

KENNESAW STATE UNIVERSITY ORAL HISTORY PROJECT

INTERVIEW WITH JONATHAN W. LEWIN

CONDUCTED AND EDITED BY THOMAS A. SCOTT

for the

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Thursday, 4 October 2012
Location: CETL House, Kennesaw State University

TS: Today we're interviewing Jonathan Lewin who in 2012 was the recipient of the KSU Foundation Distinguished Teaching Award. Jonathan, why don't you start by talking about your background—when and where you were born and where you went to school and a few things like that?

JL: I was born in Johannesburg, South Africa, and I grew up in South Africa. I finished my bachelor's degree in '62 and my bachelor's degree with honors in '64. I was extremely lucky to get a teaching post as the lowest of the low temporary junior lecturers at the Witwatersrand University at that time. I taught for close on three years, and then I went to the University of Wisconsin where I did my doctoral study and then to Jerusalem where I did my post-doctoral study.

TS: I don't know anything about the post-doc. You did a two-year or one-year post-doc?

JL: It was a one-year connection with people in roughly my field of mathematics. After that I took an appointment as what they call a *martzeh* [lecturer] at the Ben-Gurion University in Beersheba where I stayed for three years. Then the Witwatersrand University where I had originally been an undergraduate in South Africa made me an offer of a senior lectureship that I could not refuse. I returned to South Africa and stayed there for a few years. Then I was effectively sort of recruited by a small place in northeastern Wisconsin where the job wasn't up to much, but it did come with a green card, and I felt that I could not turn that down. My family and I then moved back to the United States to Wisconsin, and I stayed in Wisconsin for about three years—I don't quite remember—and the winter began to really get me down. I glanced very enviously at people in nice places like Georgia and sent an application to Kennesaw. I've been here for almost thirty years.

TS: I noticed that you've been here since 1983. You spent a number of years up in the cold country before you came here. Just a little bit about your background along the way—what attracted you to the field of mathematics?

JL: That's actually very interesting. I hated mathematics in high school. Although I found it really easy, it bored me. In my first two years of university, I also regarded mathematics pretty much as one of these things that you just had to do.

It was easy; it never worried me; but there was very little that caught my fancy. Then, since you've asked me, I'll tell you the story. I had been for a very short time a chemistry major. Chemistry, I hated, and I knew I wasn't going anywhere with that. I was checking one day with the professor—the head of the department of mathematics, whom I knew in a vaguely social kind of way, because I was very interested in his music. Godfrey Isaacs is still today a concert pianist, a very, very good musician. These days he lives in Florida. He's retired. He asked me one day, "Mr. Lewin, what are you doing on campus?" I said, "I'm actually going to drop out because there's nothing for me to do. I was a chemistry major, and I don't want to do chemistry." He said, "Have you thought of going to the third-year mathematics level?" I said, "I cannot do that because the one topic which is the rigorous part of the calculus, what we call real analysis, I didn't do because I did the course that they give to the chemistry people." He said, "Oh, yes, well, that is the most difficult part." I said, "I don't really agree. To me that stuff is not the most difficult. I don't know what the fuss is about." He said, "How can you say that if you haven't had the course?"

I said, "Well, I've got my friend" Natalie Kehr—a very good friend of mine whom I still know today, and she was too busy running around on dates and everything, and she never did any work, and so she depended on me to tutor her. I said, "I've got this friend I'm tutoring on this material, and she is going to get a reasonably good pass. She's not going to get a first, but she's going to pass on the basis of my tutoring. I know that material." I seemed to just be able to see through it. He said, "Do you mean to say that you think that you can take the final in this course without attending the course? It's never been done before." I said, "You want to try me?" He said, "I'm going to get you into that exam." Ten months after the registration deadline, he called the exam office, had a shouting match with them, and got me in. I did very well in that final, and that projected me into the third-year and into mathematics. Natalie still says today that she's responsible for my career. That's how I got into mathematics, quite by accident.

TS: You went through a British educational system I guess and so

JL: In some ways it might be related to the British system, but the South African system has a life of its own. But it might be closer to the kind of UK system than it is to the American system.

TS: I was thinking just from reading some of your materials and what you had said about required courses that I assumed that if you were a chemistry major, you didn't have to worry about history classes unless you wanted to take them or anything else.

JL: Yes, the atmosphere at the Witwatersrand University in those days was to encourage people to experiment. You could take other courses to the extent that you had time. There was an incentive to do so because this horrible institution that we have, called the GPA (which is something that I regard as professional

malpractice) was never calculated. There was no fear of doing some damage to yourself academically if you suddenly took a course in a topic that had nothing to do with your mainstream. You're obviously not competing on an equal footing with people who are in that world, and it didn't matter. So lots of people did that. At the same time, there was an awful lot of cultural activity in literature, poetry, music, especially in music, that was not part of a course environment. I spent all the money that I earned as an undergraduate on two things, on girls and on membership in musical societies, which was very expensive. Here in the USA, I notice that everything that people do seems to be related to some kind of course for credits. Courses are imposed upon people without the institution particularly being able to guarantee that this course is needed by the students. This actually impacts some of the things I'd like to talk to you about when it comes to criteria to determine what is distinguished teaching.

TS: So you came through a system that would not have had a general education curriculum where you have to take so many English, so many history, so many math.

JL: That's quite right. In my first year I did Physics I, Chemistry I, Mathematics I, and Applied Mathematics I. In my second year, [I did] Applied Mathematics II and Mathematics II. In my third year, [I took] Applied Mathematics III and Mathematics III. That's it. I was capped. Then in my fourth year for honors I did six mathematical topics.

TS: In the South African system, you basically take final exams, and if you pass the course you pass the course and no grade assigned, that's it?

JL: The grade for a course is published either as one, two, three, or you didn't take the course. If you did not pass the course, you had the same status as somebody who had never entered it. The course was not on your transcript.

TS: No "F's."

JL: There was no punitive notion that, if one enters a course and fails it, that event should sit like a criminal record on the student's head, which is the way things work here. My feeling (and I'm also quoting Anatole Beck) has always been that faculty who support this punitive view should also be willing, when they submit a resume, to keep a list there of their *rejecta*. Of course faculty don't want to do that, so there's a double standard. The grade for a course was based on a final and on some midterms. Now, in my day courses were academic year courses, not semester courses. So you had a midterm in April and another midterm somewhere in September and then the final is in November—remember that's the beginning of summer. So everything was based upon these things, and the final was quite important.

TS: So one, two, three is kind of like an A, B, C?

- JL: It's sort of like an A, B, C. Actually, we didn't say one, two, three. We spoke about a "first", a "second" or a "third" class pass in a course. Getting a first meant that you did an outstanding job. A second was also a mark of some distinction in many subjects. In many subjects, a third was still a quite respectable pass. You didn't get any prizes for getting third class passes, but you had passed the course in good standing with a third. In some subjects, firsts were quite rare. They might not see a first for several years. There was no feeling that you had to earn a first. At the end of the third year, thirty-five of us finished the bachelor's degree in mathematics as math majors, and only three of us were invited to the honors year. The three of us, I, my ex-wife Myrtle Lewin, and James Ridley went into honors, and all three of us got firsts. It was a big deal that they got three firsts that year.
- TS: Sounds almost like graduate school in the American system, that year of honors mathematics.
- JL: Well, we were covering material that many students here see in graduate school. Then I spent nearly three years while I was teaching there studying further and increasing my knowledge. It was the best thing I ever did because when I arrived in graduate school, I found that I was a couple of years ahead of most other beginning graduate students. This helped me to make a good first impression and, as they say, you make your first impression only once. My strong background also served to accelerate me and to enable me to bypass some of the basic "weed-out" courses.
- TS: That was enough for you to teach on a college level in South Africa then. You didn't have to have a master's degree to teach.
- JL: They didn't require it at that time because they were desperate. In those glorious days in the early 1960s, there was such a shortage of faculty all over the world that they took what they could get. But I believe I gave them their money's worth. My ex-wife, Myrtle Lewin, also got a job. She's a fabulous teacher, and between us we definitely gave them their money's worth.
- TS: I guess the case for the general education curriculum is that everybody needs a smattering of this, that and the other just to have an appreciation for different fields whether you're ever going to use that knowledge or not. You don't buy that?
- JL: Well, my feeling is that you study something as part of an ongoing life development. I understand the argument that is so often expressed, that students are unable to express themselves proficiently in their mother tongue. The philosophy in the USA is to attempt to remedy this deficiency by giving incoming students a course in English writing. But I ask myself whether, for a person who was not willing and able to absorb these skills during twelve years of primary and

