THE THAYER METHOD: STUDENT ACTIVE LEARNING WITH POSITIVE RESULTS

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Graduation from West Point requires successful completion of four courses in the mathematical sciences. These core mathematics courses include topics in discrete dynamical systems, differential and integral calculus (single variable and multivariable), differential equations, linear algebra, probability, and statistics.

The instructional system employed throughout the core is the "Thayer Method," named for Colonel Sylvanus Thayer, "the Father of the Military Academy." In the Thayer Method, traces of cooperative education and "discovery learning" are evident. It is quintessential active learning. The West Point catalyst is the fundamental principle that cadets are responsible for their own education.

Introduction

Efforts to "reform" mathematics education have flourished since the mid 1980's. Release of the National Council of Teachers of Mathematics Curriculum and Evaluation Standards in 1989 [1] and initiation of the "Calculus Reform" crusade were two catalysts in the campaign. Curriculum and pedagogy were subjects of the major reform efforts.

It is difficult to correctly and concisely summarize the current state of mathematics education reform. Efforts to provide such a summary in the popular press often cite the "New Math" reforms of the '60s. Nowadays, it is even fashionable to employ belligerent terms to report on the controversies; for example, the term "Math Wars" was applied to describe a controversy over curriculum reform efforts in California [2].

However, it is possible to provide a few themes common to many of the contemporary reform movements in mathematics education. Cooperative education, inquiry based learning, and student active learning are three such themes. Moreover, the role of modern technology in the teaching and learning of mathematics is usually prominent in every discussion.

Part of the problem and indeed, the source of some controversy, is the difficulty in assessing and evaluating curriculum or pedagogical change. It is not possible to produce evidence

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as from an experiment in chemistry or physics. Instead, one considers a combination of anecdotal, qualitative, and quantitative information. It is necessary to draw "conclusions" with caution and to phrase statements with care and precision. The approach is that of a social scientist, not a physical scientist.

In this paper, I provide a brief description of a mathematical sciences program that has many features of today's "reform" programs. The themes cited above are present. In particular, student active learning is evident, as it has been for more than a century.

We begin with some historical remarks. See references to support and supplement this necessarily brief account [3,4,5,6,12].

Historical Remarks

The United States Military Academy (USMA) at West Point will soon begin the third century of its existence. By act of Congress on March 16, 1802, the country's first national education institution was established. America's first Commander in Chief, George Washington, had anticipated the need for officers educated in the science and art of the military, especially artillery and engineering. With its Washington and Jefferson pedigree, West Point swiftly emerged as a source of officers and engineers for the young nation. The westward expansion required design and construction of roads, bridges, and the development of a national infrastructure. As the first engineering school in the country, West Point was a wellspring for faculty needed to staff engineering programs emerging in public and private institutions of higher education.

The core of the West Point educational process and program was (and still is) mathematics, the physical sciences, and engineering. First and foremost are the mathematical sciences, the foundation and cornerstone of a West Point education since Sylvanus Thayer's term as superintendent.

Sylvanus Thayer was Superintendent of the Academy from 1817 to 1833. He was born in Braintree, Massachusetts on 9 June 1785. Thayer graduated first in his class from Dartmouth in 1807. His best friend at Dartmouth was George Ticknor who later became one of the great educators of Harvard College. Ticknor and Thayer were friends for life. President James Madison appointed Thayer to study at West Point on the recommendation of General Benjamin Harrison.

Thayer completed the West Point curriculum in one year and accepted a commission in the Corps of Engineers. He was assigned duty as Inspector of Fortifications for New England. In 1810, Thayer was appointed Assistant Professor of Mathematics at West Point. During the War of 1812, he became convinced of the need to modify the method of preparing army officers for duty.

In 1815, Thayer was sent to France to study the French system of preparing engineers and to purchase books, maps, and equipment. He visited École Polytechnique and the artillery school at Metz. Thayer was influenced by the "prescription system," a dominant feature of the military education at École Polytechnique. "Prescription" was also in place at the University of France established by Napoleon. Science was the core of the subject matter—all courses were set down (hence the term "prescription")—and attendance was mandatory!

