

**ACTIVITY 3:**  
**EDUCATIONAL MATERIALS FOR THE  
DIDACTICS OF NATURAL NUMBERS**

*Numerical sticks - HTU Box*



**Group 8**

Lola Barquín Plaza

Rocío Del Carmen Garrochena González

María Pastor Plaza

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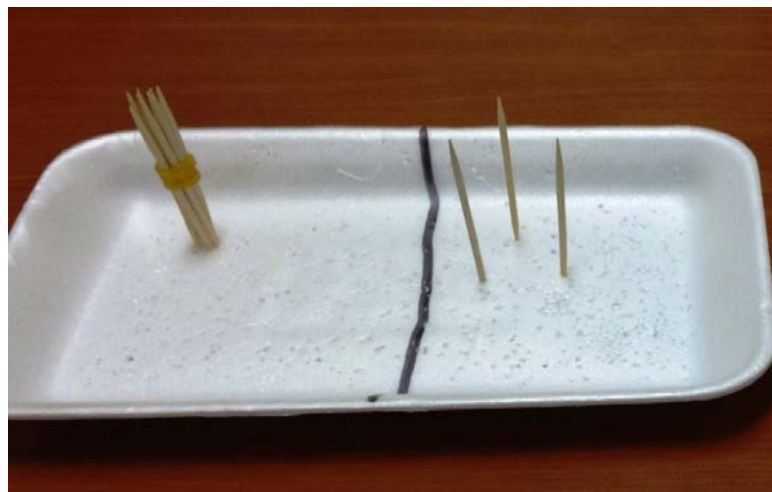
## 1. General explanation of the Numerical sticks - HTU Box

The numerical sticks consist on a mathematical resource that allows the children the exploration and manipulation of numbers, promoting a correct comprehension of the Decimal Number System. In this line, we can consider it as a great tool to build the Base-ten System. The children start constructing the first nine numbers, then the ten and the quantities until ninety nine. To work with the numerical sticks, it is usually used a box divided in three parts which correspond to the units, the tens and the hundreds. For this reason, it is called the HTU (hundreds, tens and units) Box.

Here we can see an example of this box:



Also, in other cases, it is used a white cork tray to work with the numerical sticks. The children punch the sticks in the tray and do the movements that they need. Here we can see a white cork tray divided in tens and units:

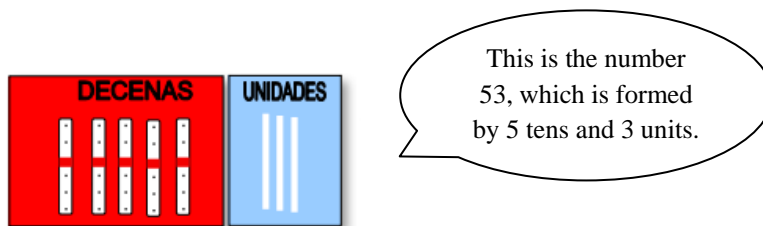


As we can see in the HTU Box, the hundreds are identify with the color green, the tens with the color red and the units with the color blue. This allows the children to distinguish better them and, also, when they are using the numerical representation of numbers (for example, **145**) they can identify each cipher easily and internalize their positional value. In addition, with these colors, the children can learn that our numerical system is a Base-ten System in which the ciphers go “ten in ten”. This is, ten units are

equivalent to one ten, ten tens are equivalent to one hundred, ten hundreds are equivalent to a thousand...

It is important to teach the children that when they have a number (for example, 67), they have to start collocating the sticks from the highest cipher until the smallest, which is the units, so they have to go from left to right, like if they were writing. In this way, they will have more facility to read it correctly. On the other hand, it is also important to tell them that when they do the mathematical operations with the sticks (addition, subtraction, multiplication and division) they have to start from the units as if they were doing it on a paper.

The numerical sticks and the HTU Box allows the understanding of the number and its size, because it provides a concrete and faithful model to the visible reality, which gives meaning to the use of the written symbols and to the concepts related to the positional value (Bracho López y García Pérez, 2015). In this sense, we have to combine the use of these resources with the mathematical representation of numbers and the verbalization of the changes produced in the different numbers, if not they will find difficulties in the future.



