The **Dyscalculia** Resource Book

Games and Puzzles for ages 7 to 14

Ronit Bird

2nd Edition

PART I
Addition and Subtraction Games and Puzzles

1 Components & Key Components [1–10] – a game for 2 players

Teaching points

◗ The key components of all the numbers up to 10. The words 'key components' here refer to the doubles and near-doubles facts, e.g. 5 and 4 are the key components of 9.

◗ Practice in recognising the dice patterns.

◗ Only the numbers 1 to 5 (but not 6) are key components of the numbers up to 10.

◗ The same small number can be one of the key components of up to three larger numbers. For example, the number 4 is one of the key components of 7 and of 8 and of 9.

◗ Any number can be built by combining two smaller quantities (the basis of addition).

◗ Any number can be partitioned into two smaller components (the basis of subtraction).

Note to member of staff or parent

◗ Make sure the child is learning to recognise the dice patterns, not counting the dice spots.

◗ The child is not allowed to add by counting in ones, on fingers or otherwise. Anyone who is not yet at this stage should spend more time learning through concrete materials.

◗ Explain to the child that 'key facts' are so called because they are important facts that unlock a logical route to other, related facts. A focus on key facts, e.g. learning a single fact for each number up to 10, means minimising the number of facts that have to be committed to memory.

◗ Make sure the child understands what is meant by 'key components'. For example, 5 and 4 are the key components of 9 because 5 + 4 is a near-doubles fact. Other components of 9 are 3 and 6, or 2 and 7, or 8 and 1, but these facts are not key facts.

◗ Point out to the child that the colouring task is a way of highlighting the most important combinations, i.e. the key component facts, not simply a way of scoring this game.

◗ Once both players have had nine turns each to throw the dice and draw the dominoes, it is the child who should undertake the scoring by finding, colouring and reading aloud the key facts on both players' boards.

◗ The game should be played more than once and on more than one occasion.

Equipment needed

Two ordinary 6-sided spot dice. A second game board for an opponent. A pencil each and two coloured pencils in two different colours.

2

1. Components & Key Components [1–10]

Name:

Date:

When to hand it in:

Instructions

Take turns to throw two dice and throw again if you get a 6. Copy the two dot patterns from the dice onto any domino shape on your board, drawing each dice pattern separately on either side of the same domino. Announce (but do not record in digits) each number as you copy it as well as the total value of the domino that is created, i.e. the sum of the two dice.

When each player's game board is full, use a coloured pencil to shade in all the dominoes with a doubles pattern, for instance an 8 that is built of two 4s.
This is a key fact which must be read aloud: say "The key fact about 8 is double 4" or "4 and 4 are the key components of 8".
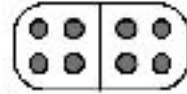
Use a different colour to shade in any dominoes with near-doubles facts, such as 4 and 3, 4 and 5, etc. Say these key facts aloud, too, like this: "The key components of 7 are 3 and 4".

The winner is the player with the most dominoes showing key component facts.

Components & Key Components [1–10]

Player 1

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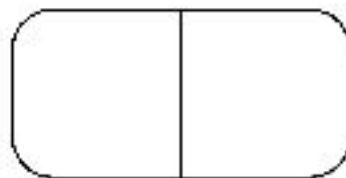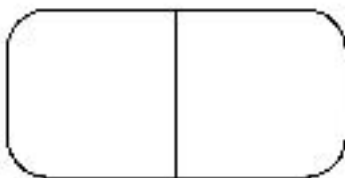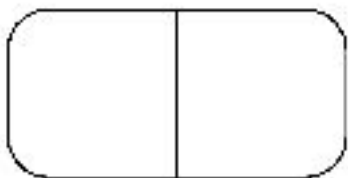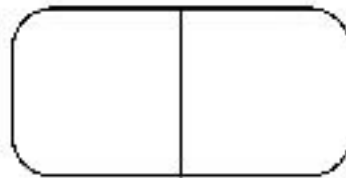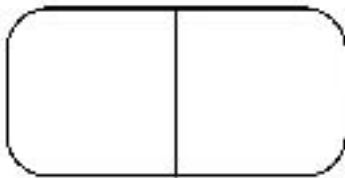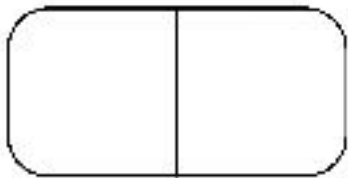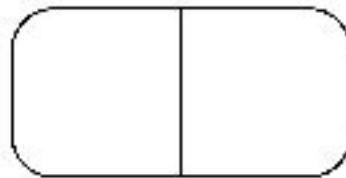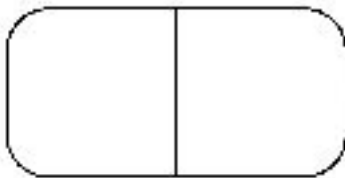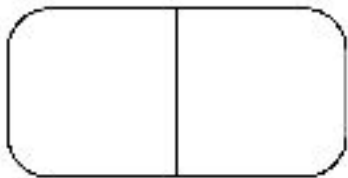
2   Collect 5s – a game for 2 players

