HOW TO PLAY *Number Path Games*

Math children are practicing:

- Number magnitude and understanding that numbers come *before* or *after* other numbers
- Recognizing written numerals 1-5 (or up to 10)
- Number order
- Using one-to-one correspondence when counting
- Subitizing: Recognizing how many immediately
- Composing and decomposing numbers: Identifying the new number created when numbers are combined or separated
- Number-before and number-after: Recognizing the number that comes before and after other numbers
- Executive functions: self-regulation (inhibition), working memory, and attention shifting (cognitive flexibility). See also: Joswick, Clements, Sarama, Banse, and Day-Hess, 2019: https://www.researchgate.net/publication/332182701_Double_Impact_Mathematics_and_Executive_Function

Materials

- *4 Lily Pad* boards 1 to 5
- *4 Lily Pad* boards 1 to 10
- *2 Lily Pad* boards 11 to 20
- 2 dot cubes with dots 
- 2 dot cubes with dots  (from Session 3)
- 8 frog tokens
- (optional) dice with any other combination of numbers
- (optional) dice with written numerals 1 and 2; or 1 to 3.

Picture Book: Mouse Count by Ellen Stoll Walsh

This adorable story is great for practicing counting forwards and backwards. The snake is gathering up the mice and counting them ("1, 2, 3", up to 10) as he puts them in a jar to eat later. When he goes off to gather up one really big mouse, the 10 mice tip over the jar and escape! They "uncount" themselves 10, 9, 8, 7, 6, 5, 4, 3, 2, 1.

- *Small group or circle time:* After reading the book a few times, children could act it out with children playing the mice and you (or another child) playing the snake gathering them up. They can count themselves into the jar and then count themselves back out.
- *Math Station*: To extend the learning in this book you could make ten mice and a sock snake. Have children act out the counting in the book by placing them in a clear container, then have them escape and counting backwards. Children can retell the story as many times as they would like.

This work has been supported by funding from the National Science Foundation and Heising-Simons Foundation.

Citation: Reed, K. E., & Young, J. M. (2017). *Games for Young Mathematicians: How To Play Number Path Games.* Waltham, MA: Education Development Center, Inc. http://ym.edc.org/

For session 4:

✓	Game	Materials
	Explore board and cubes	Board and dot cubes
	Number path floor game	Floor number path and one large dot cube
	1 to 5 board	1 to 5 board and dot cube
	1 to 10 board	1 to 10 board and dot cube
	1 to 10 board	1 to 10 board and dot cube
	Go to pond and back to home on 1 to 10 board (forwards and backwards)	1 to 10 board and any dot cube
	Counting on	Have children count on from lily pad rather than count jumps.
	Land *exactly* on 5 and 10	1 to 10 board and dot cube, moving forwards *and backwards*, land exactly on 5, 10, then 5 again, and home.
	1 to 20 game	1 to 10 and 11 to 20 boards and dot cube

Tips from the classroom:

- Many children will not have had experience playing a board game and will need to practice moving a piece one space at a time. Children need practice learning how to jump forward a certain number of spaces. They have to learn to count the jumps, remember the number they rolled, and then remember to stop jumping once they've taken that number of jumps. They are practicing a lot of skills.
- Children enjoy getting to jump backwards from the pond to home. As they are jumping backwards, encourage them to say the number of the lily pad that they are hopping on. This gives them practice moving backwards on the number line.
- Counting on is particularly hard for children (and teachers) to remember to do. When you try this with children, be patient with them and yourself!
- Have children say out loud what they rolled before they move their frog.

This work has been supported by funding from the National Science Foundation and Heising-Simons Foundation.

Citation: Reed, K. E., & Young, J. M. (2017). *Games for Young Mathematicians: How To Play Number Path Games.* Waltham, MA: Education Development Center, Inc. http://ym.edc.org/

Questions to ask:

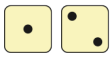
- Which number did you start on?
- Which number did you land on?
- How far are you from the pond?
- Who is closer to the pond? Who is further away? By how much?
- How far are you from home?
- Who is closer to home? Who is further away? By how much?
- What would you need to roll to land exactly on 10? On 5?
- How many flies are next to the 5? How many flies are next to the 10?

This work has been supported by funding from the National Science Foundation and Heising-Simons Foundation.

Citation: Reed, K. E., & Young, J. M. (2017). *Games for Young Mathematicians: How To Play Number Path Games.* Waltham, MA: Education Development Center, Inc. http://ym.edc.org/

Explore *Lily Pad* boards and cubes		
Skills practiced: counting, subitizing, cardinality, written numbers, and composing numbers		
Materials: Board and dot cubes		
1-2 players	**5-10 minutes**	**Ages 3+**

1. Give children the 1 to 5 *Lily Pad* board and ask them what they notice. Do they recognize the numerals? *For kids who are ready, use the 1 to 10 board.*
2. Count with children as they point to the numerals.
3. Have the children count the number of flies and notice that there are 5 flies between the lily pads with the numeral 5 and 10 flies between the lily pads with the numeral 10.
4. Give children a frog token to hop on the lily pads. Have them hop and say the number as they hop. Have them put their frog on a number. Ask "if I hop one more towards the pond, what number will I land on? What if I hop one back toward home?"

