PROBLEM SOLVING IN REMEDIAL ARITHMETIC:

Jump Starting the Reform

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REASONS FOR REMEDIAL MATHEMATICS IN COLLEGE

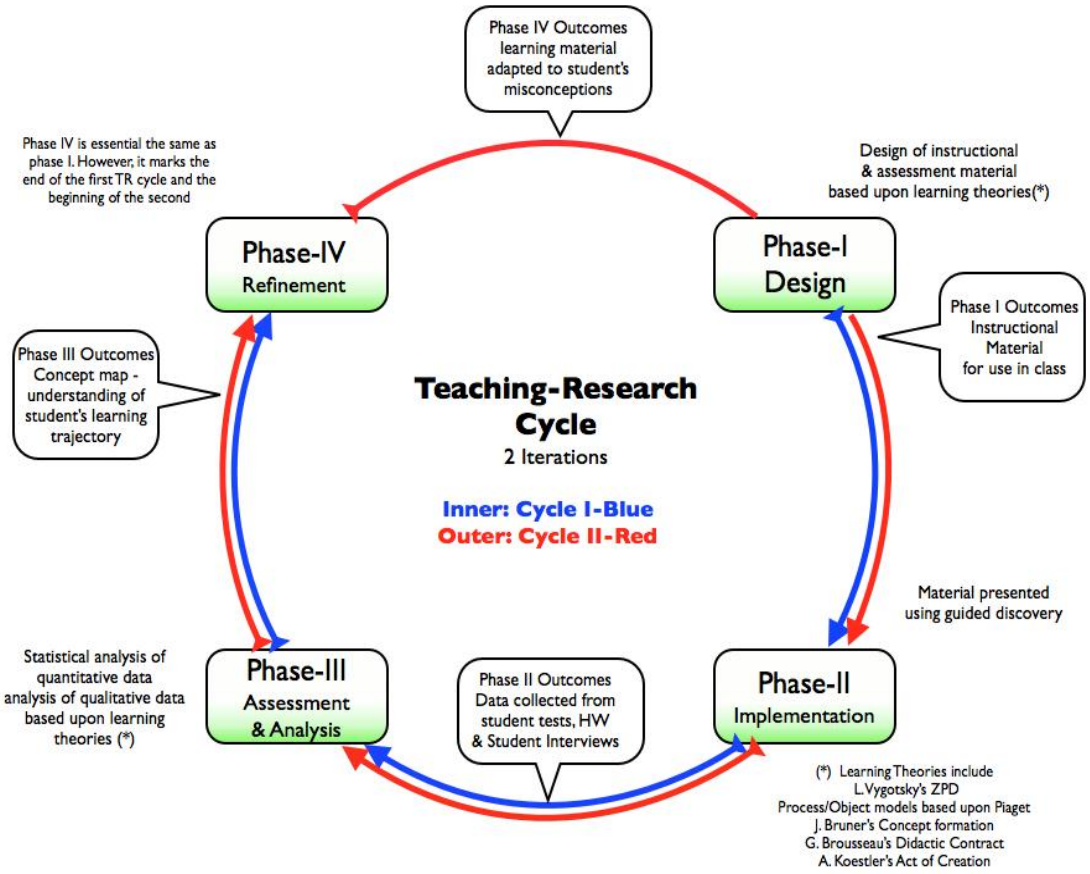
The community colleges of the City University of New York have been responsible for continuing the tradition of open admission, that is admission of all candidates who finished high school. The policy of open admission was established as a result of student rebellions in 1970 has been a reaction to the persistent inability of high school to prepare college ready students. The aim of remedial education in mathematics at community colleges is to complete high school education while at the same earning college credit whenever possible.

Remedial arithmetic and algebra courses are taken by 75% of the freshman student population in both colleges; further college mathematics education depends essentially upon success in remediation. The student population is in its majority African-American and Latino; HCC, the only bilingual (English/Spanish) public college in the CUNY system, has decisive majority of female students.