secondary schooling, one more stint of ten weeks will make repair the damage. I don't see evidence that it works. Nor do I see evidence that a course in the appreciation of music induces people to appreciate music, and I say this as a music lover. Even today I sing for a men's choir. I'm also a cantor. I'm not a great singer I have to add. I'm no Pavarotti. But I will say that I'm one of these people who can hear a piece of music and say, "Oh, this comes from this piece of Brahms or Sibelius or whatever. I am a music lover, and yet I really dislike these courses in appreciation of music because I don't think that people develop appreciation when they are regimented into taking courses. A student who takes a course that has been imposed on him or her cannot be expected to display the same kind of enthusiasm as one who takes a course spontaneously. Somehow, the university systems across the country seem to be failing in giving people courses like that.

I'm going to go further. I'm going to say that it seems to me that academic institutions in the United States, and maybe elsewhere as well, are being run pretty much like businesses. The administration are executives and management, and the faculty are workers. That's the viewpoint, which is not in my mind healthy. The main thrust of activity seems to be help for the institution and fee gathering. I have a sneaking suspicion that many of the courses that we impose upon our students, which we say are there to produce balanced educations and guided citizens who have insight and all the rest of it, I have a feeling that much of their motivation or at least some of their motivation is that we are collecting fees and growing. We have a big institution, and we are effectively giving students a three year degree in four years. I wonder what it costs the country in billions of dollars, so I worry about these things.

TS: That could solve several problems including the large amount of student loans now and also from a faculty perspective the large sizes and large numbers of uninterested students in those general education classes if people didn't have to take them if they didn't want to.

JL: Yes. When it comes to a course like mathematics, we have a dilemma. The instructor walks into the classroom from the standpoint of believing that his or her mandate is to impart understanding and appreciation for mathematical principles and to pave the way to future study in mathematics or to the application of the mathematics in other disciplines. But the students do not necessarily share that perspective. Many of them are told you've got to have mathematics course "xyz" because it says so in the rules because you have this elective and this compulsive recourse, and this goes here, this goes in column A, and that goes in column E, and they're coming to the course. The students don't necessarily have the same intention. So if the instructor and the student are not meeting eye to eye on the objectives of why we are even sitting in the room, it becomes very difficult to assess exactly what the teacher's duty is.

Now I've always been a diehard idealist. If you look at some of the remarks that were made about me including those that were made when the award for which this interview is being conducted was announced, they talked about my passion. Well, that passion has to be based on something. It has to be based on some notion in me that I want to achieve something in my classroom. I see mathematics as telling a story. I see my job as tracing logical patterns. I tell my students: I don't care two hoots whether you can quote to me that the derivative of sin is cos. I don't care. It makes no difference to me. You will go nowhere with that knowledge. I want to know that you can explain *why*. I say to my students in mathematics, being right is nothing. Being able to explain why you are right and how ideas are linked together is everything. That isn't necessarily what the community says. Our community is oriented much more strongly on working things out. I look at exam papers across the country and maybe across the world, and I see more and more that exams say work this out and work that out and come to this answer. Students have been taught in various places to come to the end of some kind of mathematical problem and put a little box around some magic number at the end. I say, "Don't you dare ever do that in one of my courses! You want to put a box around something, you put it on the whole page across the top margin, down the left and right and at the bottom because everything you write is your answer."

An answer to a mathematical question is a piece of mathematical writing with attention paid to correct use of symbolism and fundamental grammar that has to work. You are expressing your understanding of what you are saying." This is the way in which I teach my mathematics, and this is the type of thing to which they might be referring when they talk about my passion. It's not easy to do that when one is in a general academic community, which gives a focus in the other direction of work this out and work that out. I mean, if you don't mind, I want to say one more thing. It was always a problem. This was a problem in the 1960s, but it's become a lot worse with the advent of technology. Technology is the most wonderful thing that's come upon the scene, correctly used. Just like a motor car can be correctly used. You can use a car to be able to get somewhere in a way that you could never get anywhere before, but you can also use a car to knock down a child. Technology can be misused, and it is very largely misused. We are a community who for centuries were in a little backwater. Nobody was interested in us, and we made our decisions on what we thought. All of a sudden there are people all over, software producers, hardware producers, who have a stake in what decisions we make, and we are pushed by products that they hawk at us.

I go to some of these mathematics meetings. You need a motor scooter to get from one side of the booth to the other for some software products. I would love to name them, but I'd better not in an interview. I'm fairly horrified because when I see how these products are used—and these products are being used, and they also are used here at Kennesaw State by many instructors—and those products emphasize more strongly than ever before the notion of mathematics as

work this out and work that out and come to this answer—and come to that answer instead of explaining mathematical principles. My feeling is you don't have a lecture in order to learn how to do the homework. That's the illusion. The truth is you do the homework in order to help understand the lecture. A problem is done for a purpose because it teaches you about a principle. A mathematical exercise in homework has no more relevance to mathematics than finger exercises when you are learning to play the violin. Now, of course it's necessary. If you want to play the violin, you've got to go through the finger exercises, there's no doubt about it. When you finish the famous book of Kreutzer exercises, you have arrived, you are a violinist, so they tell me. I'm a failed violinist. Mother Nature didn't give me any talent. But the fact is that the homework that we give has the same role. It's necessary, of course you have to do it, but it's not the objective, it's not our end object, it's not where we're aiming. It's there as a tool to provide the understanding of the ideas just as the exercises in playing music are there so that one day you can actually play the melody.

The melody in mathematics is the appreciation of the logical connections. For people who want to become mechanical engineers or economists, they have to understand these same logical connections because, when you go outside of the academic institution, and you are applying your mathematics in the real world in some way, the problems that you will encounter are never the same type of problems that you encountered in somebody's calculus book. They are different from anything you've ever seen before, and you have to make decisions, decisions based upon your understanding of principles. If you don't understand those principles, then you might be a member of the team, but you'll be the person who makes the coffee, and the other people will do the creative work.

TS: So the homework is really to prepare you to understand what goes on in class the next day instead of carrying out the application of what the instructor showed you at the board.

JL: To some extent that's so. The homework is there to illustrate what we've been doing. Sometimes it gives a certain amount of on-the-spot direct practice writing concrete items that bring out general ideas, so you're not just understanding for the sake of the next lecture. You're also understanding a principle that, on its own, would have been difficult to understand without actually working at it and doing something. We learn when we are doing the speaking and writing, not when we're listening. Then, of course, what you said about being prepared for the next class is critical. I tell my students that their major obligation in a mathematics course is to come to class ready for that lecture. I never ask my students to study for tests. I have a survival guide out there, and my survival guide says, you need to go through what we do in class. You become the author of it, you write it out. Imagine that you are tutoring somebody at \$55.00 an hour, and that you want that person to come back. Did you do a good job? Did you explain yourself? Did you express yourself clearly in proper language? Was your notation valid? If so, then you, yourself, are understanding.