While Thayer was in France, George Ticknor was visiting Göttingen. The liberalism, academic freedom, and the electives in the curriculum, which Ticknor observed at Göttingen, were the basis for reforms that he later promoted at Harvard College. The adoption of these Germanic based reforms spread throughout American higher education.

In 1817, Thayer was appointed Superintendent of the Academy. His work as superintendent earned him the honorary distinction, "Father of the United States Military Academy." We limit our remarks to his contribution in establishing what are often called the Thayer System and the Thayer Method. For my purpose, the former refers to the merit based system of evaluation that Thayer instituted, and the latter applies to the mode of learning and instruction.

Thayer's merit-based system evaluated each cadet's performance in academics, military preparation, and discipline. Every cadet was graded on every activity. A competitive atmosphere was created, but the Corps of Cadets appreciated the elimination of favoritism. Instruction was in small sections grouped by ability. There was monthly resectioning based on order of merit. The smaller class sizes necessitated more instructors and these were drawn from the ranks of the military, in fact from a pool of graduates of "the old West Point."

The beginnings of the Thayer System are described well by the eminent historian, Stephen E. Ambrose in *Duty, Honor, Country*. Ambrose's book was reissued in 1999 as a paperback (with an afterward by General Andrew J. Goodpaster, Superintendent from 1977-1982) [3].

The Thayer Method

In order to graduate from West Point, a cadet must successfully complete four courses in the mathematical sciences. These core mathematics courses include topics in discrete dynamical systems, differential and integral calculus (single variable and multivariable), differential equations, linear algebra, probability, and statistics. Maximum capacity of each section is eighteen cadets.

The Thayer Method of instruction is employed in the core mathematics courses. To be sure, the present day version is a modification of the version used in the early part of the 19th century, but some essentials remain. For example, question and answer interaction and student oral presentations to the class are a major portion of every class period.

To present a sense of the mid 20th century West Point classroom in mathematics, we refer to two articles by COL Charles P. Nicholas, Professor of Mathematics, USMA [7,8]. COL Nicholas graduated from West Point in 1925. He was Head of the Department of Mathematics from 1959-1967. His perspective of the Thayer Method as practiced in the West Point Mathematics classroom is that of a student learner and a professorial practitioner.

In *Preparing the Weapon of Decision* [7], COL Nicholas begins by writing, "A fundamental purpose of mathematics at West Point is to prepare the cadet's mind for a career of military decisions." Following a discussion on the technical objectives of mathematics at West Point (the subject content of the core mathematics courses and the role of each in the curriculum and the military careers of West Pointers) Nicholas writes:

> But to return to the most fundamental purpose of all, it is the function of mathematics at West Point to shape the cadet's mind into an effective instrument of military leadership. This is accomplished by a particular method of teaching which, although features of it are certainly used in other good colleges, is perhaps nowhere else directed so uniquely toward the objective of leadership as at West Point. This method of teaching regards mathematics as an intellectual discipline, and not as a tool for computation; it regards a mathematical process as a pattern of

> thinking, and not as a manipulation of symbols. In short, the course is taught as a liberal arts course in the true sense of that term, and not as a cookbook course of formulas for the technician. The emphasis is on the understanding of fundamental concepts, on precision of analysis, and on logic.

He then provides an account of General Ulysses S. Grant's "mental pattern" in formulating a battle plan for the attack at Vicksburg. His point is that Grant was "supremely confident of [his] ability to figure out an original solution of an unexpected problem" and that he was "accustomed to reasoning in terms of the abstract". Grant (and other great military leaders) had acquired the ability to understand their own thoughts with clarity and to formulate them effectively to others. It is COL Nicholas' contention that proper training in mathematics provides the means to acquire these abilities and, therefore, the study of mathematics is essential in development of successful military leaders.