NATURE OF REMEDIATION

- The remedial courses run along uniform departmental syllabi and final exams are agreed upon by the Curriculum Committee of the Mathematics Department. The syllabus includes positive integers together with the organization of the decimal system, operations on integers, fractions, decimals with scientific notation, ratio and proportion, per cents and conversion of units. The topics of remedial courses and their lack of effectiveness indicate challenge of public education system in developing sustainable learning and teaching of the mathematics in a concerned, systematic, self-improving fashion,which gives justice to the cognitive and affective components of learning. 75% of graduating high school freshman entering CUNY require mathematics remediation; only 33% of those progress to college level courses.

METHODOLOGY: Teaching-Research NYCity Model



POLYA 'S APPROACH TO PROBLEM SOLVING

Four stages, (1) understanding of the problem, (2) planning of the solution, (3) performing all calculations to obtain the solution, (4) reflecting upon and checking the process.

INITIAL AIMS OF THE TEACHING EXPERIMENT:

- *Will the instructional emphasis on the second stage of Polya's problem solving approach improve student problem solving capability in arithmetic?* and
- to produce the *Teaching-Research Guide to Problem Solving (TRGPS)*-- containing the description of different successful problem solving strategies annotated teaching sequences

PROBLEM SOLVING: Four Different Approaches

- 1. Discovery Method
- 2. Zone of Proximal Development
- 3. Strategy Choice
- 4. Learning Trajectory

<u>Independence of improvement on the particular approach:</u>

The ANOVA analysis indicates differences between approaches were not significant ($p=0.82$) for the results and neither was the interaction between instructor and group ($p=0.94$). This indicates that differences in students' performance was not related to which instructor they had nor was the difference in one professor's mean score from pre- to post-test more noticeable than another's. Most importantly, it suggests that, for any instructor using this method one would expect a similar improvement in their students' performance.

CURRICULUM: distinguishing features of a mathematics curriculum that is structured around various problem-solving approaches is

- The presence of the **Inquiry to Discovery** method of teaching. The method appears in different guises depending on the problem solving approach: *conceptual discovery, working within ZPD, problem solving teaching sequence, strategy choice.*

- On one hand

  problem solving is the tool of the **Inquiry to discovery method**,

and on the other,

the **method of inquiry to discovery** can be employed by problem solving in any math curricula.

CURRICULUM: identify and examine feasible ways to clearly relate problem-solving principles to the organization and structure of mathematical contents,

- Problem solving can be adapted to particular goals of the didactic design, each time playing a different role:

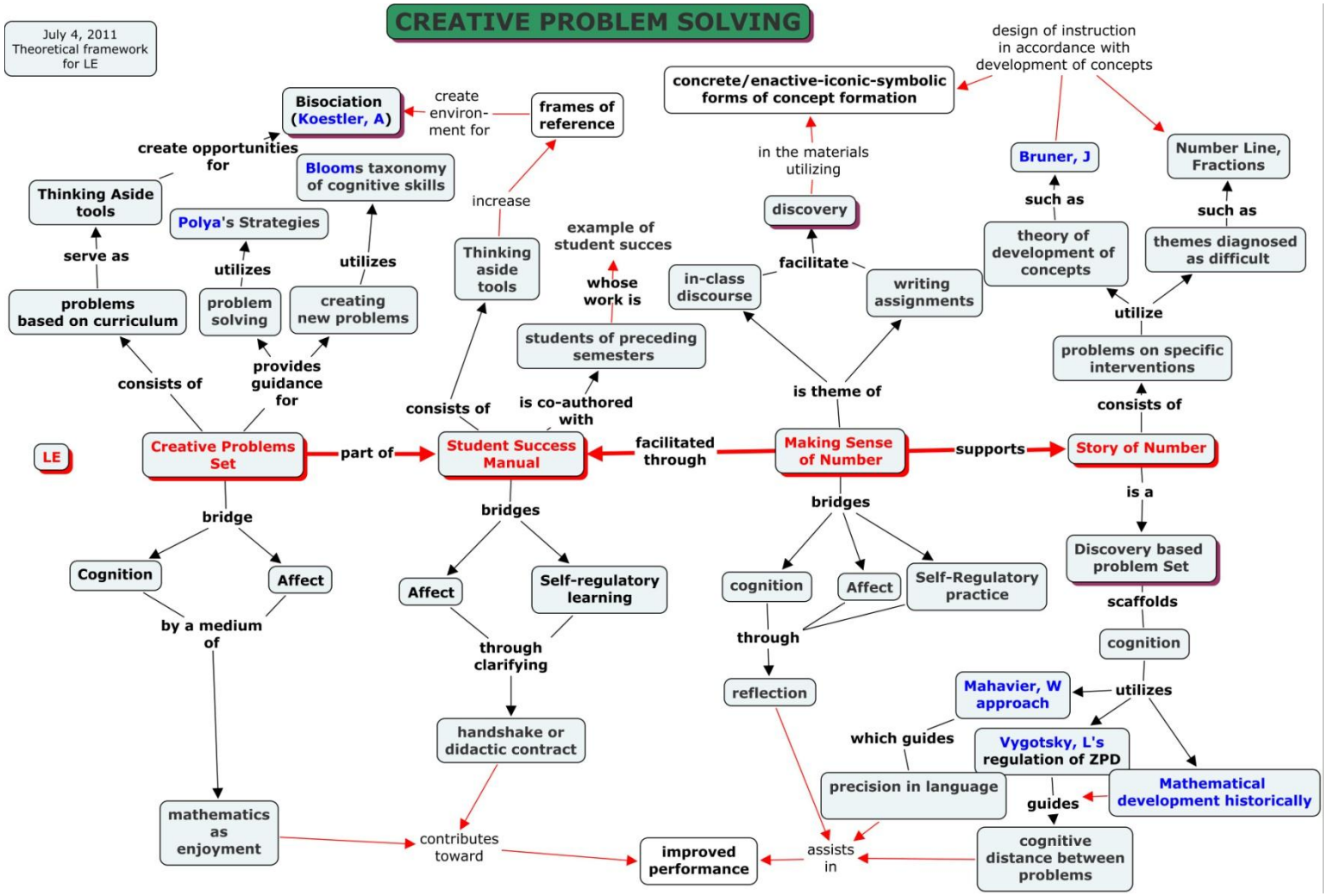
  * for **development of concepts across ZPD**, MPS is the tool with the help of which the integration of spontaneous concepts with scientific can proceed.

  * for the **Moore discovery method**, MPS is the **enquiry** engaged in by the student in the facilitation of **discovery** of a mathematical concept**.**