These resources should play a main role in the first years of numerical work, changing after to more abstract resources. Also, we need to relate the quantities in the box to other resources in the classroom (numerical tape, panel, rulers, tape measure, abacus...) to work with interchangeable representations. This will help the children to develop gradually a greater flexibility in reasoning and the connection with modes of representation that require a greater level of abstraction (Bracho López y García Pérez, 2015).

### **1.1. Uses**

Firstly, with this method, we can work the Decimal Number System (units, tens and hundreds). Through the units, the students learn to work with the ten. Then, with the work of the ten, it is easier for the students to learn the hundreds, so that they build their knowledge about units, tens and hundreds.

We can verify the structure of this new element: the students learn the composition of the tens through the units and in turn a hundred is formed by ten tens, each of which

contains ten units. Using this method, the equivalence between the different orders is visible and verifiable (Bracho López y García Pérez, 2015).

In addition, students can work on composition and decomposition of numbers. Children can divide a number into units, tens and hundreds and then represent them with the numerical sticks. They will put the corresponding number of sticks in each space of the HTU Box, so it will be easier and clearer for them to see the decomposition and to do composition too.

Also, students can perform activities on "major and minor than". They can decompose the numbers in units, tens and hundreds with the numerical sticks, and taking into account the number of sticks in each space of the HTU Box, they will be able to see which number is major and which number is minor. This means that children can experiment directly and easily with numbers.

Moreover, children can make calculations using the sticks and the HTU Box. As for the calculation, the box connects directly with decomposition strategies and facilitates the graphic transcription that is derived from the manipulation of quantities. Especially it is a very useful resource for the operations with "carrying"). Students can realise operations such as addition, subtraction, multiplication and division, and it will be easier for them to see and do it with the sticks rather than do the operations in a traditional way. It is because the sticks allow them to experience, touch, manipulate, put and remove them.

Besides all this, we can do with children manipulative activities as competitions, manipulative dictates... With these activities children can work and reinforce all the contents mentioned before, and also they will be motivated and will have more interest in learning mathematics.

### **1.2. Benefits and drawbacks**

According to Bracho López y García Pérez (2015), we can find different **general benefits** of the use of the numerical sticks and the HTU Box to teach mathematics in Childhood and Primary Education:

- They promote in students a favorable disposition and progressive security and confidence towards the interpretation and the use of numerical information.
- They facilitate the creation of contexts in the class-group that lead to participation, communication and cooperation.
- They encourage personal initiative and autonomy.
- This resource motivates, encourages attention and encourages learning.
- They adapt to individual characteristics and needs and allow attention to diversity.

On the other hand, we find other **benefits more concrete**:

- Leads to a solid understanding of the Base-ten System (SND).
- Avoids common mistakes of traditional algorithms: intermediate zeros, how to align, etc.
- Allows children to “see” the relative size of numbers. In this sense, the numerical sticks and the HTU Box allow them to realize of the similarities and differences between two quantities as we can see in this example:



How much do you need to match these two quantities?

- Eases the understanding of addition and subtraction with “carrying”.
- Helps the acquisition of strategies for mental calculation.
- Understand the concepts of unity and ten and positional value.
- Progressively build the numbers that make up each section (1 to 9, 10 to 19 ...).
- Compose and decompose quantities inside the box.
- Compose and decompose quantities out of the box.

All these benefits shows that the numerical sticks and the HTU Box show us that they are a great tool to work with children, but they do not replace the traditional resources or those derived from new technologies. All of them can and must unite to coexist in the classroom forming a rich and diverse framework for quality teaching and learning (Bracho López y García Pérez, 2015).

