A Measurement Approach to Place Value Concepts

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2018 NCTM Annual Meeting & Exposition
April 26, 2018
What ideas do you associate with place value? (2-3 words)

When poll is active, respond at PollEv.com/seanyelleyag351. Text SEANYELLEYAG351 to 22333 once to join.
Learning the concept of place value within a measurement context

Lessons were adapted from the *Measure Up* project (Dougherty, et al., 2002) based on the work of Davydov (1975a), (1975b).

- Spontaneous concepts vs. scientific concepts
- Generalized contexts preceding specific ones
Mathematics through the context of continuous quantities

Length

Area

Volume
Out-of-this-World Adventures

Illustration by Kelli Ann Harada

WELCOME TO QUINAR
● Using only place II and place I units, how many ways can you make length A?
Concurrent Multiple Representations
More Extraterrestrial Adventures!

Illustration by Kelli Ann Harada
● Use your units to create an area that is represented by your number.

● Represent the measure of your area using
  ○ line segments
  ○ a part-whole diagram
  ○ as an equation
  ○ a number
  ○ a table
Lengths

- Black rod
- Pink rod
- Orange rod
Base Match

Match the equation to the base number system.
Welcome to the Decimal World

Use the length-unit ("one, base ten") to make

- A place two length-unit ("one-zero, base ten")
- A place three length-unit ("one-zero-zero, base ten")
Using area units to represent each base ten place

How big is a thousand area-unit?
Place value as a structure

4. a. $E$ is the main measure.

<table>
<thead>
<tr>
<th>II</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

(5) (3)

Draw $E_{II}$ for base 5.

From the table, draw the base 5 segment.

Draw $E_{II}$ for base 3.

From the table, draw the base 3 segment.
<table>
<thead>
<tr>
<th></th>
<th>(43_5) (&lt;\ 43_7)</th>
<th>(21_3\ \boxed{&gt;\ 12_3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>I looked at 43₅ and 43₇, since the 43 in both of them it was up to the base. 5&lt;7 so 43₅ is &lt; 43₇.</td>
<td>I looked at 21₃ and 12₃ since the base is the same it's up to the digits 21₃ &gt; 12₃. 2₁₃ &gt; than 12₃.</td>
</tr>
</tbody>
</table>
a. $43_5 < 43_7$

$43_5$ is lesser than $43_7$ because base 7 is higher than base 5 and $43_7$ has more units.

b. $21_3 > 12_3$

$21_3$ is greater than $12_3$ because even though there is the same base 3, $21_3$ has more units.
Time to Reflect

● How can working in different base number systems deepen students’ understanding of place value?

● How does using continuous quantities compare to using discrete objects for modeling place value concepts?
Questions?

Thank You!

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