

Developing Academic Registers: The Joint Construction of Definitions

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Hallmarks of scientific writing

1. Concealment of rhetoric

- ❖ “it is not a laboratory notebook... Cleansed of messiness, portrays knowledge as unproblematic, unambiguous, repeatable truths...” (Collins & Shapin)

2. Use of grammatic metaphors

- ❖ turn “happenings” into “stable phenomena” (*parameter-induced stochastic resonance*) (Halliday, 2004)

Hallmarks of scientific writing

3. Empirical evidence as a tool of persuasion

- ❖ “Observation and experiment ... are the handmaidens to the rational activity of generating arguments in support of knowledge claims...” (Driver, Newton & Osborne)

4. Addressivity of science texts

- ❖ high degree of intertextuality, “invites, in fact solicits, responses from others and seeks to engage them...” (Sharma & Anderson)

5. Coordinates multiple modes

- ❖ connecting representation, mathematics, images, text

Exclude participation in science:

- ❖ concealment of rhetoric:
 - ❖ “final form,” a “rhetoric of conclusions” (Duschl; Schwab)
- ❖ grammatic metaphors:
 - ❖ ambiguous, abstract, remote from concrete experience
- ❖ role of evidence:
 - ❖ easily misunderstood as proof or goal of inquiry
- ❖ addressivity:
 - ❖ requires a knowledge of the ongoing debate
- ❖ multiple modes:
 - ❖ requires understanding and translating between modes



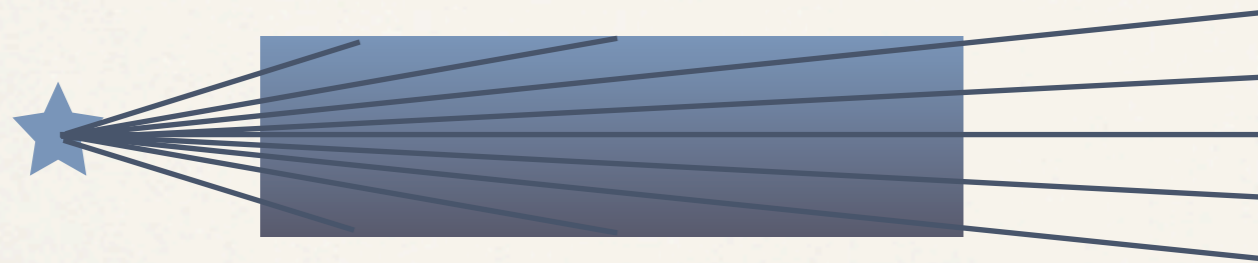
NSCI 321: Scientific Inquiry

- ❖ undergraduate Liberal Studies majors (future multiple-subjects credential students)
- ❖ 21 women, 2 men
- ❖ engage students in scientific inquiry into perception
- ❖ co-taught with a biologist (neuroscience)
- ❖ week 2/3

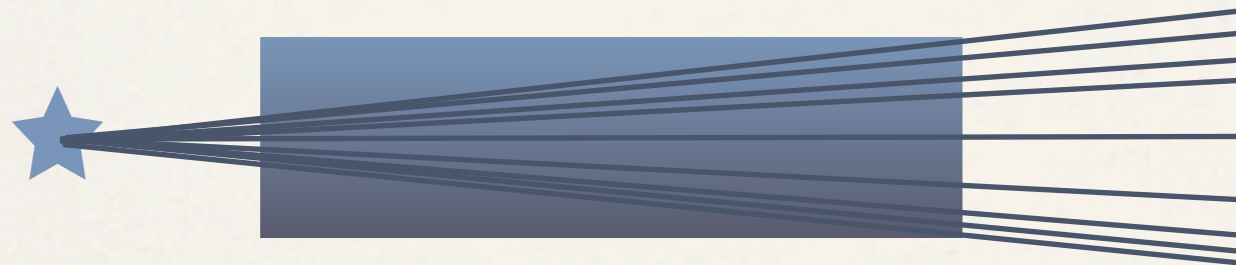
Developing scientific literacy in context

- ❖ Literacy practices are embedded in a larger practice: a social context of developing and constructing arguments in scientific ways
- ❖ Key features of science reading and writing emerge within the discourse rather than be demanded extradiscursively
- ❖ To what degree can scientific ways of writing and reading develop from scientific ways of constructing knowledge?

Explanations for a spot of light



tube as "blocking"

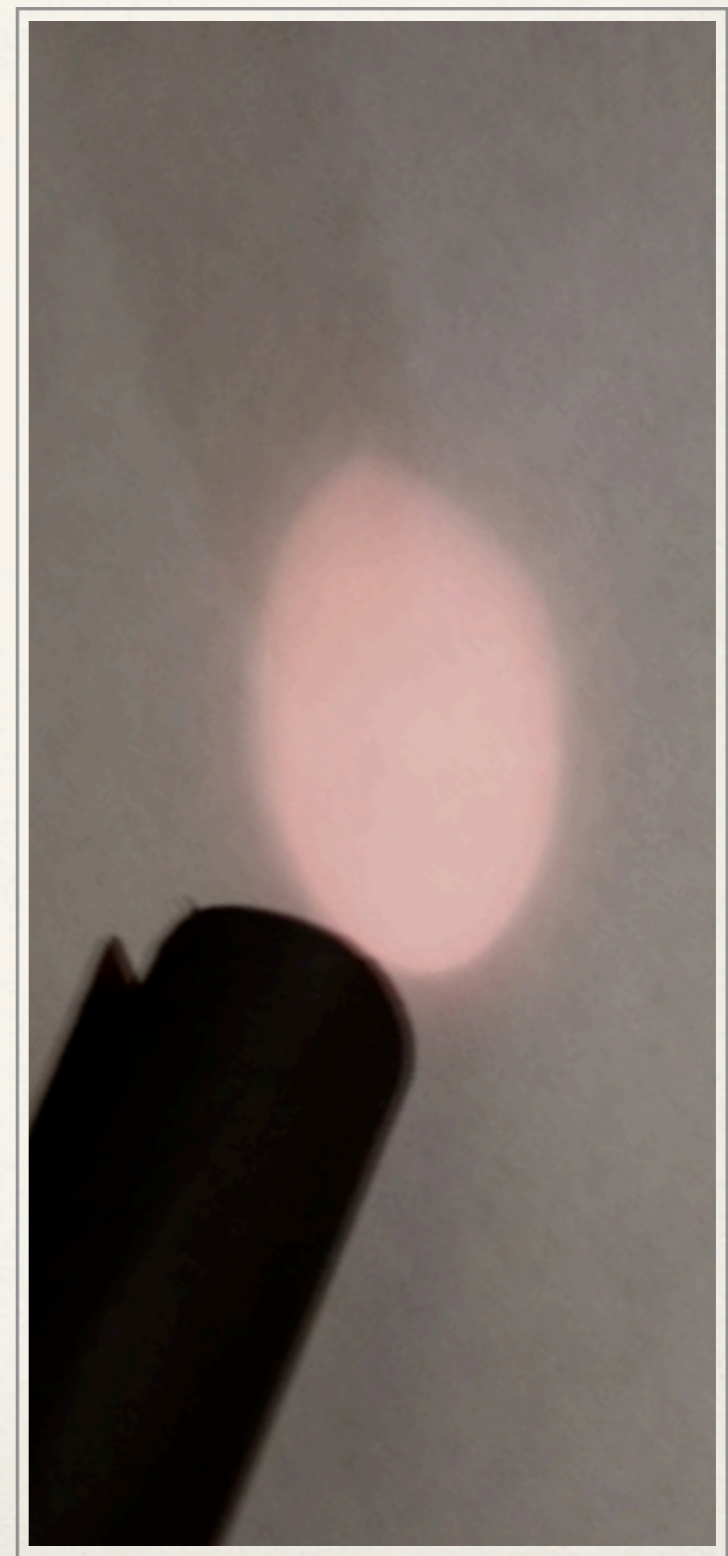
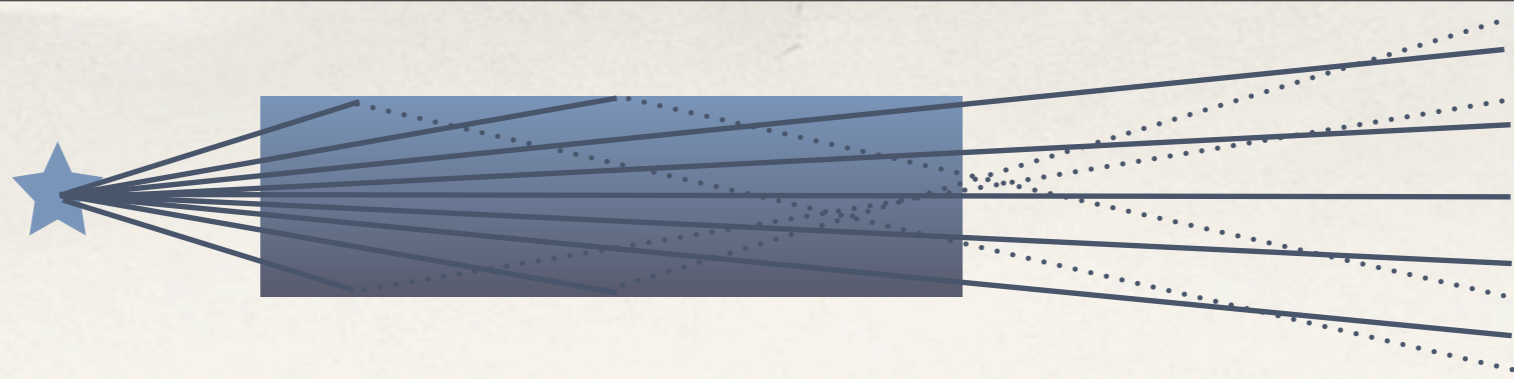


tube as "corralling"