Teaching points

◗   There are only two ways of building the number 5 from two components.

◗   Inside the pattern of 5 one can see the pattern of 3 superimposed onto the pattern of 2.

◗   Inside the pattern of 5 one can see the pattern of 1 superimposed onto the pattern of 4.

◗   The commutativity of addition, i.e. $4 + 1$ is the same as $1 + 4$, and $2 + 3 = 3 + 2$.

◗   Mental addition of two numbers below 5 to create a total of between 2 and 8.

◗   Moving away from using concrete materials in order to combine these small quantities and towards the stage of using visualisation techniques to find the answers mentally.

Note to member of staff or parent

◗   Make sure the child is recognising the dice patterns, not counting the dice spots.

◗   Make sure the child is not adding by counting in ones, on fingers or otherwise.

◗   Be sure to talk about what is going on at each step, especially when either player puts two components together to make 5.

◗   At first, prepare two game boards to suit the size of your counters.

◗   After playing a few times, preferably on different occasions, try the more abstract version of the game using the two boards on the next page.

Equipment needed

Two 6-sided spot dice, altered as follows: cover the patterns of 5 and 6 with a sticker and cover the stickers on one die with one pattern of 2 and one pattern of 3, and on the other die with one pattern of 4 and one pattern of 1. Counters in two colours (later, coloured pencils in two colours). Two paper game boards on which are drawn five patterns of 5, making sure the drawn circles roughly match the size of your counters.

2. Collect 5s

Name:

Date.

When to hand it in:

Instructions

Preparation: Attach stickers to each of two 6-sided spot dice, so that the numbers 5 and 6 are covered and replaced by the numbers 2 and 3 on one die, and by 4 and 1 on the other.

Rules: Take turns to throw both dice together and announce the total. If the total is any number other than 5, that is the end of your turn. If the total is 5, take counters of one colour to match one die throw and counters of the other colour to match the other die. Use the counters to cover one complete pattern of 5 on your board as follows: for components 4 + 1 it is the central spot that must be in a different colour to those forming the outer square; for components 2 + 3, the three counters of the same colour should be arranged along one of the diagonals in the pattern of 5. The winner is the first player to cover all 5 of the patterns of 5.

