Fast, slow, fast: Looking for slow

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Come take a *look!*

Let's ***chat*** for a moment.

Here's ***one more*** to look at.

17 x 24 = ???

Let's ***chat*** for another minute.

Background

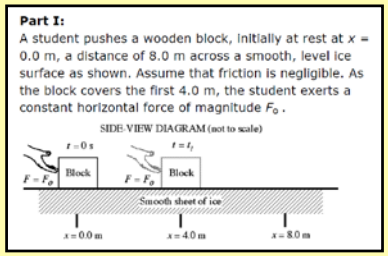
- Conventional thought has been that a majority of students come with an inconsistent analytic reasoning pattern into collegiate studies
- *Extended heuristic-analytic theory of thinking and reasoning* proposed by Evans[1]
  - Heuristic: involving or serving as an aid to learning, discovery, or problem-solving by experimental and especially trial-and-error methods.[2]
  - Analytic: skilled in or using analysis especially in thinking or reasoning.[2]
  - Process 1 (Fast thinking)
  - Process 2 (Slow thinking)

References: [1]J. St. B. T. Evans, The heuristic-analytic theory of reasoning: extension and evaluation, Psychon. Bull. Rev. 13, 378 (2006). [2]http://www.merriam-webster.com. [3]M. Kryjevskaia and M. R. Stetzer, Examining inconsistencies in student reasoning approaches, AIP Conf. Proc. 1513, 226 (2013). [4]M. Kryjevskaia, M. R. Stetzer, N. Grosz, "Answer first: Applying the heuristic-analytic theory of reasoning to examine student intuitive thinking in the context of physics," Physical Review Special Topics - Physics Education Research, 10, 020109 (2014).

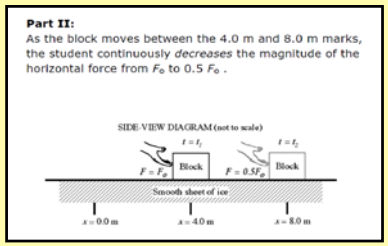
Methods

Questioning sequence

Screening Question



Target Question



Coding

- Based on students language from reasoning answer
- Key words or phrases demonstrating conceptual reasoning, coded as analytic (a)
  - **Student's reasoning – coded as analytic**

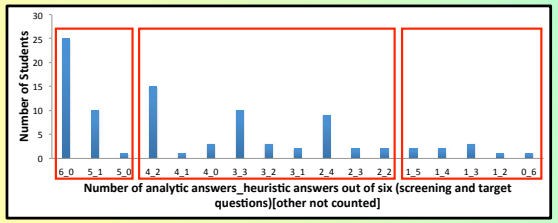
> "The block speeds up. The block still accelerates since there is force but the acceleration is not constant anymore."

- If surface features from question or no language showing analytic reasoning , coded as heuristic (i) or other (o)
  - **Student's reasoning – coded as heuristic**

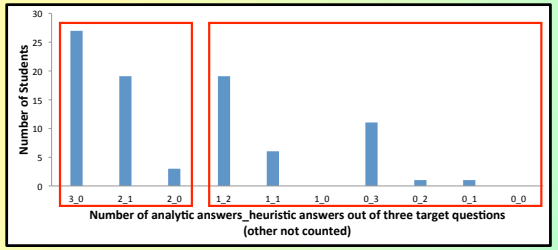
> "The block slows down. If the student continuously decreases the magnitude the block would start to lose speed and slow down by the time it reached 8 m."

- Coded three tests for analysis containing both screening and target questions

Results



- Looking at ***both*** screening and target answers
  - 39% (36 of 92) showed consistent analytic reasoning (slow thinking) of conceptual questions [6_0, 5_1 & 5_0 combined]
  - 51% (47 of 92) showed inconsistent analytic reasoning [4_2 thru 2_2 combined.]
  - 10% (10 of 92) showed consistent heuristic (fast thinking) [remaining.]



- Looking at target answers ***only***
  - 56% (49 of 87) showed consistent analytic reasoning (slow thinking) of conceptual questions [3_0, 2_1 & 2_0 combined.]
  - 44% (38 of 87) showed inconsistent analytic reasoning [remaining.]
- More students seem to be consistent analytic thinkers (slow) than originally thought
- Question that arises: How do we get to the other population of inconsistent (fast, slow, fast) thinkers?