EDITOR'S NOTES

Unlike most mathematics departments in the United States (and elsewhere) we are not primarily in the business of developing mathematicians. Quite simply, we are in the business of developing leaders

In this issue we explore the relationship between teaching mathematics and developing leaders. What is the connection? How can we do both? Is this a recent trend? How is it done elsewhere? We have a collection of interesting articles that answer these questions and more.

MAJ Greg Graves starts us off with a historical perspective, and CDR Joel Morisette takes the "Polya approach" to developing leaders. Professor Caroline Mellis shows us how USNA attracts future leaders into the mathematical sciences, and MAJ Jeff Broadwater presents his way of developing leadership in the classroom at USMA. Finally, we hear from "Down Under," where Geoffrey Aldis and Colin Pask introduce us to the ADFA. I invite you to read how studying mathematics can help our future leaders become competent, confident problem solvers.

As the new Editor-in-Chief of *Mathematica Militaris*, I must give special recognition to Dr. Mary Jane Graham, who has recently left West Point for a job at Lawrence Livermore National Laboratory. Her contributions as the Editor-in-Chief over the past four years have been tremendous, as her hard work and dedication have left their mark on this journal. She will be sorely missed. Good luck, Mary Jane!

Enjoy the articles, and we look forward to seeing many of you at the 11th Annual Service Academy Student Mathematics Conference on 13 April 2001 at West Point.

Best wishes from West Point.
Phil Beaver

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Leader Development in the Math Classroom: A Historical Perspective

MAJ Gregory H. Graves
United States Military Academy

"The driving force is his own will, and he creates order by means of decision and communication." [1]

"He finds that in every crisis of uncertainty, salvation lies only in energy of will, swiftness of decision, and precision of expression." [1]

Upon reading these two statements, one might conjecture that they have been taken from a treatise on leadership. Both statements convey qualities that we desire in our leaders and in our military leaders in particular. Qualities such as decisiveness and clarity of expression are crucial to successful leadership. The ability to influence a situation so that one's intent or will is accomplished is one of the accepted definitions of leadership. The opening statements seem to imply that, in whatever endeavor the individual in question is pursuing, success is dependent on that individual displaying desirable leadership attributes. This implication is true, and what may be surprising is that the two statements are taken from an article describing the desired effects of mathematics instruction.

Colonel Charles P. Nicholas was Head of the Department of Mathematics at West Point from 1959 until 1967. In 1959 and 1967, he wrote articles for the USMA Association of Graduates publication *Assembly* entitled "Preparing the Weapon of Decision" and "Mathematics and the Making of Leaders." These articles described the methods of instruction that cadets received in mathematics and tied these methods to leadership development. Although some methods have changed slightly (though not as much as some cadets would prefer), making a significant contribution to a cadet's development in the areas of *decision-making* and *communication* remains one of the primary desired outcomes of the current core mathematics curriculum.

In reviewing Colonel Nicholas' articles, certain similarities between the instructional practices in the Department of Mathematical Sciences today and the practices in the Department of Mathematics over 30 years ago are readily apparent. The reason that we continue these practices today is because of their contributions to the development of mental habits that will serve cadets well as future leaders. Colonel Nicholas listed four "mental traits" that he considered to be "characteristic of the greatest military leadership." These traits are:

a. 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.
b. 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.
c. The habit of logic.
d. The power to communicate fluently and precisely. [2]

Notice that three of the four traits are referred to as habits. This term implies that these are not inherent capabilities but characteristics that can be developed through the exercise of discipline and practice. "The problem of education, then," wrote Colonel Nicholas, "is one of causing the young mind to *exercise* each day, in order to enlarge its powers of fundamental thinking and

communication." [2] This remains true today as instructors must engage students daily in order to encourage them to exercise their minds. A primary goal of the current faculty is to foster an *active learning* environment within the classroom where students stay engaged.

Perhaps one of the most notable methods of engaging cadets that remains in use at West Point today is the practice of having cadets solve problems during class at the blackboards. Cadets work individually or in small groups to apply the principles they have been studying to new problems. After solving the problem, certain cadets are selected by the instructor to give an oral presentation on the solution and the process used to arrive at that solution. Both now and as noted by Colonel Nicholas over 30 years ago, "In giving this talk [the cadet] is required to state his assignment clearly and then outline the plan of solution, stressing fundamental principles." [2] Colonel Nicholas clearly explains the rationale for having the cadet clearly state the objective of his efforts at the outset of his briefing: "The opening statement is required in order to train the cadet in the habit of formulating his mission in precise terms before attempting a plan for accomplishing it, or before attempting to explain his plan to others who will help him. He must know exactly what he is trying to do in order to direct all efforts successfully." [2] Questions on the problem solving process are directed to the cadet presenting the solution after he concludes his briefing. This requires the cadet to have confidence in the method chosen to solve the problem as well as the application of that method.