Collect 5s   *Player 1*

Collect 5s   *Player 2*
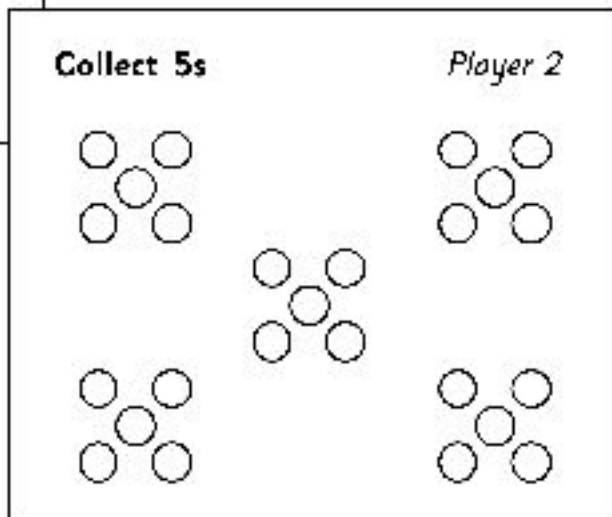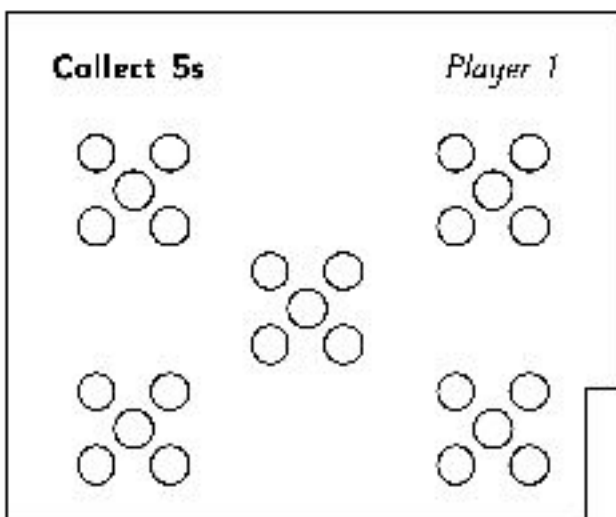
Play again without counters: After playing the game a few times with counters on larger boards, play it with two colours of pencils instead on the boards above. Use the same dice as before. Shade in the patterns of 5 every time your dice add up to 5, using different colours to represent each die throw just as you did when playing with the counters.

3   Clear the Deck of 6s – a game for 1 player

Teaching points

◗   Components of 6. There are only three ways of building the number 6 from two components.

◗   The connection between addition, subtraction and missing addend problems.

◗   Mental addition of two numbers up to a total of 10.

Note to member of staff or parent

◗   Make sure the child knows that adding in ones, on fingers or otherwise, is not allowed.

◗   As the child picks up pairs of cards during play, both numbers should be spoken aloud.

◗   Make sure the target number is spelled out clearly. Although the layout of the cards makes no difference to the game, an arrangement of two rows of three may act as a reminder of this game's target number, which is 6.

◗   The game should be played more than once and on more than one occasion. Encourage the child to keep playing until the components of 6 are easily recognised, rather than calculated.

Equipment needed

A pack of cards made up of four each of the numbers 1 to 5 inclusive. If you have no digit cards, remove the appropriate cards from a standard pack of playing cards and treat the Aces as 1s.

3. Clear the Deck of 6s

Name:

Date:

When to hand it in:

Instructions

Use a pack of cards made up of four each of the numbers 1 to 5 inclusive. Shuffle the cards and lay out five of them face up, arranged as shown below. Put the remaining cards together in a pack face down at the bottom right-hand corner of the array.

Clear away any two cards that add up to the target number of 6. As you pick up the cards, name both the numbers aloud. Fill the two empty spaces with new cards from the top of the pack and continue in the same way, searching for pairs of components of 6.

The game is won if you manage to clear all the cards in the pack.

Clear the Deck of 6s   A Solitaire Game

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4   3-in-a-Line Dominoes – a game for 2 players

Teaching points

◗ The key components of all the numbers up to 10. The words 'key components' refer to the doubles and near-doubles facts, e.g. 4 and 4 are the key components of 8.

◗ The numbers 1 to 5 (but not 6) are key components of the numbers up to 10.

◗ The same small number can be one of the key components of up to three larger numbers, e.g. the number 4 is one of the key components of 7 and of 8 and of 9.

◗ The commutativity of addition, i.e. when combining two numbers it does not matter which is taken first.

Note to member of staff or parent

◗ Make sure the child is recognising the dice patterns, not counting the dice spots.

◗ The child should be able to identify the total value of each domino without having to count or add in ones. Encourage a lot of talk about component values and total values.

◗ Be sure to explain the rule that, whatever the throw of the dice, that pattern must be taken as a whole, e.g. a throw of 4 cannot be split into smaller components: a throw of 4 can only result in the player shading in one of the components of the number 7 or of the number 8 or of the number 9, and if all four of the 4s on the board are already shaded the player misses the turn.