Children should be familiar with the dot cubes from the game *Two Numbers*, but if they need more practice, give children the  dot cube and show them how to roll the dice. Have them informally roll the cubes and move the number of spaces on the board.

Things to notice as children play.

Notice if children recognize the numerals and can point to them correctly as they count. This is another step in children making the link between the number words, the written numerals, and the quantity.

The numerals on the lily pads are arranged vertically. We want children to see as they move from 1 to 5, or 1 to 10, they are moving further from the start (home), and how much further: 10 is much further away from home than 2. At this age, children are developing their understanding of number magnitude—knowing that 5 is greater than 2 and beginning to understand how much greater. Each time children jump on the lily pads one by one they are reinforcing kinesthetically that each number gets bigger by one jump. It is also helping them to understand that the distance between consecutive whole numbers is the same—10 is one bigger than 9 just as 2 is one bigger than 1.

This work has been supported by funding from the National Science Foundation and Heising-Simons Foundation.

Citation: Reed, K. E., & Young, J. M. (2017). *Games for Young Mathematicians: How To Play Number Path Games.* Waltham, MA: Education Development Center, Inc. http://ym.edc.org/

Number path floor game		
Skills practiced: number-after, stable counting order, one-to-one correspondence, counting on		
Materials: 1 to 10 board and  dot cube		
1-2 players	**5-10 minutes**	**Ages 4+**

1. Prepare a number path on the floor that is big enough for children to jump on. Start with a path from 1 to 5, and make the path longer as children gain experiences (and as space allows).
2. Player 1 starts as the frog, starting at the beginning of the number path but not on lily pad 1.
3. Player 2 rolls the large game cube and calls out how many to jump.
4. Player 1 jumps that many spaces, counting as she goes. For example, roll  ; count "one, two"; land on 2.
5. Play continues until Player 1 jumps on (or beyond) 10 and goes for a swim in the pond.
6. Many children enjoy continuing the game by jumping back to 1. This gives them practice counting backwards.

Things to notice as children play.

This game asks children to integrate many concepts. When children roll the cube, they have to use their counting or subitizing skills to know how many dots in all. They have to remember the number that was rolled and then jump that many spaces—one space for each count (one-to-one correspondence). They also have to know when to stop jumping (cardinality) and roll again.

As children gain confidence in those skills, they can start paying attention to the written numerals they are jumping on. You can ask children which number they started on and which number they landed on. Playing this game, children are learning the relationship between number words, quantity, and written numerals. Help them learn to describe what they've done by summarizing it: "You started on 4, jumped two spaces, and landed on 6." When you think they are ready, you can ask them to describe their moves.

Playing the game on a life-size board, where children do the jumping form on numbered space to another, helps them better understand number paths and get excited about board games. Having children be the tokens that jump on the number path provides an ideal context for learning how to count on from the number they are standing on.

This work has been supported by funding from the National Science Foundation and Heising-Simons Foundation.

Citation: Reed, K. E., & Young, J. M. (2017). *Games for Young Mathematicians: How To Play Number Path Games.* Waltham, MA: Education Development Center, Inc. http://ym.edc.org/

1 to 5 board		
Skills practiced: number magnitude, number-after, stable counting order, one-to-one correspondence, written numerals		
Materials: 1 to 5 board and dot cube		
1-2 players	**5-10 minutes**	**Ages 3+**

1. Give each pair of children the 1 to 5 *Lily Pad* board and one dot cube. Each child gets one frog token.
2. Place the frog token on the picture of the frog below the number 1 (home).
3. Taking turns, children roll the cube and jump that number of lily pads.
4. Play continues until children's frogs land on (or past) 5 and go for a swim in the pond. Then the frogs swim in the pond.

Tips:

- Have children say (or count) the number of dots that they roll. Then count as they jump on the lily pads.
- Ask children which number lily pad they started on and which they landed on.
- Note that beginners often start their counting *on* the pad they are sitting on, not on the first *move* from that pad. For making sense of the result, they need to count *hops*, not lily pads.

Things to notice as children play.

This game asks children to integrate many of the skills they have been practicing for the last few months. Children roll a dot cube and subitize or count to know how many spaces to move. Children have to hold that number in their head (working memory) and then jump that number of spaces and stop jumping when they reach that number (a form of counting out). To practice reading written numerals, you can ask children which number they started on and which number they landed on. This is a complex set of skills to integrate and it may take many attempts before children are comfortable with the whole process. You can help them learn to *describe* what they've done by summarizing it yourself: "You started on four, hopped two steps, and landed on six." When you think they can, you can ask them to describe their move. This, too, asks children to keep a lot in their heads!

At this age, children are still learning how to play games and practicing skills like taking turns, moving pieces, using dice, and counting out spaces. These skills are important in and of themselves because they allow children to access other opportunities for game board play. Many board games have mathematical elements including counting, counting on, numeral recognition, logic, strategy, and

This work has been supported by funding from the National Science Foundation and Heising-Simons Foundation.

