MODELING AND BLOCK SCHEDULING: a good match

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April 1998

Many people think that for students to excel in a course, you must have special students. I don’t think I necessarily have special students, but they are excelling with the modeling method used in block scheduling.

In academic year ‘94–’95 my suburban high school moved to block scheduling, where there are large blocks of time in which to teach. I had to confront the issue of structural time management in blocks, and my task was to use the structural time more effectively and to improve student learning in physics. I think that’s our main objective in teaching.

Before we went to block scheduling, we had traditional scheduling with 45-minute periods. In the regular physics course we had one double period per week, for a total of 300 minutes per week or 180 hours per year. In AP physics, (and let me note that that’s a first-year course), we had two double periods per week, for a total of 350 minutes per week or 210 hours per year. (I just call it AP, I don’t want to necessarily define B or C yet.) Then in 1994 we went to intensive scheduling or block scheduling: the regular physics course decreased to 18 weeks; that is, it became a one semester course with 450 minutes per week, 135 hours in a semester; so it decreased by 25% in time. AP Physics went to a 27 weeks double course: 450 minutes per week, 202 hours for the course, so the time decreased by 4%. My administration was telling me “less is more”, but I think what they really meant is I had to do more with less time!

This is a concern of mine, and in our school we had people coming in weekly and looking at our block scheduling. So I had to consider some things. First of all, in traditional scheduling, you have these short bursts of time, so you tend to teach by the lecture-demonstration, teacher-centered method. You have from 40-45 minutes, so you take control; you supply little bits of fragmented knowledge each day, and you have these kids come in and out, 125 or so per day. Whereas when you use block scheduling, it encourages an interactive atmosphere. What are you going to do for ninety minutes? There’s more time to complete the lesson per day; you have more time to use cooperative learning, technology, present lab activities to help students learn; there’s more time to interact with students and to know the students better, and you deal with fewer students.

With this problem I chose to enter the modeling workshop sponsored by Arizona State University in the summer of 1995. I entered because I had some concerns about what was happening in our school and was hoping the modeling method would be a good fit to block scheduling.

The modeling method is interactive engagement/active learning. It is highly integrated and systematic. The student’s classroom experience is more closely related to the physicist’s. Students design their own experimental procedures and they justify their interpretations of data. The models created from experimental interpretation are deployed in problems and activities. I focus mostly on mechanics models in my AP course: for example, the “free-particle” zero-force model, a “constantly driven” constant-force particle model, and a “centrally bound” central-force particle model.

Another main reason I entered the modeling program is that I knew that my instructional methods would be evaluated through my students’ results on the Force Concept Inventory. That was one thing I’m concerned about personally: evaluation of what I’m doing.
Now let’s consider time management. That’s a big issue; how do I keep the students actively engaged for 90 minutes each day? I know you’re thinking, “I would love to have students for 90 minutes” . . . until you get them. Because in the traditional schedule, if you don’t plan the double lab period effectively you can say, “well, I can get to the lab the next day, I’ll have 40-45 minutes”; but in my situation they come in for 90 minutes one day, and the next day I have them for 90 minutes again. If I don’t use that time properly I lose it, because I don’t have them for a whole year. So those 90 minutes can be very difficult to plan.

One of the questions that arises with the block schedule planning is, “Will I be able to cover all the content in my curriculum?” Some anecdotal comments I hear from teachers who use block scheduling with traditional teaching methods are, “I find that I need to prepare two or three meaningful lessons each period; we have 90 minutes; you’re not just preparing one lesson.” Some teachers find that they have to switch every twenty minutes. They have to keep switching topics, otherwise the students can’t stay on task. (It is very typical; I have watched some of the teachers, especially the student teachers who haven’t had any instruction in block scheduling and are used to the 40-45 minute period. They have a hard time adjusting. It is very difficult for beginning teachers. They find that they tend to have a lot of time left over.) Another comment I hear is, “I do not cover as much content as I did under the traditional schedule”. That was one of the complaints by the members of my department: “We’re just not covering the content!” -- this “less is more” issue.

My colleagues around the nation who are using the modeling method with traditional scheduling encounter some problems too. They say things like, “I only have 40 minutes!” “Why does it take me so long to cover Newtonian mechanics? I finished mechanics in April”. “The class periods are too short. It takes more time to model.” “Whiteboarding worksheets takes a lot of precious time. I cover less content using modeling.”