◗ Make sure the number patterns created during the preparation stage are drawn as small circles, not dots, so that they can be coloured in during play. After preparing the game board, each column should look like a vertical arrangement of this:
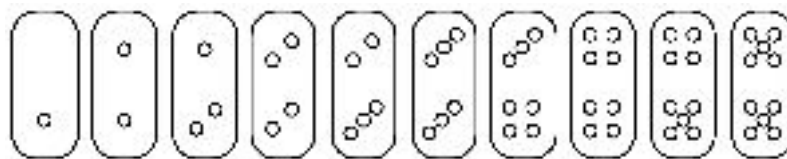
◗ As there is not much space inside the domino shapes on the next page, you may prefer to create larger game boards on paper. Simply sketch ten blank dominoes arranged in either a vertical or a horizontal line for each player.

Equipment needed

An ordinary 6-sided spot die. Paper and pencil.

4. 3-in-a-Line Dominoes

Name:

Date:

When to hand it in:

Instructions

Preparation: Draw small empty circles into the blank domino shapes below, to create the key component dot patterns for the numbers 1 to 10, in order (ascending or descending).

Rules: Take turns to throw a die and throw again if you get a 6. Match the throw of the die by shading in the empty circles of the same pattern in any one place that the pattern appears on one half of a domino. The winner is the first to shade in three whole consecutive dominoes, i.e. to complete all the components contributing to three consecutive numbers.

3-in-a-Line   *Player 1*

Dominoes

3-in-a-Line   *Player 2*

Dominoes

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5   Dot Pattern Stickers Race – a game for 2 or 3 players

Teaching points

◗   Dot patterns for numbers up to 10 that are based on doubles and near-doubles facts, i.e. the key component facts.

◗   Matching digits to dot patterns.

◗   A stage in the transition from concrete materials to more abstract representations by using stickers rather than counters and digits rather than spot dice.

Please note that before playing this game, children should already be familiar with dot patterns for all the numbers up to 10, and should have had plenty of experience of using concrete materials to create and explore the patterns.

Note to member of staff or parent

◗   Make sure the child uses only the dot patterns that are shown here. It does not matter if the patterns are made horizontally or vertically or upside-down, nor if the three dots from the pattern of 7 are arranged in a straight line or as a diagonal.

◗   Ask the child to teach you the necessary dot patterns before the game starts (even if you already know them).

◗   When taking stickers from the sheet, the child should engage in the minimum amount of counting, e.g. if the die shows 8, the child can take all but two of the stickers in one row.

◗   When creating the dot patterns on the next page, remind the child to put the stickers close together within each pattern so as to leave room for all the numbers from one game.

◗   Players each need a separate piece of paper on which to stick their number patterns.

◗   Encourage lots of talk about how the numbers are built out of their two key components.

Equipment needed

100 or 150 (depending on the number of players) small round self-adhesive stickers, all in the same colour. A piece of paper for each opponent. A 6-sided die on which the digits – note digits, not dots – for the numbers 4 to 9 appear once each (use a blank die or an ordinary die covered with stickers on which to write the numbers).

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5. Dot Pattern Stickers Race

Name:

Date.

When to hand it in:

Instructions

Preparation: Take self-adhesive small round stickers and allocate 5 lines of 10 dots to each player, using scissors to cut the backing sheet if necessary. Alter a die to show all the numbers from 4 to 9 inclusive, as digits (not dot patterns).

Rules: Players take turns to throw the die and take the number of stickers to match the throw. Arrange the stickers to create the doubles or near-doubles dot pattern for the number. Put the stickers close together within each pattern so that several numbers can fit on the page. At the end of the game it is not necessary to wait for an exact throw of the die. The winner is the first player to use up, or run out of, all 50 dot stickers.

Dot Pattern Stickers Race

Player 1

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6   Components & Key Components [5–10] – a game for 2 or 3 players

Teaching points

◗   The components and the key components of the numbers 5 to 10.

◗   The commutativity of addition, i.e. 2 + 3 is equal in value to 3 + 2.

◗   Mental addition of two small numbers to create a total of 10 or less.