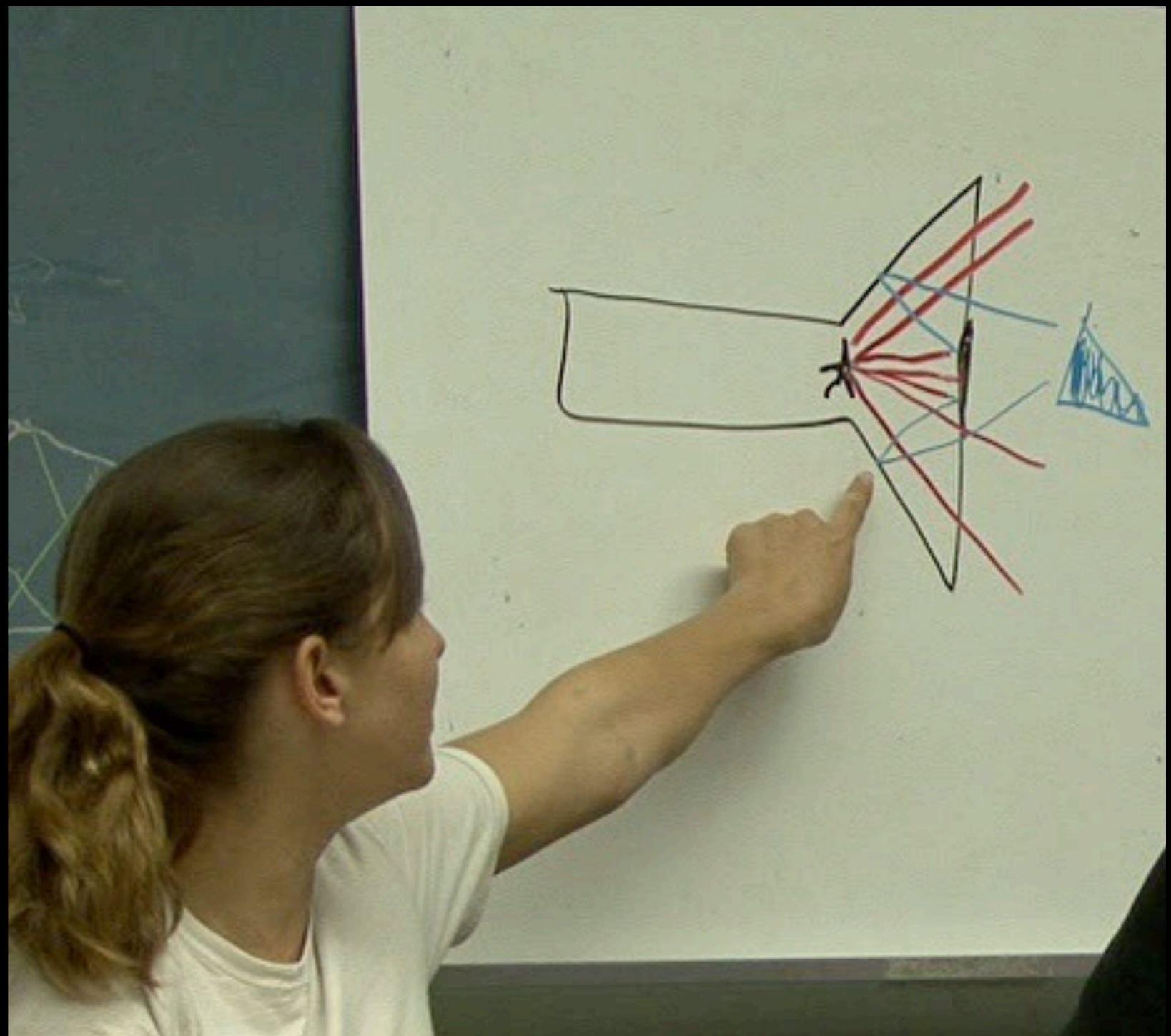
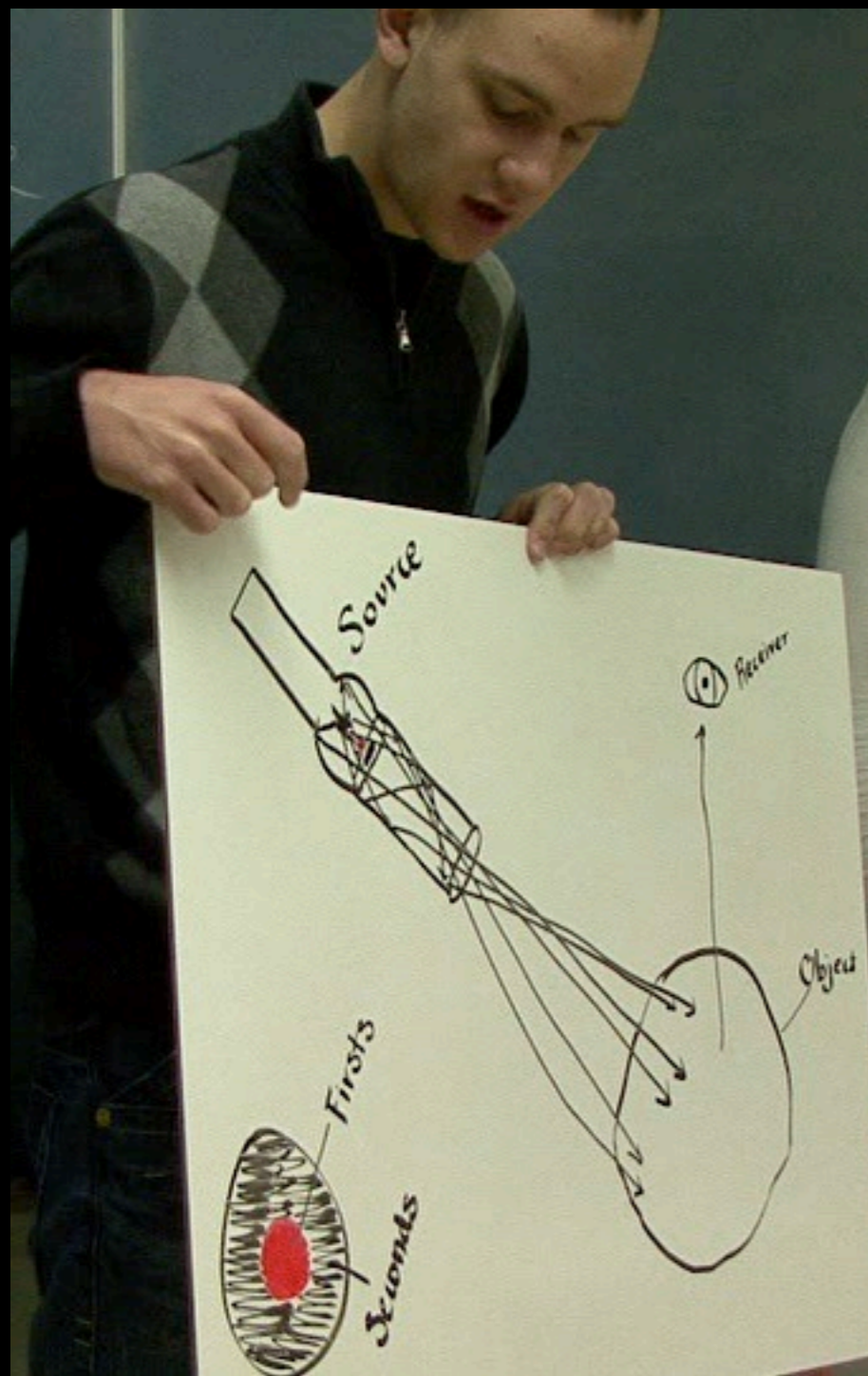
Jessica: Okay -
Jordan: So we're holding them the same



