FRAMING DISCOURSE FOR OPTIMAL LEARNING IN SCIENCE AND MATHEMATICS
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"Big D" Discourse in physics

Modeling done well involves exteriorization of thought process, comparing one's model to the models of others, subjecting it to reasoned analysis, justifying or discarding it, and identifying its boundary conditions.

Whether or not students are engaging in these activities can be seen in the features of the Discourse (remember James Gee's definition of Big D discourse as the language of a particular community, in this case the communities of physicists or mathematicians, that carries with it particular identities, activities and cultural "stuff") that they attach value to, and what function their Discourse serves for them in the activity of modeling. The Discourse is not the model, but it is an important part of playing the modeling game—it is one of the "rules of the game". At times, however, it can be mistaken for the game itself.

In the following excerpt, honors physics students channel a Greek chorus chanting responses they have learned from repeated drilling over the previous eight weeks, as their teacher talks them through how the conclusion for the their laboratory report should be written during a board meeting:

Teacher: …Can everybody read what they've got written in yellow here? [murmuring] Yeah, the text that they've got written in yellow at the bottom right here…

Chorus: For every one kilogram in mass 9.875 Newtons is increase in force.

Teacher: What's that? What have they done already?

Chorus: Physical interpretation.

Teacher: Yeah. They've done the physical interpretation of the graph. So what was the shape of all the graphs?

Chorus: Straight diagonal line passing through the origin.

Teacher: How is it that we know that they're straight diagonal lines?

Chorus: Linear fit with a correlation of one.

DHS 10-20-05

This "Greek chorus" was often a feature of the board meetings I observed in this classroom, and occurred from time to time during whole class discussions as well. This sort of "target practice" style questioning that called for one or two word answers or the completion of sentences was common in all four of the classrooms observed, but in the classroom excerpted above there was a particular emphasis on using the language of physics. Here the teacher is explicit about his expectation for the

students to engage in Big D Discourse:

Student: The graph of elastic energy would be directly proportional to the final velocity squared.

Teacher: How would we know it's directly proportional? Again, this is the important subtle part of the language that you need to get down.

Chorus: By the correlation.

Teacher: What kind of…what would the graph look like to tell you that it was a direct proportion?

Chorus: Straight diagonal line.

(DHS 12-7-05)

Discourse can be used to clarify a student's ideas regarding their conceptual model. It can also be used, however, to constrain or limit those ideas. It is possible to "speak physics" without a clear understanding of the meaning of what one is saying—not unlike the way people bandy about phrases in another language without knowing that language (i.e., mea culpa, mazel tov, coup d'etat). If students believe that they can earn points for "speaking Physics", they will attempt to do so whether or not their words have meaning for them. This is neither big D Discourse nor is it little d discourse (language in use). It may simply be an incantation (i.e., Dominus vobiscum. Et cum spiritu tuo) they believe they are expected to utter at a specified time.

Teacher: No. And actually what we were trying to find out is…..the kinetic energy. Our big idea was that we were putting elastic energy into the system in the beginning and we were having that elastic energy be shifted into the kinetic energy account in the moving cart. So is kinetic energy directly proportional to velocity? (no answers) Is the velocity v. elastic a straight diagonal line?

Ara: No.

Teacher: No. Kinetic energy is not directly proportional to velocity. What shape did the elastic energy v. velocity look like?

Ara: Top opening parabola.

Teacher: A top opening parabola. What's the implication of a top opening parabola?

Ara: That elastic energy is proportional to velocity squared.

Teacher: Again a little bit louder.

Ara: That elastic energy is directly proportional to velocity squared.

Teacher: How are you going to check and see if Ara's point about elastic energy being directly proportional to velocity squared is correct?

Chorus: Test plot.

(DHS 12-7-05)