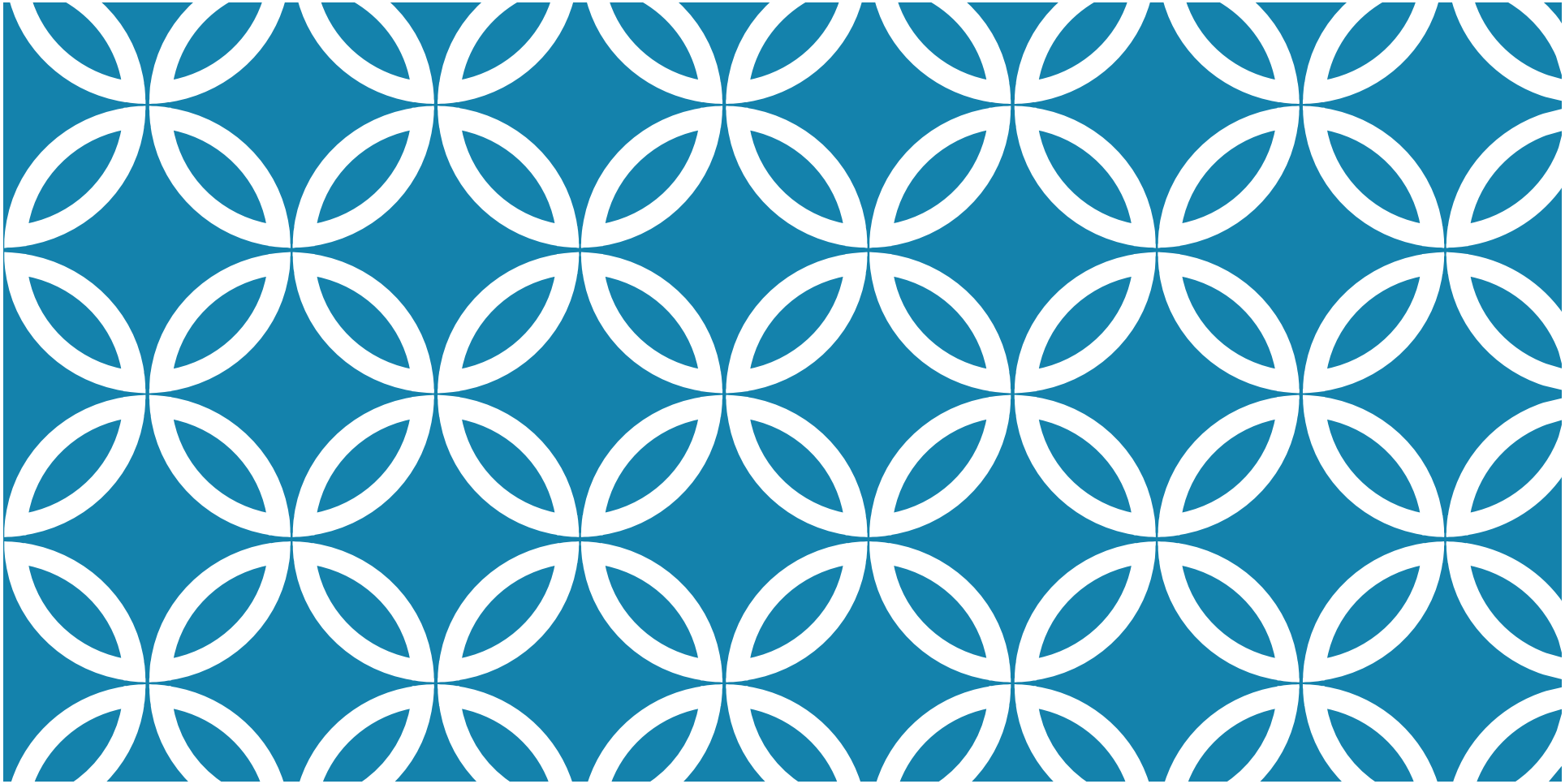

SHIFTING PARADIGM IN PROBLEM SOLVING: ALGEBRAIC VERSUS ARITHMETIC THINKING

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OUTLINE OF THE SESSIONS

Session 1:

Creation of an awareness of the limits of the operational paradigm

Session 2 :

Introduction of the relational paradigm in relation to algebraic and arithmetic thinking

Session 3:

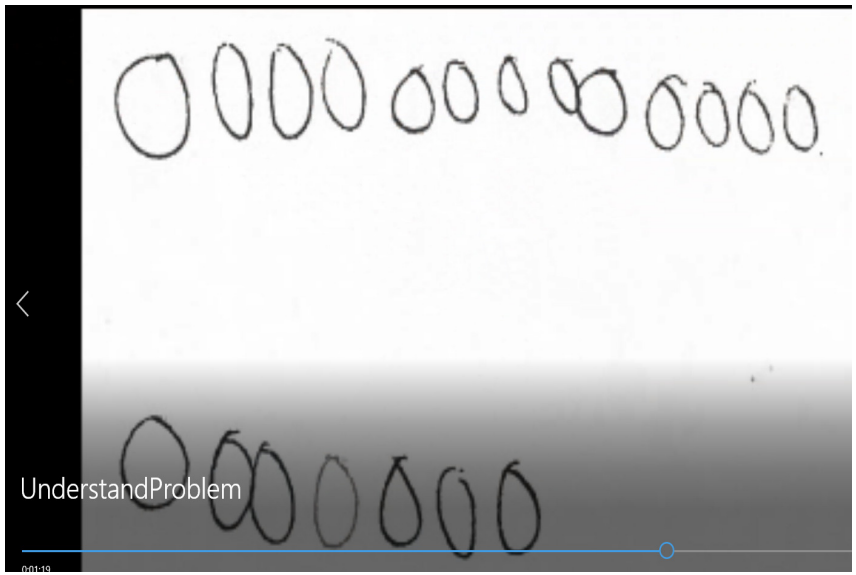
Theorization of the two paradigms in problem solving; algebraic versus arithmetic thinking

HOMEWORK

While solving problems, what did you work on?