- TS: Despite your critique of the general education curriculum, I think you've given a beautiful explanation of the value of a general education curriculum because you've really talked about connections. You're talking about not learning math for math's sake, but being able to explain the theory behind something, which is writing skills and thinking skills and what-have-you.
- JL: I'm not sure if I'm really referring to general education there. What I'm really thinking about is that, first, when one is studying mathematics, one should without any embarrassment be able to say, I'm studying mathematics. In other words, I don't go along with those people who feel that the motivation for mathematical study comes only from its application in the "real world". Mathematics can live in its own place. When I talk about connections, I'm talking about the level at which mathematical statements connect with one another. If somebody comes to me and says, I know that this fact in calculus is so—the product rule, or whatever it happens to be, the mean value theorem or any basic statement—I say, well, I'm not terribly interested in your ability to quote me that formula. I want to know if you understand how these things link together logically with other mathematical topics and tell the story. I'm not sure if that's really the same as talking about general education. I'm very much in favor of people developing an awareness of the world around them and ability to write and read and be aware, whether it's cultural or whether its music or whatever it is, I'm very much aware of this. My worry is that if students come into a course because they have to, that isn't always the best environment to give them appreciation of its content. I wish the universities could find another way to entice people to go into cultural activity on campus without imposing the feeling that they're pushed into it.
- TS: I guess what I was thinking is that I've advised plenty of history students over the years that didn't want to take a math class because they'd say, I don't need that for anything, I hate math, and I don't do well in math anyway. I would just love for any of those students that said that to hear what you've just said. Even though they thought they didn't like math going into it, I've got a feeling that your passion might persuade them by the time they got through that they were glad that they were there even though they would have never signed up for the course on their own.
- JL: Well, it's possible, but there are other problems. We don't start with a clean slate when we're teaching a subject like mathematics. I don't know what it's like in history. If somebody is unaware of the events of the French Revolution, that person might be able to study the history of China, I don't know. In mathematics there's never a clean slate. When people come into a course unprepared because things didn't work earlier, then we can't say, oh well, we'll teach you this course now, and we'll try to liven it up and inspire you. Unfortunately, there are no shortcuts, there's no free lunch.

TS: It is a big difference between history and math.

JL: I have to tell you that I know a young lady to whom I was very close; she lived with me for many years, and she came to me and said, “Jonathan, I don’t think I’m anything but smart. I won a national prize for English writing, and I’m a really good artist.” And she is a wonderful artist. Her pen and ink drawings are outstanding, something that will blow you away to see them. She said, “But you know, when I was in high school, I didn’t even do the course called elementary algebra. I hated the mathematics, and I couldn’t understand anything, and I’m curious to know why that happened?” I said, “How curious? Are you so curious that you are willing to do what I would do? It’s not going to be, if you go through a process with me, it’s not going to be in fifteen weeks, it’s going to be at least two years and it’s going to be hard work. Are you that interested?” She said, “Yes.” I worked through a couple of South African high school textbooks with her—it took me two years—and at the end of the two years I said, “You could get what we call a matric [matriculation] with an A in South Africa today. You can go to university and take university mathematics courses.

She said, “To prove whether you’re right or wrong, I’m going to do it.” She checked into Kennesaw State. Nobody knew there was any connection with me. She got a string of A’s with a couple of B’s and went through the whole calculus sequence and much more, and then said, “I’ve satisfied my curiosity.” Then she left and went to the Atlanta College of Art and got an art degree. Today she is studying anthropology and all sorts of stuff like that. So you can do things, but we can’t do something by giving a little course somewhere. It has to be a lifestyle adoption of something, and it’s not easy. It’s a matter of going through the hard work; there’s no free lunch. Can we do that in these particular courses that are designed to give a smattering of mathematics to history students? I have my doubts. I think the majority of them are going to find out what they have to do to get the course off their backs. They’ll do what has to be done. They’ll memorize a bunch of things. Two minutes after the course has ended, they’ve forgotten everything. And you know what is an indictment is of our system? The nasty little tables that spring up at the end of every term where students go and sell their books. I never saw students selling books when I was an undergraduate. You took the courses because you wanted to take the courses, and you bought books because that was part of your ongoing education. You didn’t sell your books. When a student sells a book at the end of the course, that student is giving us the message that “I have no interest in this. You imposed this course on me. Now I owe more in student loans because of it. I got nothing out of it. I’m getting rid of this book, and good riddance to you.” That’s what it means to me when I see those little tables.”

TS: I’ve got a pretty good feeling why you became a math major. Why did you not become a music major?

JL: I don't believe I have the talent. I am a music lover. I can hold a note. I have a fairly good ear, and my good ear let me know how really bad I was when I tried to play the violin. My position changing was terrible. I could hear that the intonation was very bad, and I'd far rather be a hobbyist. I'm quite interested in nineteenth-century Jewish music. I'm also interested in a number of kinds of classical, romantic music. It doesn't have to be very high brow. I'm very fond of Gilbert & Sullivan, and I can whistle all kinds of Gilbert & Sullivan melodies—I'm not going to do it here in the interview because I have some mercy—but mathematics seemed to be the natural place for me to have gone.

TS: One more question about South Africa. I grew up in the segregated South. You grew up in the apartheid era in South Africa. What was it like growing up in South Africa?

JL: Well, we felt the pressures. The funny thing is what we had was a mirror image of what I saw going on in America at the same time. There the universities were trying to integrate, and the government was stopping us. Here in the United States the universities were trying to remain segregated in the South, and the government was trying to integrate them. It was very strange. The rank and file in places like the Deep South, the feeling on campuses and in many other ways was very much like the sort of feeling that we got in the apartheid government. We at the Witwatersrand University were doing our very best to subvert that system. At one point in South Africa, I was actually teaching in an illegal school, teaching African students. I would have been arrested if they had known what I was doing. I got a number of people through the so-called matric exam and into universities with this clandestine activity. What was I doing? I was teaching science and mathematics to them. It was a strange environment, and I really never had much hope for the future of South Africa.

South Africa could have been so great. There was so much wonderful stuff going on in South Africa, and the resources. Are you aware that the first heart transplant was in South Africa? Are you aware that the polio vaccine was developed in South Africa? One thing after another, South Africa had a lot of greatness to it, but I didn't feel that it had a future. It was based on prejudice and racism, and unfortunately it is no different today. There are just different people in charge, in my opinion. I know that what I'm saying is politically incorrect. You're supposed to say how much better it is now; it is not. There's an awful lot of crime, and there's an awful a lot of corruption on the part of the government officials, and there's an awful lot of nasty activity based on racism and prejudice. I'm very glad I left and took my children out, even though I had to take a very severe step down in the world when I left. I left a very senior, good post to go down back to the rank of assistant professor when I came to the United States. I had to earn my keep and pay my dues when I got here, but I'm glad I did it.

TS: I guess a senior lectureship is a pretty prestigious position in South Africa. I mean, we think lecturers are at the bottom of the pecking order in America, but I

assume the little bit I know about that kind of system in other countries, like Nigeria for instance, you're toward the end of your career sometimes before you become a professor. You've been a lecturer or whatever along the way.

JL: Yes. This is merely a matter of semantics. Lecturer was a fully tenured position, and you were in very good standing as a central member of a department. Senior lecturer, you were somebody who was dealing with department leadership matters; you were a big shot. Then the head of the department had "the chair" and the chair was the professorship, and that person was professor, and everybody else was Doctor so-and-so and Mr. or Ms., or whatever it is. A few people who were doing unusually profound and striking research got special chairs. My friend Alan Sinclair became Professor Sinclair. He was never head of the department but he became Professor Sinclair on the basis of the wonderful work that he was doing.

TS: You really wanted to get out, and you got a chance to come to Wisconsin, and it's a step down, but at least it gets you to America. Is that the way it worked?

