REFLECTIVE NARRATIVE

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TEACHING

Over the course of my education I have been fortunate to have excellent teachers in whose footsteps I try to follow. I also have been given many opportunities to guide others in enriching their lives through learning. My undergraduate degree in Math Education from Mercyhurst College provided me with many hours of practical classroom experience each semester and culminated in full-time student teaching experiences at a local middle school and high school. During my undergraduate study I also was involved in private tutoring and help sessions for freshman-level math classes. But these teaching experiences did not satisfy my desire to be involved in the learning process. It was not until Graduate School at the University of South Carolina that I became truly excited by teaching and learning. As a Graduate Assistant at USC I had full classroom responsibility for a wide range of courses, such as Basic College Math, Trigonometry, Precalculus Math, Calculus for Business Administration and Social Sciences, Calculus I & II, Finite Math, and (undergraduate) Real Analysis. These courses formed the foundation of my current teaching experiences.

My teaching philosophy is encompassed in the belief that learning takes place in the correct mixture of well-planned guidance, personal responsibility and time. Throughout my teaching experiences students are given ample feedback in the forms of daily homework, weekly quizzes, and many opportunities for questions so that they may track their progress and evaluate their own understanding. Realizing the dependence of future material on previous concepts, the class does not move on until we have answered all our questions and improved our understanding of the current topics. Much of the responsibility of learning is placed on the student by not regularly checking homework assignments, but rather helping them to realize that their understanding will improve only after they have mastered the necessary skills. I believe achieving at least this level of personal responsibility is essential in any learning process, and most necessary in any worthwhile college education. My favorite comment on a teaching evaluation was "Try to teach more instead of us figuring it out on our own". I can tell from this comment that this student probably learned a

great deal that semester. I can only hope that he/she feels the same way. Because the big picture of Mathematics is often lost in mundane details and technicalities, students in my class are constantly reminded of learning objectives and the ultimate goals of the course. Connections made to previous concepts and material yet to be discovered help students appreciate and value those goals. I keep the students interested and involved by presenting ideas in a simplified manner and constantly posing questions to the class. I try to help them see that Math is never as difficult and mysterious as most people think it is. It is a very natural manifestation of how our brains work. As often as possible I use various technological resources to help students visualize abstract concepts. For example, I use Geometer's Sketchpad as a tool for visualizing functions on the Complex Number Plane, a task that involves thinking in four dimensions. (An example of this can be found in the appendix to this portfolio. Other examples can be found in the additional online materials.) As a teacher I receive feedback from the students through mid-term evaluations as well as end-of-semester evaluations. On these many students express their gratitude for my clear indication of what will be required of them, regular review of past material, simple and straightforward explanation of ideas, and frequent use of examples to model concepts. Some students have said that my class was the first time math was ever easily understood and actually fun for them. I am convinced that each of us is limited only by time in our understanding of any idea. This belief gives me patience in my teaching and reminds me that true understanding may come to some students long after they have left my classroom.

I have always been intrigued by learning and I believe that one main purpose in life is to stretch our lives as far as possible in the short time we have here. Learning is an integral part of that extension. I have been given the ability and the desire to help others extend their lives, and this, in turn, extends mine. Teaching is, for me, the ultimate learning experience in which the teacher learns along with the student. As a result, my teaching is always changing as I discover more about student learning and understanding. My experience at Lynchburg College has changed the way I teach and learn. When I arrived here I believed my role as teacher was to pass knowledge on to each year's new generation of students. This knowledge represented all the tools that future leaders in Science and Mathematics would need. After five years of teaching students with a wide range of abilities, motivation levels, and goals, I have changed the way I view my contribution to the learning process. While in

most of my classes I continue to present material in the traditional sense, I now focus a greater part of my efforts on modeling how Mathematicians think and work, discovering new ways to explore topics that will get students interested in thinking Mathematically and developing experiences that will put them in control of their learning. Working towards these goals brings me closer to satisfying the characteristics of excellent teachers as listed in the Faculty Handbook.