1. *Story (context)*
2. *Operations (arithmetic)*
3. *Relationships (algebraic)*

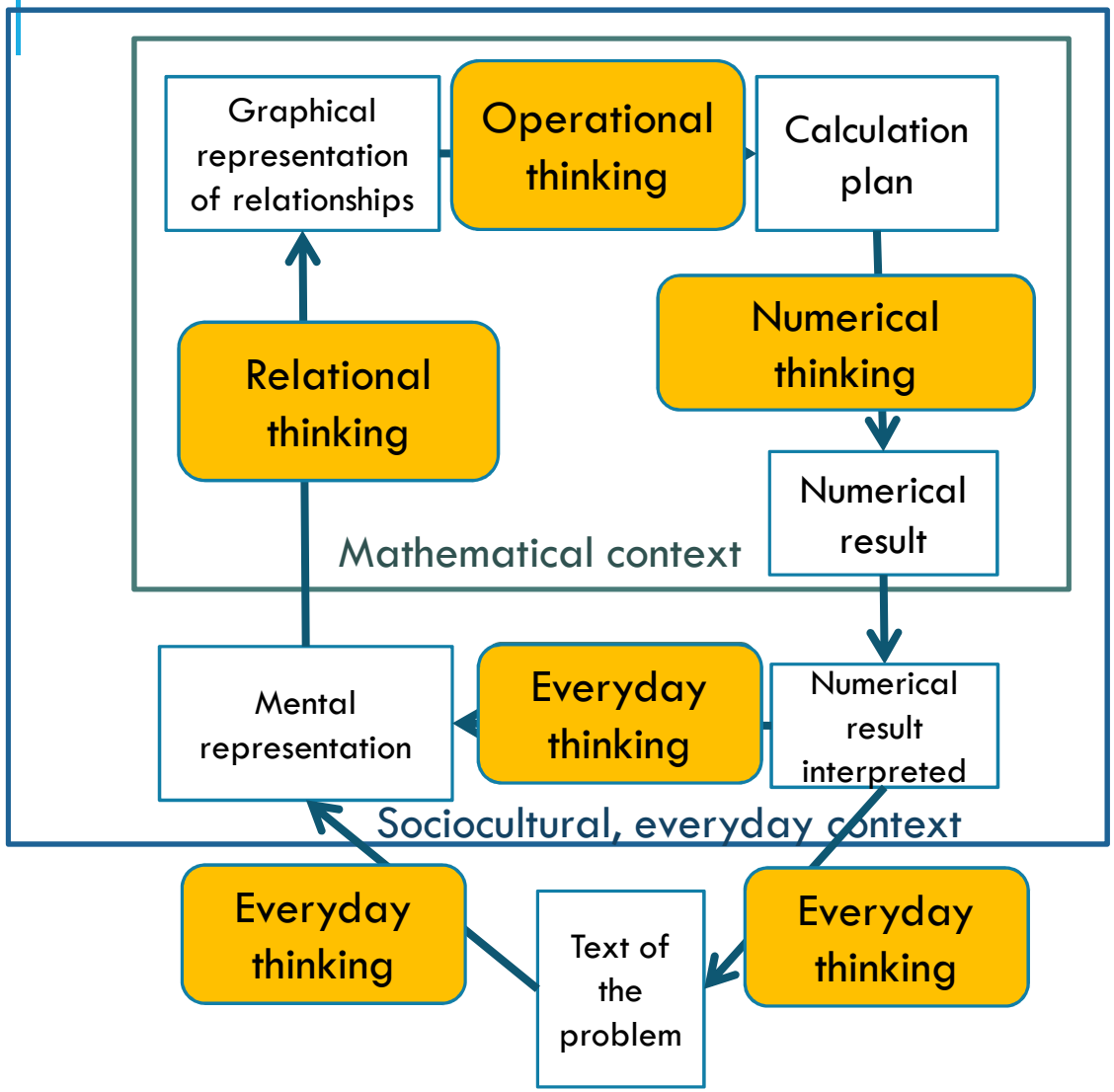
UNDERSTANDING THE PROBLEM



REVIEW OF SESSION 1 & 2

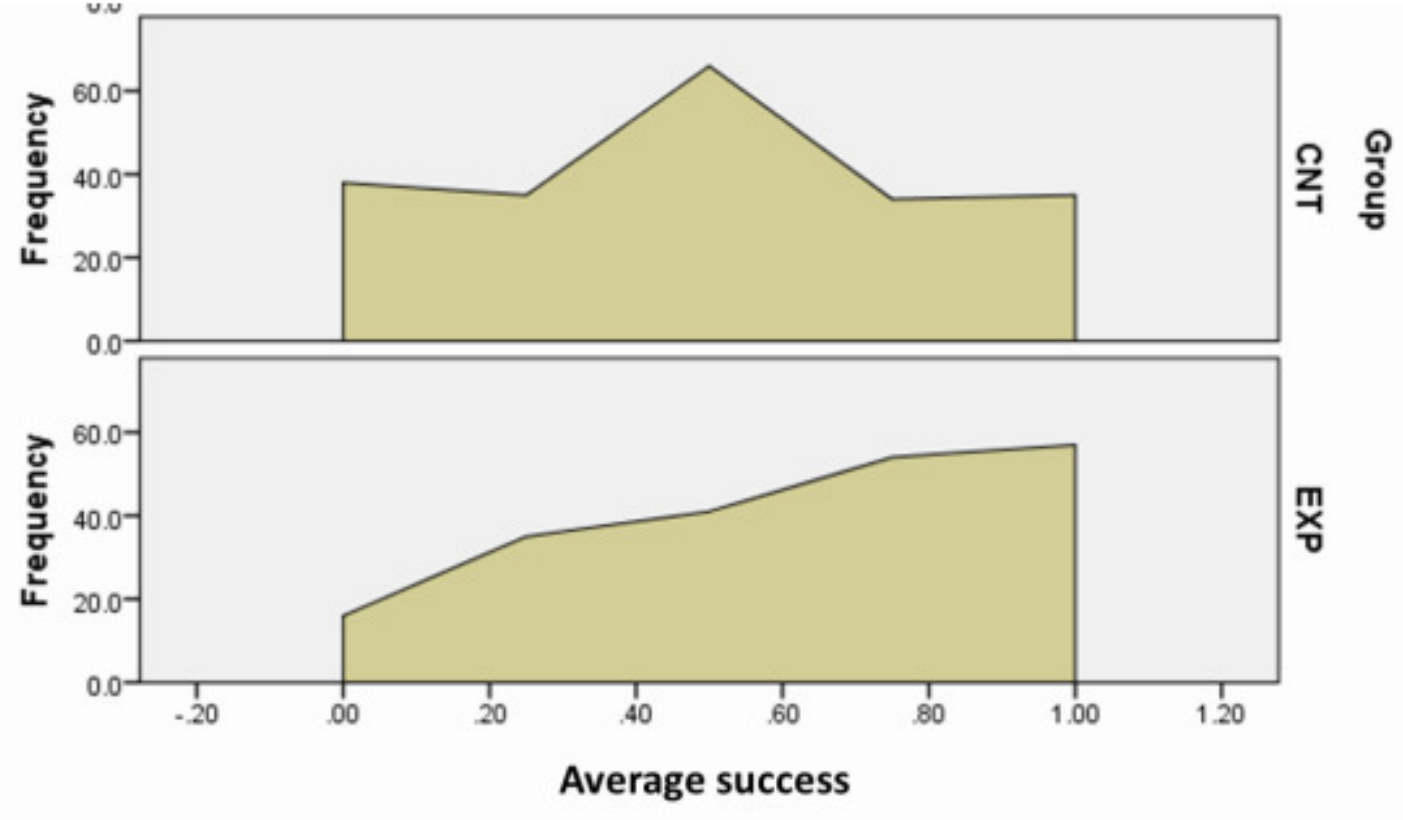
- *Understanding the problem* is a critical step in problem-solving, yet it can be processed differently with different learning outcomes.
- *Operational thinking*, *relational thinking*, *numerical thinking* and *everyday thinking* are different ways of thinking.