Note to member of staff or parent

◗   Make sure the child is recognising the dice patterns, not counting the dice spots.

◗   Make sure the child understands the term 'key components' to refer to number bonds that are also doubles and near-doubles facts, i.e. the key component facts of the numbers 5 to 10 are: 2 + 3, 3 + 3, 3 + 4, 4 + 4, 4 + 5 and 5 + 5.

◗   Ask the child to teach you the key components (even if you already know them).

◗   In preparation for the game, players choose 6 digits, choosing between the numbers 5 to 10 inclusive, to create their own game board. The choice of digits is a free choice. So, a player might wish to write the same number in each box, or write a different number in each box, or write some repeated numbers and omit other numbers altogether. The numbers may be written in ascending order, descending order, or no order at all.

◗   During the game, discuss the fact that if either dice shows a 6 it must be thrown again because 6 is not a key component of any of the numbers up to 10.

◗   Encourage plenty of talk about how to combine the dice totals without counting. For example, if the dice show 2 and 4, the child can reason that the answer must be 6 from their knowledge of the key facts of 5 (i.e. 2 + 3) or of 7 (i.e. 3 + 4), or by visualising the dice pattern of 6 and seeing within it a pattern of 4 and a pattern of 2, or by knowing that adding 2 to any number will be not the next number in the counting sequence but the one after that.

◗   The game is suitable for more than 2 players.

◗   The game should be played more than once and on more than one occasion.

Equipment needed

Two ordinary 6-sided spot dice. Two coloured pencils in two different colours.

6. Components & Key Components [5–10]

Name:

Date:

When to hand it in:

Instructions

Preparation: Players write a number inside each of the six boxes on their own game board below, choosing freely between the numbers 5 to 10 inclusive. Decide which of the two colours of pencils will be used for the key component facts and use it to colour in the letters of the words *key component* here (to help remember which colour is which).

Rules: Players take turns to throw both dice. If you get a 6, throw the die again. Add the two dice numbers mentally and announce the total. If the total matches a digit in one of your boxes, shade that box using the relevant coloured pencil, depending on whether you had to add key components to reach the total, or not. If you have no matching box, or one that is already shaded, you can do nothing on this turn.

The winner is the first player with any three boxes shaded in the colour for key component facts, or the first with five out of the six boxes shaded in any colour, whichever happens first.

Components & Key Components [5–10]   *Player 1*

Components & Key Components [5–10]   *Player 2*

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7   Regroup – a game for 2 players

Teaching points

◗ Exploring the possible component pairs, or number bonds, of any number up to 10.

◗ The connection between addition, subtraction and missing addend problems.

◗ Practice in visualisation of small amounts.

◗ Using logic to derive a new fact that is one reasoning step away from a known fact, e.g. reasoning that $3 + 5$ must be equal to the same total as $4 + 4$.

Please note that children should have had previous concrete experience of creating numbers out of two groups of counters or nuggets in order to explore what happens when one unit is moved from one group to the other.

Note to member of staff or parent

◗ Make sure the child is recognising the dice patterns, not counting the dice spots.

◗ When adding amounts, the child is not allowed to count in ones, on fingers or otherwise. The whole point of this game is to develop logical reasoning in order to derive new addition or subtraction facts from known facts.

◗ Make sure the child understands the term 'triad' to refer to three numbers arranged so that the number at the top is equal in value to the sum of the two numbers below.

◗ Explain to the child that this is a guessing game and that incorrect guesses are simply bad luck.

◗ Provide a screen, such as a large book or box file, behind which both players can hide their dice throws and scrap paper during play.

◗ The game board provides space to record five turns each but, if both players' score is the same after five turns, play on until one player emerges as a clear winner.

◗ The game should be played more than once and on more than one occasion.

Equipment needed

Scrap paper and pencil. Tokens for scoring. Three 6-sided spot dice altered so that the single spot, i.e. the number 1, is covered by the dot pattern for 7 on one die, the pattern for 8 on another die and the pattern for 9 on the third die. The three substituted dot patterns should look like these:

You can find a short demonstration video of this game on the CW.