The experience that the cadet gains through the successful repetition of this process is a key element in the fulfillment of the mission of the Department of Mathematical Sciences today. Our mission states that the purpose of our interaction with cadets is to develop in them "the competence and confidence to be effective problem solvers in a rapidly changing world." [3] This purpose echoes the comments with which Colonel Nicholas closed his 1967 article and with which I close this one:

> "Whether to achieve mastery over an academic subject or leadership over men, the cadet must have full confidence that it is within his own mind that he will find the secret of overcoming difficulties. Whatever the nature of his duty in the years ahead, he must be ready to face each new situation resolutely and drive straight to the heart of the problem. He must be ready to decide boldly what has to be done, and then explain – in terms that are unmistakable to those who look to him for leadership – his motives and his plans. That is the way of life for which his education must prepare him, a way requiring not only knowledge and a capacity to learn, but also energy of will, swiftness of decision, and precision of expression. These are the objectives of our teaching." [1]

References

[1] Nicholas, Charles P. "Mathematics and the Making of Leaders." *Assembly*, Spring 1967, 12.

[2] Nicholas, Charles P. "Preparing the Weapon of Decision." *Assembly*, Winter 1959, 11.

[3] Department of Mathematical Sciences. *Current Program: Academic Year 2000-2001*. (West Point, New York: 2000), 4.

Problematic Leadership

CDR Joel Modisette
United States Naval Academy

Mathematics Faculty at a Service Academy may face the challenge of a midshipmen/ cadet asking, "What does mathematics have to do with being a leader and an officer?" As a Naval Officer and teacher, my favorite reason for teaching mathematics to future leaders is the development of abstract problem solving skills. However, motivating midshipman on the practicality of these skills can be, well, problematic. What better way to convince students than using a Mathematics professor's tool of the trade: the problem solving method? In the military we would pronounce this "leadership by example." For this problem I draw heavily on and attribute full credit to the Mathematician G. Polya and his four step method in "*How to Solve It"*.

UNDERSTAND THE PROBLEM

How do we learn leadership through mathematics? Structure this as a two-part problem. First, accept that mathematics enhances problem solving. Few students will argue this step, the role of problem solving in mathematics is primal (humor counts). Next, we link problem-solving skills to an officer and leader, and this may require some convincing. Fortunately, the military has long recognized this skill. The following excerpt was drawn from the Joint Staff Officer's Guide 97:

> "*A military commander continually faces problems that involve uncertainties and alternative possibilities in their solution. The exercise of command… revolves around the solution of problems.*"

Basing an argument on a quote from a military staff journal does not constitute good leadership. Midshipmen encounter dozens of leadership quotes more stirring than one that talks about problems.

DEVISE A PLAN

Instead I develop a strategy to lead, or teach, with mathematics using Polya's suggestion, "Relate a similar problem." Here a similar problem for a midshipman should be one they encounter frequently and can identify with.

I propose that the basic element of Naval Academy physical development, the pushup, has some common qualities with mathematics. So if a midshipman accepts pushups without question, can mathematics exercise likewise be accepted prima facie?

CARRY OUT THE PLAN

I announce to my next class that mathematics makes you a better officer. Incredulous looks spread across the room, but I press on. Could a reason be similar to the motivation behind push-ups at the Academy? Now the midshipmen are curious. What does college mathematics possibly have to do with push-ups?

The argument begins with the analogy. No midshipman questions (at least not to an upperclassman) the utility of a pushup -- its use is self-evident. Why a midshipman may do thousands of pushups without question in their four years at the Academy- a strong precedent for any argument! More seriously, push-ups, with consistent practice, build a ready reserve of upper body strength, on call for any emergency. Other familiar secondary benefits, such as cardio-vascular development and mental discipline occur as well. Pushups implicitly cultivate a habit we value in the military: a habit of developing capabilities we may need for an uncertain future.

For the students, apply this logic to learning problem solving and thus mathematics. Mathematics, with

consistent practice, builds a ready reserve of mental prowess, on call for any emergency. Other familiar secondary benefits, such as concentration and mental agility, occur as well. Mathematics, like push-ups, cultivates a habit of preparation.