Citation: Reed, K. E., & Young, J. M. (2017). *Games for Young Mathematicians: How To Play Number Path Games.* Waltham, MA: Education Development Center, Inc. http://ym.edc.org/

classification that are worthwhile and can extend children's learning outside of school. For most children, the game playing skills take time and patient and explicit support to develop.

1 to 10 board and dot cube		
Skills practiced: number magnitude, number-after, stable counting order, one-to-one correspondence, written numerals		
Materials: 1 to 10 board and dot cube		
1-2 players	**5-10 minutes**	**Ages 4+**
1. This game is just like the previous game but children use the 1 to 10 board.		
Things to notice as children play. When children are comfortable with jumping back and forth with the numbers 1 to 5, have them play on the 1 to 10 board.		

1 to 10 board and dot cube		
Skills practiced: number magnitude, number-after, stable counting order, one-to-one correspondence, written numerals		
Materials: 1 to 10 board and dot cube		
1-2 players	**5-10 minutes**	**Ages 4+**
1. This game is just like the previous game but children use the dot cube. Children can move more quickly across the board.		
Things to notice as children play. Using the dot cube adds a bit more complexity to the game and children are jumping further each time.		

This work has been supported by funding from the National Science Foundation and Heising-Simons Foundation.

Citation: Reed, K. E., & Young, J. M. (2017). *Games for Young Mathematicians: How To Play Number Path Games.* Waltham, MA: Education Development Center, Inc. http://ym.edc.org/

Go to pond and back to home on 1 to 10 board (forwards and backwards)		
Skills practiced: Number magnitude, number-after, number-before, stable counting order, one-to-one correspondence, written numerals		
Materials: 1 to 10 board and your preferred dot cube		
1-2 players	**10 minutes**	**Ages 5+**
Instead of ending the game when children get to the pond, have them roll the die to hop all the way back home.		
Things to notice as children play. Children enjoy getting to hop backwards from the pond to home. As they are hopping backwards, encourage them to say the number of the lily pad that they are hopping on. This gives them practice moving backwards on the number line.		

Counting on		
Skills practiced: number magnitude, number-before, number-after, written numerals, and counting on		
Materials: 1 to 10 board and your preferred dot cube		
1-2 players	**10 minutes**	**Ages 5+**
Instead of counting out the number of jumps, have students 'count on' from the space that their frog was on. If the frog is on 2, and a child rolls  , the child counts "3, 4" as they jump—saying the names of the numerals they are jumping on.		
Things to notice as children play. Several research studies have shown that children gain more mathematical skills by counting on from their starting number on a game board than by counting moves. Children gain skills in number estimation, number magnitude, and are better prepared to use the counting on strategy when they get to addition in elementary school.		

This work has been supported by funding from the National Science Foundation and Heising-Simons Foundation.

Citation: Reed, K. E., & Young, J. M. (2017). *Games for Young Mathematicians: How To Play Number Path Games.* Waltham, MA: Education Development Center, Inc. http://ym.edc.org/

1 to 20 board		
Skills practiced: number magnitude, number-before, number-after, written numerals, and counting on		
Materials: 1 to 10 board and your preferred dot cube		
1-2 players	**10 minutes**	**Ages 5+**
Use masking tape or velcro to attach the 1 to 10 board to the 11 to 20 board. Have children play the game hopping their frog from 1 to 20. Children can use any variation of the rules that they would like.		
Things to notice as children play. Pay particular attention to helping children say the teen numbers. Remind them that 15 is 10 and 5; 16 is 10 and 6. While we write 15 with a 1 and a 5, in the teen numbers, the 1 represents 10. Help them see the pattern of 0-9 that starts in the ones, continues into the teen numbers and beyond.		

Land *exactly* on 5 and 10		
Skills practiced: number magnitude, number-before, number-after, written numerals, and counting on, planning and strategic thinking		
Materials: 1 to 10 board and your preferred dot cube		
1-2 players	**10 minutes**	**Ages 5+**
1. This game is similar to the previous versions but children can move forwards *or backwards* on *each* turn. 2. Children roll to land exactly on the 5—and their frog can eat the 5 flies. If they go past the 5 on one turn, they must move backwards on their next turn until they land exactly on the 5. Then, they move on, trying to land exactly on 10 to eat the 10 flies.		
Things to notice as children play. This advanced game requires children to hold several goals in mind at once (land on 5, land on 10, go back to land on 5, go back to home) as well as think strategically about how to accomplish those goals. They may be on 4 and roll a  and have to decide whether to hop on to 7, or hop back to 1. This gives them great practice moving forwards and backwards on a number path but is challenging, especially for children who are easily frustrated. Feel free to make modifications that the children suggest. For example, you could have each child roll two two-dot cubes and they could pick whichever number they prefer. This incorporates strategic thinking.		

This work has been supported by funding from the National Science Foundation and Heising-Simons Foundation.

Citation: Reed, K. E., & Young, J. M. (2017). *Games for Young Mathematicians: How To Play Number Path Games.* Waltham, MA: Education Development Center, Inc. http://ym.edc.org/