JL: That's pretty much the way it worked. I'm glad that I took my children out, and I gave them some good opportunities, and my two girls did very well. Both of my children, if I have to blow my own horn a little bit, both of them have graduate degrees from Harvard University. My one daughter is an investment banker. She has a Harvard MBA, and my younger daughter, Shira, has a Ph.D. in Economics from Harvard University, although these days she's a stay-at-home mom because she has three children. That's the reality. She's also a Rebbetzin. She's married to a rabbi, so she maintains a rabbinical household in Reading which is west of London, that's where they live.

TS: What's the name of the older daughter?

JL: Lana. Both of my girls did really well, and I feel that we did the correct thing by bringing them here.

TS: We haven't really talked about mentors along the way. Anybody that stands out?

JL: Well, in some ways, yes. Oddly enough I can say that when I was in Parktown Boys' High School in my secondary years in what we called Form 3, let's see, at the tenth grade, I had a mathematics teacher at that time who first alerted me to the value of precision in mathematical language. He alerted me to that at a level that I've never seen before and did not see after him, including my university years. It probably ignited my interest in precise language in mathematics, which actually is part of my philosophy. To me there's a principle, it is easier to make sense than to talk nonsense. This teacher's name was Dennis Chamberlain, and I suspect that he's been dead for many years. I tried to look him up and could not find anything. In a way, without even realizing it, he mentored me in some ways. Precision in language and layouts has always been a big thing of mine. Shira

actually told me a story when she was in Harvard in graduate school taking economics in a course that was being run from a textbook that was in the process of being written by a couple of professors there. She was pointing out inconsistencies in the mathematical notation and grammar in the book. She sent notes to her, and they sent for her, and they said, “You know, we’ve had many students, very fine students at Harvard, but we haven’t had anybody correcting us in this kind of way. Where did you learn this?” She said, “From my daddy.” They asked, “Your daddy? Who’s that?” She said, “Jonathan Lewin.” One of them was aware of my real analysis textbook [Jonathan Lewin, *An Interactive Introduction to Mathematical Analysis* (Cambridge University Press, 2003) or one of the earlier editions] and said, “Oh, is he your father?!” So these things live after you sometimes.

I’m not sure if I had any really particular mentors at the Witwatersrand University as an undergraduate, but I was influenced to some extent by Godfrey Isaacs who was the chair, and he was also the musician. I was very greatly influenced by a couple of American professors, and I’d like to pay special respect to the late Walter Rudin [1921-2010] and to Ken Ross [emeritus professor, University of Oregon], who is still going strong. He’s retired these days. He influenced me very greatly, and I still correspond with him sometimes, even though we’ve hardly ever met in person. There were American mathematicians who mentored me by their writing and their textbooks. This happens in mathematics. You don’t actually have to be working with somebody. So there you are; you see I’m capable of splitting infinitives.

Above all, I want to pay tribute to my PhD advisor, Anatole Beck. Over the past 50 years, Anatole has been much more than merely a PhD advisor to me. I treasure the unique insights and viewpoints that I have gained from him, but he has been more than just a teacher. He has been a second father to me, and I treasure the relationship that I have with him.

TS: You have your doctorate from the University of Wisconsin, and you taught awhile in Wisconsin. You say the weather brings you to Kennesaw. Are there any other factors that attracted you to Kennesaw State?

JL: The funny thing is I had an application at what at that time was Kennesaw College, and I hadn’t heard anything, but I was getting very loud noises from Auburn University in Montgomery. That’s where they wanted me very much to the point that I felt it was worth flying down there. They sent me an air ticket, and I flew from Green Bay, Wisconsin to Montgomery. I really, really liked the people there at Auburn in Montgomery, and I really would have liked it, but I wondered about where am I going to buy kosher food, and how am I going to live there, a nice, Jewish boy in Montgomery? I just didn’t feel it was the social place for me there.

I realized that I could exist in Atlanta, so I contacted Chris [Christopher B.] Schaufele, who was then the chair of mathematics, and I said, “Look, I don’t know whether you’re interested in interviewing me because I haven’t heard anything after I sent my application, but I want to let you know that if you do want to see me and if you can see me on such-and-such a day, you can do it for free. I don’t need an air ticket.” He wrote back and he said, “You are our top candidate; we most definitely want to see you; and furthermore, if you come then and we don’t have to send you an air ticket, you can come a second time because we’ve got the money allocated for an air ticket for you.” That really opened the door to Kennesaw State. I had to pay my dues, though. I came in here as an assistant professor. I had been much higher before. I ate crow a little but—is that the word—ate humble pie and worked my way back up. Eventually, I managed to, well, they felt I was worth promoting, so I’m really pleased. I think I’ve been very well treated here. I’ve been extremely well treated by the deans that we’ve had—Herb [Herbert L.] Davis and then Larry [Laurence I.] Peterson made things very easy for me and encouraged and supported my particular teaching methods that sometimes involved some heavy expenditure. A lot of my success has to be really seen as something that could not have taken place without the help I’ve had from the deans of Science.

TS: In 1983, how would you describe Kennesaw then? We had maybe around 5,000 students if that when you arrived.

JL: Well, actually I loved it. I particularly loved the fact that our lectures were five days a week, five short lectures. Of course, the parking situation was horrendous. The students hated it. We have a commuter base of students, well, we had then, but now we have many more residential students. But a lot of our students have to work for a living. That’s a reality. So we couldn’t keep that sort of thing up. But there was an atmosphere from the days even before I came here when this place was Kennesaw Junior College and a lot of the work was preparing students to go to Georgia Tech where the academic standard had to maintain a certain minimal level because the students were anxious about how they would cope when they went to Georgia Tech. Actually, I think that when we became Kennesaw College and then later on State College and University, our standards fell to some extent when that happened. That’s to be expected. I also think our standards have fallen over the years because the base of incoming students has a quality that has eroded. We could speak for hours about why, but this is just a reality.

TS: What about the intellectual life on campus? Was it comparable to what you had in the past?

JL: The intellectual life on campus is really not bad at all. There are all kinds of things that go on. I even at one point, how they thought I was qualified I don’t know, but would you believe that I actually played in the first violins at one time for what they call the Kennesaw College Strings Ensemble! I mean, I don’t think

I was good enough for first violins, not even second violins—I don't know. There's actually quite a lot of activity, and for those who want it, it's there. I sometimes wonder, considering that it's there, do we also have to compel people to it. I have to tell you that I once had a student in an advanced mathematics course, beyond the ordinary level—he was doing something especially advanced with me—who had previously played football for Georgia Tech. Big strong guy! Football for Georgia Tech, I mean, that means something! Big, strong muscles and everything. I would never have picked a fight with him, let me tell you. This student got an A in my advanced course, a very, very strong A, and I was very happy with him. He petitioned to graduate, but they said, "No, you haven't finished your P.E." Now, come on! So he had to do a course in Spanish dance one more term, and then he graduated.

There's something wrong with this. I'm not just criticizing it here. I had a student who did business calculus with me at the University of Wisconsin, Madison, when I was there on a sabbatical year once. This particular young lady had a run of fairly good grades, and I think she was maintaining a "B" average. You needed to have at least a "B" average in order to be interviewed by certain banks at the end of the bachelor of Business Administration. She was very worried that the one thing that was going to put her down below that average was, the required course, in Physical Education. She was a rather large individual, not very graceful, and it was some kind of dancing type of thing, and she wasn't doing terribly well in that course. I felt so sorry for her that she was in danger of not getting a job in a bank because of her inability to do these dance steps. That's really what drives me when I think about the general education.

TS: A lot of people that I've interviewed are almost nostalgic about those earlier years at Kennesaw precisely because of the collegial atmosphere across campus where mathematicians met daily or frequently with musicians and historians, with biologists and so on. That sounds like what you're describing.