LOOKING BACK

Did this strategy succeed in convincing midshipmen of the relevance of mathematics to leadership? Did the midshipmen accept the analogy of mathematics to pushups?

Inevitably some will find this logic drill silly. As a Naval Officer/teacher, one should always have a backup plan. Perhaps the best solution for this leadership problem might just be an inductive one: Ask the Midshipmen if they have developed a habit of preparing for the next exercise, mathematic or push-up. If the answer is always "true", the proof is complete.

USNA Math Major Open House

Assoc. Prof. Caroline Melles
United States Naval Academy

Food! Games! Videos! On the evening of the annual math major open house, the first deck of Chauvenet Hall teemed with midshipmen, officers, civilian faculty, and visiting mathematicians, mingling over ice cream and soft drinks, browsing through room after room filled with mathematical displays, and enjoying all sorts of mathematical puzzles, films, and demonstrations. Upperclass mids proudly displayed capstone and honors projects, while dishing out ice cream and offering frank advice. A simultaneous chess game attracted a large crowd of onlookers. In the informal atmosphere, mids felt freer than usual to express their feelings about academic programs. Plebes made candid and sometimes surprising remarks about their impressions of USNA calculus courses, as compared to their high school and prep school experiences. Some spoke earnestly about their goals and aspirations. Upperclass mids gave tips on the relative difficulty of various courses and coping strategies for Naval Academy life.

Upperclass Mids, Plebes, and Faculty Gather at a Recent USNA Open House

The USNA math major open house was begun in the mid-nineties as a response to declining enrollment in the mathematics major. Since then, it has evolved into the biggest math department event of the year. Recently many other departments have followed our lead and begun to hold their own open houses. Planning begins several months ahead, with analysis of the previous year's open house, and discussion of ways to identify and attract appropriate mids for the math major. Lists are made of all plebes indicating a preliminary interest in the math major or doing well in plebe math courses. These plebes receive emailed invitations from the chairman, detailing the advantages of a strong background in math. The letters of invitation are followed up by personal invitations from the mids' math instructors, who can

answer individual questions about the major.

Meanwhile, other members of the open house committee collect materials for displays, invite outside mathematicians and recent Naval Academy graduates, prepare signs, brochures, and advertising, and arrange for availability of rooms, video monitors, easels, etc. The afternoon of the open house is always a busy one. There are refreshments to buy, classroom furniture to move, and posters to put up in the hallways and classrooms. Starting after classes, videos about mathematics and its applications run continuously on monitors in the hallways. Brochures advertising graduate programs in schools across the country are interspersed with mathematical posters on the walls. Faculty members grab a quick snack before the start of the open house, after the mids' evening meal. The department's digital camera is ready, the upper-class mids take their assigned places at the ice cream tables and in the display rooms, and the plebes in PE gear start pouring in.

Prospective Plebe Mathematics Majors Arriving for the USNA Mathematics Open House

Featured at the most recent open house were displays on

- midshipmen capstone, honors, and summer internship projects,
- operations analysis studies from an operations analysis course,
- student-faculty engineering math projects using Mathematica,
- regional and national math contests in which the USNA math team competes,
- use of number theory in cryptology—the art of making and breaking codes,
- differential geometry of curves and surfaces,
- discrete math and graph theory, with applications to computer vision, image processing, and automatic fingerprint identification,
- a chaos demonstration, using physical and computer experiments to demonstrate complex dynamics and fractals,
- splines and curve and surface fitting as tools for computer-aided design,
- image compression,
- techniques of scientific computing, computer arithmetic and chip design,
- applications of undergraduate math by submarine officers,
- faculty research for Navy labs, and
- the math department parallel computer facility.

Mathematics faculty at the open house addressed such questions as:

- Why study math?
- What are some practical applications of math?
- What careers are available to graduates with a degree in math?
- How is math used in the navy?

This year, a statistician from the Census Bureau, an analyst at the Johns Hopkins Applied Physics Lab, cryptologists from the NSA, and a USNA graduate, currently an analyst in a private firm, were on hand to answer questions about careers in mathematics outside the

navy and academia. Spouses and children of several faculty members also participated in the festivities.

Top draws at the open house were mathematical games, a soap bubble display on minimal surfaces, a coding and decoding challenge (an opportunity to try breaking some simple codes), and a multi-pendulum demonstration of chaos.