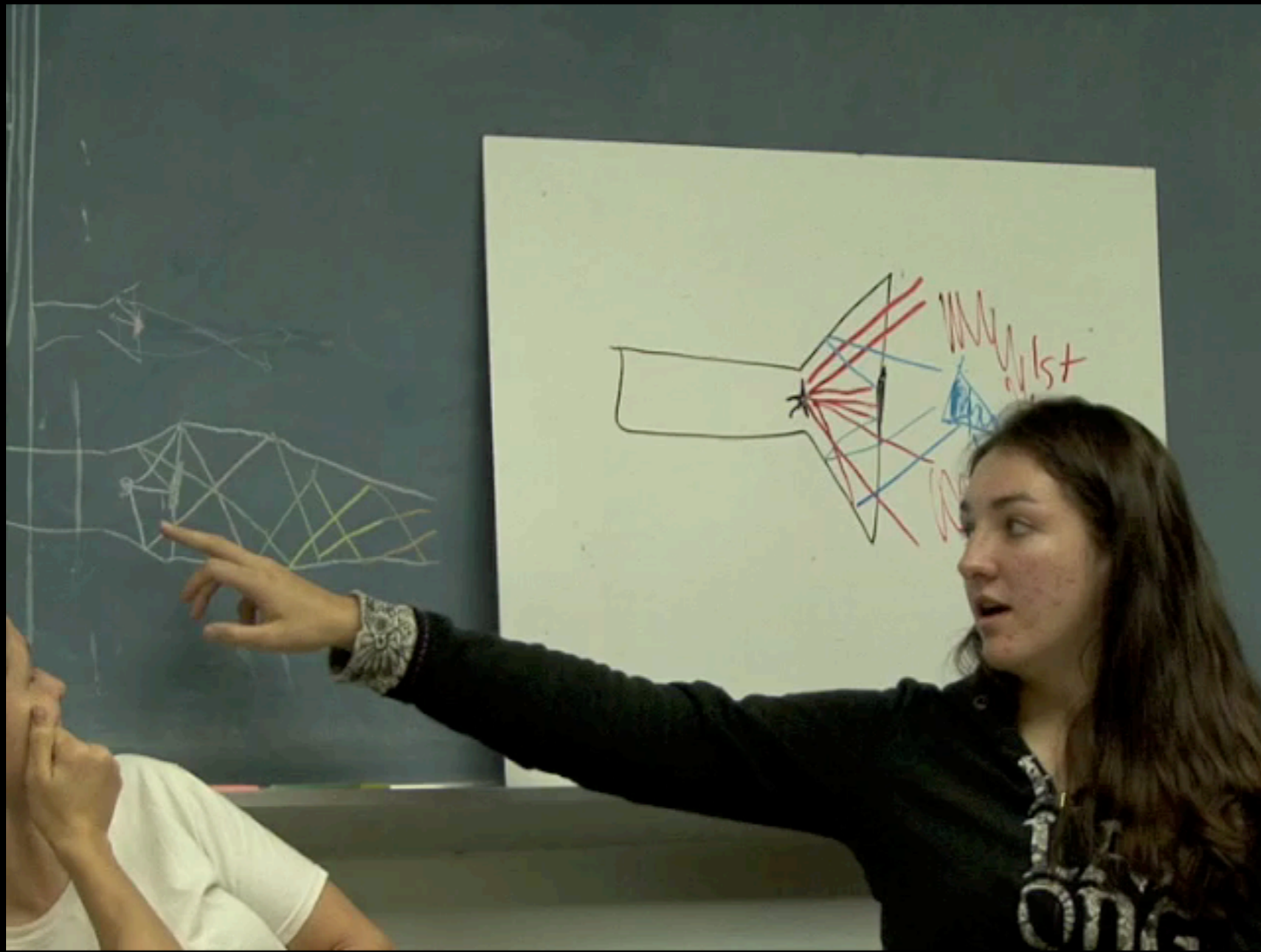
Constructing “the seconds”

Student-constructed term:

- perceptually distinct (“fuzzy edge”)
- highly theoretical: “there’s the fuzzy edge...” “those are...”
- creates a category of objects (via nominalization of “second”)
- experimental role in “carving at the joints” - a reason to believe in this “happening” as a thing to be nominalized
- largely an individual effort, but a strong role of others (Dee) - particularly dissension / skepticism



Explaining and diagramming “seconds”



Allie: Whites are the firsts

Shaping a definition

- ❖ There are thirds, fourths, fifths, etc.
- ❖ These “matter” because each successive “bounce” is dimmer than the one before.



Amanda: But I get what you're saying.



“I knew it was going to *be* a second.”

- ❖ Amanda, who invented the term, recognizes that her use of it is not as sensible as someone else's.
- ❖ subtle change in the ontology of “second” (rays *become* seconds)
- ❖ through these negotiations the ambiguities inherent in spoken language become increasingly precise
- ❖ the diagrams, in particular provide a referent for referent and signal for these ambiguities -- but how to resolve them?

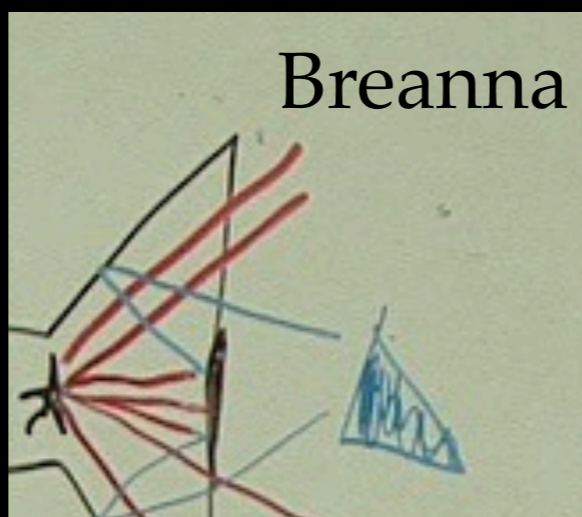


Leslie: Yeah?

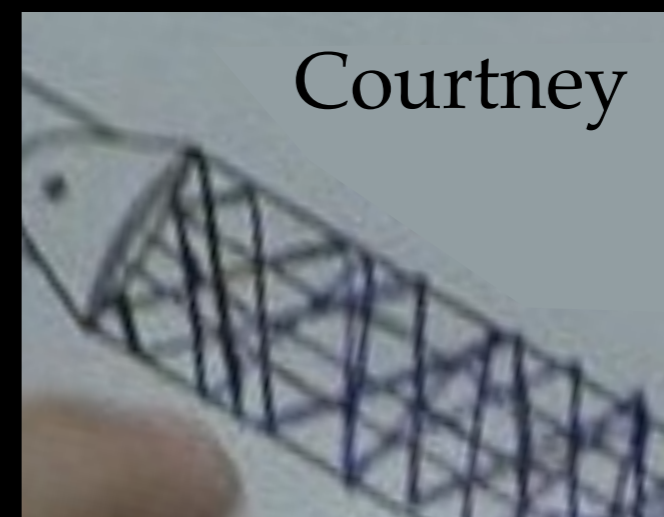
Courtney: I have a question. Umm, so



Jordan



Breanna



Courtney

Shaping a definition

- ❖ Recognition of a the social construction: “are we agreeing to call a second...?”
- ❖ Demand for precision: “I need a more set definition before I feel comfortable using it.”
- ❖ Pedagogical moves:
 - ❖ “We need to agree on terminology...”
 - ❖ “They’re calling it a second...”
- ❖ Reframing for precision: “Your question is: ‘If it bounces off of the mirror, is it a first or a second?’”

Characteristics of definitions

- ❖ Definitions in science as:
 - ❖ socially constructed
 - ❖ a nominalization (seconds)
 - ❖ subject to agreement
 - ❖ representational
 - ❖ identified (stabilized) experimentally and grammatically
 - ❖ demanding precision (intersubjectivity)



as long as it hits something, then it should be called a second.

Operationalizing “seconds”

- ❖ Definitions: a matter of convention?
- ❖ Courtney looks to instructors - is our role to help select a definition that will prove productive?
- ❖ Pedagogical moves: nature of objects in theories
- ❖ **Dee: So I guess the real question is: when it hits the mirror is any of the light absorbed? Because to me the definition of a second is, when it hits something, some of the light is absorbed, so not all of it is coming back out.**

Definition and classification tossed back to experiment

- ❖ Is any light absorbed?
- ❖ Is light off of a mirror a “second”?
- ❖ In what way are mirrors and paper reflecting light “much differently”?
- ❖ Can we distinguish 2nd, 3rd, 4ths?