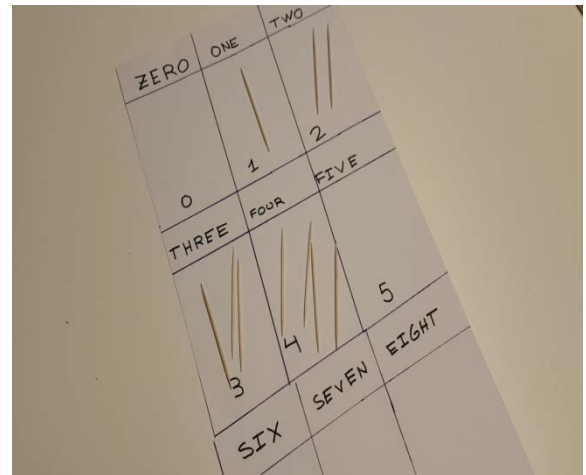
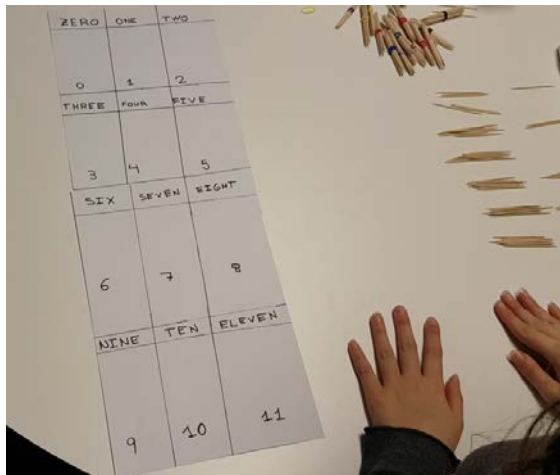
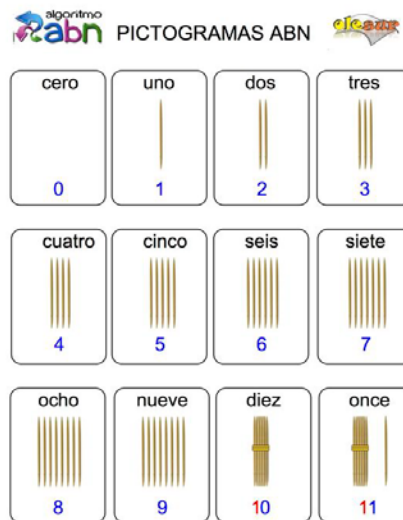
In the other hand, we can identify the following **drawbacks**:

- They require a good mastery of numeration for the manipulative understanding of what a ten and a hundred are, how they are formed, how they are decompose and what numbers need to combine to form they.
- In some cases, some teachers forget that we also have to work numerical representation on paper and the verbalization of quantities so that children are not limited to just working with units, tens and hundreds with the sticks.

## 2. Detailed description of the use of this resource to teach:

### 2.1. Sequential construction of numbers

To teach the sequential construction of numbers, we are going to explain to the children firstly the representation of each number with the sticks. In this line, we will say that the number zero correspond to zero sticks, then the number one correspond to one stick and so on, until the number ten. In this case, we will show them that when they have the number ten, it corresponds to ten stick and they are put together with an elastic band. Then, we will show them that to form the number eleven they have to pick the group of ten sticks and they have to add one more.



When the children learn the representation of numbers with the sticks, they could learn the sequential construction of numbers. We are going to use the HTU Box.

In this point, we will teach them to form firstly the numbers from 1 to 9. In this case, we will say that each stick correspond to one unit. For example, if we want to represent the

number 4, we have to put 4 sticks in the units. At this moment it is really important to teach to the children that 10 units are equivalent to one ten.

Then, we will work with them with the numbers from 10 to 99 in order to teach them the tens. For example, if we want to represent the number 32, we have to put 3 sticks in the tens and 2 sticks in the units. Finally, we will teach the numbers from 100 to teach them the concept of hundreds. In this case, we will say that 10 tens correspond to a hundred. For example, if we want to represent the number 152, we have to put one hundred, 5 tens and 2 sticks in the units. When the children control the concepts of units, tens and hundreds, we will teach them the thousands.

### *The principle of reversibility*

In order to explain the principle of reversibility we will use the following examples. If we have 9 units and we add one unit more, we put them together with an elastic band, and then, we have one ten (figure 1). On the other hand, if we had one ten and we take away 1 unit, we have now 9 units (figure 2).

