

Murdoch Middle School

Murdoch Middle School began as an idea shaped by the writings of Jay Forrester and Peter Senge and grew into a middle school of nearly 200 students. Systems thinking and system dynamics objectives were codified in the charter and approved by the state. Teachers read *The Fifth Discipline* before they were even interviewed. Local companies provided hardware and High Performance Systems donated Stella and hours of training. Board members, teachers, and the local ST/SD community watched in anticipation of sustained growth in the use of simulation models. Finally, everyone thought, there's a school where we don't need to worry about convincing people to try this. Where parents will come because they are looking for non-traditional work like modeling. Where students and teachers will have the time and support systems thinking and system dynamics demand. But sustained growth never came. There were moments of excitement, moments of backlash, and plenty of small victories and defeats. Here's the story.

Part I: Peterson in Chelmsford. An expert comes to train the staff before the school opens. What impact did the training have?

Part II: Heads above Water. The staff gels. Systems thinking and dynamic modeling show up the most public project of the year. Have they "made it"? What next?

Part III: Fear of Sustaining. The school begins to find some success and acclaim. One teacher begins to work as the ST/SD Mentor. Does the use of the tools spread?

Part IV: Negotiation. For the first time, people begin to choose publicly whether they will use ST/SD tools or not. What is the effect of this erosion of the original goal?



Steve Peterson stood in the middle of a room of teachers, talking at their backs as they hunted for different icons on the battered computers that made a stark counterpoint to the brand new walls and floor. He walked them through the concrete steps of loading Stella, registering the software, and opening new screens on which to build models. They turned in their chairs to watch him pour water back and forth between two small plastic cups, illustrating how they could find stocks and flows in everyday happenings, and then he directed them back to their screens to model the pouring water. Peterson, a tall, rangy man with an encyclopedic knowledge of thousands of situations begging to be modeled, from milk production to forestry to rocket launches, worked the room to help the eight faculty members find the features they needed. Over the next fifteen minutes, some modeled the water moving between the two cups. Some tried it and got tangled in the software's features, erased what they had with the very popular dynamite icon, and started again. Some took out catalogs hawking young adult novels or art supplies or gym equipment and began to make selections, and still others wandered out of the room, making phone calls or locating desks for their empty classrooms, then wandering back and asking colleagues what exactly they had missed over the past hour.

There were times, in fact, during which Peterson, who had delivered this training successfully scores of times before, found himself alone in the room, offering a costly and specialized training (This session was offered free to the school.) to no one at all. “The building,” recalled Peterson, who remembered being impressed by the energy level of the teachers with whom he was working, “was completely chaotic.” But consider that these were teachers unburdened by any sort of contractual restrictions that might limit the amount of time they could stay for training. Indeed, they were teachers who had come together specifically to start a school in which students would, among other things, learn to use Stella, the modeling software produced by Peterson’s company, High Performance Systems, Inc. In addition, there was no possible way the staff would be able to find the money or time to replicate the training within the next twelve months. So what in the world was going on?

Peterson had arrived at what was then called the Chelmsford Public Charter School (The school has since been renamed after one of its founders, Linn Murdoch, and is now called the Murdoch Middle School.) in the middle of August 1996, about two weeks before the school would begin to educate its first students. The faculty, seven teachers and the principal, Sue Jamback, had spent their time leading up to his visit in what many schools would consider an unorthodox way. Jamback, a veteran art teacher and principal who had worked in schools in New Hampshire and Connecticut over a twenty year career, believed strongly in establishing a “shared vision” before plunging into what might be called short tasks—the ordering, organizing, decorating, and alphabetizing that passes for summer work in many schools. To be sure, there are numerous teachers across the country who spend their time away from students in rigorous pursuits that improve their professional practice, but to find an entire school engaged in higher level work together is rare. And so their first day together, Jamback talked with the staff about the vision spelled out in the charter – one calling for real-world, hands-on work, preparing students for the 21st century – and how they might go about making it their own.

Within a few days, they had settled on the wording for four academic objectives for all of their students and had begun to create projects. Since the charter dictated that classes would be based on real-world events and not simply on textbook material, the work of “creation” extended from dreaming up scenarios that would pass for “real-world” to locating numerous trade books to provide content for the activities kids would be asked to do. The work was often interrupted as prospective students wandered in with their parents and were enthusiastically shown around the nearly empty building and put through the uncomfortable process of making small talk with their seventh-grade teachers while their beaming mothers looked on. Teachers asked students their opinions on matters ranging from possible colors for the walls to topics about which the students wanted to learn. In the evenings, as energy for writing curriculum waned, teachers made attendance lists, organized grade books and classrooms, and pasted up bulletin boards.