Literacy

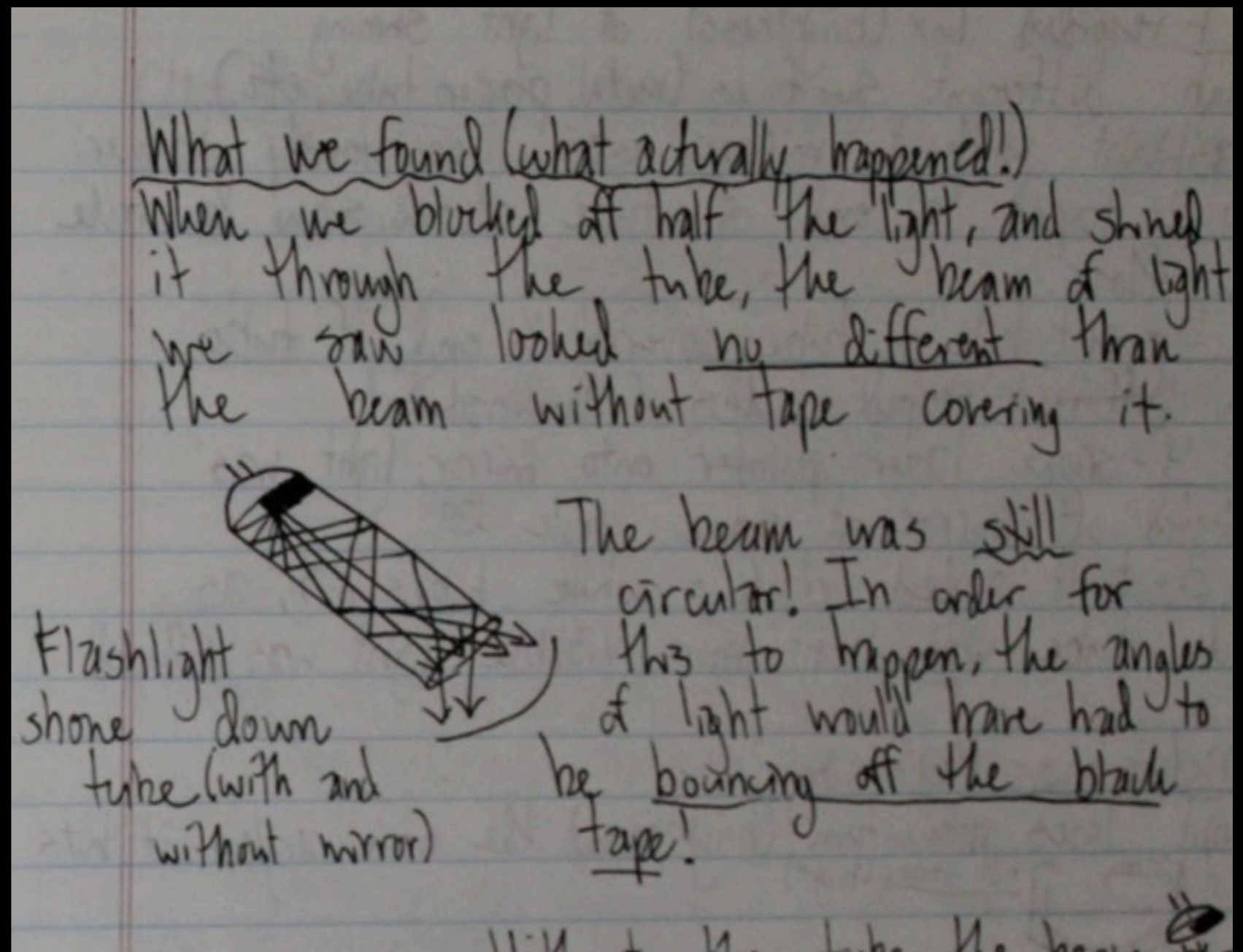
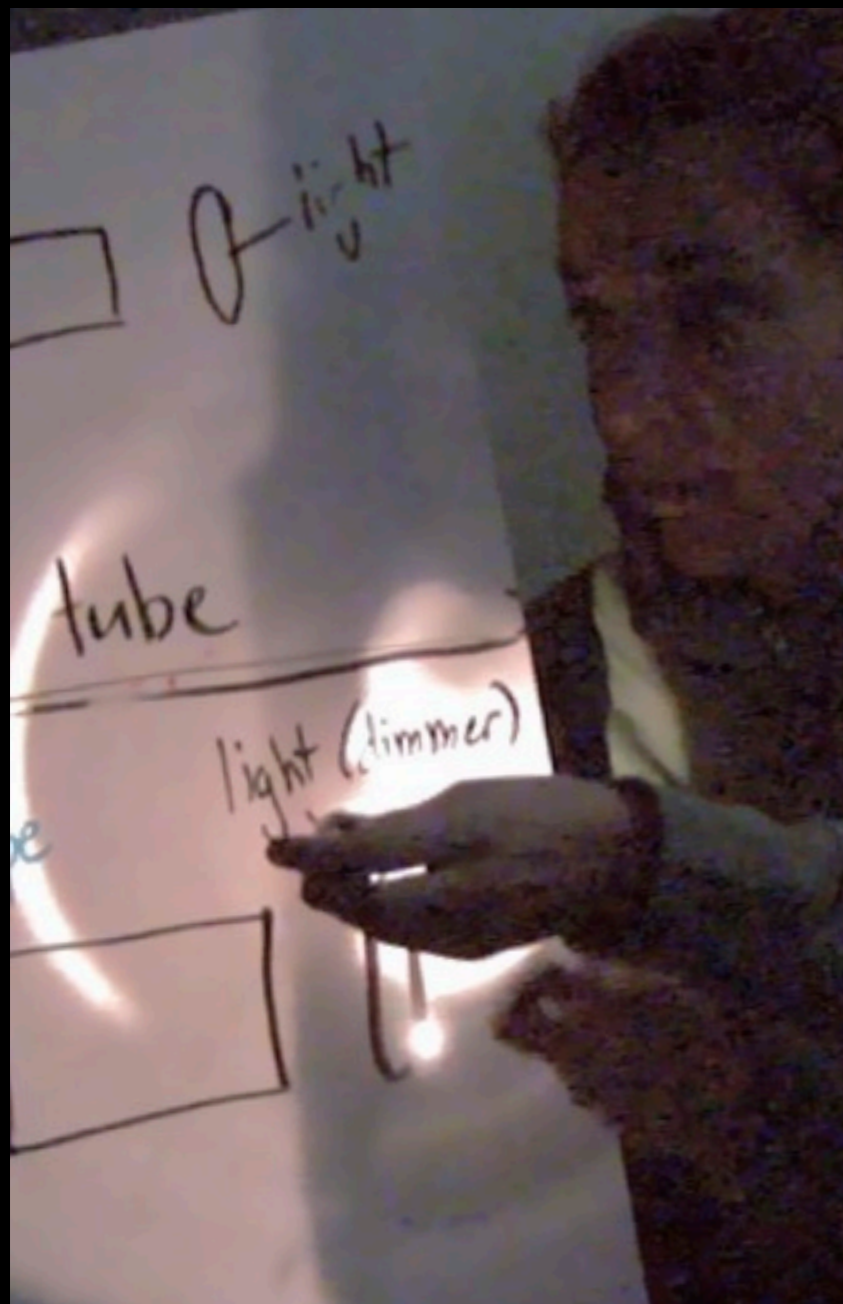
- ❖ conversation --> reading & writing?
- ❖ addressing skills commonly associated with “literacy”



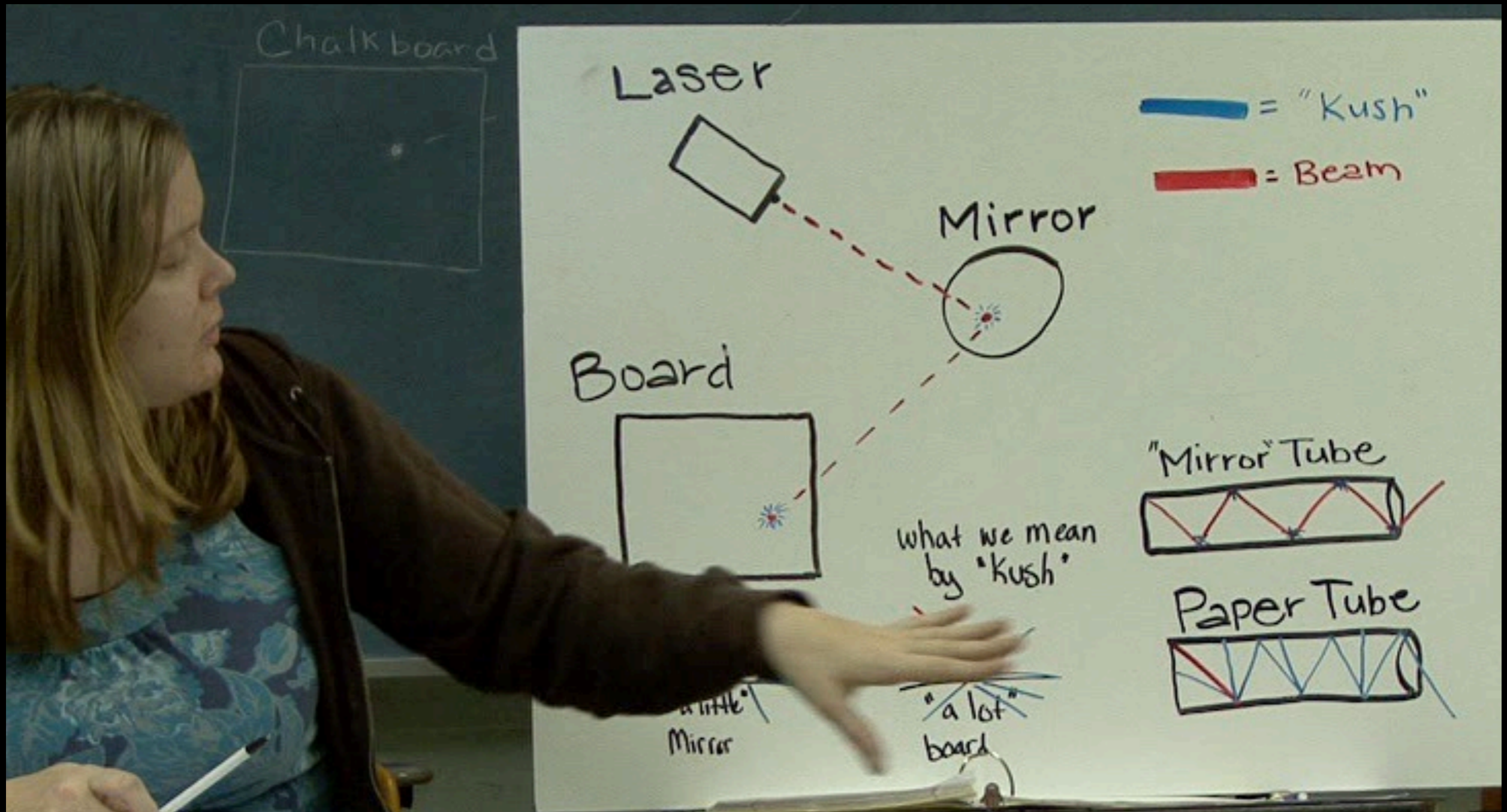
“The transition [from talking to writing science]... is facilitated when students are provided with opportunities to express themselves... utilizing means of expression that bear iconic relations with the situations they experienced and the gestures they used...” -Roth, 2004



