Manuscript to Linearity and Integration in PreSchool through IconCounting and NextToAddition

http://youtu.be/R2PQJG3WSQY

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01. The MATHeCADEMY.net Channel welcomes you to Linearity & Integration, in PreSchool, through icon-counting and next-to addition. Welcome to Math as Many-ology, the natural science about Many.

02. Sticks are counted in two ways, as ones, or as bundles. Four sticks are counted as four ones, or as a bundle of one fours, that can be rearranged into a 4-icon with four strokes. Three sticks can be rearranged into a 3-icon with three strokes, if written in a less sloppy way. Likewise with two sticks.

03. And a bundle of five sticks can be rearranged into a 5-icon with five strokes. In this way, we create icons, until the number ten, that has no icon.

04. Counting in fives, we count one, two, three, four, bundle, one bundle one, one bundle two, etc. Here we use no 5-icon. Counting in sevens, we count five, six, bundle, one bundle one, one bundle two, using no 7-icon. Counting in tens, we count eight, nine, bundle, one bundle one, one bundle two. So, when counting in tens, we need no ten-icon.

05. Counting 7 sticks in fives, we get 1 5-bundle and 2 unbundled singles. The 5-bundle goes into a left bundle-cup as 1 stick representing the 5-bundle; and the 2 unbundled sticks go into a right single-cup. Using brackets instead of cups, we write the total T of 7, as 1 bracket, 2 bracket fives, or as 1.2 fives, using a decimal point to separate the bundles from the unbundled. Likewise, 7 sticks can be counted as 2.1 threes; or as 3.1 twos. Thus, a natural number is a decimal number with a unit.

06. An abacus contains beads moving along a wire. An abacus can be Chinese or Japanese, or it can be Western, with ten wires, each with ten beads. Two beads can move as 2 ones or as a bundle of 1 twos. Moving 4 2-bundles to the right creates a total stack of 4 twos.

07. We change a unit by re-counting the total in a new unit. Rolling 3 dices provides an example. Moving 4 4-bundles creates a stack of 4 fours, to be re-counted in sixes.

08. To change the 4-bundles into 6-bundles, we move 2 beads back twice. This shows that re-counting 4 fours in sixes gives 2 6-bundles and 4 unbundled, which can be written as the decimal number 2.4 sixes. Changing unit is called proportionality or linearity.

09. A calculator can predict the result, before the re-counting takes place. 4 fours is entered as 4 times 4, that is counted in sixes, when divided by 6. The result is 2 dot some, that we find if from the 4 fours we take away the 2 sixes, which leaves 4. The prediction, that 4 fours can be re-counted as 2.4 sixes is verified by an abacus. Thus stacking bundles is iconized as a multiplication-cross, showing the lifting of bundles. Counting is iconized as an uphill stroke, showing wiping away a bundle many times. Finally, removing a bundle is iconized as a horizontal subtraction-line, showing dragging away a bundle only once. Now decimals can also be written as fractions, where 2 counted in fives can be written as 0.2 fives, or as 2 stroke 5, fives.

10. A 3-table shows the results of re-counting threes in tens. On an abacus, 4 times 3 is 4 threes, which is ten, minus 1, plus 3, that is 1 ten 2, or 1.2 tens, or 1 2 if written shortly. And 7 times 3 is 7 threes, which is 2 tens, minus 2, plus 3, that is 2 tens 1, or 2.1 tens, or 2 1. Finally, ten times 3 is ten threes, which is 3 tens, or 3 0 if written shortly.

11. A calculator can predict the results of re-counting threes in tens, that is the content of a 3-table. The calculator uses the short form directly by writing 1 2 instead of 1.2 tens.

12. Once counted, totals can be added on-top of, or next-to each other. Rolling four dices provides an example, asking ‘1 threes and 4 twos, total what?’ We show the totals on an abacus. With on-top addition the units must be the same, so we re-count the twos in threes, or the threes in twos.

13. To change the 2-bundles into 3-bundles, we move 1 bead back twice. This shows that on-top addition of 1 threes and 4 twos, gives 3 3-bundles and 2 unbundled, which can be written as the decimal number 3.2 threes.

14. With next-to addition the question is ‘ 1 threes and 4 twos, total how many fives?’ . Again, we show the totals on an abacus.

15. To change a 2-bundle into a 5-bundle, we move 3 beads back. This shows that next-to addition of 1 threes and 4 twos, gives 2 5-bundles and 1 unbundled, which can be written as the decimal number 2.1 fives. Next-to addition is called integrating areas, since it combines multiplication and addition. Counting in tens uses next-to addition: The number three hundred forty five, is written as 3 ten-tens, and 4 tens, and 5 ones, or as 3 times 100, plus 4 times 10, plus 5 times 1. With the same units, the four tens are added on-top, but with different units, the 3 ten-tens and the 4 tens are added next-to, since ten-tens cannot be re-counted in tens.

16. Again, a calculator can predict the result. The 1 threes and 4 twos, counted in threes, is entered as 1 times 3, plus 4 times 2, divided by 3. The result shows 3 dot some, that can be found by removing the 3 threes. The prediction 3.2 threes is verified by an abacus. Likewise the calculator predicts that next-to addition of 1 threes and 4 twos, gives 2.1 fives.

17. Addition is reversed when asking, ‘what to add to 3, to give 8?’ On an abacus, moving back 1 threes gives the answer, 8 take away 3, which is 5.

18. Multiplication is reversed when asking, ‘how many threes, give 8? On an abacus, moving back 2 threes gives the answer, 8 take away threes, which is 2.2 threes.

19. Next-to addition is reversed by asking ‘1 fours plus how many twos, gives 1.4 sixes?’ On an abacus we pull out 1 fours, and then fill up to 1.4 sixes.

20. To find the answer, first we push back the 1 fours, and then we rearrange the rest in twos, to get the answer, 3 twos. Reversing next-to addition is called differentiation, because it combines subtraction and division.

21. Again, a calculator can predict the result when reversing addition, also called solving equations. Asking, ‘what plus 3 gives 8’, the answer is 8 minus 3, found by moving plus 3 across the equal sign as minus 3. Asking, ‘what times 3 gives 8’, the answer is 8 divided by 3, found by moving times 3 across as divided by 3. So, moving to opposite side with opposite sign, solves an equation. We reverse next-to addition by asking ‘1 fours plus how many twos total 2 sixes?’. From 2 sixes we take away 1 fours, and count the result in twos by dividing by 2, to get the answer 4 twos.

22. Negative numbers come from loans. To take away five from three, we borrow two on the top wire, representing our loan.

23. Read more in the book, ‘Many-Math, My-Math’. And watch the YouTube-video, ‘Preschool Mathematics’.

24. The MATHeCADEMY.net Channel hopes you enjoyed the video, and welcomes you to other videos, presenting Mathematics as Many-ology, the natural science about Many.