Specifically, the mental traits that are characteristic of the greatest military leaders are [7]:

- The habit of thinking fundamentally, or the ability to see each new problem as representing a more general design to which basic principles are applicable; the power of abstraction
- The habit of confidence that one's own mind contains all the resources needed to solve a problem; the capacity to learn for one's self
- The habit of logic
- The power to communicate fluently and precisely

A fundamental principle at West Point is that cadets are responsible for their own learning. Indeed, certain assignments have the force of a direct military order.

The following summary of specific features of the Thayer Method is described courtesy of my colleague, LTC Donald Engen, Assistant Professor in the Department of Mathematical

Sciences and USMA '81, in his unpublished manuscript entitled, *Thayer Method of Instruction*. There is some overlap with what appears above.

Components of the Thayer Method implemented in the core mathematics courses at West Point are summarized as follows:

- For each class, a text lesson is assigned. This assignment includes a reading and specific problems associated with the reading material. Each cadet is expected to "work the problems." (Note: Prior to 2000 these problems were called "drill problems"; the current terminology is "suggested problems.")

- "One learns mathematics by doing mathematics." Cadets are encouraged to be active learners and to "do" mathematics. Group work is encouraged and expected. Special projects are a major portion of each core mathematics course—work on these projects is done in teams of two or three.

- Cadets are required to study the concepts of each lesson in such a way as to be ready to use them in three ways:

    1. To express them fluently in words and symbols
    2. To use them in proof and analysis
    3. To apply them to the solution of original problems

- The instructor's goal during each lesson is to cause the maximum number of cadets to actively participate in the day's lesson. One of the instructor's roles is to facilitate the learning activity in the classroom. This may take the form of a question or a remark to clarify a point.

- Class begins with the instructor's questions on the assigned text lesson. Cadets are asked if there are questions on the assignment. Example problems are worked and discussed. Cadets are sent to the boards to work in groups of two or three on specific problems that are provided (so called "board problems"). These board problems may be similar to the problems assigned with the text lesson or they may be "original."

- Cadets are selected to recite on the problems they work. Questions are encouraged.

- The instructor spends a few minutes to discuss the next lesson. This practice is commonly called the "pre-teach."

We return to Stephen E. Ambrose for another brief summary of the Thayer Method:

> ... each cadet received an assignment from the text each day, upon which he recited and was graded the next. The teaching was intensely practical, with little or no attempt to impart the theory of a subject. Many found the method deadly, while others prospered under it; for Thayer, the important point was that it seemed the most thorough system for imparting knowledge [6].

During the academic year 1998-99, I taught at West Point while on sabbatical leave from University of Massachusetts (UMass) Amherst. The course was *MA391: Introduction to Mathematical Modelling*. There were thirteen students in the course: six seniors ("firsties"), six juniors ("cows") and one sophomore ("yearling"). All students had completed the "core." My plan for the course was to import several topics usually covered in the undergraduate mathematical modelling course (*MA456*) at UMass. Moreover, I intended the course to be "project based" as *MA456* has been since my colleague, George Avrunin, designed it in the mid 1980's. We provide a brief description of the modelling course below [9].

The course is an introduction to the mathematical modelling process. Different types of models in use in the physical, social, behavioral, biological, life sciences, and engineering are analyzed. For example, we attempt to introduce examples of deterministic, simulation, probabilistic, statistical, and axiomatic models. Special consideration is provided to models in the social sciences since many of the students have experience with models in the physical sciences and engineering (e.g., models of spring mass systems, electrical circuits, planetary motion). Moreover, in recent years there has been an explosion of applications of the mathematical modelling process in the social and life sciences. For example: in medicine, we can consider the problem of modelling the immunology of AIDS and in public policy we have the problem of modelling stratified populations to "fix" Social Security and Medicare.