REASONING DEVELOPMENT

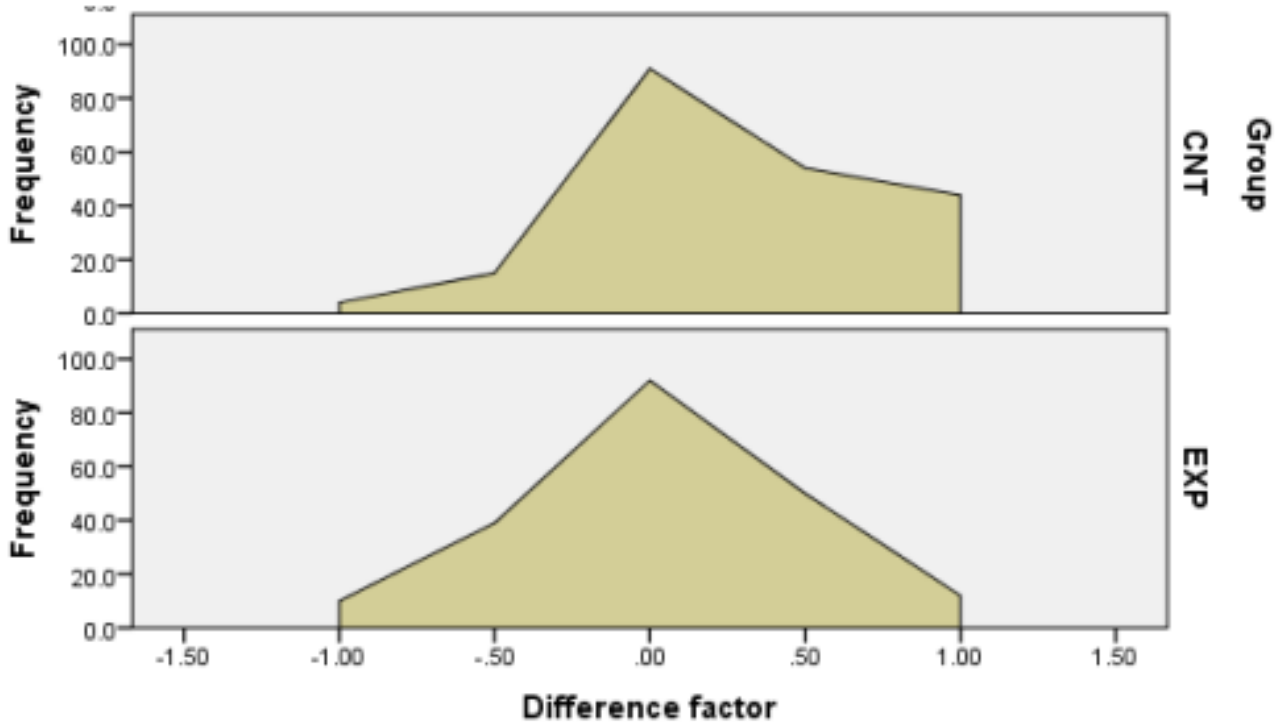


What kind of thinking is promoted through the problem-solving process?

PATTERNS OF AVERAGE SUCCESS



PATTERNS OF STRUCTURE SENSITIVITY



THEORIZATION

- There is no clear distinction between operational and relational thinking in the classrooms.
- Is the numerical thinking the basis for the relational thinking?

LOOKING THROUGH THE EXISTING THEORY

Romberg, T. A. (1982). An emerging paradigme for research on addition and subtraction skills. In T. P. Carpenter, J. M. Moser, & T. A. Romberg (Eds.), *Addition and subttraction* (pp. 1–8). Lawrence Erlbaum Associates Publishers. Retrieved from Hillsdale, New Jersey

Carpenter, T. P., & Moser, J. M. (1982). The development of addition and subtraction problem-solving skills. In T. P. Carpenter, J. M. Moser, & T. A. Romberg (Eds.), *Addition and subtraction: cognitive perspective* (pp. 9–24). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Vergnaud, G. (1982). A classification of cognitive tasks and operations of thought involved in addition and subtraction problems. In T. P. Carpenter, J. M. Moser, & T. A. Romberg (Eds.), *Addition and subtraction: A cognitive perspective* (pp. 39–59). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Thompson, P. W. (1993). Quantitative reasoning, complexity, and additive structures*. *Educational Studies in Mathematics*, *25*(3), 165–208.

Davydov, V. V. (1982). Psychological characteristics of the formation of mathematical operations in children. In T. P. Carpenter, J. M. Moser, & T. A. Romberg (Eds.), *Addition and subtraction: cognitive perspective* (pp. 225–238). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

LOOKING THROUGH EXISTING PRACTICE

Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M., McGarvey, L. M., & Folk, S. (2015). Chapter 9. In *Elementary and Middle School Mathematics: Teaching Developmentally* (Fourth Can, pp. 139–162). Pearson Education Canada.

Small, M. (2017). Meanings of Subtraction. In *Making Math Meaningful* (Third Eddi). Nelson Education.

WHAT DID WE LEARN SO FAR?

Please take 10 minutes to discuss with your team mates:

- *What was new for you in this workshop?*
- *What questions do you have?*
- *What can be future discussions about?*

CONCLUSION OF SESSION III