Overall, the annual math department open house has been a great success. The number of math majors has not increased spectacularly, but the open house has at least increased awareness that mathematics can be fun as well as useful. The open house is an enjoyable and rewarding experience for faculty and math majors alike. It offers an opportunity for faculty to display and explain their research, not only to other faculty members, but to students. It fosters a feeling of community among the math majors and a sense of pride in their accomplishments. Most of all, it provides a relaxed and informal setting for mids and faculty to get to know each other better.

Upperclass Mids Demonstrate "Applications" of Mathematics at the "Game Table"

For photos and more information on this year's open house, please see the website at

http://www.usna.edu/MathDept/major/open2000/

Developing Leadership Traits in the Classroom

MAJ Jeffrey D. Broadwater
United States Military Academy

Instilling leadership traits in cadets is a task that every instructor in each department at the United States Military Academy (USMA) should strive to accomplish. On a daily basis, especially in the plebe (freshman) math classes, instructors teach, coach and mentor cadets on the qualities of a successful leader by personal example.

The definition of leadership, as defined in FM 22-100, Army Leadership, is " Leadership is influencing people…by providing purpose, direction, and motivation…while operating to accomplish the mission and improving the organization." There are many ways to demonstrate and help develop each cadet's leadership ability in the classroom. I will discuss what I feel are the five best ways to help our future leaders develop their leadership ability to their fullest potential. The five topics I will focus on are: confidence, developing problem solving skills, time management and organizational skills, developing collaboration/group skills and striving for personal accountability.

Convincing young leaders that they can succeed in math is not just a problem at USMA, but nation-wide. Even the most gifted cadets need encouragement to strengthen their skills and desire to succeed in mathematics. Many times it

seems we try to develop or steer our teaching and classroom methods to aid the typical cadet. While this is important, it can become boring and uninteresting to the brighter students or the cadet that understands concepts more quickly than others.

At USMA in the first semester plebe core math class we organize our class period by discussing the lesson the cadets have read the previous night and answer any questions about the material. We then send the cadets to "Boards", where they work individually or in pairs on problems relating to the lesson. This gives the instructor time to personally help each individual and see what problems each cadet is having solving problems related to the course objectives. Having the better math students help the ones having difficulty during "Boards" is a great way for cadets to help learn how to get their ideas understood by others and build their own confidence. After "Boards" we try and spend the last 15 minutes of class covering the next lesson. This helps the cadets understand some of the concepts they will encounter in the next lesson as they read and work problems that night.

Pairing students together also builds the trait of Competence. Professional competence is a skill all leaders must display and constantly seek to improve. One of the best ways to ensure an individual fully understands a concept is by having them teach it to others. Not only does this help promote the value and respect the trait of competence brings, but also allows the instructor to give more attention to the cadets having a tougher time. This keeps frustration down on the part of the struggling cadet, and once the cadet understands the concept his or her own self-confidence improves.

The next tool in developing leadership in the classroom is one that many high school and college courses develop subliminally--problem solving skills. This skill is important but sometimes overlooked. It is important because problem solving is a skill all cadets will use regardless if they serve over 20 years in the military or decide to join the civilian work force after their obligation ends. Problem solving is overlooked because students, as well as, instructors just focus on how to work the tool and not on how we can apply the tool. This is a growing problem, especially since we now have calculators and computer programs that allow us to just enter the problem and the machine does the mathematical operations without requiring the operator to understand what mathematical skills are being applied.

An example of this is the derivative. Many students just want to learn the rules on how to take the derivative of various functions. They are not concerned that the derivative is also the rate at which something is changing. An effective way to introduce this concept is to introduce each topic with a real-world problem. These examples do not need to be so complex that the students get confused in the set-up of the problem. Another way I have had success is introducing the problem and then coming back to solve the problem once we have covered the skills in the classroom.

The most effective tool in developing problem solving skills has been the course project. We develop projects that are current with the world news or that the student might have to solve after they graduate. Also, we try to make the projects interesting for the cadets in order for them to see that math is not just something they will need to balance their checkbooks after graduation. The projects require the cadets to use skills they have learned or will learn between the project assignment and due dates. Regardless of

the problem being solved the following basic steps should be followed:

1. Identify the problem
2. Define variables and make assumptions
3. Develop a relationship (model) between the variables
4. Solve the model
5. Verify the model and interpret the results.

These projects, along with the problems used during Board time in class, help cadets develop a thought process that will allow them to be better problem solvers in the future, thus making them better leaders.