“If our knowledge is to be organized systematically (especially if this depends on being able to measure things), we need phenomena that are stable: that persist through time, and can readily be grouped into classes.” - Halliday, 2004



“Scientific literacy.. is the ability to make meaning conjointly with verbal concepts, mathematical relationships, visual representations, and manual-technical operations.” - Lemke

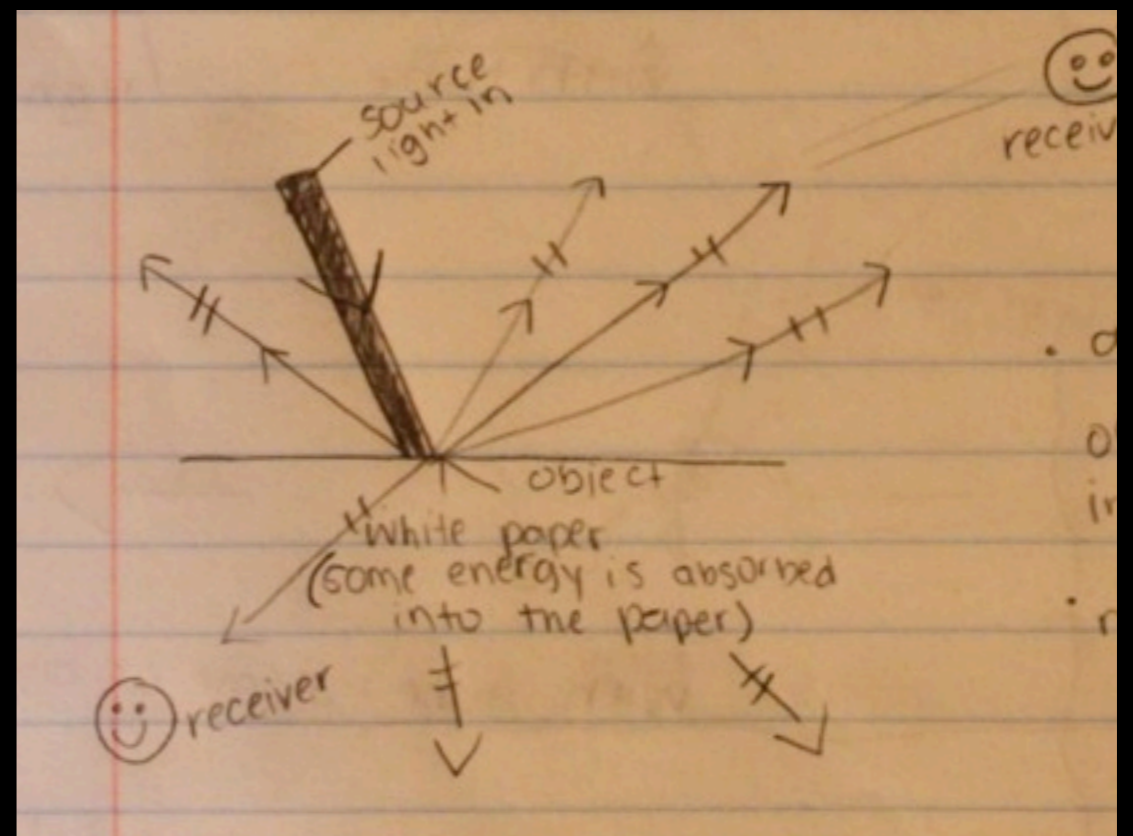
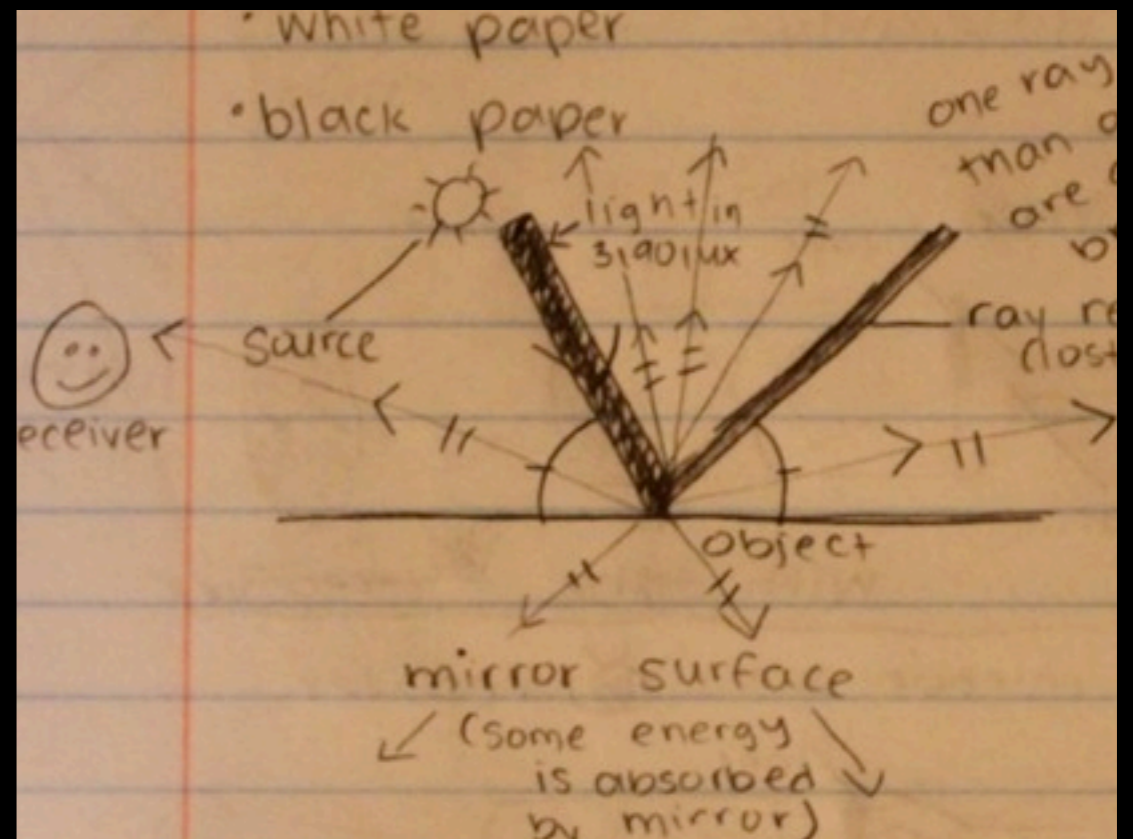
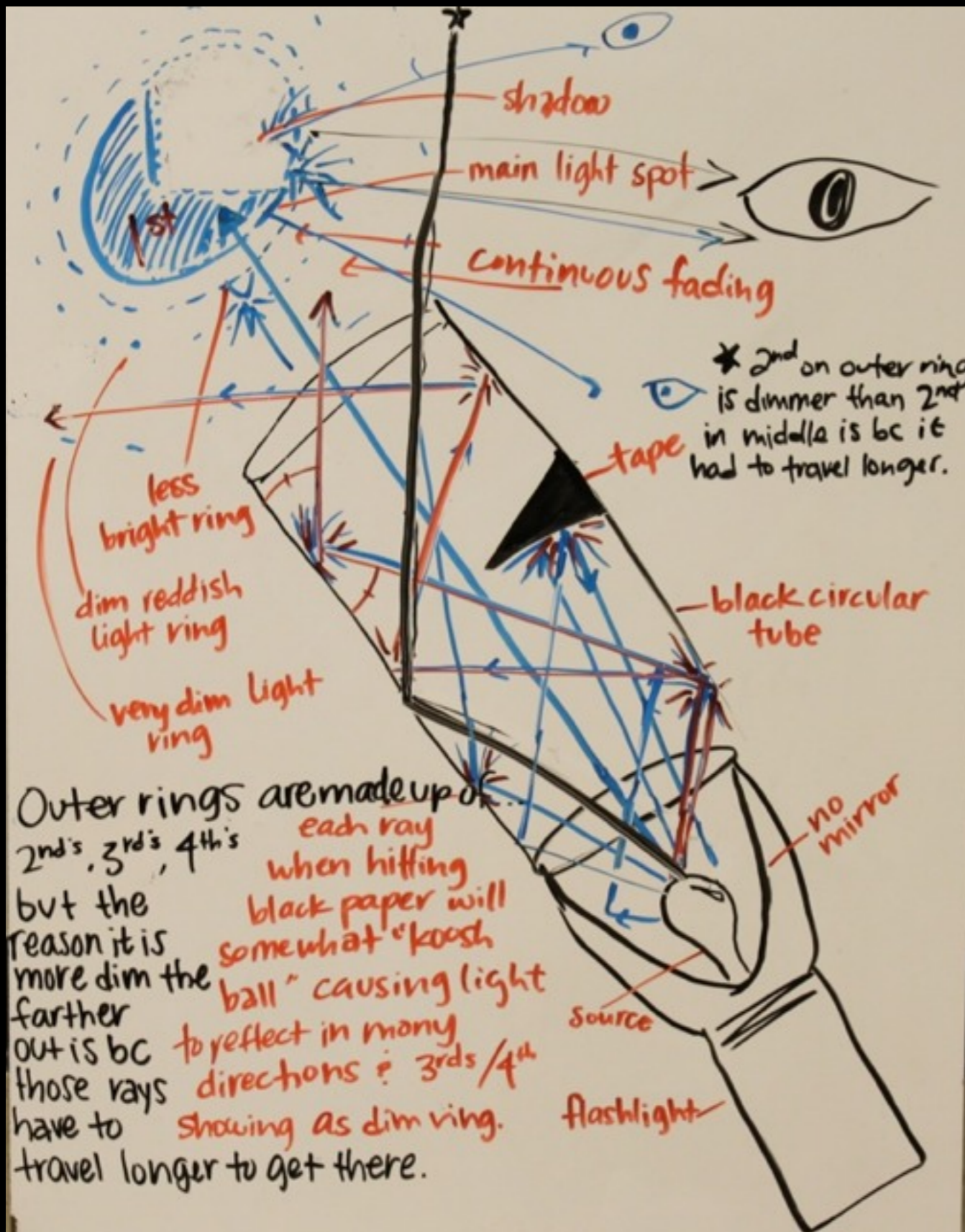