Excellent teachers:

- Demonstrate a strong preparation in their subject area manifested by an ability to connect their scholarship and professional experience to classroom and student projects.
- Demonstrate innovative teaching that motivates and engages students to higher levels of student growth and achievement.
- Maintain productive relationships with other colleagues when working on interdisciplinary courses and collaborative projects.
- Demonstrate success in teaching courses outside of their primary subject area.
- Demonstrate success in the development and teaching of new courses, courses that serve a wide range of student abilities, or courses or projects reaching across disciplinary boundaries.
- Effectively supervise student research and scholarship.
- Successfully use a variety of teaching approaches.

Excellent teachers demonstrate a strong preparation in their subject area manifested by an ability to connect their scholarship and professional experience to classroom and student projects. I pride myself on being excessively prepared for class. This includes composing detailed notes with motivating examples, practice examples, and ways to connect the new material with past and future ideas. Many of my students have commented that they have appreciated how thorough, organized, clear my lecture notes are. Giving students a clear picture of the journey and how the pieces fit together helps them make the individual steps along the way.

Students also seem especially interested in hearing how particular topics from our class might be useful to Mathematicians or other scientists after graduation. Too often our experience of education is a sequence of disjointed learning experiences that have no connection with each other or experiences beyond the classroom. I recently

developed a new General Education Math course called *Problem Solving in Mathematics*. In this course we focus on the student's ability to use various techniques to solve problems that are not traditional Mathematical problems. One additional purpose of the course is to get students to realize how they might use similar techniques to tackle problems in other courses and in real life situations. It takes some time for them to adjust to the non-traditional nature of the course, but once they do, they usually end up surprising me (and themselves) with their natural problem solving talents despite their dislike of Math.

One of the most valuable teaching experiences at LC has been directing Senior Research Projects. I have been the faculty mentor for six projects and have learned a great deal through minor involvement in projects guided by other Math Faculty. Not a single one of these projects has been in my particular field of Mathematics so I have found myself learning at least as much as the students along the way. These projects are a great opportunity to help them 1) transition from the classroom model of learning to that of independent research, 2) realize the collaborative nature of being a Mathematician, and 3) communicate effectively through the reading and writing of Mathematics. I have been attempting to bring more of these aspects into my other classes to give the students a head-start on the transition. (Examples of this can be seen in the class projects for Math 104 and 105 in the additional online materials).

Excellent teachers demonstrate innovative teaching that motivates and engages students to higher levels of student growth and achievement. Very rarely do I require my students to simply demonstrate memory of material. I constantly remind them that their goal should be to understand the material and then they will never have to memorize anything. In entry-level classes this understanding helps students decipher problems, determine which techniques are appropriate or required, and begin working towards their solution. In advanced classes this understanding is critical in applying definitions and previous results to prove new theorems. Many students have commented that my classes were difficult but challenged them to learn a great deal. Many of them also say that this was the first time they had ever enjoyed a Math class. Surely this enjoyment results at least partially from their rising to meet the challenge.

When I work with students on independent research projects I encourage them to take their projects as far as possible. In the beginning they are given the freedom to pick any topic they wish, so they are motivated to work hard and learn. As they

near the end they are encouraged to take pride in their achievement and present their work in the annual Student Scholar Showcase.

Excellent teachers maintain productive relationships with other colleagues when working on interdisciplinary courses and collaborative projects. While we have not had any formal collaborative research projects together, the members of the Mathematics faculty are constantly bringing new ideas to each other, sharing projects we have developed for our classes, working on interesting problems we come across in journals or that arise from student interaction, and regularly model professional collaboration for our students. For example, while developing a worksheet for a Calculus II class I stumbled across an alternative version of the concept of population growth rate. I worked with Danny Cline and Kevin Peterson to understand this new idea and eventually found a developed theory of Multiplicative Calculus in several journals. This enhanced our understanding of Calculus and allows me to bring more to my students to deepen their understanding as well. This was also the subject of the talk I gave at VCU in Spring 2008. (The worksheet, entitled Differential Equations, can be found in the appendix to this portfolio. Other examples as well as the slides for the VCU talk can be found in the additional online materials).