JL: I think for people who want to meet and have social or academic connections with people in other disciplines, you can do it today if you are willing. I've had such connections with other people on campus. We could do it then, and you can do it now. There have been other ways in which the atmosphere at Kennesaw has changed. In the old days I remember being warned when I first applied, they said, "You know, this is a teaching school. Don't come here thinking that you're coming into a research institution." I said, "That's okay; I want a balance." They said, "All right, as long as you're interested in teaching." I've always been passionately interested in teaching, which is why probably I'm here with you today. I remembered that in some of my early years here at Kennesaw I got a very, very good paper in what they call the *Crelle* journal in Germany. It was a major, major paper. It's a very prestigious journal, and I had a very good paper there at that time. Accidentally, the interim chair at that time omitted mention of that paper in my annual review. I went to see him and said, "I really would like this to be a feature in my annual review." He said, "Oh, Jonathan, I agree with

you, yes, we should add this. We do like to encourage this sort of thing as long as it doesn't interfere with your work." Now they would not say that today. Today people are being denied promotions because we haven't seen enough of these refereed publications in fully accredited journals.

TS: But the implication was teaching was your work and scholarship was

JL: Your hobby. And we don't mind it as long as it doesn't interfere with your work. That changed.

TS: Was that Chris that said that?

JL: It wasn't Chris. Chris would not have said that.

TS: I wouldn't think so; that's why I was asking.

JL: No, we had an interim chair at that time, and I don't think I should say who. It was somebody whom today I still know and very, very much respect. He's a very nice guy, and I think it slipped out, but he was representing something given to him rather than giving his own view. I'm not saying that it's for all a good thing to emphasize research. I came here for a reason. I've been in heavily pressured research environments. While I really, really believe that you can't have a commitment to mathematics education or to the teaching of mathematics unless you are passionately committed to mathematics itself and involved in studying mathematics while you are teaching it, while I really believe that, I also think that many of these research institutions have gone far too far. They're producing faculty where too much of the criterion for faculty approval is that work as opposed to the fact that there is this important ingredient in reaching the next generation and producing educated and inspired students. The balance that we have at Kennesaw has always been something really dear to me, and it's one of the reasons why I've been very happy here.

TS: So you've managed to keep up with your scholarship and publications over the years.

JL: The nature of my scholarship has changed from time to time. As I've gotten older, I've moved somewhat more into book writing and the production of materials. I'm very much involved in video products these days. I'm very interested in the ways of reaching people with my perspectives of mathematics teaching by creating these products that have a strong video ingredient in them. Unlike the video we're making today, my mathematics videos do not show my ugly face. Again, I have some mercy! What these videos are showing is my white board, which is my computer screen. My calculus product, which is a complete university calculus, actually has more than 100 hours of playing time in those videos. It's very, very intensive.

TS: I did look at one that was on your website that was a speech that you made on campus and you had your white board there for part of it.

JL: Was this the “Lies My Instructor Told Me”?

TS: That’s right.

JL: Yes, I tried to get people to watch that. Unfortunately, it’s aimed at the mathematical community more, and so there would be items in it that wouldn’t reach somebody who is outside of mathematics. They’d say, “What’s he talking about?”

TS: So you’re not really talking literally about your professors along the way when you say, “Lies My Teacher has Taught Me”?

JL: No, no, not at all. I’m talking about the community at large. My feeling is that the basis for understanding is the same as the basis for teaching. I tell my students there is no such thing as a person who is so deeply involved in the mathematics, so smart and profoundly genius, that that person cannot descend to the level of ordinary mortals like you and me and explain it to the rest of us. Such a person has never existed. The best mathematicians, the people who have the deepest understanding, are the people who explain it in the simplest and most approachable way. When somebody cannot explain, it comes only for one reason. The person does not understand the material. In mathematics itself, time and time again, we’ve had a feeling that a certain type of principle or theorem was very, very hard and very difficult to explain. Then one day somebody cuts through the unnecessary stuff and gets through it and says, here’s what’s really going on, and we understand it in a much better way.

Some of my own publications in the *Monthly* have actually been that kind of thing where—I would love to go into detail on some of these things, but we cannot in this interview. But there’s a result known as the Arzela Bounded Convergence Theorem, which everybody “knew” was outside the scope of an undergraduate curriculum because it’s terribly, terribly difficult, and you can’t explain this to ordinary mortals in undergraduate classrooms. One day I discovered the proof. It took me something like fifteen years of misery where I was wishing that I could do it until one day I was standing in the shower after swimming, and suddenly I thought, “Oh my G-d, after all these years I’ve suddenly realized how this can be done.” It in fact changed the nature of much of my writing.

I would love to tell one more story if I can; you can always cut this out; but when I talk about the fact that you need to understand to be able to explain, here is a story I tell my students. It’s a story against myself. I was standing in a hi-fi shop in downtown Johannesburg shortly before I left South Africa to be a student in the United States. I was buying a turntable for vinyl records, which we had in those days, if you will remember those things, and the turntable would turn at 33 and

1/3 revolutions per minute. You would have a diamond stylus on it so you could play your music. Well, I asked the salesman a question. "What if anything can be done to take this Swiss turntable to the United States? Is it possible?" He said, "Oh yes, but you have to do three things. One, you have to switch at the back from 220 to 110 volts." I said, "I understand." He said, "Number two, you have to slip the turntable out, and below there's a cog with teeth. You have to take that cog out, and you see where it says fifty, you have to turn it over to get this to sixty Hertz AC power, and put it in the other way. Otherwise the turn table is going to turn at six-fifths of the speed that it would turn here." I said, "Right. That's going to put your musical notes up by a minor third." You don't want that to happen, so you put the cog back with the word 'sixty' showing." I said, "I understand." He said, "the last thing you must do for the fine tuning, there's a little aluminium disc that sits on top of the turntable with lines on it. It's a little stroboscope, and there was a fine tuning knob that you would turn, and you would have the illusion that the lines are motionless when the turntable is turning exactly at 33 and 1/3 revolutions per minute. When you get to the United States flip this little disc over, and there's a slightly different pattern." I said, "I don't understand. Why should this disc care what kind of electricity is being used to drive the turn table? Either the turntable is turning at 33 and 1/3 revolutions per minute or it is not. Why should the pattern be different? I don't understand."

He said, "I'll explain it to you again. When you are in South Africa you put it this way, and when you get to the United States you put it this way. Do you understand now?" I said, "You've told it to me twice, and I still don't understand." You see, this is how many people teach mathematics. After he'd explained it to me for the third time, and I still was a real dunce because he was telling me what to do, and I didn't understand the idea, that was the same reason that this young lady couldn't understand mathematics in high school, and then she worked for me for two years. I gave her the logical processes, and all of a sudden it worked, and she was able to do calculus and more. That was the same thing, but he had a problem customer. So he called in the manager. The manager smiled, but never a word said he. Instead of saying anything, he pointed with his hand up at the electric lights. I said, "Thank you so much. I've been silly. Of course, I understand now." That salesman probably to this day still doesn't understand. He couldn't understand why the manager, by saying nothing, explained the idea to me, and he was telling me what to do. Because how does the stroboscope work? The electric light above your head is flashing, and the way in which it flashes is different in a 60 cycle area. So the stroboscope is different. I had said to the salesman, "I don't see that what turns the turn table should have anything to do with it. Look here, I could have a camel walking around turning it to 33 and 1/3 revolutions per minute. What's that have to do with electricity?" This is the basic principle that when you understand something, you will find the words to explain it well. That's the heartland. The heartland of any kind of explanation is that you understand the principle, and that gives you the ability to convey that understanding to other people.

TS: I think you probably already answered this in many ways, but how would you explain your philosophy of teaching? When you go into a mathematics class at Kennesaw State what are you trying to accomplish?