“It is more productive not to converge on a definition until further empirical and theoretical progress points us toward the best way to ‘cut up [nature] ... along its natural joints.’ -Elby, 2009



Dee's definition is wrong?

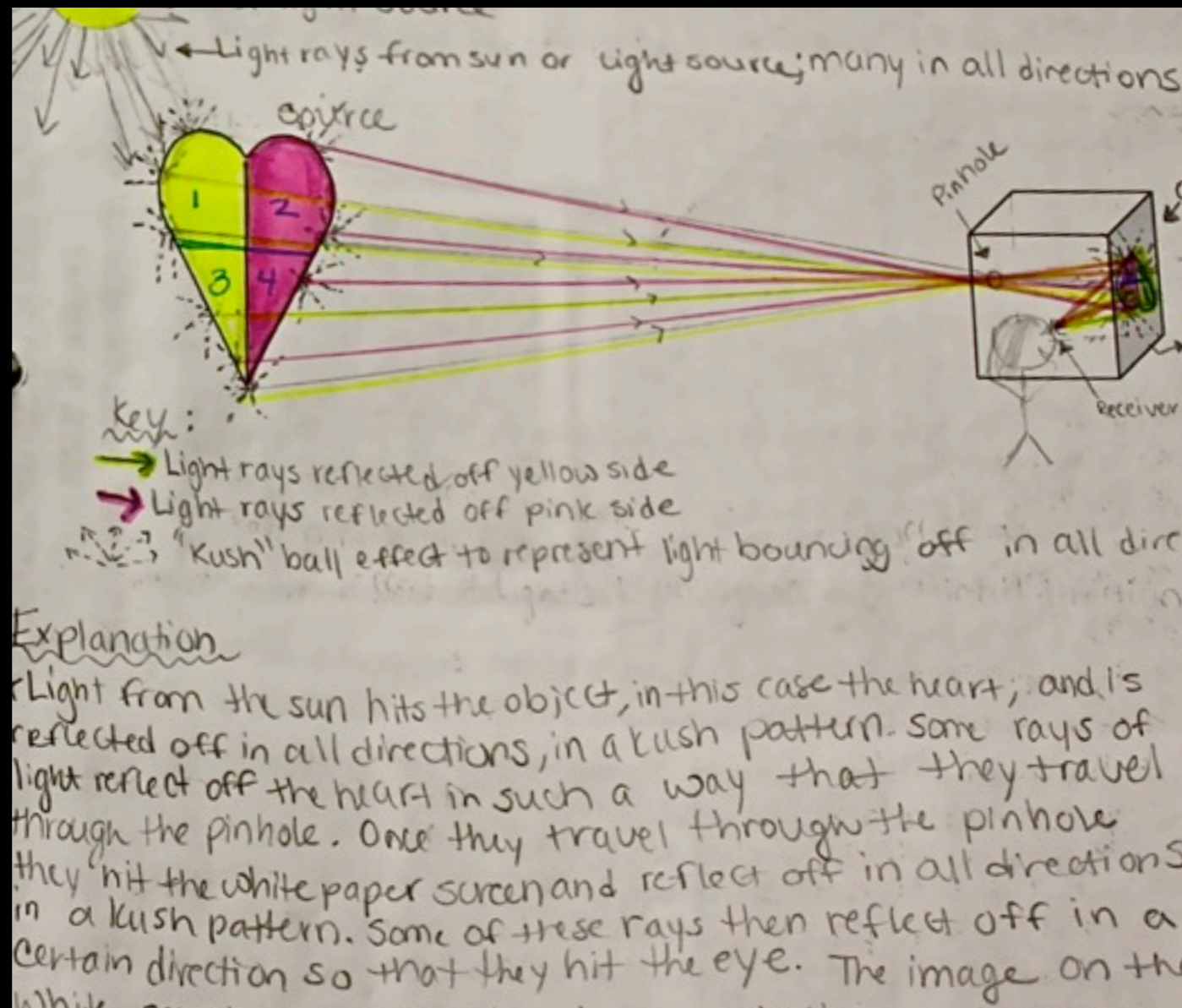
- ❖ Dee: "To me, the definition of a second is when it hits and some of the light is absorbed, so not all of it is coming back out."
- ❖ a negotiation with the *world* regarding our definitions: "carving nature at its joints"



Participation in scientific practices as lever

1. concealment of rhetoric
2. Use of grammatic metaphors (nominalization)
3. Empirical evidence as a tool of persuasion
4. Addressivity of texts
5. Coordinating multiple modes

Some of the light from the flashlight will be blocked from directly reaching the white paper because there is black tape covering half of the flashlight. The beams of light that leave the flashlight travel in straight lines, and some of them will hit the back of the tape and bounce off of it. Once the light bounces off the black tape in all directions, some of it will leave the flashlight at angles that will allow this secondary light to reach the white paper. This light will illuminate the white paper, but because it has bounced off so many surfaces prior to reaching the white paper, it will not be as bright as the primary light.



Implications

- ❖ students can develop literacies of practice in contexts of practice --
 - ❖ argumentation, modeling, representation, and investigation
- ❖ essential role played by social interactions
 - ❖ attempts to achieve intersubjectivity can drive scientific practices of representation, precision, operational definitions

Challenges

- ❖ Gee “a face-to-face conversational framework is problematic for the acquisition of scientific academic language”
 - ❖ “the rich get richer and the poor get poorer”
 - ❖ supplement conversations with “monodialogical discussions”
 - ❖ use of expanded texts, “placed in the midst of practice and discussion”
- ❖ Second-language and underrepresented groups:
 - ❖ argumentation: different cultural resources and reactions to argumentation, particularly in academic settings