Excellent teachers demonstrate success in teaching courses outside of their primary subject area. While I had a great deal of teaching experience before arriving at LC, there were several courses that I had not taught before, and whose material I had not seen since taking the course as an undergraduate student. On several occasions I have taught a class that is outside my particular field of Mathematics and required a dedicated effort to stay one step ahead of the brightest students. As mentioned previously, none of the senior projects I have directed were in my field of Mathematics. The key to success in these situations is preparation, and in all cases the experience was a rewarding learning experience.

Excellent teachers demonstrate success in the development and teaching of new courses, courses that serve a wide range of student abilities, or courses or projects reaching across disciplinary boundaries. After teaching Liberal Arts Math a few times I realized that this was not the ideal General Education Math course. Its content is interesting and useful for a handful of students, but otherwise it only fosters their fear and hatred of boring, useless Mathematics. The ideal General Education Math course should show students some of the very best

Math has to offer (the parts that made us fall in love with the subject) and should have at least a tiny bit of usefulness somewhere in their lives. With this in mind I developed MATH 105: *Problem Solving in Mathematics*. This course is completely project-based and aims to develop the student's problem solving skills. Connections are made to problems outside the class in several ways. Most of the projects do not appear to be Mathematical and therefore most of the students use techniques to solve them that they would not consider to be Mathematical. It is easy for the students to see that these techniques can be applied to problems solving situations in other classes or fields. Later I show them how their solutions relate to a formal Mathematical solution. Their ability to read and assess arguments and formulate their own arguments is also developed. Throughout the semester students write Reading Reaction Papers in response to non-technical science writing describing some problem or issue in science, society, or the environment. In their reaction papers the students are required to summarize the main arguments in the paper, discuss the effectiveness of the writing, and relate the issues to another class they have taken at LC. While a few of them have complained that these reading and writing assignments are a lot of work, many of them claimed to have learned a lot from them. (An example of two projects from this course can be found in the appendix to this portfolio. Other examples of these projects and writing assignments can be found in the additional online materials by clicking on the MATH 105 course web page).

Excellent teachers effectively supervise student research and scholarship. I have directed six independent Senior Research Projects over the past four years. None of these has been in my field and all have required me to learn a lot about new areas of Mathematics. These are by far the most rewarding of my interactions with students since we both work and learn together. The projects I have directed are summarized below. (Copies of a few of these papers can be found in the additional online materials).

(1) *Cryptography and its Uses* with Selena Austin: A general overview of Cryptography and the RSA algorithm along with its application to internet encryption.
(2) *Topspin Solvability* with Ben Grannan: A survey and discussion of recent results in solvability parameters of the sliding number game Topspin. This project inspired Ben to go on to grad school in Math. He is currently working on his Masters degree at VCU.

(3) *Modeling the spread of disease on a College Campus* with Andrew Crawford: A computer model of the spread of a disease on a college campus with certain infection rates.
(4) *The Philosophy of Mathematics* with Jess Sollner: A survey of the main schools of thought and major contributors in the Philosophy of Mathematics.
(5) *Random Walks* with Jimmie Greber: Several models of random walks using various scenarios to determine the direction and number of steps taken.
(6) *Transcendental Number Theory* with Crystal Moorman: A survey of the major results of Transcendental Number Theory including approximation, continued fractions, and Hurwitz' Theorem.

Excellent teachers successfully use a variety of teaching approaches. Recently I have spent a lot of time developing assignments and activities for my classes that put the students in control of their learning. My goal is to move away from the model of education that has them listening to me talk about concepts towards one that has them discovering concepts through reading and experimentation. This sort of learning will serve them better in their later classes and after graduation. As with any change from what they're used to, the students resist this at first, but most of them eventually realize their responsibility as the learner and put in as much as they want to get out. I have found that varying the class slightly occasionally allows students with different learning preferences to experience success and makes them more willing to work hard to adapt to learning modes that they do not prefer. For example, in Calculus II most of the classes have a traditional lecture format in which new material is presented and several examples are worked out in order to prepare the student to complete the homework exercises. Recently I have composed a few multi-day group labs that require the students to read new material and work examples as they go along. They are also asked to respond to some abstract conceptual questions to gauge their understanding. This models the kind of learning and experimenting that Mathematicians do when they encounter a new idea and prepares them for experiences in upper-level classes in which they are required to read and comprehend more abstract ideas. I envision my ideal learning situation as a one-on-one student-driven independent study in which the content, momentum and direction of the course are all determined by the interactions of the professor with the particular student. Since this is not possible with so many students, we must try to find opportunities for each of them to contribute in whatever way they prefer.