JL: In a way I've spoken about this already, but I make the assumption, rightly or wrongly, and sometimes wrongly, that people who have come into the course have the intention or maybe can be prevailed upon to attain the intention to understand the ideas and material of the course. I see my role as conveying, telling a story and explaining mathematical ideas, and helping them to hear the melody of the underlying mathematics, which I believe is precisely what they would need for success at the next level of study. That's the way I look at it. I don't see my role as teaching them how to do this and how to do that. I don't see my role as teaching people how to solve problems, no. To me, the greatest problem solving technique in mathematics is familiarity with the ideas and standing on the shoulders of other problems you have seen solved so that you have a basis to know what to do. That's how we become expert. That's why the teacher always seems to be such an expert because the teacher has seen it before. That's really what I see as my principal role is to give people that understanding. I reach a lot of students with that.

I've had a lot of students who will say I've changed their lives. They said, "Dr. Lewin, I never looked at things in this way before. It's changed my whole perspective, and I don't know where you've been all my life." I have these people who will do this, and they're so happy, and this is the first time I've ever done well in mathematics in all my life. There are also many people who say, "What the hell is all this? Other professors tell us what to do, and then we can do it and get the hell out of here, and now you are making us understand things." I had a student who wrote a bitter complaint: "Dr. Lewin keeps making us understand." This was his complaint! I said, "I plead guilty!" Normally, I don't plead guilty. I was going to quote Rumpole, but I better not go there. Are you familiar with Rumpole?

TS: Yes. [*Rumpole of the Bailey*, a British television series written by John Mortimer]

JL: He said never plead guilty. There I pled guilty. But if you look at student opinion about me, you will find people who are very, very happy that they came to me and feel that this was something very precious and unique. Then there are other people who will say, keep away from him. Sean Ellermeyer, our present chair, who is incidentally a wonderful person—I think we're very lucky to have him—Sean Ellermeyer said, "You know, I read something that somebody wrote that if you want to understand mathematics, Lewin is for you; there is nobody else. But if you're just trying to get a course credit, go somewhere else."

TS: So what's wrong with the student evaluation instrument where we find out that you have an average score of 3.9 on students strongly agreeing that they learned a lot in your course?

JL: 3.9? What's the maximum? How does that work?

TS: I don't know. What's wrong with the student evaluation process?

JL: Well, the student evaluation process, I have to tell you that it is very well known in my department that I never look at these things. Perhaps, it's arrogant, but I say I'd rather believe that my 48 years of teaching have guided me more accurately than the off-the-cuff, knee-jerk reaction of a student who is just coming to the end of a course. My feeling is I'm very interested in student opinions, but I'd like to hear those opinions after the course has ended, preferably two years after the course has ended. I would like students to have matured. I would like for them to have taken other things and then come back and say—just like I spoke about Dennis Chamberlain, whom I had in the tenth grade. I didn't appreciate him then. It took me a couple of years. I said, "You know what? I suddenly realize how much Dennis Chamberlain gave me." I went back to the school and said, "You know, you taught me something." He was the first person who refused to let us talk about "parallel lines". I suddenly realized, you can't talk about parallel lines. "Parallel" is not an adjective. You can say that lines are parallel to one another or that they are not parallel to one another. Is that nitpicking? If you speak accurately and grammatically, you make the mathematics easier because you can trust what you said. That's what he taught me. So you come back later and you appreciate things when you mature a little bit.

And one other thing, I would like any type of statement of opinion to be subject to cross questioning. Not for nothing do we have rules of evidence in a courtroom. You don't have somebody just submitting an anonymous statement. I saw that person commit that murder. You want to know who, who saw? Where were you standing when you saw? What was the light like? Were you wearing your glasses? There are questions to ask. That's why we have rules of evidence. I think that we are not being very scientific in having these anonymous submissions. Even though I hear by word of mouth that there is a strong student approval of me, well, that doesn't make me support it more. I'm glad that there's an approval of me because then it doesn't look like sour grapes. It doesn't look like the emperor's new clothes. I am able to say the king is in the altogether. You know that old Danny Kaye song? I better not sing here! The fact is that it is very hard to speak against the evaluation process because it looks as though you are saying the emperor is naked. In that old story of Hans Christian Andersen, the idea was anybody who couldn't see the clothes was not fit for the office that he bears. It was a very well stated story.

TS: Okay, there are serious flaws with student evaluation instruments, and you don't think they should be used for personnel decisions, right?

JL: I don't, no.

TS: How would you prefer to be evaluated?

JL: That's very interesting because we're being evaluated on the basis of some kind of understanding of what the objectives are in the courses. This is very difficult to know. We've just had a strike among Chicago school teachers in which one of their complaints, which I think is a very valid complaint, is that they will be measured by levels of student improvement. They said, what if students come in in some environments, who are already fairly strong? They don't show improvements. Does that mean that the teacher is bad? In mathematics there could be some idea that, well, we'll test the students and see whose students do best in the test. Well, who is going to set the test? If I set the test, my students are going to do much better than other people's students because I'm going to ask questions about the connections. Somebody else may set the test where there might be some kind of answer in a box or worse, multiple choice testing. That is anathema to my philosophy. I tell my students, "Don't you ever give one of those tests!" Mathematics teachers do not test mathematics by multiple choice. It has never happened. I call them ping pong coaches. I'm very blunt about this kind of thing.

So how do you measure? You've got to have some notion of what needs to be achieved. All I can say is that in the old days, in the 1960s and '70s at the Witwatersrand University, when I was in the department of mathematics, we knew jolly well who the good teachers were, and we did not base it on students' submission of filling forms. However, the way in which we do the evaluations today is much better than it was in the old days at KSU. We used to have these SIR things if you remember them, and I remember that one of the questions was about the labs. I didn't have any labs, and the students who loved me wrote that my labs were wonderful, and the students who hated me, these labs are terrible. What labs? We didn't have any labs. So really all you're really measuring in those things is a sense of student happiness. Maybe we should just have one question, "Are you happy?" It's difficult to measure. Just because something is difficult to measure doesn't mean that you shouldn't try.

We actually had a discussion in a Mathematics department meeting a couple of years ago in which we were actually talking about course objectives. As always, people look at me and think, oh, there he goes again. Lewin is talking about the objectives of Calculus I or Calculus III would be understanding these principles and understanding connections and all the sort of thing I talk about. Other people will say, you've got to be able to use the product rule; you've got to be able to work this out or work that out and find the maximum volume of a box and so on. Somebody in the department actually said, "What Jonathan is saying cannot be our criterion because it's impossible to measure it. We need something that we can get our hands on and measure." I said, "Well, I'm sorry if my stated objectives are hard to measure, but things are hard sometimes." You know we live in a society in which everybody understands that it takes a lifetime of hard work to learn how to kick a ball on a field, so it's going to be easy to be a

professor of mathematics? It's not. Sometimes things are hard. You don't look for the easy. You don't look for your ring that you've dropped under the lamp post because there's more light there. You look where you dropped it. I'm not sure if I really answered the question you asked me.

TS: You have in part but let me ask it another way. What evidence do you have of the effectiveness of your teaching?

JL: That's one of the hardest questions to answer. I can say that I don't have any scientific evidence that I can write down and publish in any of these teaching journals where they like to draw graphs and create quantitative assessments of things that I do not think can be reduced to numbers. And yet, when I see that I have students who ride with me through the system, when I see that I've inspired people, when I send people to other campuses and they write back to me—do you know I had a letter from somebody a year ago who said, “I don't know if you remember me. My name is Ian Mordant and you taught me 41 years ago.” When I get these letters, and I get a lot of them, I know that I've had an impact on people. When I get a letter from somebody who has received a Ph.D. in mathematics—I've had a couple of people who are walking around with Ph.D.'s in mathematics because I inspired them into, they couldn't put it down. It was like reading a mystery novel, and you've got to go through it; you can't leave it. When they write back and tell me that I made this possible for them, then this is just a little bit of evidence.

