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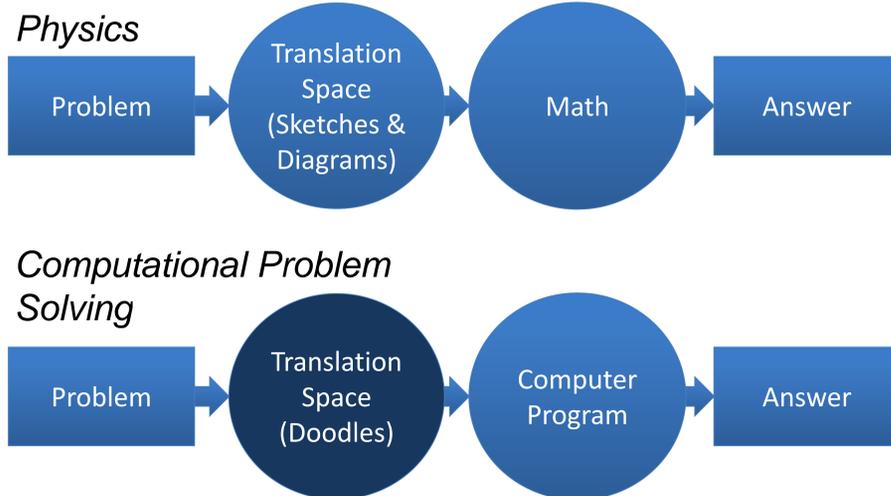
Presented at the *Fourth Annual Research and Scholarship in Engineering Education Poster Session*. 10/22/09.

Abstract

This investigation looks at deliberately evoking skills more typically associated with emotions to help first-year engineering students do computational problem solving.

Background

- Decision-making sciences indicate the use of amygdala (emotion), not just prefrontal cortex (logic) (Lehrer, 2009)
- Computational problem solving may be analogous to problem solving in physics
 - In physics, a *translation space* helps to determine the direction math should take (Root-Bernstein, 1991)



- Use of drawing (doodling) has been indicated with use of amygdala (Ablon, *et al.*, 1993)