The following table summarizes teaching assignments and marks on teaching evaluations at Lynchburg College using the latest Student Evaluation Form. The rating shown is the average of questions 6-16 with the range of response: 1 (high) to 5 (low).

TERM	COURSE	COURSE TITLE	ENROLLMENT	RESPONSES	RATING
Spring 2008	Math 104	Calculus II	20	NA	NA
Spring 2008	Math 105	Problem Solving in Math	24	NA	NA
Spring 2008	Math 105	Problem Solving in Math	25	NA	NA
Fall 2007	Math 103	Calculus I	17	10	1.76
Fall 2007	Math 103	Calculus I	16	9	1.40
Fall 2007	Math 104	Calculus II	17	11	1.20
Fall 2007	Math 407	Advanced Calculus	12	12	1.57
Spring 07	Math 106	Liberal Arts Math	24	14	1.27
Spring 07	Math 106	Liberal Arts Math	25	6	1.88
Spring 07	Math 104	Calculus II	18	NA	NA
Spring 07	Math 311	Probability	19	17	1.23
Fall 06	Math 103	Calculus I	18	7	1.29
Fall 06	Math 103	Calculus I	19	14	1.37
Fall 06	Math 104	Calculus II	15	12	1.72
Fall 06	Math 407	Advanced Calculus	11	4	1.54
Spring 06	Math 102	Precalculus	16	14	1.83
Spring 06	Math 104	Calculus II	21	16	2.21
Spring 06	Math 106	Liberal Arts Math	27	11	1.29
Spring 06	Math 313	Complex Variables	15	11	1.34

The following chart summarizes teaching assignments and marks on IDEA teaching evaluations at Lynchburg College. The student evaluation rating is *Overall Excellence of the Instructor* with the range of response: 0 (low) to 5 (high).

TERM	COURSE	COURSE TITLE	ENROLLMENT	RESPONSES	RATING
Fall 05	Math 102	Precalculus	25	10	4.1
Fall 05	Math 102	Precalculus	22	17	4.8
Fall 05	Math 104	Calculus II	18	13	4.1
Fall 05	Math 407	Advanceed Calculus	6	5	4.3
Spring 05	Math 104	Calculus II	22	17	4.2
Spring 05	Math 106	Liberal Arts Math	25	16	4.3
Spring 05	Math 106	Liberal Arts Math	27	15	4.6
Spring 05	Math 333	Mathematical Statistics	7	6	4.5

Fall 04	Math 102	Precalculus	24	20	4.7
Fall 04	Math 102	Precalculus	24	15	4.6
Fall 04	Math 311	Probability	12	11	3.9
Fall 04	Math 407	Advanced Calculus	8	8	3.5
Spring 04	Math 102	Precalculus	20	14	4.6
Spring 04	Math 106	Liberal Arts Math	25	11	4.4
Spring 04	Math 106	Liberal Arts Math	24	6	4.4
Spring 04	Math 104	Calculus II	23	16	3.8
Fall 03	Math 102	Precalculus	21	14	4.6
Fall 03	Math 102	Precalculus	20	14	4.4
Fall 03	Math 106	Liberal Arts Math	24	17	4.8
Fall 03	Math 407	Advanced Calculus	11	6	4.2

SCHOLARSHIP

My dissertation research was on the structure of Banach Spaces, in particular conditions that guarantee the existence of certain types of biorthogonal systems in Banach spaces. The work extended results of my advisor, Dr. Maria Girardi in the paper *Geometry of Banach spaces and biorthogonal systems* which she wrote with S.J. Dilworth and W.B. Johnson in 2000. My results were well-received and my paper *Biorthogonal systems in Banach spaces* was published in the journal *Studia Mathematica* in 2004. I believe this work has been the basis for further research as several Mathematicians have contacted me asking about it. A copy of this paper can be found in the additional online materials.