By the time he arrived, then, Peterson encountered a group that saw little time in its day for anything resembling a traditional *I talk, you listen*, or even an *I show, you do*,

classroom. Though they sat through his instruction, which many remember as interesting, and even fun, most could not conceive of mastering a new piece of software, integrating it into projects that they were not entirely sure of how to plan in the first place, teaching students to interpret graphs and charts as the software generated them, and then making the whole thing run dependably on the school's donated, jury-rigged computer network. He was doomed before he started. Peterson says that he was convinced that the teachers and principal were very interested in systems, and that some people definitely showed a knack for building models, but also that he doubted that the new school would have the "infrastructure to support all the activities" that would need to go on to take them from interest to instruction. He reiterated High Performance's desire to support the school in its mission and scheduled a follow-up meeting for a time that seemed incredibly far away, certainly long enough to allow people to get on their feet – November.

The Chelmsford Public Charter School, housed in a rickety office condominium equidistant from an expensive coffee bar in one direction and a trailer park in the other, was the product of roughly two years of work by a small group of parents from Chelmsford, Massachusetts. Laws allowing groups of citizens to petition state Boards of Education for the right to start their own publicly funded schools were first passed in Minnesota in 1991. In 1994, Massachusetts passed the Education Reform Act, which aimed to improve the Commonwealth's public education offerings by injecting equal parts autonomy and accountability into the system through the law's two most notable features: charter schools and high-stakes testing. Charter schools are independent public schools that are approved and carefully monitored by the state and receive their funding from the same sources as district public schools. Students attend by choice, and the schools are not allowed to require that students take entrance exams or demonstrate academic qualifications any more rigorous than to prove that they live somewhere in Massachusetts and are of the appropriate age to attend the grades offered.

Chelmsford sits roughly twenty-five miles northwest of Boston and is home to a good many engineers and sales vice-presidents, though it does draw students who qualify for free and reduced lunch and still boasts more than one working farm and an Agway feed store. In addition, and more relevant, Chelmsford was already the sort of place to which people move "for the schools." Most of its students graduate from Chelmsford High School or one of a few well-regarded religious schools in the area, and nearly all of them go on to four-year colleges. And yet, as the founding group had seen firsthand while trying to bring some energy for reform to the town's school system, some residents were not satisfied with the institutional feel and resistance to change endemic to large public schools. Their charter proposal included a focus on what is often called student-centered or hands-on education, as the founders envisioned a school in which students did not attend one-size-fits-all lectures but instead worked on a mixture of individual and small group projects. An example from their application to the state describes a scenario in which students notice pollution in a local lake and, with coaching from their teachers, concoct a series of labs to diagnose the problem and devise a cure. With visions of this sort of assignment in mind, one of the founders heard Jay Forrester speak on the topic of system dynamics in education. From there, system dynamics was an easy sell to the rest of the board, and it appeared prominently in what became the final proposal.

Once the school year began, whatever modeling knowledge teachers might have picked up from the work with Steve Peterson was nowhere to be seen. The day-to-day work of rolling out (and almost immediately adjusting) the new projects to students conditioned by years of fill-in-the-blank schoolwork proved to be an even larger task than simply inventing the new projects in the first place, and the infrastructure about which Peterson wondered as he drove away in August was certainly not there. On the subject of whether changes in the initial training could have produced more teachers who were actually able to build models while attending to all the other tasks before them, Peterson is straightforward, saying, “There’s no way we could have done that.”

Indeed, the initial units, in which some students had to design and implement a physical education program for the school and others wrote a school constitution, did not call for even the tiniest bit of either systems thinking or system dynamics. The projects began with great fanfare and rolled on for weeks. Parents raved about the quality of instruction. The server crashed almost daily. Orders came in late or failed to go out. The parking lot remained full during nearly all daylight hours. There were days of wild excitement, such as the one when a girl managed to get a local judo teacher – judo did, in fact, ultimately become one of the phys. ed. offerings – to provide a demonstration lesson, complete with the breaking of boards and a great deal of shouting. There were days of nearly unbearable frustration as students and teachers confronted the idea that it isn’t always that interesting to research and plan gym classes or school constitutions. And then, in an attempt to add some order to the curriculum, the teachers picked due dates and cut the projects short. Kids settled on solutions and implemented some of them. It was, to everyone’s surprise, nearly November. Steve Peterson was on his way back.

He met with the staff in a fifth-and-sixth grade classroom one afternoon as the school buses were hauling kids around the winding roads of Chelmsford and the sun was beginning to set. Again, he poured water between two cups. This time, though, no one sat at a computer. Peterson drew behavior-over-time graphs representing the movement of water and got more of a response than he had over the summer. He asked the group, point-blank, what they wanted to get out of using the Stella software. Did they want kids to learn to build their own models? To understand dynamic behavior? To understand solutions to specific problems or nuances of particular situations? It turned out that, while no one really knew, most liked Peterson’s idea that he might arrange for a local system dynamicist who could come more frequently and actually plan with teachers—something that the group thought might be more useful than the “airlift” method they had been trying. The conversation turned from one in which Peterson led the group to learn modeling techniques and more towards one in which he helped them figure out how they might continue their training in ways that would better fit into the sort of work that they were already doing and would not require him to drive three hours from Hanover, New Hampshire, to conduct the training himself. Satisfied that two people in particular, a fifth-and-sixth grade teacher named Leah Zuckerman and a seventh-and-eighth grade math teacher named Ruth Corbett, would begin to fulfill the school’s mandate to use system dynamics in its curriculum, the staff went back to their classrooms to grade papers and

prepare for the next day. Most would still be there at seven o'clock that night, and all would be back before seven the next morning.