Some of the topics we have covered are: population models (including several different models of one population as well as models of competing populations from ecology); models of social choice (how groups make decisions); economic models (the Cobb-Douglas production model); models of the epidemiology and the immunology of AIDS; models of strategic armaments of two countries (Richardson's Arms Race Model); and, simulation models in planning and development. For more on some of these subjects see one of the texts formerly used in *MA 456* at UMass Amherst [10].

In our treatment, we stress that mathematical modelling is an ongoing and dynamical process that is useful in daily life. An early activity is to use the daily newspaper as a source of "scenarios" for mathematical modelling problems. Later, we introduce "modeller's minute," a few minutes of class time for members (or the instructor) to present a modelling scenario recently encountered (e.g., how does a university decide how many students to accept in order to have a first year class of 4,321?).

I include a brief description of the four projects. Note the progression from describing and analyzing an existing model from the literature to designing a model to solve a problem of their own choosing.

Project 1. This is a report on a model that the students must find in a book (other than the text) or a scholarly journal. They are provided a series of questions that they are expected to address in the **context of their written project report**. (Emphasis added—we expect the answers to be woven into the text and not listed as a litany.) For example, what is being modeled—what is the nonmathematical problem under investigation—what are the underlying nonmathematical assumptions of the model—are these assumptions reasonable or not—what is the mathematical representation—is this representation accurate—what additional assumptions are implicit in the precise formulation of the model—are these assumptions reasonable—what mathematical reasoning is applied—what are the results—what type of interpretation is made of the mathematical results—is this interpretation tested in any way—is the interpretation sound. The length of the paper is left to them, but we expect five to ten pages with references.

Project 2. The students are given a choice. Present two distinct models of the same phenomenon (as was shown in our prior study of several different population models) or present one model applied to two distinct phenomena (as the logistic equation is used to model population or to describe learning theory in psychology). They are expected to address the same series of questions as in Project 1.

Project 3. This is an activity on simulation. They may report on a simulation from the literature or they may develop a simulation on their own. They are advised to look ahead to the final project when they will be asked to create a model on their own. It is allowed to have Project 3 serve as a beginning of the final project. Again, a series of questions are provided and they are expected to answer these questions in the context of the project.

Project 4. They are expected to develop a model on a topic of their own choosing. Several examples are provided as suggestions (many are topics treated by former students).

At West Point, I intended to cover some of the topics previously covered in modelling courses at USMA but not at UMass (not surprisingly, some of these were military applications). Students would do projects in teams of two or three (members would be changed from project to project). Oral reports on the projects would be presented during class. West Point's fully residential setting is conducive to group work. At UMass Amherst, I can (and do) encourage my students to work in groups. However, students with a long commute to campus or demanding work schedules can do collaborative work only with extraordinary effort (and sometimes not at all).

As it happened, the course I offered at West Point in Fall 1998 resembled the UMass course more than its West Point counterpart. (Course End Reports are written for each course at West Point. I had access to these for the mathematical modelling course.) For example, students were allowed to select the topics for the projects. The cadets seemed to welcome the opportunity to choose. This choice was in contrast to the required projects in core mathematics courses where the entire course is assigned the same prescribed problem (perhaps with different data for each section).

On the day projects were due, student teams presented oral reports or "briefs" to the class. Immediately, I noticed the effect of the Thayer Method. The presentations were well organized, and delivered with confidence and clarity. There were questions from the audience and answers and discussion followed. The experience of two years of practice briefing in the core courses was evident.

In my modelling course at UMass Amherst, I also require that students report to the class on their projects. My objectives are twofold: to provide an opportunity for the students to learn about the wide variety of mathematical models (this they acquire by listening to their classmates and participating in the discussions) and to provide experience in "communicating mathematics." The second objective has the potential to develop personal skills useful in their future endeavors. Many former students have told me that they had very little experience in presenting reports prior to taking my modelling course (which I had suspected from my many years of listening).