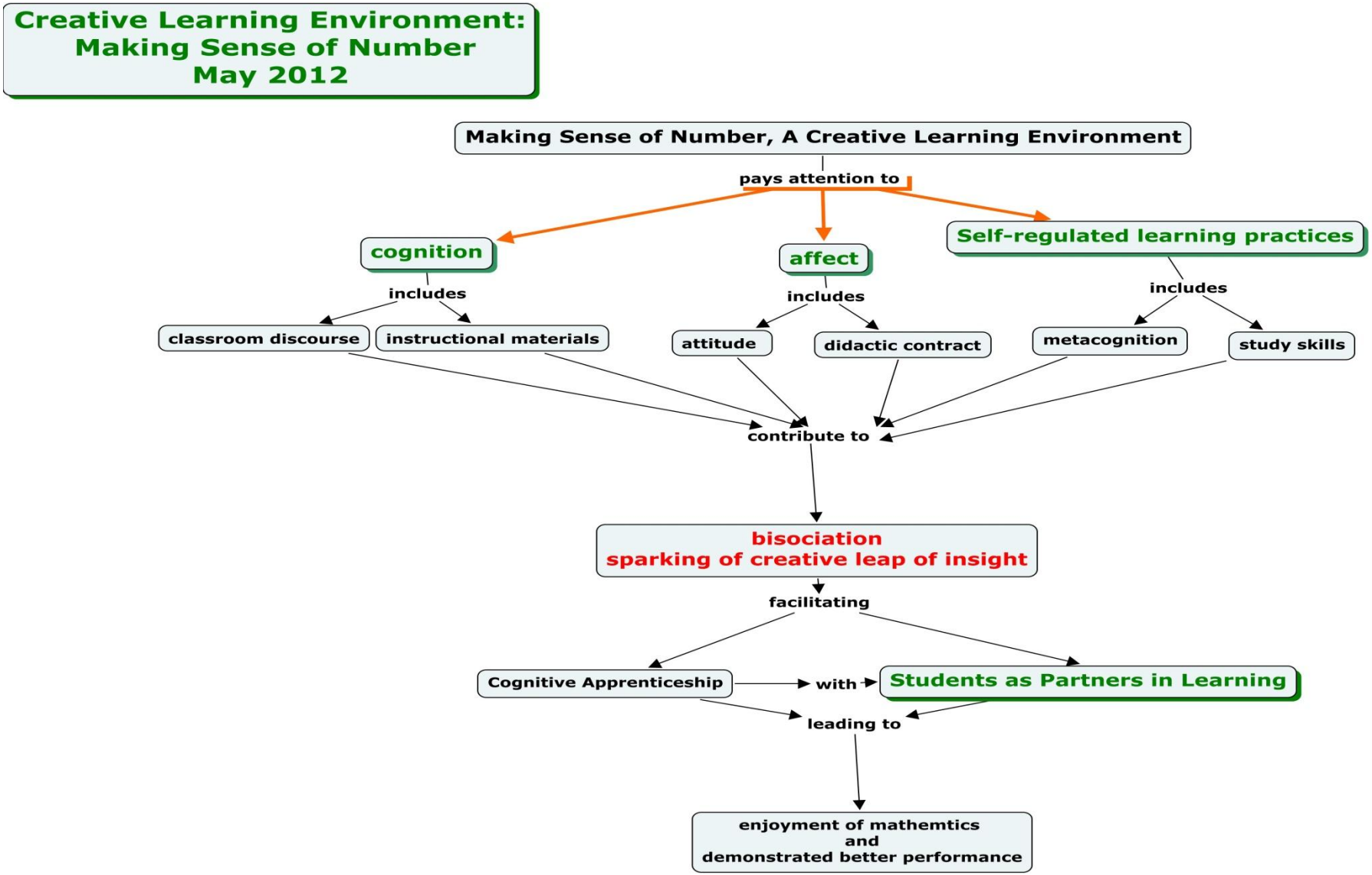
  ***** for the **Strategy Choice** approach, MPS is practice in decision making

  * for the **problem based learning trajectories,** MPS propels the student along the trajectory.

CREATIVE LEARNING ENVIRONMENT-merging cognitive/affective divide



CREATIVE LEARNING ENVIRONMENT



TEACHING-RESEARCH and PROBLEM SOLVING

- Integration of problem solving across curricula can be achieved through the discovery based teaching – research in which attention is paid both to the cognitive development and to the surrounding learning environment.
- Problem Solving is bridging the gap between initial situation and the target (Koeslter,1964)…through thinking backward from the unknown to the given. It is a sequence of thought, upward with analysis and downward with synthesis.
- Cycle of TR coordinates very well with Polya's stages and further with the need for backward and forward thinking to facilitate the discovery and solution of the problem.
- How research and practice merge to emerge as a teacher-researcher's guide to Problem Solving for the problems faced in the classroom*?-By simultaneous attention to cognition, affect and self-regulatory learning practices with writing as a systematic tool for the monitoring of all three as encountering challenging mathematics, finding enjoyment leading towards mastery.*