Zuckerman and Corbett set up meetings with Gary Hirsch, a management consultant who had studied under Jay Forrester at MIT and had made a career solving problems for a variety of industries using dynamic models. Hirsch lived only a few miles from the school and graciously offered to take advantage of his somewhat flexible schedule by coming in whenever the teachers found it most convenient. He met with each of the women for planning sessions and then came in for Zuckerman's ecology unit and Corbett's algebra class. In both situations, the teachers planned the lessons and reviewed them with Hirsch, who offered a few ideas here and there and then showed up for class with a plan to work with students on the computers as they manipulated flight simulator models from the High Performance archives or the Creative Learning Exchange. Hirsch's role was a combination of tech support, science instructor, and middle school system dynamics teacher. He soon found himself trying to talk old computers out of crashing and asking questions along the lines of, "What do you notice about the slope of the line in this graph?" to groups of ten- to fourteen- year olds, who provided answers along the lines of, "It's slanted?" Earnest effort on both ends led nowhere. Zuckerman, Corbett, and Hirsch concluded jointly that there had to be a better way, but, lacking knowledge of what that way might actually be, they agreed to suspend efforts to collaborate to avoid further frustration. Yet again, the new school had taken on the best that the system dynamics world had to offer and stared it down.

To be sure, this was not a case of a faculty rising up to crush a new initiative foisted upon it by an out-of-touch administration. It would be hard to imagine an administration—admittedly, a silly word when it is used to describe only one person—more in touch than Sue Jamback. She insisted on weekly, two-hour staff meetings at which the group tackled large and substantive issues. Though she had as little spare time as the teachers, she managed to get herself into all of the classrooms several times. She demanded and encouraged staff input on issues ranging from the school's budget to its teacher evaluation system to its graduation ceremony. She was a student of systems thinking, if not system dynamics, herself, and would later allocate more than half of the next year's professional development budget to sending more staff to High Performance Systems' training over the next summer.

In addition, staff was hired only after an interview that, in part, focused on their understanding of the concepts explained in Senge's writings. They were, by and large, well-educated, technologically able, and quite devoted to the school, and not at all averse to hard work. Most had participated enthusiastically in dialogues centering on *The Fifth Discipline*, which, though its content does not lead one directly to dynamic modeling, could be considered a fine introduction to the concepts involved.

So why did the implementation fail to take off in what seemed like a fertile environment? One explanation offered by Peterson and echoed by several teachers was that it "probably wasn't the optimal time for the training." Though it seemed better to begin with the training early to avoid having it appear like something tacked on to the

“real” curriculum, such scheduling also brought with it the consequence of adding yet another variable to the equation of projects, materials, classroom management, and all the other uncertainties facing a new school. In other words, even if you aren’t sure how to create a project around, say, *The Outsiders*, you can be confident that you will be able to read it and that you will most likely grasp S.E. Hinton’s themes and symbolism. Not so with system dynamics modeling. Though the teachers were generally comfortable learning to use new applications on the computer, the idea that all were learning together and were then expected to quickly begin teaching students to use this program scared people off. It was, after all, the first time many had tried to learn and apply anything in public, with a group of peers to which they could be compared, since high school. Unsure of how to do the job before them, perhaps they didn’t want to get into this kind of risky learning until they felt more settled.

Hidden within this explanation is another one: learning to build system dynamics models is *hard*. Go back to the example with *The Outsiders* and imagine hiring a building full of illiterate teachers to teach it. And then imagine that there is no *Outsiders* – just a mandate that teachers should plan classes that use something new called “novels,” which they will learn how to write in three days and should prepare a few of for the school year. Would the trainer spend a day on basic reading skills, a day on basic writing skills, leave a day for free writing, and then expect to see manuscripts? Would you want your kids reading those manuscripts in school? Even Peterson now says that the number of people that he would expect to learn to construct models while they were busy teaching school is “very, very small.”

Another possible reason involves what I will call “survival addiction.” Teachers got used to planning one day’s lessons—one that would, for example, help kids make sense of research on different physical education programs—just hours before that day began. The staff would regularly plan long parent nights—at which parents would have a choice of four different activities, plus a speech from the principal and, for example, a short talk on the school’s new report cards—on the afternoon of these events. By and large, the classes, parent nights, and whatever else they tried went well. There were bumps, and kids left by choice and new kids came in to replace them, but most parents were happy with the school.

The support offered by Hirsch and Peterson, while the equivalent of having Pedro and Nomar [two superstars of Boston’s baseball team] come and offer input for the phys. ed. project, called on the teachers to plan weeks, or even months, in advance. While there was no one at the school who would have regarded this planning as a bad idea, there was also no one who would have thought it possible. To take time on a winter evening to plan something for a unit to be delivered in May, when the very next day held gaping stretches of time for which teachers had specific academic goals but little in the way of actual plans, seemed preposterous. Perhaps the work would have to take place over the summer. Or the next year, or the year after that, or the year after that.

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