We label everything - we need to to clar- that's the reason of science

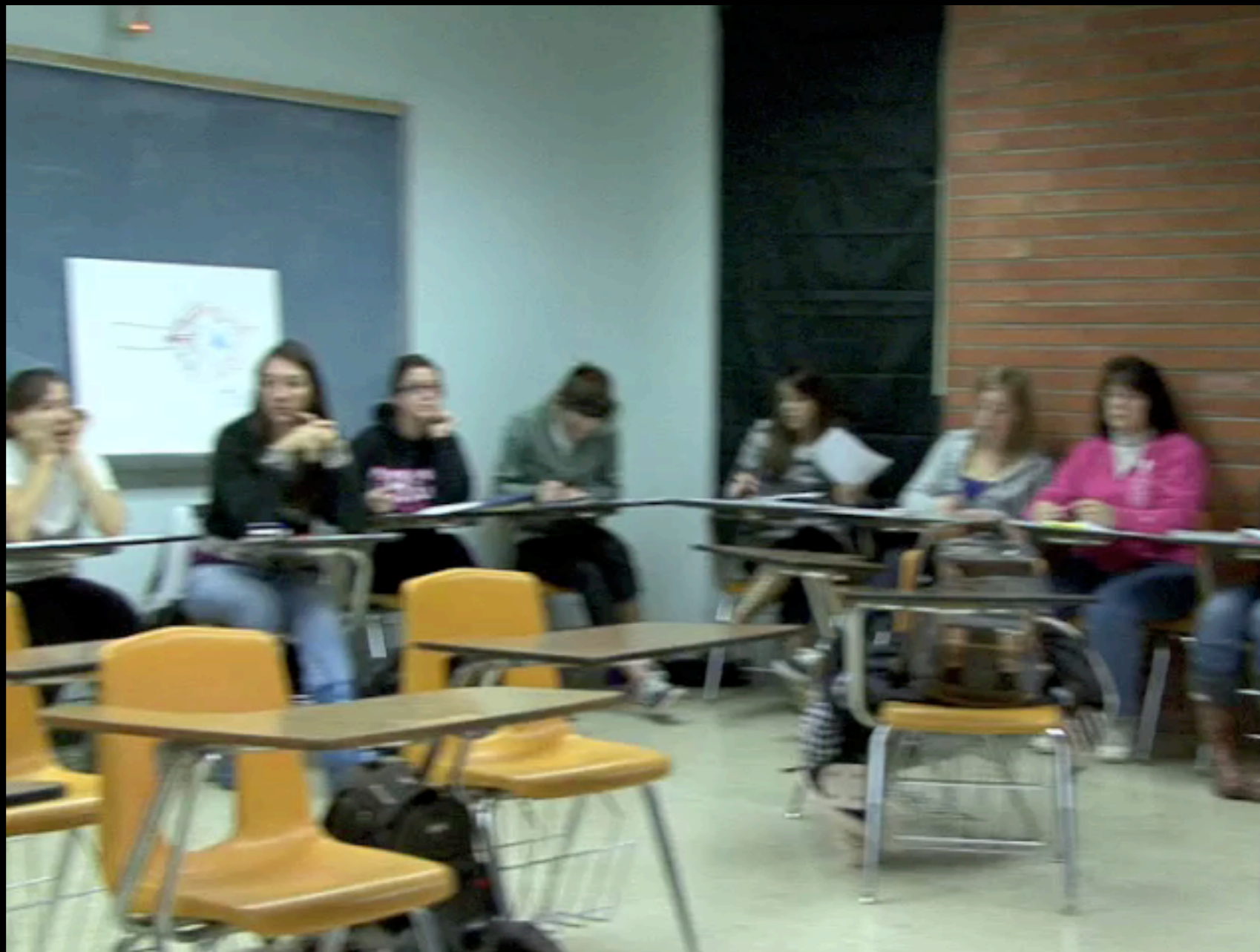
(Are black & white colors?)