I've got a string of people right now in graduate school in various stages of doctoral study, and I've got people who are doing other kinds of work. I've got somebody who did business mathematics and is now working in some kind of finance predictor type thing. I don't know what it is that he does, but he earns a lot of money, and he attributes a lot of his ability to the mathematics that he studied with me in ordinary calculus courses that I effectively turned his mind on. And there have been a number of people including, I think, even in my own daughters. Although I must also, at that stage give the same tribute to my ex-wife Myrtle Lewin because I didn't do this alone. She is a very great mathematics teacher. She's also a professor of mathematics.

TS: Are there some innovative things that you use in the classroom?

JL: Well, I've pioneered some techniques and you'll notice that I did not dwell on that because that's the easiest sort of thing to talk about. Anybody can say of Jonathan Lewin: “Look what he does, he makes video in the classroom, he makes his notes and everything”. That's easy stuff to talk about, but I don't really believe that's the reason why my teaching should be regarded as distinguished if indeed it should be so regarded. The fact is that I have pioneered some techniques. I discovered in Israel many years ago when I had students who had been called without notice into military duty while they were taking courses with me, I discovered then that it was a really good idea for an instructor to provide

notes. That was way back in 1971, and since that time I've had a policy of giving my students complete, self-contained, clear lecture notes in one form or another. In the old days you had to mimeograph and spirit copy and all of these horrible things. One of the great advantages of modern technology is that we have such wonderful ways of doing it today.

I have this policy of providing my students with the notes so that they can, if they wish, give all their attention to receiving information and understanding in the lecture because they know the lecture notes are there for them. They don't also have to write a textbook while they're sitting there. At the same time while I'm doing this I'm creating video of my lectures. The particular way in which I make video is almost unique. I'm beginning to hear a few people who are proximating it, and one of the closest is one of my former students who is now doing it in his tutoring. He wrote to me just recently a few days ago and he said, "I'm using your technique while I'm tutoring people, and handing them video files together with the document file just as you do in the lectures, and it's helped my tutoring." So these particular techniques have done an awful lot for me and for my students. There are other ways in which I've got particular techniques, but this is the kind of thing that I think would come to mind outside of the discipline of mathematics when you look at what I'm doing.

TS: You have on your website some fundamental principles of sound mathematics teaching, and I think we've talked about most of them, but there's one I thought maybe you could elaborate on. "A person who cannot find the words to give a beautiful and clear explanation of a mathematical idea is not having a problem with words. That person does not understand the mathematics."

JL: Well, that represents me to a T. Yes, I've already said this to you today, when a person is unable to explain and to explain well, it is because that person doesn't have anything to explain, does not understand the idea. In mathematics, as we advance in mathematics, we make things easier to explain because we get to understand them more profoundly and more clearly. So that is a fundamental principle, and it's being stated by others. The late Paul Halmos said this kind of thing. The great mathematician [Paul] Erdős used to say that God has a great, big book with all the theorems of mathematics—each one of them with a beautiful, simple proof, easy to explain and understand. Sometimes He gives us a little peek into the book. Yes, when you understand, when you know what you want to say, then you can explain well. I tell my students, "You want to be a good teacher, make sure you understand the material and appreciate and why." I tell them something else: "When you're teaching mathematics, no matter how much you think you know, you have to continue to be a student. One reason is when you are learning stuff that you didn't know yesterday and you're learning it today, you feel that same fear that every single one of us feels, and it reminds you about how painfully difficult and scary mathematics is. The moment you stop being a student, you get the feeling, 'Oh, well, mathematics is easy, and why are these people not able to follow? They must be dumb.'" That little story about the

turntable and the lights, again, that bears out the same principle that you can explain only when you understand. The salesman had no idea why you turn the disk over. He just knew that's what he was supposed to tell the customer.

TS: Maybe he didn't care.

JL: He just didn't know and yes, he didn't care to find out, he wasn't curious. The manger just smiled and pointed at the light, so I think that story really it bears it out in many ways.

TS: You mentioned earlier your survival kit. Talk a little bit about your blue print for student success.

JL: Well, that blue print, which I think needs a bit of rewriting because I think it is written a little bit too much for eighteen-year-olds, and I need to have a version of it for older students. One of these days I'll get around to it. The basic message that I have there is that your duty is preparedness. When you come into a course, this is something I said earlier here, the course does not start with a clean slate. You have an obligation to come into the course ready for that course. If you discover that you're not ready, you have an obligation to try to catch up. If practically it's impossible to catch up, then you must accept the inevitable and sometimes go back and take earlier courses if that would help. Sometimes it doesn't help. If you have neglected your study for twelve years you can't fix it in one semester or some type of remedial course; it doesn't work. I'm not very much in favor of little review courses and glossing over things to try to get people—either you do something or you're not doing it. I tell people that you have a duty to be ready for the courses that you enter. Then you have a duty to be ready for each lecture. You're going to be sitting in the classroom—it's physically impossible to sit in a long lecture and understand everything that the professor is saying. Personally, Jonathan Lewin can tell you. Jonathan Lewin never understood a lecture in his life, either as an undergraduate or graduate student. Never. I could take in a certain proportion of what the professor was saying, and then I had to say things to myself. Best of all, if I could get somebody to listen to me and say, "Let me say this to you, and think aloud in your direction to see whether I've got this idea correctly." You learn by hearing your own voice.

I tell the students, I do all these videos and pretty lecture notes and everything complete. But you don't learn mathematics by reading a book. You don't learn mathematics by having something explained to you. You don't learn mathematics by watching a video. As important as any of these things might be, you learn finally when you are the one who is driving the vehicle. I tell them, "You want to work in a group? Fine. Make sure that the other people in the group don't even get to open their mouths. You must be the only one doing the talking. Then you will learn, and they will learn nothing."

TS: How much time do you spend with students outside the classroom?

JL: It's hard to say because in this technological age I'm in touch with my students almost twenty-four/seven. Firstly, I give all my students my home telephone number because my students who work for a living and can't be on campus just any odd time during the week really appreciate being able to reach me that way, and then we use e-mail to convey mathematical documents created in the mathematical word processing systems that I use in my courses. They can send me letters with attachments, and five minutes later I've written back with all sorts of comments in a different color, so they can see this is what the student wrote and this is what I wrote. Then the student can write back to me in a third color, and I can write back in a fourth color. We have this kind of connection, and I have this kind of thing going on sporadically all the time every day. It's hard to put this in classical terms to say, well, I have this many office hours sitting there—actually I have few office hours of the classical kind because my students can't use those, so when people want to see we make arrangements and sometimes those arrangements are in my office, and sometimes they're in my home. I ask, "Where do you live? If you live in Marietta we're not both driving to Kennesaw."

Effectively, there are some advantages sometimes to seeing students in my home, and I'll sometimes see them in little groups, particularly my advanced students. I have groups of students on Sunday afternoons. We work at my kitchen table. We drink coffee, and that's really how that works. It's actually difficult to measure in simple terms of counting hours how much time I spend with my students.

TS: I shouldn't have asked a mathematician for a number, I guess, but the answer is a lot.

JL: Well, as we always say, mathematics doesn't have much to do with numbers.

TS: We've talked a lot about teaching, and we've talked a bit about scholarship and publications. Where does service fit in the mix in your mind on a college campus?

JL: My service activity has been a little bit unusual. I've done some classical service in the ordinary kinds of ways. In recent years I've given such a strong emphasis to the academic side of what I do that I've done much less committee activity than before. There's been a certain tolerance of this. They say, "Well, you've reach this ripe old age, and you've earned your right to go your own way to some extent." Recently, I've done less classical service. I've actually acknowledged that a lot of the valuable work I've done academically and in curriculum work and with students has been possible only because other people have been willing to take over some of the time consuming service work that I see myself as not doing. I've got to really acknowledge that it's only because people have been willing to do that. I actually wrote a statement to that effect recently.