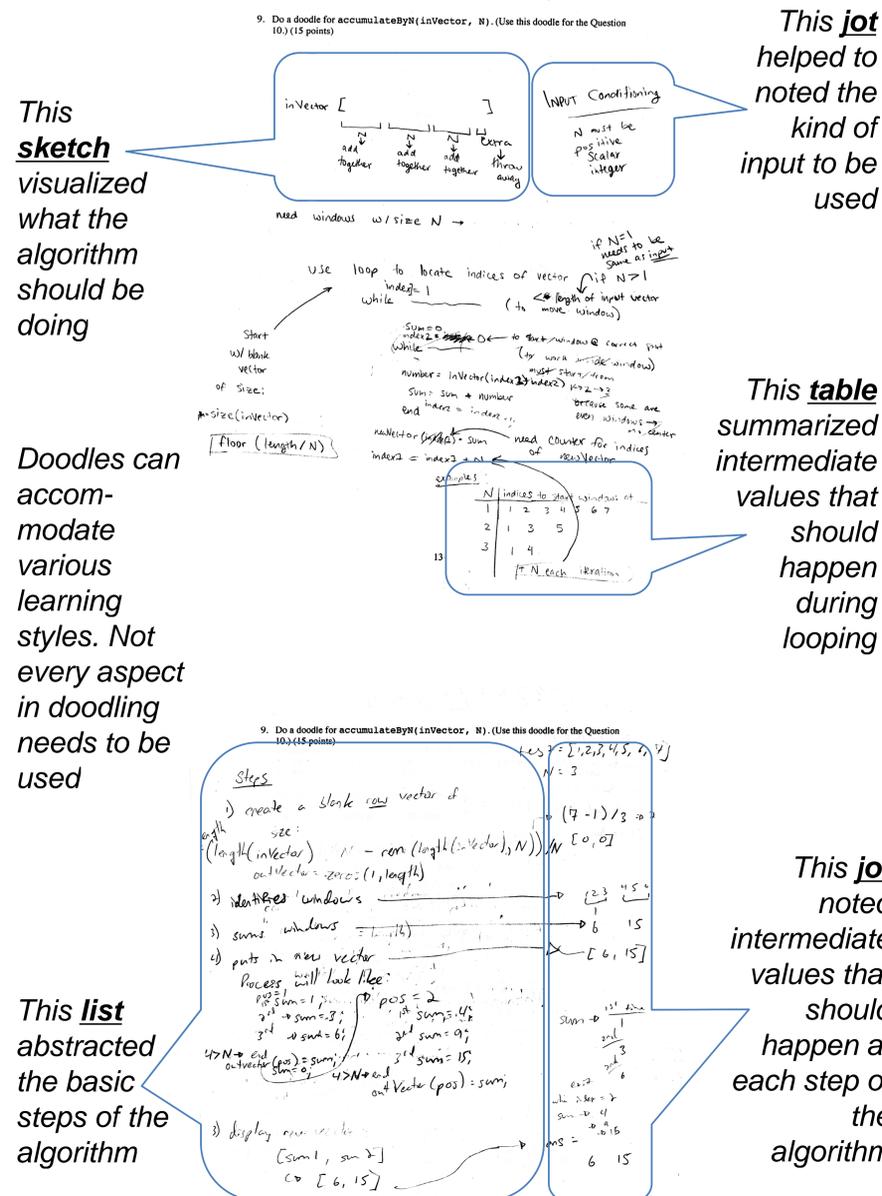
Method

- Incorporate structured doodling into lectures / labs (Winter 2009 ENGR 101, Introduction to Computers and Programming, Section 100) (test)
- Comparison with Fall 2007, ENGR 101, Section 100, which had a similar curriculum (control)

Results: Examples

- Successful doodles do abstract various subtasks that are implicit in an algorithm
- Successful doodles do examine an algorithm from more than one aspect (e.g., sketch, list, table, test case, jot)
- Example: Accumulator

9. Do a doodle for accumulateByN(inVector, N). (Use this doodle for the Question 10.) (15 points)



This sketch visualized what the algorithm should be doing

This jot helped to noted the kind of input to be used

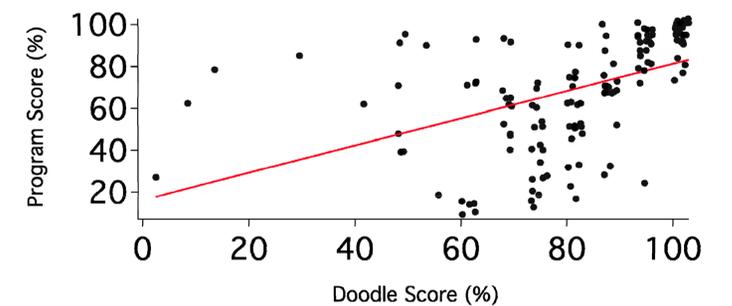
This table summarized intermediate values that should happen during looping

This jot noted intermediate values that should happen at each step of the algorithm

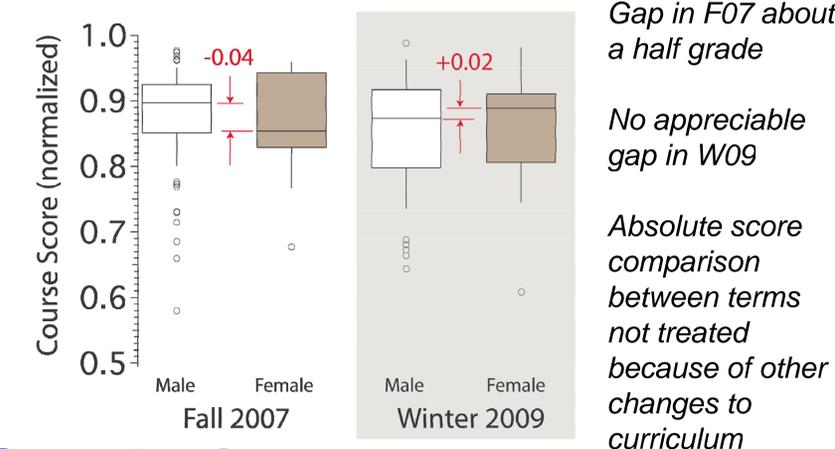
Doodles can accommodate various learning styles. Not every aspect in doodling needs to be used

Results

- Proficiency of doodles is positively correlated with a proficiency in programming
 - Q9 (doodle) & Q10 (associated program) on second midterm, W09 ($N_{2009} = 131$ students)



- Doodling seems to benefit women
 - Median grade gap between men and women narrows considerably ($N_{2007} = 146$ students)



Conclusions

- Introduction of structured doodling into curriculum indicated an overall beneficial effect on learning
- Women seem to have benefited significantly
- More study needed to adjust for possible confounds

Acknowledgments

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