COMPILATION: Differentiation within the Modeling classroom

Date: Fri, 29 Mar 2002
From: "Park, Nicholas" <ParkN@CFBISD.EDU>

Does anybody have any personal experience with differentiation within the modeling classroom? From what I've seen, the modeling approach places a great emphasis on the class as an investigative team, split into small groups for investigations and coming together to share results and form models. Does this leave room for differentiation -- i.e. for tailoring the assignments of different students in a heterogeneous classroom so that each can be challenged at his/her own level?

Date: Sat, 30 Mar 2002
From: mitch johnson <mitchjohnson@EARTHLINK.NET>

I think getting an A in physics differentiates the class very well. I only have 10-15% earning an A and no one has ever told me it was easy. *Have you thought about using quarter projects as your tool to challenge your students?* Minimum is a C, extra effort a B and for superb effort and results an A is earned. I start with a biography of a physical scientist first quarter, then a contest (exploravision, bridge building, NASA missions, AAPT photo contests... second quarter, third we race mouse trap cars, and fourth they design a roller coaster with hills and loops such that the occupants are between 4 and 0 g's.

Date: Mon, 1 Apr 2002
From: Joseph Vanderway <jvanderway@CSUN.EDU>

As far as I see it, "Differentiation" = "Tracking"
(I've yet to hear anyone explain it in any other way.)

Date: Tue, 2 Apr 2002
From: Joe Zoller <CycoPhizzix@MAC.COM>

Joseph V. wrote: <<As far as I see it, "Differentiation" = "Tracking" >>

You say that as though "tracking" is a bad thing. You might as well have said that "issuing grades of any kind is tracking" because "all you are doing is pointing out the differences among students." Differentiation is not a bad thing. If you look at differentiation as a method to allow students to learn in the ways that best accommodate their own learning style, then how can you knock it?

The "traditional" physics teaching method has been ridiculed as being too rigid; it doesn't allow students without a natural affinity for math and science to succeed. The modeling approach

seems like one of many ideas out there that make the information in physics more available to the "common" student. In short, I see modeling as one method of differentiation. I don't know that it is possible to differentiate much *within* the modeling approach though.

(I _do_ like the "quarter-project" idea mentioned by someone yesterday.) --

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Date: Tue, 2 Apr 2002
From: Gheri Fouts <Gfouts@pixi.com>

Differentiation: I think this is an interesting topic. I remember my modeling mentors suggesting that we enrich the curriculum, and I soon saw that enrichment was appreciated by students at every level. I want the student to demonstrate to me that she can use scientific method to explore the physical world around her. I use physics to have the students experience science by doing science. *Each student is required to produce a proposal for original research, which includes a literature search of current investigations in the topic of their choosing, and then at the end of the course, each student does her research and presents the findings to the rest of the class.* Some want to work in groups, but I limit the group size to no more than 2 students.

The original research must be pertinent and demonstrate critical thinking and scientific method of gathering data, analyzing data, and coming to a conclusion that supports or does not support her hypothesis. I have had even the very weakest students pull together a small research project that might start out as a show and tell sort of exhibit, but soon evolves into a problem question equipped with hypothesis and variables.

This year I am teaching freshmen in a Physics First curriculum, and I hesitated on requiring original research thinking that freshmen could not handle it, but I was pleasantly surprised at the wonderful research ideas and the scientific dialog that goes on when these students take the initiative of putting together their own research activity in a topic that they are interested in. I save some time at the end of the course for their presentations and I have found only a very few do not get the point and try to bring in a look-see exhibit which they quickly realise missed the point.

I am alerted to this ahead of time so they can go back to the drawing boards and get some real research done.

I find the modeling curriculum to be excellent in getting the students to be involved in their own learning and thinking critically. And I find that the younger students seem to be more involved with the course and always so surprised at counter-intuitive topics. I think Leon Lederman is correct in suggesting physics to be taught first. Thank goodness for “Graphical Analysis” and all the computer hardware to make these experiments more precise and tech based.

Date: Wed, 3 Apr 2002
From: Patrick Leighton

Boiled down to its bare bones, differentiation can be likened to having tracked classes where all the tracks are in the same room at the same time, where students can move from track to track (so tracks are fluid), and where eventually the students don't know which track they are each in. A difference is that the course grades they receive are not distinguished by which track they are in.

The idea of a learning cycle helps to see how Modeling Physics can be differentiated. The modeling process is heavy on having students construct the model, which is the beginning of a learning cycle. They use their prior understandings as a basis to develop/construct the new model. A set of learning activities are chosen that have a minimum of distraction, that accommodate a span of skill levels, and that build the essential attributes of the model in a coherent manner. All students, regardless of skill levels, experience the "same" first stage of constructing an explicit comprehension (a term carefully chosen a la Bloom). But the ultimate goal is to have students become adept at transferring and applying that knowledge to a wide variety of questions in many different contexts with many different phenomena.

Once the model has become explicit and comprehended, the last part of the learning cycle is to have a wide variety of often cluttered or "noisy" learning activities (i.e. real-world) that require students to practice the transfer of their new knowledge. *It is during this transfer stage of the learning cycle that differentiation can be used to great advantage.* For transfer, the choice of question, phenomenon, skill mode, context, etc. can accommodate to student, teacher, school community interests and backgrounds. The variety is an asset, because *all students can share on the basis of the common model that all are using while learning from each others' efforts to apply that model to the many different questions and contexts.* The whiteboards become a fast and furious means for each group of students working together on a common task to share it out with the others, often many times during the process, to get input from the class as a whole, not just as a final presentation. (e.g. the first 15 min of class are dedicated to groups seeking advice from other groups or the class as a whole on their own task.)