TS: It sounds, though, like you're defining service as serving on committees, and what you're really saying is you're doing some other things that are really professional service beyond committees.

JL: Yes, I feel that my best role is to look for the ways in which I can provide the best service. I try to use the talents that I have to give the service that I can best provide and to provide some of the items I feel that must come from me. There are a few things that I do that other people don't do. Then I try to do those as well as possible and as much as possible. This is acknowledged sometimes because just in the last couple of days a letter circulated through my department. It came from Michael Nelson, who did advanced courses with me and with Josip Derado. Between me and Derado, we guided Michael through various advanced courses, and he's now taking a Ph.D. at the University of Cambridge in England. He wrote, and he said, "I have to acknowledge the enormous value I had from Jonathan Lewin and Josip Derado." This type of thing, without us, he would not be doing what he's doing today. I feel that if I can provide that kind of thing, then ordinary service of another kind, if I don't as much of that, I feel perhaps I'm refusing to Peter Principle myself in some ways. It's like, "if you're good at one thing, then we'll give you something else that you're less good at to do, and we'll move you until we find something that you are not competent to do and leave you doing that."

TS: Are you doing the service to the profession with professional organizations?

JL: Yes, I do. I work very closely with the Asian Technology Math Conference, and I'm an editor for the electronic *Journal of Mathematics and Technology*. I've done some review for the *American Mathematical Monthly*. There hasn't been one for awhile. I have a lot of interest in the Asian world, which is the reason why I'm giving an invited address at the Asian Technology Math Conference in two months' time in Bangkok. I'm going there because they particularly chose to invite me to give a full hour presentation because they want to hear me. I'm involved in that way with a wider community. I'm also giving a workshop there, and then I'm also demonstrating my video approach to mathematics teaching.

TS: We haven't said anything about the Asian connection. How did that come about?

JL: To some extent I was projected into it by the use I made of Scientific WorkPlace, which is a product of MacKichan software. I found myself meeting Professor Wei-Chi Yang, who is a professor of mathematics in Radford University in Virginia, and who is one of the main forces behind the Asian Technology Math Conference. In 1994 or 1995, I forget, he and I had done a certain amount of workshop presentations. He invited me to come to the Asian Technology Math Conference in Singapore at that time. Since then I've been back a couple of times. I went to the conference once in Malaysia and once in Thailand. It's in Thailand again this year. Also there was a spin-off. I gave a two-week workshop in China that wasn't connected specifically with that conference, but I was known

by people who are connected, which is why I was invited and hired to give that two-week workshop. I was actually teaching high school teachers in Macau, the island of Macau, on the use of my teaching techniques in the teaching of calculus. It was a two-week workshop and very valuable, I thought—not a one-day thing. My connection with Professor Yang was probably generated by my use of this technology. It, in turn, increased my connection with the Asian Technology Math Conference. Professor Yang and I once wrote a book together. It's still in print, but it's becoming a bit dated now. It's a book called *Exploring Mathematics with Scientific Notebook*. It was published by Springer.

TS: One of our original math instructors at Kennesaw came from Macau, Micah Chan.

JL: I remember him, but I didn't know that he came from Macau.

TS: That's where he came from.

JL: I do remember. I didn't know him too well.

TS: Well, he was probably out of the Math department pretty soon after you got here.

JL: Yes, he was in Mathematics, and then he moved I think to the business school, and I lost touch with him.

TS: You also do a lot of community service, at least through your synagogue it sounds like—not the kind of thing that we get evaluated on around here.

JL: Yes, I don't count that as part of my professional work, but for the past twenty-six or twenty-seven years, I've lost track, I've been the essence of a proper professional *chazzan* cantor. I have been the cantor of this synagogue in a center for old people in Atlanta. This was based on the fact that I sang in choir and learned a lot of this Jewish music when I was much younger. In fact, a few of us who did that kind of singing have collected here in the metro Atlanta area, and we formed the Atlanta Jewish Male Choir of which I'm a member, and 60 percent of us are former South Africans.

TS: Is that right?

JL: Including the main force behind the choir which consists of my friends Meyer Janet and Barry Herman, and both of them are former South Africans, but there are others. After I leave you today, I'm going to get back into ordinary civilian clothing. Then I'm going down to Sandy Springs for a choir rehearsal. I hope after speaking to you, I'll have some voice left to be able to sing.

TS: Where are you a cantor; you said it's in the senior center?

JL: It's a conglomerate of three institutions, the William Bremen, the Zaban Tower, and the Jewish Tower. The Jewish Tower is an independent living complex. The Zaban Tower is an assisted living. And the Bremen Home is really much more a nursing home where people need nursing assistance. I've been effectively running that synagogue. The nature of the service is quite different from something you would know. I'm standing on my feet singing during that whole service. You think of people speaking and talking to people. That could be done outside of a service; it's not part of the service. The service is the actual production of the material of that particular festival or Sabbath or whatever it is. We're going through that stuff in a structured way with a musical connection that conveys the mood of what we call the *nusach*, the whole atmosphere of what you produce is connected with the kind of musical scale that you're using. The music is actually quite interesting music. It's something that has interested me for some time, and it just happens I had enough recall of that stuff that I'm able to do this sort of thing.

TS: The Atlanta Jewish Male choir, where do you perform?

JL: We do weddings from time to time, and we've done some concerts. We don't have as many concerts as we would like to have, but we have one coming up in Denver in a few months. We've gone to a few places. We like to do weddings. I've always joked with the guys that we'd probably get more work if we also did divorces, but there's no musical repertoire for a divorce!

TS: What has kept you at Kennesaw for twenty-nine years?

JL: Well, I've done a lot of moving around, from South Africa, to America, from America to England, from England to America, from America to Israel, from Israel to South Africa, from South Africa to America—I'm losing track—then finally I was in Wisconsin and then to Georgia. Enough is enough. I've done enough travelling. I've been very happy here, and I've been well treated, and I really like the community here. I really have felt very happy at Kennesaw. I felt happy with the way it was in those days, and I'm happy the way it is now. For the most part, I've been very happy with the people under whom I've worked. There have been exceptions. Not every department chair we've had has met my approval—I better not go into detail—but the fact is we have a great chair now. As you get older, you feel less inclined to move. For the second time in my life I had tenure. I had tenure in South Africa. It wasn't easy to make the decision to leave.

Actually, I didn't tell you, this place in Wisconsin that recruited us, my ex-wife and me, I said, "I don't know if we want to work here." She said, "See what happens. We're going back to South Africa. You put in the application with the Department of Labor, and we'll see what comes up. Then if and when they rule that we've got labor certification, that we can come in here without displacing an American citizen from employment, then we'll make a decision." Eight months

later I got a postcard from the U.S. Department of Labor saying, you're labor certification is granted for you. Then I went into the consulate and said, "I want an immigrant visa." The lady said, "What makes you think you can have one?" I said, "This is what makes me think." I handed that little rectangular card, and they said, "Oh yes, we'll start the process." It took several months more, and it was not without its bumps in the road, I can tell you. But it was quite difficult for me to make the decision to leave this great job we had, these two senior lectureships. I had a beautiful home, a half acre with my rolling lawns and fruit trees and everything. It wasn't easy for me to pull those roots up and move into a tiny little place in Appleton, Wisconsin, and have this schlocky little job, you know, it wasn't easy. Then finally for the second time in my life I had tenure when I was here at Kennesaw. This time I was happy and somewhat older to say the least, and you reach a point where you say, you know, the ship is come into harbor; I'm not leaving here. There might be people who are disappointed to hear me say that, I hope not, but I am in my harbor here now.

TS: Well, maybe that's a good way to end the interview. I thank you very much. It's been very interesting.

JL: I'm delighted to have been here.

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