During the spring term of 1999, I made changes in the course. I attempted to include a few more components of the Thayer Method. Course handouts were distributed in "daily" packets and combined with reading and problem assignments from the text(s). This would align with the assignment of a text lesson for each class. For example, when we investigated the axiomatic modelling of social choice and Arrow's Impossibility Theorem, supplemental packets were distributed daily with a specific reading assignment and problems. The reading and problems were discussed at the beginning of the next class. However, I avoided student board work on "drill" problems except in a few special cases.

Let me digress somewhat and comment on Arrow's Impossibility Theorem. The Arrow is Nobel Laureate Kenneth J. Arrow. Professor Arrow was a co-winner of the Nobel Prize in Economics in 1972, in part for his work on the Impossibility Theorem. The setting seems to be more in the realm of political science than economics as it is the problem of considering what criteria determine a fair method for a group to make a choice. There's not too much controversy if there are a finite number of voters and two candidates. Majority rule might do the job just fine.

But what if there are three or more candidates? Now it gets a bit more complicated—in fact it gets a lot more complicated. Suppose we can require that each voter make an ordered choice of preferences—so each voter submits a ballot with a #1 choice, a #2 choice etc. How to choose a winner? Majority rule? There may be no majority choice. Plurality? Well, there may be a tie. Even with a clearly defined tiebreaker there are problems with a plurality system. There is a method called, "plurality with run-off." There are point systems (one such is called the Borda count). There are elimination methods. There are "head to head" systems (one is called the Condorcet method). However, it is possible to construct an example with five candidates and 55 voters, such that each candidate is a winner under exactly one of the five systems cited (each voter rank orders the candidates on a ballot with a first choice, a second choice, etc.). There is a video, *For All Practical Purposes*, produced by COMAP with an elementary exposition of this example; also, chapter eleven in *For All Practical Purposes* offers further insight [11].

Professor Arrow considered the problem of deciding which criteria characterize a "fair voting system." Or, as we say in mathematics, what set of axioms must be satisfied by such a fair voting system? In the language of mathematical modeling, we are asking for an axiomatic model of a fair voting system. More generally, we are asking for a clear process to pass from the level of individual choice to the level of societal choice.

Before proceeding with Arrow and his axioms, let me comment that this topic produces more lively debates and class discussion than any other I have covered in my modelling courses. We have developed a series of examples of various voting methods. Some are factual (e.g., primaries and general elections, political parties' selection procedures [at conventions], Baseball Hall of Fame elections, and a mathematics department's method of selecting its personnel committee). Other examples are manufactured to illustrate the complexity of the process of determining "society's choice." Obviously, the United States presidential election of 2000-2001 will be featured in our next course! [10,11].

One axiom that is easy to state, and not at all controversial, is the Axiom of Unanimity—namely, if all voters choose candidate A then society's choice is A. Another possible axiom would be the transitivity of society's choice—namely, if society prefers candidate A over candidate B and society prefers candidate B over candidate C then society prefers candidate A over candidate C. Transitivity is not as innocuous as it seems!

Oh yes, clearly we don't want to allow a dictator in a society that seeks a fair election process, so we "axiomatize away" the existence of a dictator. Arrow's Impossibility Theorem states that no "fair voting system" is possible where a "fair voting system" is one that satisfies five axioms (one of which is Unanimity, another is the Nonexistence of a Dictator). For a complete statement of all five axioms *and* a complete proof, read Michael Olinick's *An Introduction to Mathematical Models in the Social and Life Sciences* [10]. Yes, even in these days of mathematics courses without proofs, we cover in class the proof of a theorem of Nobel stature, and we do so honestly and completely.

The impact of Arrow's work on economics, political science, and philosophy is an important historical event. It is a substantial example of mathematics applied to the behavioral sciences. Moreover, it provides an example of axiomatic mathematical modelling.