Acknowledgements

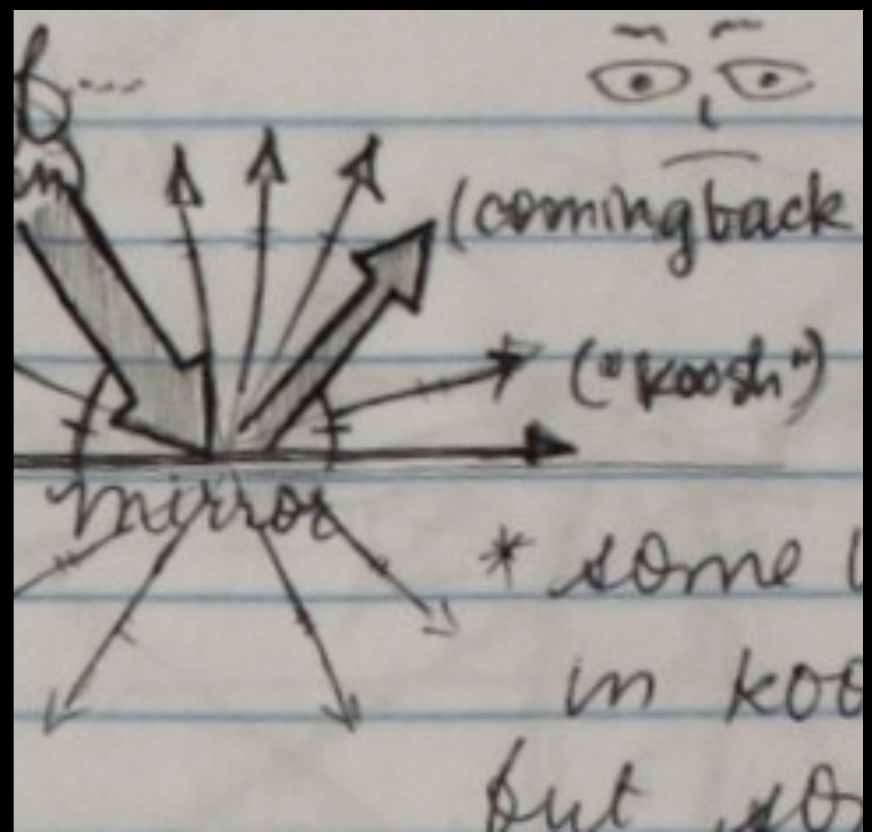
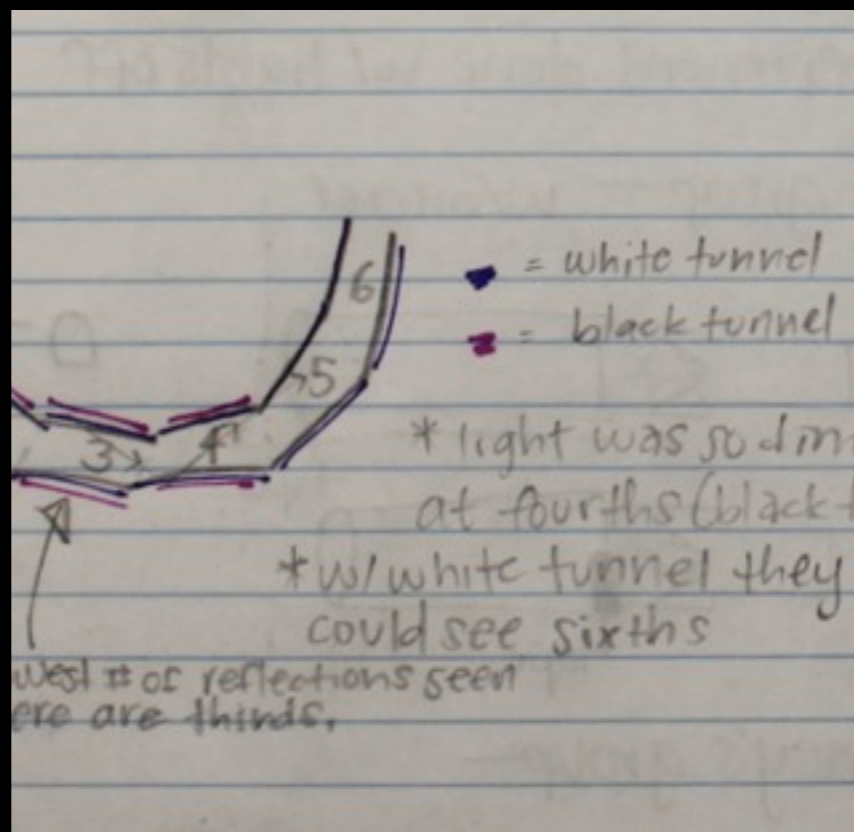
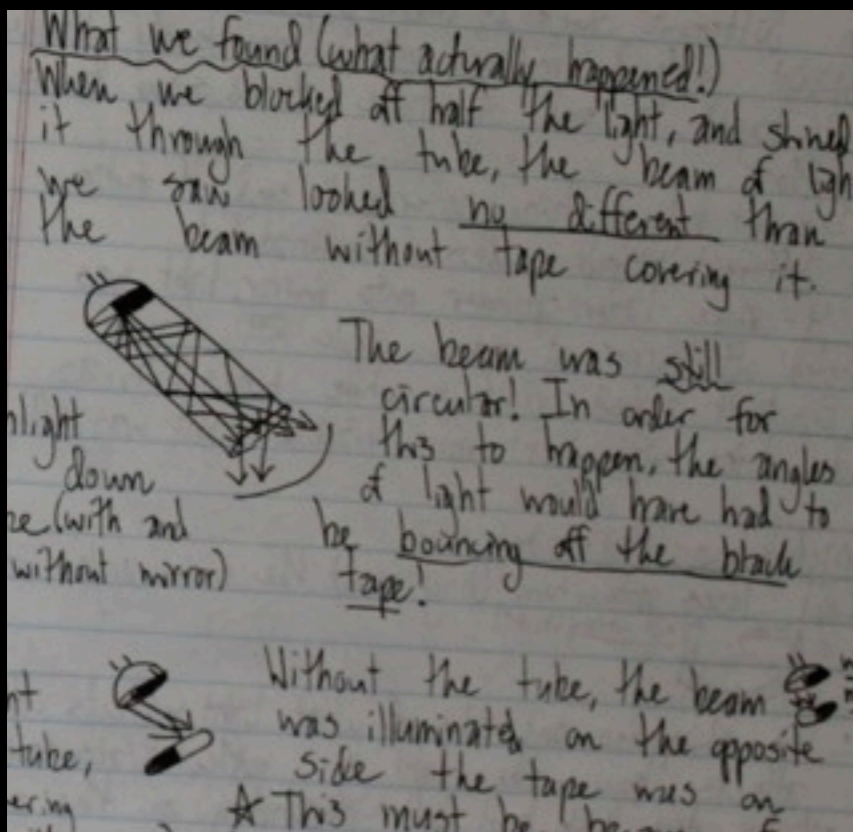
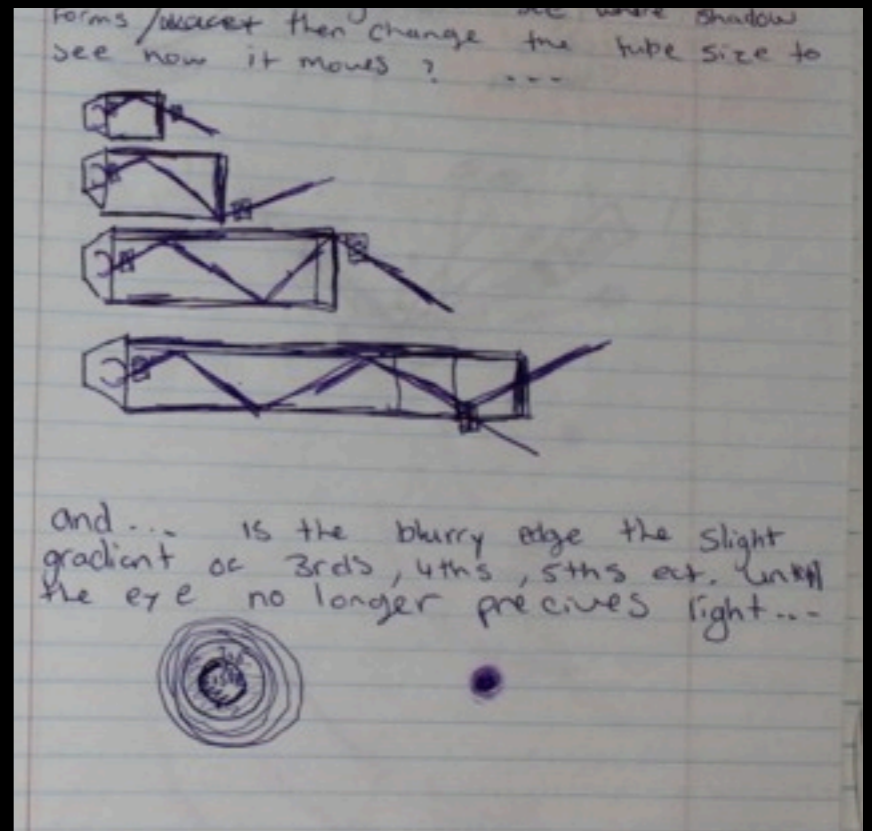
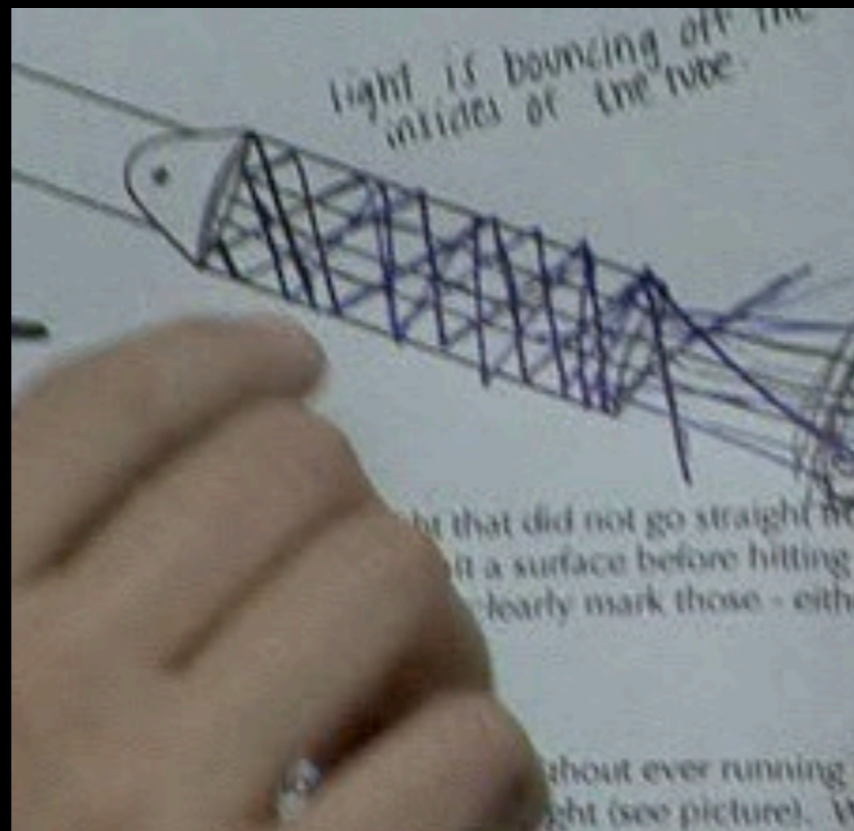
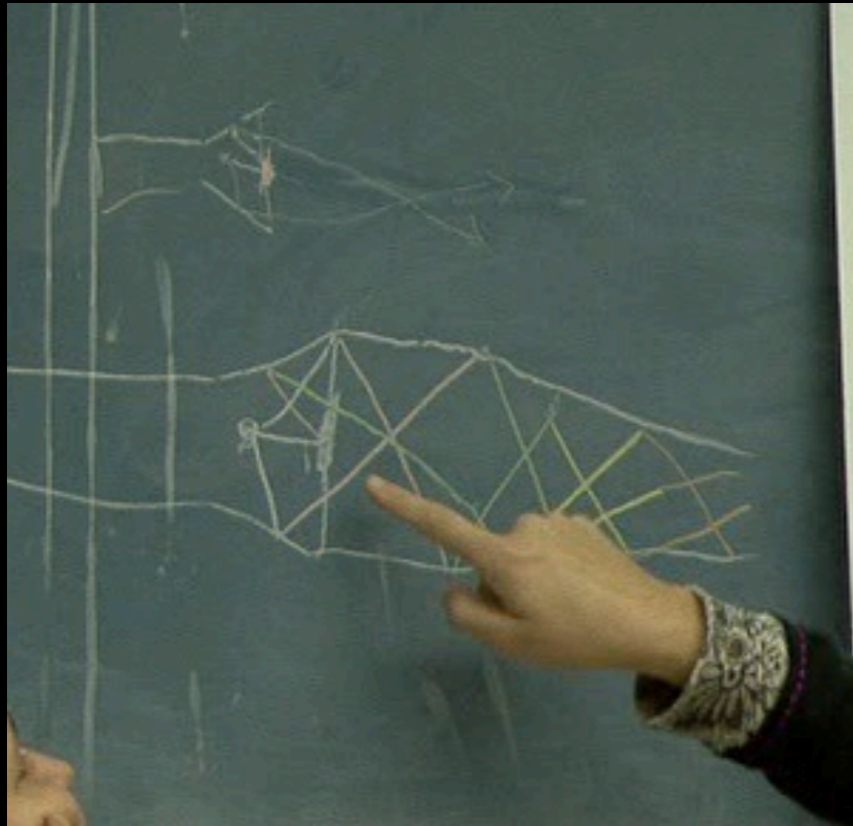
- ❖ Students of NSCI 321
- ❖ co-instructor Irene Salter
- ❖ videographer Vanessa Quevedo
- ❖ NSF CCLI 0837058

"In Bacon's day the word acid meant only *sour-tasting*; then it came to mean *a sour-tasting substance*; then, *a substance which reddens litmus*; then, *a compound that dissociates in aqueous solution to produce hydrogen ions*; then, *a compound or ion that can give protons to other substances*; and most recently, *a molecule or ion that can combine with another by forming a covalent bond with two electrons of the other*. The tasting and taster vanish as the structure emerges."

-Bazerman



Steven: I think it's going to be extremely hard to differentiate



Reading? Writing?

- ❖ Writing Intensive course - weekly assignments, 2 large papers
- ❖ Reading: Case studies of perception (Salter), Newton, Berkeley, Helmholtz
- ❖ Workshop: diagrams, writing groups
- ❖ Daily class blog



And in fact, I think we use "focus" a lot-- or I was looking over some of the older tests

“Of course, I see your point of view, Archie, I do. But my point is, and has always been, from the very first time we discussed the subject; my point is that this is not the full story. And, yes, I realize that we have several times thoroughly investigated the matter, but the fact remains: full stories are as rare as honesty; precious as diamonds. If you are lucky enough to uncover one, a full story will sit on your brain like lead. They are difficult. They are long-winded. They are epic. They are like the stories God tells: full of impossibly particular information. You *don't* find them in the dictionary.”

- Zadie Smith, *White Teeth*