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Coaching Mathematics and Other Academic Sports

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It was one of those gorgeous autumn afternoons: a deep October blue sky contrasted with the brilliant golds and crimsons of the trees, the dazzle of the sun moderated the crispness in the air, and the spirit of the Homecoming crowd brought the stadium to vibrant life. It was a perfect day for football — and hardly the time or the place to be meditating about teaching. But that's where I first began to wonder ... to wonder why the football coach seemed to have so much more success with his team than I had with my mathematics class. A strange thought, it was.

After the game, I decided to ask the coach the secret of his success. And then I talked with other colleagues in music and drama. It was an odd collection of consultants, but they had one thing in common: they all coached students. They did not just teach, they *coached*. And they all seemed more successful than I, who merely “taught” students. Why?

For one thing, these coaches worked a lot with students on an individual basis. To be sure, they also dealt with students in groups — a team, a choir, a cast — just as I dealt with students in a class. But the crux of their work was individual coaching, something I found that I rarely did. And when I did work with students individually, it was more or less a miniature version of what I did in the classroom everyday: explain theory, work problems, ask a few questions.

One big difference was that I rarely asked my students to perform, other than on infrequent hour tests. The coaches were always asking

their charges to perform *under observation* — to run plays, to sing arias, to act out roles in rehearsals prior to their big tests. And another big difference was how the coaches dealt with student performance. They carefully reinforced correct performance — one step at a time. They pointed out wrong stances, flat pitches, inappropriate inflections. Then they had students practice repeatedly until one behavior was correct before going on to another.

What did *I* do? I *showed* students how to work problems, whole problems, with several steps carefully ordered in logical sequence. If the students nodded, I assumed that they understood and I went on to other problems. Imagine a football coach himself throwing passes and running plays with precision throughout practices while his players watched him — and then leaving them on their own and expecting them to do the same things just as well on the day of the game!

I quickly realized that I might not have time to coach all my students individually all the time. Some talented ones seemed to do pretty well without frequent attention, so I focused my efforts on those who were barely “making the team” — my team — academically. I invited them — no, that’s not the word — I *urged* them, and even required some to come to my office for one-on-one coaching sessions. Sometimes I opened these with a brief example to illustrate a concept. More often, I posed a problem and had the student work it on my office blackboard. I was careful to provide reinforcement for correct and proper procedures. I provided guidance only as necessary, and I pointed out inappropriate behaviors — one at a time. Then I had the student correct that behavior and practice in similar problems until I felt sure that the technique in question was mastered. I discovered that even the better students sometimes needed to correct little mistakes of which they had never been aware. In addition, I tried to ask questions that allowed the student to organize and summarize, rather than to do these things myself.

It was challenging work and it was harder work than I had been doing, but it seemed to pay off in terms of learning. Grades on tests improved and the response from students was quite favorable. I realized that I was putting into practice some principles that I always knew were valid: positive reinforcement and immediate knowledge of results. Somehow these had gotten lost in the shuffle of dividing

courses into weeks and days and in the process of covering material "efficiently."

There was an interesting carryover into my daily classroom activities. I found myself asking more questions in class and asking questions more effectively. I was consciously mixing coaching strategies with my customary presentation strategies. I was viewing students more as individuals than collectively as a class. I also began to reduce the time between examinations and to incorporate more short quizzes. (Eventually, in one course I replaced all the hour exams with a pattern of frequent quizzes.) I found it more effective to respond to incorrect problems one at a time, rather than to dump as many as a dozen corrections on a student at once, as had sometimes been the case previously when I graded an hour exam. (The coach never waited until half-time to give his quarterback a truckload of criticisms and suggestions!) And I found myself making a point to write more positive comments on examinations before I returned them to students.

Yet, I wasn't quite satisfied. I went back to the football field for more pointers and more consultation. I noticed some other things that happened there. Players practiced with each other — blocking, tackling, chucking, and all those special behaviors that have begun to make football a complicated (if not fine) art and science these days. Often, they corrected each other without any help from the coach. I decided to have my students sometimes come to coaching sessions in pairs to work with each other, and I encouraged them to continue to do so on their own. Some of them, having experienced the value of working together, did so and reported favorably. In one class, collaboration evolved into a system for students to prepare and post solutions to homework problems for others to use in comparison to their own work. I'm now exploring how to capitalize on the process of students working together during actual class time.

Another thing I noticed on the football field was the relationship between practice and performance. Procedures were learned slowly in practice and gradually improved to the point of rapid and accurate performance (the coach calls it execution) on the day of the game. I recognized that most of my mathematics students grew in ability in the same way. (How could I have been so blind before?) While I continued to have my ever high hopes for them, I came to expect that

they would not have much speed or finesse early on. I encouraged them to work toward refined execution so that they would be ready for the big game — uh, the examination.

I also recognized the role played by that ultimate performance, without which practices would lose much of their meaning and purpose. The game, the concert, the play, the examination are very important as goals and incentives. They provide a focus and a target for students' continually improving efforts. In those highly visible instances, students are on the line. Successful performance is not only a reward in itself, but also an incentive to continue to perform well.

I renewed my efforts to help students succeed. I was less willing to let students fail. I even began to give practice exams when appropriate, just as my colleague coaches staged dress rehearsals and final scrimmages. I began to think of learning and teaching from a new perspective. Again, I sensed that students were responding well. Of course, I recognize that football involves a much larger measure of psychomotor skills than does mathematics, with its heavy focus on cognitive skills. I'm trying to be careful to not overdraw the comparison. But it has been an instructive analogy, and the initial results I have found certainly support its usefulness.

I'm continuing to study my teaching from a coach's perspective, and I expect that I'll discover some other new approaches. I hope so. It's been very satisfying to find that an old teaching dog could learn new tricks.

Can coaching concepts be employed in other academic fields? I think so; they involved some fundamental learning principles. Some of my colleagues in English and in foreign languages are doing so with success, so I suspect that what I learned from the coaches has fairly wide applicability.

Last Saturday, the football team lost rather badly. I came up with several ideas on how the game could have been handled better. I'm waiting for the coach to drop by my office and ask me for some advice ... I owe him one.