Unit 2: Fluency

Handout 1: What does it mean to be fluent?

Richard Skemp on ‘understanding’

Relational understanding

“… what I have always meant by understanding … knowing both what to do and why.”

Instrumental understanding

“… what I have in the past described as ‘rules without reasons’, without realising that for many pupils and their teachers the possession of such a rule, and ability to use it, was what *they* meant by ‘understanding’.”

Skemp, R. R. (1976) 'Relational understanding and instrumental understanding.' Mathematics Teaching, (77) pp. 20-26.

Susan J Russell on ‘fluency’

Fluency includes the idea of efficiency

“*Efficiency* implies that the student does not get bogged down in too many steps or lose track of the logic of the strategy. An efficient strategy is one that the student can carry out easily, keeping track of sub-problems and making use of intermediate results to solve the problem.”

Fluency includes the idea of accuracy

“*Accuracy* depends on several aspects of the problem-solving process, among them, careful recording, the knowledge of basic number combinations and other important number relationships, and concern for double-checking results.”

Fluency includes the idea of flexibility

“*Flexibility* requires the knowledge of more than one approach to solving a particular kind of problem. Students need to be flexible to be able to choose an appropriate strategy for the problem at hand and also to use one method to solve a problem and another method to double-check the results.”

Fluency rests on mathematical foundations:

“Knowing the meaning of operations and how these relate to each other (including ‘inverse’).

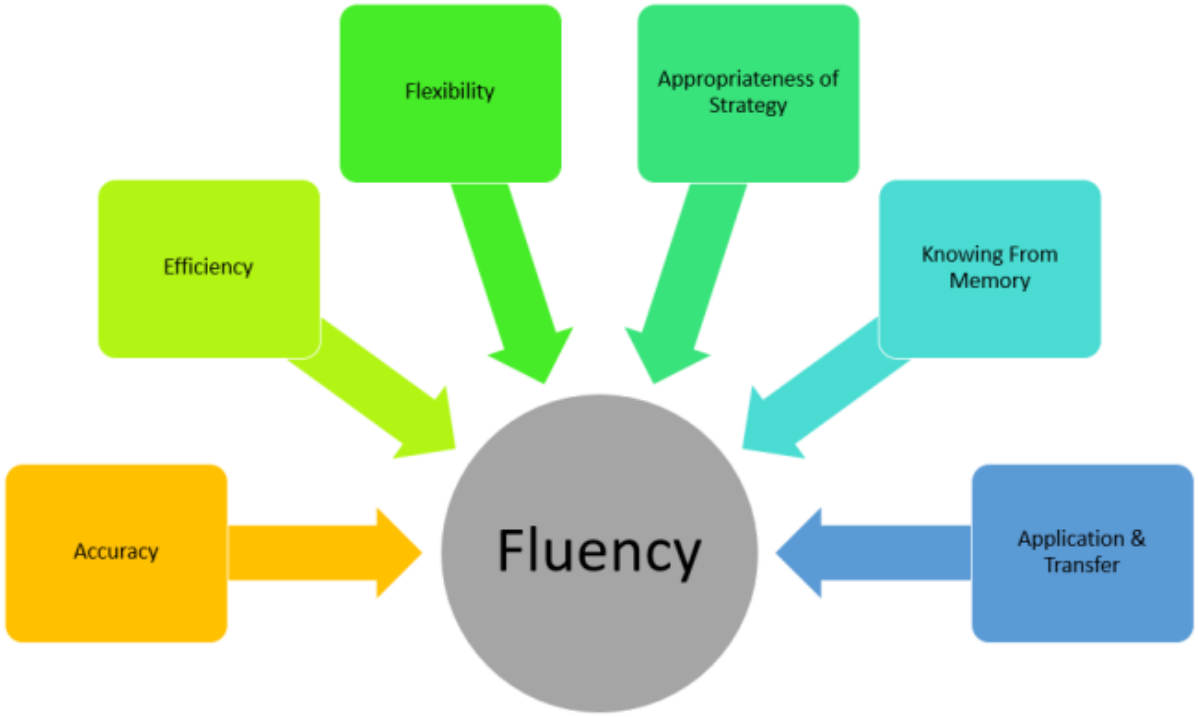
Knowing number relationships including ‘key facts’ and using these to derive others.

Having a good understanding of the base-10 system.”

Russell, S. J. (2000) 'Developing Computational Fluency with Whole Numbers.' Teaching Children Mathematics, 7(3) pp. 154-158.

Joe Roicki on ‘multi-dimensional fluency’

Roicki builds on the work of Russell and suggests that these six elements make up fluency.



Roicki, J. (2017) Multi-dimensional fluency. Math Musings. [Online] [Accessed on 21 January 2020] https://mathmusingsblog.wordpress.com/2017/08/19/multi-dimensional-fluency/

Eddie M Gray and David O Tall on ‘knowing and using facts’

“The less able are doing a more difficult form of mathematics, which eventually causes a divergence in performance between them and their successful peers.”

They distinguish between ‘a meaningful known fact’ and ‘a fact remembered by rote’.

Gray, E. M. and Tall, D. O. (1994) 'Duality, Ambiguity, and Flexibility: A "Proceptual" View of Simple Arithmetic.' Journal for Research in Mathematics Education, 25(2) pp. 116-140.

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