going to use indi to act out these number stories.

Exploration: indi's Number Stories (25-30 minutes)

1. **Setting the Scene**:
    - Divide students into small groups (2-3 students per indi robot).
    - Provide each group with an indi robot and a set of color tiles.
    - Designate a clear, open space for each group to work.
2. **Modeling a Word Problem** (Teacher-led):
    - Present a simple addition word problem, for example: "**3 birds were sitting on a branch. Then, 2 more birds flew to the branch. How many birds are there in all?"**
    - **Step 1:** Visualize the first number. **"First, there were 3 birds."** Place 3 picture cards of birds on the floor.
    - **Step 2:** Represent the first number with indi**. "Let's make indi move 3 steps forward to show the first 3 birds."** Guide students to place 3 green "move forward" tiles in a line. Have indi drive over them.
    - **Step 3:** Visualize the second number. **"Then, 2 more birds flew to the branch."** Place 2 more bird picture cards next to the first 3.

- **<u>Step 4:</u>** Represent the second number with indi**. "Now, let's make Indi move 2 more steps forward for the 2 new birds."** Guide students to add 2 more green tiles to the end of the line. Have indi drive over the entire line of tiles.
- **Step 5**: Find the total**. "How many steps did indi take in all? Let's count all the tiles indi drove over!"** Count the tiles together. **"So, 3 birds plus 2 birds equals 5 birds!"**

3. **Guided Practice (Small Groups):**
    - Give each group a different simple addition word problem (e.g., "I have 4 flowers, and my friend gave me 1 more. How many flowers do I have now?").
    - Provide picture cards relevant to their word problem.
    - Circulate among the groups, guiding them through the steps:
        - Reading the problem.
        - Identifying the numbers.
        - Using indi to represent the first number (e.g., placing green tiles).
        - Adding more tiles for the second number.
        - Counting all the tiles indi moved over to find the total.
    - Encourage students to verbalize their thinking as they program Indi.

Wrap-Up and Discussion (10 minutes)

1. **Share Out**: Bring the class back together. Have each group share their word problems and demonstrate how indi helped them solve it.
2. **Connect to Math:** What did indi help us do today? indi helped us act out our number stories and find out how many there were in all!"

3. **Reinforce Concepts:** Briefly review what addition means (putting together) and how counting all the tiles helped them find the sum.

Differentiation:

- **Support:**
    - Use smaller numbers (within 3-5).
    - Offer physical manipulatives (counters, blocks) alongside Indi to help visualize.
    - Pair students with stronger peers.
- **Challenge:**
    - Introduce simple subtraction word problems (e.g**., "indi had 5 tiles, but 2 tiles blew away. How many are left?"**). Students would program indi to move forward for the initial number, then perhaps use a different color tile (if applicable for a "take away" action or simply remove tiles) to represent subtraction.
    - Encourage students to create their own simple word problems for indi to solve.
    - For advanced learners, introduce the Sphero Edu Jr. app to program indi with drag-and-drop blocks for more complex sequences.

Extension Activity:

- **indi's Maze of Word Problems:** Create a larger maze on the floor using tape or markers. Place different word problem cards at various points in the maze. Students must solve the word problem at each stop by programming indi to move the correct number of steps or turns to reach the next problem.

Exit Ticket:

- Give each student a small paper with a simple word problem (e.g., **"I have 2 red cars and 3 blue cars. How many cars in all?"**).
- Students can draw a picture to solve the problem and write the answer. Alternatively, they can draw the color tiles indi would use to solve it.

Assessment:

- **Observation:** Observe students during the exploration phase.
    - Are they able to correctly identify the numbers in the word problem?
    - Can they translate the numbers into indi's movements using color tiles?
    - Are they able to count the total number of steps/tiles indi moved to find the sum?
    - Are they collaborating effectively with their group members?

Exit Ticket Analysis:

Review student drawings and answers on the exit tickets to gauge their understanding of solving simple addition word problems.

RESOURCES LIST

To help you get started and continue exploring the world of coding with Sphero Indi, I've put together a resource list. You'll find essential materials for hands-on activities to digital tools and relevant Florida Educational Standards. This list is designed to be a practical guide as you integrate "indi on the Move: Learning by Coding" into your teaching practice. You can refer to it whenever you need support or want to delve deeper into any of the topics discussed.

1. Sphero Central Website: https://edu.sphero.com
2. Sphero Edu Jr. app
3. **CPALMS.org Standards Search:**

- **Main Website:** https://www.cpalms.org/
- This is the official hub for all Florida B.E.S.T. Standards, allowing teachers to search by subject, grade level, and keyword.
- **Florida's B.E.S.T. Standards for English Language Arts (PDF):**
- **Direct PDF Link:** https://www.cpalms.org/Standards/Standardsbooks.aspx (On this page, look for the "English Language Arts (PDF)" link under "Standards.")
- **Alternative PDF Link (Full Document):** https://www.fldoe.org/core/fileparse.php/7539/urlt/elabeststandardsfinal.pdf
- **Florida's B.E.S.T. Standards for Mathematics (PDF):**
- **Direct PDF Link:** https://www.cpalms.org/Standards/Standardsbooks.aspx (On this page, look for the "Mathematics (PDF)" link under "Standards.")

- **Alternative PDF Link (Full Document):** https://www.fldoe.org/core/fileparse.php/18736/urlt/StandardsMathematics.pdf