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7. Regroup

Name:

Date.

When to hand it in:

Instructions

Preparation: Alter the 1s on three 6-sided spot dice to a 7, an 8 and a 9

Rules: Two players take turns to throw all three dice, hiding them from the other player. Discard the die showing the smallest amount and make a hidden note on scrap paper of the other two numbers. Mentally add the numbers on the two dice, and write the total at the top of one of the triad shapes on your game board. Next, visualise one spot moving from one die face to the other, and write the two newly visualised components at the bottom of the triad. E.g. if you throw two 4s (having discarded the third die), write 8 at the top and 3 + 5 (or 5 + 3) at the bottom, as shown here. The second player uses this written clue to guess the two original components. A correct guess (4 + 4 in this example) wins a token for the second player; an incorrect guess (6 + 2 in this example) wins a token for the first player. The winner has most tokens.

$$\underset{5 + 3}{\overset{8}{\bigwedge}}$$

Regroup *Player 1*

+

+

__ + __

__ + __   __ + __

Regroup *Player 2*

−

+

__ + __

__ − __   __ + __

8   Twos & Threes – a game for 2 players

Teaching points

◗ Adding 2 and 3 to other small numbers.

◗ The commutativity of addition, i.e. 2 + 3 is equal in value to 3 + 2.

◗ The 'difference' between numbers can be expressed as addition as well as subtraction.

◗ The connection between subtraction and missing addend problems.

Note to member of staff or parent

◗ Make sure the child is using knowledge of components, or number bonds, and is not counting in ones.

◗ Allow the child to discover for him/herself that only a difference of 2 or 3 will translate into a sum of the type needed for this game.

◗ Encourage the child to read aloud each recorded number sentence, leaving it up to the child to judge whether the sum makes sense, i.e. it is the child's job (rather than yours) to check whether the right numbers have been copied into the right boxes.

◗ The game should be played more than once and on more than one occasion.

Equipment needed

A pack of cards made up of four each of the numbers 4 to 10 inclusive. If you have no digit cards, remove the appropriate cards from a standard pack of playing cards.

8. Twos & Threes

Name:

Date:

When to hand it in:

Instructions

Shuffle a pack of cards made up of four each of the numbers 4 to 10 inclusive. Players take turns to pick up two cards at a time from the pack and announce the difference between the numbers. Have another turn if the two cards you pick up are the same. If it's possible, complete one of the number sentences on your board by copying the two numbers from the cards into the empty boxes of one sum. Replace the cards in a new pile. The winner is the first player to complete all six sums on their board. Alternatively, once the pack has been gone through twice (shuffle the cards again before reusing), the winner is the player with the most number sentences completed.

Twos & Threes   *Player 1*

☐ + 2 = ☐   2 + ☐ = ☐   ☐ = 2 + ☐

☐ + 3 = ☐   3 + ☐ = ☐   ☐ = 3 + ☐

Twos & Threes   *Player 2*

☐ + 2 = ☐   2 + ☐ = ☐   ☐ = 2 + ☐

☐ + 3 = ☐   3 + ☐ = ☐   ☐ = 3 + ☐

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9   Component Su Doku Puzzle

Teaching points

◗ Combining small components to create numbers up to 9.

◗ Splitting numbers into chunks, i.e. into components, or number bonds.

◗ The connection between addition, subtraction and missing addend problems.

◗ Logical reasoning.

Note to member of staff or parent

◗ The child should begin by answering the questions in the Tips section. Make sure the child thinks about each question and is not simply copying the answers from a previous puzzle.

◗ The Tips section must be folded back so that the answers are hidden before the child starts to solve the puzzle.

◗ There must be no adding or subtracting by counting in ones, on fingers or otherwise.

◗ The child may choose any way of distinguishing between possible answers and final answers, but may like to know that a commonly used method is to write the possibilities very lightly and very small and to rub out these digits once a conclusion has been reached about any square.

◗ The child should use only logic. The puzzles in this book have been carefully designed so that the solver need never resort to guesswork or trial and error.

Equipment needed

A pencil and rubber.

⇖ You can find a demonstration video of how to solve Component Su Doku puzzles on the CW.