For the project briefings, cadets are expected to use whatever visual aides or technology is needed. I was quite favorably impressed with what I experienced during the briefings. Midway through the fall semester, I stated my objective to "master *PowerPoint*" before the term was through. The unit on Arrow's Impossibility Theorem would be my "briefing." And so it was—with great pride, and a little fear, I clicked through definitions, axioms, examples, and the proof. Well, truth be known, the proof is a little too long for someone of my very limited typing skill. I did use the boards and a few transparencies. When I finished my debut, one of the cadets offered the observation, "Sir, it's possible to do the *PowerPoint* in color." "Yes, I know," I responded politely, "That's my objective for next term."

The *PowerPoint* presentation of Arrow's Theorem that I had prepared for Fall 1998 was, indeed, upgraded to a "bells and whistles" version for Spring 1999 (full color with sound and animation). When the "file" was complete I sent an electronic version to the cadets in the fall course. Some of them responded with brief notes.

The slide with the axiom, "***There is no dictator!*** " now contained a clip art character ("the dictator"). Our "dictator" periodically appeared on the *PowerPoint* slides in anticipation of the "punch line " of the proof. The *PowerPoint* presentation worked superbly on the desktop in my office. It also worked like a charm in the department's seminar room. Unfortunately, the computer cabinet was locked when I went to test it in my classroom. When I made the presentation to the class we discovered there was no sound card in the classroom's computer and the projection unit was stuck in an out of focus position! My full color with sound and animation *PowerPoint* briefing fizzled. We were able to salvage the essentials of the exposition (with proof) of Arrow's Impossibility Theorem. I know that I demonstrated some teaching principles that day—perhaps not exactly as planned, but we did no harm. Teaching with technology is not learned by talking about it—as with learning mathematics, it is learned by doing.

One of the student project briefs deserves mentioning. One team based their project on a required assignment from the core course, *MA206: Probability and Statistics*. The briefing included a *tour de force* in *Mathcad*, the computer algebra package used in all core mathematics courses. The class appreciated the presentation and asked several incisive questions. Many class members had wrestled with the problems that the briefing team handled with relative ease—especially with the *Mathcad*. I allowed the discussion to run well past the allotted time and on to the end of the class period. My main contributions were the decisions to allow the discussion to continue for most of the class period and to stay out of the way! This was quintessential student active learning and teaching!

In my opinion, there were a few reasons why this particular presentation was so well received by the audience. The subject matter was a problem that most of the class had worked on with some diligence, but not complete success. They were familiar with the material and had tried to take ownership, but they didn't yet "own it." However, some of their peers had been able to develop a solution to the problem and communicate the solution in a manner that they understood.

Later that semester, I formulated a modelling problem that came to me from the baseball coaches of the Atlantic 10 Conference. Some of the coaches were unhappy with the schedule. Apparently, the same schedule had been used for several years. This seemed easy enough to remedy and, probably, no mathematical modelling was necessary! More importantly, however, was an inequity in the schedule. Some teams were scheduled for away series on the last two weekends of the season. Now "home field" advantage is a part of baseball—but presenting some teams the "home field" advantage for two consecutive series at the end of the league schedule is an inequity.

There are two divisions in the A-10 Conference, North and South. Each division has six teams. Conference games are played on weekends. Each team plays a three-game series with another conference team (in a weekend series, one team hosts all three games at its home field). Each team plays one three-game series with every team in its division and each team plays a series with two teams from the other division. As stated above, the three game series is played over a weekend at the home field of one of the two teams.

After solving the scheduling problem on my own (in the context of an axiomatic model), I posed a simplified version to the class. For example, I first stated the problem as if there were only one six-team division. Each team would play a series with each of the other five teams. We imposed one axiom that required no team have more than three home series. As another axiom, we required that no team would have less than two home series. We required that no team would host consecutive series for the final two weekends. Finally, we required that no team would have consecutive away series during the final two weekends. The first question is an existence question for this system of four axioms. Does such a system exist? If so, produce a "model" i.e., a schedule with the desired properties. Or, perhaps, there is a contradiction in the axiom system—in which case no such schedule can be constructed. Finally, there may be the possibility that one of the axioms can be established from the others. The last point is probably not of interest to coaches. Nor is the question of uniqueness of a schedule if one such should exist!