Figure 1:

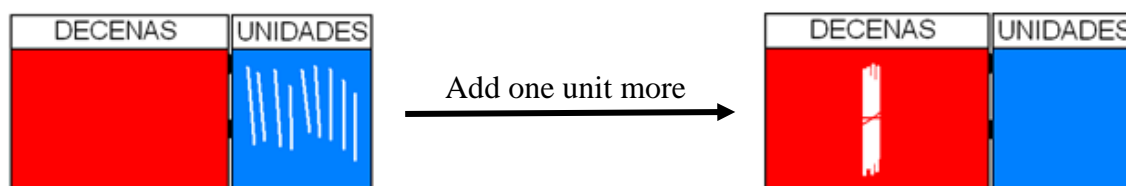
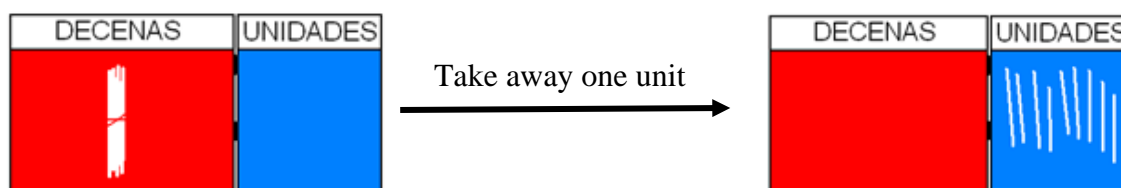


Figure 2:



### ***2.2. Representation of numbers to the hundred***

We will show to the children that in the HTU Box they can represent any number decomposing it in units, tens and hundreds. We will teach children to build numbers in the box from formal mathematical language (words and written signs). For example, we will say to the children: “write 75” and they have to build it in the box.


And in the opposite way, we can say to the children: “create 6 tens in the box” and then we ask: “To which number it correspond to?” or, “which is this number?”



### 2.3. Compose and decompose of hundreds, tens and units


- In this case we are going to go from the simplest to the complex. For this reason, we are going to start teaching the children to compose and decompose **units**.

We will say that to **compose 6 units** mean that we have to place these quantities in the HTU Box using the numerical sticks.

HUNDREDS	TENS	UNITS
		

After doing it, we will say that “6 units is 6”

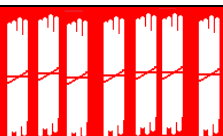

On the other hand, we will say that to **decompose 8** mean that we have to place this quantity in the HTU Box using the numerical sticks.

HUNDREDS	TENS	UNITS
		

After doing it, we will say that “8 is 8 units”



- Then, we are going to teach them to compose and decompose **tens and units**. We will use these examples:

We will say that to **compose 7 tens y 5 units** mean that we have to place these quantities in the HTU Box using the numerical sticks.

HUNDREDS	TENS	UNITS
		

After doing it, we will say that “7 tens and 5 units is 75”




On the other hand, we will say that to **decompose 53** mean that we have to place this quantity in the HTU Box using the numerical sticks.

HUNDREDS	TENS	UNITS
		

After doing it, we will say that “*53 is 5 tens and 3 units*”




- And finally, we are going to teach them to compose and decompose **hundreds, tens and units**.

We will say that to **compose 2 hundreds, 3 tens y 5 units** mean that we have to place these quantities in the HTU Box using the numerical sticks.

HUNDREDS	TENS	UNITS
		

After doing it, we will say that “*2 hundreds, 3 tens and 5 units is 235*”

On the other hand, we will say that to **decompose 162** mean that we have to place this quantity in the HTU Box using the numerical sticks.

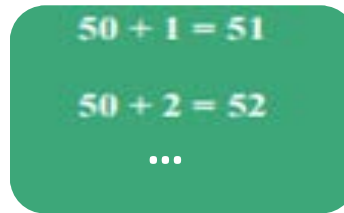
HUNDREDS	TENS	UNITS
		

After doing it, we will say that “*162 is 1 hundred, 6 tens and 2 units*”.

#### ***2.4. Additive decompose of numbers***

To teach the children the additive decompose of numbers we are going to start also with the simplest form. In this case, we will start representing a number in the HTU Box with the numerical sticks and then expressing it verbally as a sum of units. For example, we will represent 52 and we will say that 52 is 50 units plus 2 units. Also, we will represent this additive decomposition using mathematical representation ( $52 = 50 + 2$ ).

We will do the same with different numbers, writing always in the whiteboard their mathematical presentation, like this:



$$50 + 1 = 51$$

$$50 + 2 = 52$$

...