I began to use the teaching methodology employed in the Modeling Instruction workshop in my classroom during the academic year ‘95 - ‘96 and continue today. I use this constructivist methodology as fully as I know how. This is how I proceed: I start the modeling cycle with a pre-lab discussion of a paradigm experiment; then the students go into cooperative groups to develop an experiment in the laboratory session. The students analyze their data and develop their model on whiteboards. The next day we do a post-lab discussion where the students explain and defend their model. Finally comes deployment and applications of the model, again using whiteboards.

I do this in my AP course. I teach AP Physics as a first-year course and I don’t call it AP-B or AP-C, I just call it AP Physics. We get about 90 students, which is a large number for an AP population. (I don’t want you to think that we have all these bright students running around our school; I think that suburban school districts generally have similar students. It’s always been my goal to get as many into the physics classroom as possible, so I offer them a choice of regular or AP physics.) My use of the modeling method differs only in that I use the sophisticated mathematics that is needed on the AP-C exam.

I found that there is a lot of continuity to modeling in blocks. There are not as many interruptions in the modeling cycle when instruction occurs in blocks. I was pleased to find that I could complete the modeling cycle in two to three days. I do a pre-lab discussion in the first 10 or 15 minutes and then send the students to the lab for an hour and 15 minutes. I prepare something for homework that night for them so that they can start thinking about the lab write-up. The next day, in the post-lab discussion, they prepare the whiteboard presentations in their groups and write up their lab, discuss what they thought about individually that evening, and then we start the model deployment. This is a better situation than my modeling colleagues who have forty minute periods, for they have the modeling cycle spanned over a week, and some nights the students might not have homework. When you stretch something over a longer period of time you lose continuity and
the students lose focus. I find that block scheduling provides me more continuity on homework assignments, too; and I think that since my classroom time is shortened because of block scheduling, I need to include as much homework as possible.

Now, how well did my students learn using the modeling method? For evaluation, I used measures that were not generated by me and that are what my administrators and my colleagues look at. The first one was the AP-C exam. Now again, in this AP course I have 9th through 12th graders, so any student can take it. It is not very selective; I have kids who are in calculus, I have kids who are in geometry. In the ‘94-95 block, before I learned the modeling method, 24 of my 84 students took the AP-C exam, and 54% scored a 3 or higher, and 21% scored a 4 or 5. In the ‘95-96 exam, after a year of teaching modeling, my students’ scores went way up: 85% scored a 3 or higher and 70% scored a 4 or 5. The number of students were comparable: 27 of my 73 students took the exam. (Incidentally, I found out that the ‘95 exam was considered to be very difficult.) The ‘96-’97 exam continued this pattern. That was one thing I used as an evaluation tool that I can take to my administration, because they always say they don’t look at the AP test scores, but you know they do!

The second evaluation measure was the Physics Bowl administered by the AAPT. In ‘94-’95, before I learned modeling instruction, I entered the Physics Bowl because I wanted to see where I would stand, in terms of whether “less is more”. Of the 40 questions on the exam, I covered 25 of them in class. My class average was 22.1, whereas the overall Division I average was 17.1. Now these students volunteered to take this test, so they are my better students. I gave it after the course was over; they came in and just took the test. In ‘95-’96, 28 students volunteered to take the test; this time I covered 29 out of the 40 questions in class. The Central Bucks West High School average was 22.6 while the overall Division 1 average was 15.0. So my spread got bigger; thus in essence I covered less content but the students did understand more. If somebody were going to evaluate my achievement, I covered enough content, well enough, that it was acceptable.

The last evaluation measure is the Force Concept Inventory. In ‘94-95 twenty-eight students volunteered to take it, and they had a post-test mean of 67%, compared to an overall national post-test mean of 50% in traditional instruction. Again, those were my better students. I feel comfortable with the fact that in ‘95-96 I required all 73 students to take it. My class pre-test average was 32%, and my post-test average was 74%, for a gain of .61, which I was satisfied with, because although it’s called an AP course, with an enrollment of 90 or so kids they are not all AP students. (Maybe their parents think they are AP students but they’re not all AP students!) That’s what I like about using the modeling method, because often the upper level students will learn in spite of you but it’s the ones in the middle that we have to prepare our courses for in the end. The improvement continued in ‘96-’97, when I taught the regular physics course and two sections of AP Physics. My 71 students achieved a post-test mean of 74% with a gain factor of .63, which is much higher than when traditional instruction is employed. I found that my regular physics students achieved as much during the first semester when they’re excited about school as the AP physics seniors did in second semester when they’re not so excited about school.

In sum, I have been quite positively involved in the modeling method. I think that if covering the material is a concern - you know we all have this desire that we have to cover all this content - that if you do a good indepth job and cover less content, your students will be able to perform well on the tests that your administration is worried about. Maybe you, too, will convince them, as I have with the modeling method.