I published a paper on my new General Education course (Math 105) called *Problem Solving Across the Curriculum* in the April issue of the Newsmagazine of the Mathematical Association of America, *MAA Focus*. This is currently a popular issue in Mathematical teaching and my paper was almost immediately accepted for publication. I have received several supportive emails from readers who are interested in creating similar courses or have already done so. A copy of this paper can be found in the additional online materials.

In Spring 2008 I was invited to give a talk at VCU in their weekly Mathematical Analysis Seminar. I spoke about Multiplicative Calculus and some of its applications. The powerpoint presentation for this talk can be found in the additional online materials.

In Spring 2008 I refereed the journal article *On Banach Frames of Type* Λ which was to appear in the journal Matematicki Vesnik. This article is related to part of the research I did for my dissertation.

In Spring 2007 I was a reviewer for the book Mathematical Thinking and Writing by Randall Maddox.

In Spring 2005 I gave a talk in the LC Science Gang lecture series entitled *Art as a Mathform: The intersection of antipodal worlds.* In this talk I discussed the connections between the seemingly opposite field of Mathematics and Art, how Artists use Math, and how some Mathematicians are creating Mathematical Art.

I have attended several professional meetings and conferences:

- SUMS (Shenandoah Undergraduate Math and Stat) Conference at James Madison University 2005-2008.
- Fall Sectional Meeting of the MD, DC, VA Section of the MAA Ann Arundel Community College Annapolis, MD Fall 2007.
- Spring Sectional Meeting of the MD, DC, VA Section of the MAA Loyola College Baltimore, MD Spring 2006.
- Spring Sectional Meeting of the Southeastern Section of the MAA Meredith College Raleigh, NC Spring 2005.
- Joint National Meeting of the AMS/MAA; Atlanta, GA January 2005.

I have attended several Instructional Development Workshops and lunches at LC:

- Instructional Development Workshop: Lilly Conference Teaching Ideas & Writing Across the Curriculum (January 2008).
- Instructional Development Lunch: Integrating Liberal Learning in the Curriculum (November 2007).
- Instructional Development Workshop: Designing and Evaluating Group Work (August 2007).
- Instructional Development Workshop: Low-Stakes Writing.

SERVICE

I will be serving on the Educational Policies Committee in Fall 2008.
This year I will begin serving on the Curriculum Task Force.
I served on the Teaching and Learning Resources Committee 2005-2008.
I have been a member of five search committees:

- Biology Search Committee (Spring 2008)
- two Environmental Science Search Committees (2004-2005 & 2007-2008)
- two Mathematics Search Committees (2004-2005 & 2005-2006)

This year I will be a Faculty Mentor for a new member of the School of Science Faculty.
I have been a Freshman advisor since 2004. From 2004 to 2007 I assumed a half-load of advisees (7 students per year), and for the past two years I have advised a full load (15 students).
I have advised many Math majors and minors over the years. I currently have 4 Math majors and 2 Math minors.
I have taken part in the United Way Day of Caring at the Lynchburg Free Clinic in 2006 and 2008. The first project was to build a wall separating two offices, and the second project was to enclose a water pipe to reduce noise.
I took part in the Lynchburg College Habitat for Humanity Project in Fall 2006.
I have been a Faculty interviewer for the LC Scholarship Competition since 2004.
I am a member of the Central Virginia Mountainbike Association since 2006 and have taken part in several trail maintenance and trail building days at Candler's Mountain and Peaksview Park.
I was a judge for Central Virginia Regional Science Fair 2003-2007.
I was the Faculty Advisor for the LC Cycling Club 2004-2007.
I was involved in the College Readiness Project in Spring 2007.
I helped move some donated furniture for Interfaith Outreach May 2006.
I took part in the LC Experiential Learning Project in Spring 2006.
I was a Game Manager for LC Athletics 2004-2006.
I was a member of the Goldwater Scholarship Committee 2004-2005 AY.