



Bridging Informal and Formal Knowledge in Numeracy Education to Support High Quality Instruction

Yasmin Sitabkhan, Ph.D.
RTI International

Outline

- Formal and informal mathematics
- Examples from out-of-school settings
- Implications for assessment, instruction, and training

Formal and Informal Mathematics

▪ **Formal Mathematics**

- Historically-developed system taught explicitly through formal education
- Abstract
- Examples: algorithms, base-10 notation, written equations

▪ **Informal Mathematics**

- Based on everyday activities
- Concrete
- Often referred to as workplace mathematics, preschool mathematics, out-of-school mathematics, everyday mathematics, street mathematics
- Example: math used when shopping

Formal and Informal Mathematics

Children interpret formal mathematics through their informal mathematics knowledge

- Linking concrete with abstract
- Everyday understandings give meaning to formal ones, and vice versa (Vygotsky, 1986)

Illustrations: India

Aged 8-14

Living in poverty

Infrequent to no formal schooling

Sold small items on trains and railway platforms in Mumbai



Illustrations: India

Seller:



5 rupees

Illustrations: India

Seller:



5 rupees

Customer:



x 7

Illustrations: India

Seller:



5 rupees

Customer:



x 7

Seller:

35 rupees

Illustrations: India

Seller:



5 rupees

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x 7

Seller:

35 rupees

Customer:



Seller:



Seller asks customer to buy one more to make it 40 rupees, because she does not have change

Illustrations: India

Math that this young seller used was:

- Quick
- Efficient
- Tied to the context
- Accurate

Illustrations: India

Pencils are 5 rupees each
A customer wants to buy 56.
What is the total price? How do you know?

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12 year-old seller:
He says:
If 5 rupees for 1 pencil, then
50 rupees for 10 pencils
100 rupees for 20 pencils
150 rupees for 30 pencils
200 rupees for 40 pencils
250 rupees for 50 pencils
Then
30 rupees for 6 pencils
250 and 30 is 280 rupees

12 year-old non-seller:
He writes 56×5 on paper, then uses
a school-based algorithm to solve
equation

Illustrations: Mexico

Aged 5-15

Triqui Indigenous group

Living in poverty

Some schooling, though
quality low

Sold artisanal goods in
main plaza



Illustrations: Mexico

20p each
3 for 50 p



Illustrations: Mexico

Why do you sell 3 shawls for 50 pesos?

8-year-old seller:

Si, porque mira, es que como, lo damos una a 20. Y es que tenemos que bajar 10 asi no lnos compren. Si ponems a 60, no me la compraria, le bajamos a 10 por eso.

Yes, because look, it's like, we give one for 20. And we have to lower [the price] by 10 or they won't buy it from us. If we put [the price] at 60, they won't buy it from me, that's why we lower [the price] by 10.

20p each
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Illustrations: Mexico

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20p each
3 for 50 p



$$3 \times 20 = 60$$

$$60 - 10 = 50$$

Implications: Assessments

- Formal mathematics assessments measure what children SHOULD know
- Informal mathematics assessments measure where children are starting from and reveal what children already know
- Examples from TEMA-3 (Ginsburg & Baroody, 2003)
 - Naming written numerals (formal)
 - Producing sets of given numbers (informal)

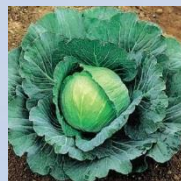
Implications: Instruction

- Instruction can be designed to link abstract with concrete
 - Often instruction begins with concrete and then moves to abstract , but there should be **EXPLICIT** linking

Implications: Instruction

Concrete

Kajol went to the market to buy cabbage. On Monday she bought 3 cabbages. On Tuesday she bought 2. How many cabbages did she buy all together?

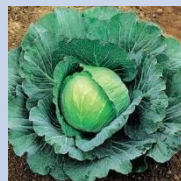


Abstract

Implications: Instruction

Concrete

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Abstract

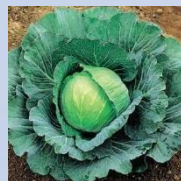
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Implications: Instruction

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Implications: Instruction

Concrete

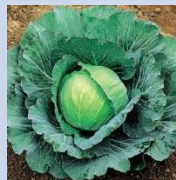
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Abstract

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3



+

2



=



Training

- Importance of informal mathematics for high-quality instruction
 - What mathematics looks like at the early grade
 - Awareness of rich mathematical knowledge that children develop out-of-school
 - Attitudes towards informal mathematics
- How to make the link between formal and informal explicit

Thank you!
Comments and
Questions

ysitabkhan@rti.org