Group projects and working at boards are the two major tools we use to develop the most important skill of leadership, working with others to accomplish a common goal. The cadets must work with a partner to determine the best way to solve the problem and how they can organize their results in a manner that is easily understood by a person with a non-mathematical background. Working the project can also develop other leadership dynamics. Sometimes cadets are faced with the challenge of working with a partner who does not have the same desire or goal of getting the best grade possible. Other groups may face the challenge of having two individuals with strong math skills and an unwillingness to compromise on a final result. Lastly, the skill of collaboration not only with an individual, but also with other groups is also developed. Collaboration with other groups is highly encouraged as long as the groups properly document their shared ideas and neither group relies too heavily on the other group's work.

Cadets also learn the valuable skills of time management and organizational skills from the project. As with any college freshman, learning how to manage ones time is a difficult task coming out of high school where the student probably did not have as many factors competing for his or her time. Cadets are also faced with the challenge of learning new technology (computer programs) that will help them with their calculations, but will require time to learn. The cadets usually have two to three weeks to complete the project. The partners must decide when they will work on the project together based on their other course requirements and extra-circular activities. Stressing the importance of time management and organizational skills within the cadets' first semester at the collegiate level will hopefully build in cadets a solid foundation that will stay with them throughout life.

The last leadership trait we try to develop is personal accountability. Making any person who has tasted only success in the past understand that they may not be doing as well as they expect or have previously, perhaps because they are not working as hard as they could, is difficult. Some common phrases given to instructors as explanations for poor performance include, "The instructor is not *telling us* what is on the exam" and "I am just overwhelmed with other events that I can not spend as much time as I should." Fortunately, in mathematics there is a certain amount of drill required to feel familiar with the objective of each lesson. Making the cadets understand they must read the lesson and do the suggested problems outside of class allows them to develop the trait of being accountable for their own actions. I like to say, "Math is a contact sport" meaning if one does not stay up with the lessons or do the suggested problems assigned, his or her grade will tackle them and not let them back up until it is too late. Developing this trait will help the future leader understand that if the unit's desired goal is not being met, it could be because they are not working

hard enough or they are focusing efforts in the wrong direction.

In closing, many of these leader traits I mentioned are not just common to USMA. Universities all over the nation use these same methods to develop their students through their collegiate careers. What is unique to the academy, and what each instructor must understand is, we are not just trying to make the students understand the course objectives. We are developing cadets to lead a platoon of over thirty soldiers as soon as they leave the Academy. In many cases, the soldiers the cadets soon will lead are older and have more job experience. Instilling positive leadership traits from day one in the classroom helps each cadet understand the importance and difficulty of being a leader.

The Kangaroo Connection -- ADFA

Geoffrey Aldis
Colin Pask
Australian Defence Force Academy

Many readers will be unfamiliar with the Australian Defence Force Academy (ADFA). Since discovering *Mathematica Militaris* on the WWW and joining the mailing list we thought we should introduce ourselves. You may be surprised at some of the differences with your own institutions. Yet we share the same academic goal: to provide a University-level education for future Military officers.

ADFA is situated in the national capital, Canberra. It was founded in 1986 as a tri-service establishment where the entrants are usually 17-18 year olds straight from high school. Of the current 903 undergraduates Army represents 44%, Navy 19%, Air Force 33% and 4% are from overseas (by Government-to-Government arrangement). Women comprise approximately 26% of the undergraduates. Students are organised into Divisions and Squadrons by service. During the academic year the three services eat, learn, play, train and do formal parades together but the students appear in their different service uniforms. During breaks in the academic year the Officer Cadets and Midshipmen move off-campus to do single service training. At the end of three years they will do further training of up to a year at a single service College before gaining postings as Officers.

At ADFA even the post of Commandant is rotated around the three services every two years. Why mix up the services like this? First, having three separate University-level facilities (as pre-1986) was wasteful. By pooling resources the facilities for all could be improved. Second, a spirit of cooperation between the services was thought desirable. Communication between the services should be better in the future when many of the senior officers will know each other well. Students at ADFA live in a military environment. They do about six hours of military studies a week on top of their academic subjects. They gain an understanding of the military culture which would be missed by students who went to a civilian university before joining up.