After it, we will take advantage of this situation and use it to do some activities with the children in order to reinforce their knowledge. We will ask them the following questions:

- ¿How many tens and units have each number?
- Write the number that have 5 tens and 1 unit.
- Decompose the number 52 as a sum ( $52 = 50 + 2$ ).

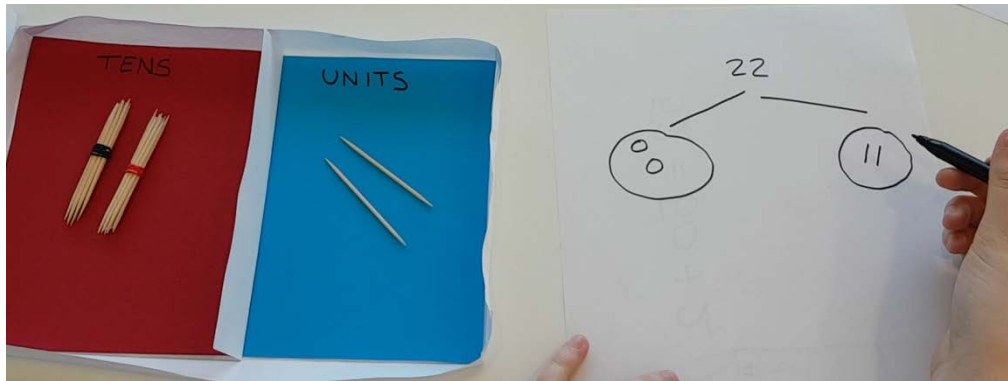
### *The house of the numbers*

In this case, the numbers are introduced to the children as neighbors of a house with some floors that, together, they always sum the quantity of the house of the numbers that they are working with. For example, in the number 138, we divide the house in three floors and we will use the sticks. In the first floor, there will be one hundred plus 3 tens and plus 8 units (we will represent it on the paper). In the second floor, there will be 0 hundred plus 13 tens and plus 8 units (we will represent it on the paper). In the third floor, there will be 0 hundred plus 0 tens and plus 138 units (we will represent it on the paper). Then, we will make the additions of each floor of the house and realize that all of them have the same result (138).

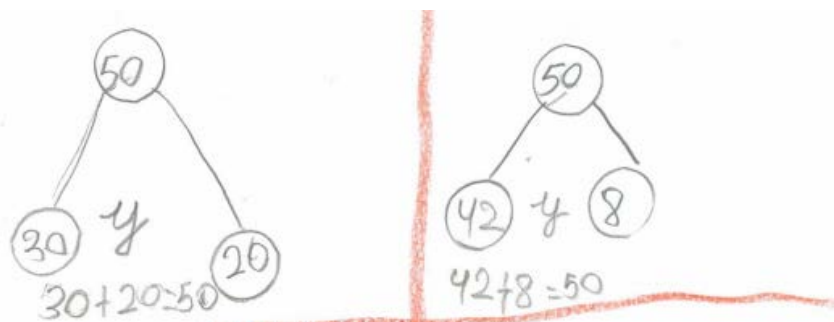


Also, there are another way to express the additive decompose of numbers. Now, we represent the number in the HTU Box (for example, the number 22 that is 2 tens and 2

units) and then we express it on the paper writing the number 22 at the top and dividing it in two parts. The first one will have two circles that represent the tens and in the other part we will have two lines that represent the units. This method is adequate for the first years of Primary Education or childhood because it is an easy method for them.



Finally, we can use a third possibility to work with the additive decompose of numbers. This case is similar to the last one, but the children do not have to represent the numbers with the draws. However, they have to do it with the mathematical representation. Following the example that we did before, we use the number 22 that is represented with the numerical sticks as 2 tens and 2 units. After it, we will represent it on the paper writing the number 22 at the top and dividing it in two parts. In the first one we will write the number 20 and in the other part we will write the number 2. This method is used in more advanced school years for use more abstract concepts (the mathematical representations of numbers).



### **3. Bibliography**

Bracho López, R. y García Pérez, M. T. (2015). *Materiales didácticos para el desarrollo del sentido numérico en los primeros años de aprendizaje*. Uno: Revista de didáctica de las matemáticas, 70, 31-35.