As the class made progress on the first version, we formulated the general problem—namely, the full conference schedule with interdivision play. We factored in the need to rotate the schedule from year to year. We discussed an attempt to accommodate a "weather condition." This condition would schedule the "cold weather" teams for an away series at sites of "warm weather teams" early in the season. As it happens, this weather condition cannot be imposed uniformly without, say, adding "warm weather" teams to the conference. In fact, this year a warm weather team, Virginia Tech, left the Atlantic 10 to become a full member of the Big East Conference.

I announced that a solution was good for a 100-point bonus. Several complete solutions were submitted and awarded the appropriate bonus points. I sensed that there was a genuine interest in the problem. They enjoyed working it. I conjecture that the number of submissions would not have declined "much" if there were no bonus points. One solution paper was exceptionally clear and well organized. With the student authors' permission, I submitted their schedule model to the Atlantic 10 Conference. It is my understanding that the Atlantic 10 Baseball Schedule to be used in future years is the one designed by the students and the professor. By the way, the solution can accommodate teams leaving and entering the conference, as with Virginia Tech's departure.

Conclusion

It is quite legitimate to question the effectiveness of some of the staples of contemporary educational reform. For example, what evidence do we have to justify the implementation of, say, a cooperative education approach to teaching middle school mathematics? Is the evidence "hard" or "soft"? What methods should be used to assess and evaluate? In this spirit, we ask whether the Thayer Method is effective.

With little more evidence other than my own experience of three years of teaching at USMA, I have a positive and definite affirmative answer. Yes, it has been very effective at West Point. My answer is framed in the context of the special mission of West Point and the highly structured and compact curriculum. The mission of West Point is as it was two hundred years ago—to prepare officers educated in the science and art of the military. The current mission statement of USMA, "Educating Army Leaders for the 21st Century," reads in part, "To educate, train, and inspire the Corps of Cadets so that each graduate is a commissioned leader of character committed to the values of Duty, Honor, Country; professional growth throughout a career as an officer in the United States Army; and a lifetime of selfless service to the nation."

I know of no other academic institution that monitors its curriculum as carefully and conscientiously as is done at West Point. The academic curriculum is integrated and interactive. The academic units communicate in a real and substantial way. Interdisciplinary activity is genuine, not contrived, superficial, or perfunctory.

Recently, the Academy considered a change in technology. My officemate was a point person on the proposed change and the recipient of numerous phone calls, e-mails and visits from faculty in other departments. The faculty worked as good custodians of the curriculum in their departments and programs—they asked the questions that needed to be answered. It was impressive to observe.

Would this "system" be successful at another institution, say, a liberal arts college? Maybe. Yes, if the faculty and students had a common sense of purpose and commitment. There are such institutions. Ditto for universities. But recall the words of Ambrose quoted earlier when he wrote of the Thayer Method, " Many found the method deadly, while others prospered under it..."

Finally, I've been asked to comment on how the benefits to the military leadership component are equally applicable to corporate or government leadership roles. I see this as two questions. One asks if the West Point model can be used in an institution other than West Point. My brief answer is "Yes, if that institution is properly structured and receptive." To be honest, I am not the one to answer that question—there are many at West Point who can, and probably have in their papers, books, and lectures. The second version of the question is whether those who go through West Point can "make it in the civilian world." Well, novice as I am about West Point history, I can start a list that includes presidents, corporate executives, founders of large and successful companies, highly successful basketball coaches, educators, engineers, and even, the celebrated Abner Doubleday. But the real important question is about the current state of the institution. In the last three years, I've had students as good or better than I've known anywhere. I'm not quite ready to sign on to Andrew Jackson's description of West Point as "the best school in the world."[12] But, I am certain that Charles Dickens got it right when he said of the Academy, "The course of education is severe, but well devised..." ■

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This paper is dedicated to the United States Corps of Cadets and to the memory of COL Sylvanus Thayer.

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