Another local difference is that almost all the academic staff ('faculty' to Americans) are civilians. ADFA has two components (military and academic) and two people in charge: a Commandant and a Rector. The academic side is part of the University of New South Wales, whose main campus is in Sydney. In setting up ADFA the military wanted the best degrees available and it included University College (UNSW) as part of ADFA. Academic staff and the courses taught are

treated in the same manner as at the main campus. Some might think this is an uneasy alliance. Luckily the popular stereotypes -- effete, procrastinating academics and intolerant, boorish military personnel -- are far from reality. Having only about 900 undergraduates also means that ADFA is on a 'human scale.' It is possible to know a lot of the staff and students.

University College is divided into 12 Schools: Civil, Electrical, Aerospace and Mechanical Engineering; Chemistry, Computer Science, Mathematics and Statistics, Geography and Oceanography, Physics; Economics and Management, History, Language Literature and Communication, and Politics. Although the College is part of the larger University of NSW, it is in many ways a small compact university. That makes it an interesting and enjoyable place to work.

The School of Mathematics and Statistics has about sixteen academic staff and a similar number of research fellows, research students and support staff. We teach applied mathematics and statistics to students in the Science and Arts degrees (3 years) and Engineering degrees (4 years). Students can do a further year in Science or Arts, involving a thesis, to gain an honours degree. Normal class sizes are around 100 for first year Science and Engineering, reducing to about 15 for our third year Science majors.

ADFA was the first campus in Australia to adopt calculus reform texts and we require students to buy a graphics calculator. We currently use a mixture of prepared notes and textbooks. Unlike the U.S. all our students arrive knowing some calculus from high school. However it is traditional in Australian universities to revise and deepen that knowledge in first year. In 1997 we had two trial classes of 'Calculus and Maple' (Davis, Porta and Uhl) but decided not to adopt this approach. Normally our classes are 'large-group' lectures but since 1998 the first year Science calculus class has been broken into sections of 20-25. ADFA is unique in Australia since it draws its students from all parts of the country. This means our students have different State high school educations and first year is used to bring them up to the same assumed knowledge in calculus and algebra. First year also introduces some statistics and probability, complex numbers and bifurcation theory. ADFA has a site license for Maple and a number of our second and third year subjects involve Maple labs. Later year subjects include Mathematical Modeling, Financial Mathematics, Industrial Mathematics, and Biological Mathematics.

The ADFA motto is "To lead, to excel." The military side delivers formal leadership training to our students and monitors leadership qualities. The academic side supports this by demanding intellectual rigour and a high level of integrity. Most academics also fight very hard to get students to think, rather than respond in "the correct way." Broadening minds is definitely a mission for us. Teaching styles have changed over the years. Our first year Maths course now has fortnightly 2 hour 'labs' where students work in groups. This develops cooperation and leadership skills. We find our students are quite good at delivering oral briefs. In Biological Mathematics (3rd year) students are required to make oral and written reports on a current scientific paper of their choice. The papers need some work to be understood. Taking students out of their comfort zone, as with this task, can be a rewarding experience. A number of other subjects have a project-based component. Students who elect to do an extra Honours year get a special boost to their leadership qualities. These students see what University research is about and it is

almost always a surprise for them. In working on their thesis, honours students develop an ability to plan ahead and they gain confidence in thinking around problems. They come to believe that if they need to know something, they really can work out how to do it. Honours students are encouraged to take a first year tutorial class for the year. They respond well to this leadership task. They also understand that you have to know a subject well to teach it and to answer the inevitable curly questions.

All ADFA undergraduates are Officer Cadets, Midshipmen, or Officers extending their qualifications. Graduate students also attend University College and these may be civilians. Currently about 680 students are enrolled in postgraduate study, of which about 100 are doing research projects for a Ph.D.

The research of our School falls into four broad categories: optical waveguides and vision (optical fibres, nonlinear optics, visual systems in man and insects), continuum mechanics (combustion, bushfire spread, deformable porous media, biological fluid dynamics, Doppler ultrasound), applied statistics (bushfires, ecology, criminology, sport) and mathematical education. There is also a growing interest in modeling infectious diseases. Our research tends not to be directly defence-related, probably because we were appointed through a civilian University. However we are always looking for interesting military problems for teaching and research. In May 1998 the School organised an inaugural three-day Defence Science Study Group looking at landmine clearance, detecting fumes in a Hornet cockpit, ricochet, and thermal signatures. Our School web page (http://www.ma.adfa.edu.au/) has more details about staff and their teaching and research.

We look forward to learning more about our cousin institutions through *Mathematica Militaris* and we hope to contribute to some future issues. If readers are in the vicinity of Canberra they should feel welcome to arrange a visit to ADFA.