

Math For Business Decisions: An Equation For Success

University of Arizona



Most tales of technology transfer collaboration don't begin with a thorny, difficult situation. But that's how *this* story begins.

For years, the University of Arizona (UA) mathematics department faculty had been teaching finite mathematics and brief calculus to undergraduate pre-business students. This two-course sequence was required for students who hoped to enter the Eller College of Management as business students at the start of their junior years.

Just one problem.

"These courses were not popular with the students," says Richard Thompson, now a retired professor of mathematics at UA. "We were failing to teach them in a way that related to their world."

What's more, the mathematics professors didn't enjoy teaching students who weren't interested in the material and did not want to learn it.

Professor Chris Lamoureux, head of UA's department of finance, adds that although the traditional courses were theoretical in nature, they were scaled back for pre-business students.

"It was as though these pre-business students were considered 'little math students'," he explains. "Yet these

students *were* capable of handling rigorous math.”

Recognizing the need to change, Thompson convened a group of deans and faculty to explore the problem. The group unanimously agreed that mathematics and business professors would have to work together to find a better approach.

So in 1997, Thompson took the next step — or several hundred steps, as it were.

“I remember walking across campus to discuss this with Chris Lamoureux for the first time — it took a while to get there!” recalls Thompson with a chuckle.

You might say the physical distance between Lamoureux’s and Thompson’s offices on campus was a metaphor for the gulf between their respective disciplines, at least as far as teaching pre-business mathematics was concerned. The mathematics department’s approach was more abstract, while business faculty focused more on applied learning.

Fortunately, Lamoureux and Thompson hit it off, and started creating a brand new way of teaching math to prebusiness students.

The Experiment Begins

After a series of meetings and lengthy discussions, Thompson and Lamoureux fashioned a brand new set of courses, Business Math I and II, incorporating three key “pillars” designed to engage the students.

“Real World” Examples

Within each of the semester-long courses, the students had to solve two major business “problems,” using the mathematical concepts at the core of the classes. The problems included:

- Loan work outs: Using bank records to decide whether to foreclose or attempt to work out repayment on a delinquent loan.
- Stock option pricing: Determining the value of stock options.
- Technology marketing: Developing a marketing strategy for computer hard drives.
- Auction bidding: Bidding on an offshore oil lease.

Each of these problems involved realistic amounts of data, giving the students a sense of the scope, depth, and complexities of an ever-changing business environment.

Technology

In the business world, computer applications — namely Microsoft® Excel®, PowerPoint® and Word® — are common tools of the trade. Both courses integrated these software programs commonly used by business professionals, particularly Excel, into the real-world tasks of preparing reports and making presentations.

Working in Groups

In contrast to “traditional” math courses, in which students work individually on assignments, students in Business Math I and II are required to work in groups.

While Lamoureux was largely responsible for designing the overall structure of the projects, Thompson provided the mathematical content and developed the texts supporting the courses. Instead of offering texts in print, they were available in an electronic format, in keeping with how students learn in the digital age.

You might think that even though the new courses were based heavily on experiential learning, the sophistication and difficulty of the math involved may have been compromised, or at least less rigorous than traditional math classes.

Think again.

“The mathematics underlying two of the courses actually is based on Nobel prize-winning economic theories,” explains Lamoureux.

The auction bidding project involves the Nash equilibrium game theory, for which John F. Nash (who was depicted in the Academy Award-winning film, “A Beautiful Mind”), John C. Harsanyi and Reinhard Selten won the 1994 Nobel Prize in Economics. The stock option pricing project entails the Black Scholes formula, which is part of the work that earned Robert C. Merton and Myron S. Scholes the 1997 Nobel Prize in Economics.

“It would take about five years to learn the math involved in these projects,” says Thompson. “But we use computer simulations, based on historical data, to help the students understand the concepts and methodology.”

During 1998-1999, Lamoureux and Thompson taught the new courses, and quickly realized they were onto something big.

“*The students, it turned out, were energized by the new format, and wholeheartedly embraced this new approach to learning business mathematics. They realized that math was vitally important to helping them solve real-life business problems.*”

After that first year, the Business Math I and II replaced their unpopular predecessors — finite mathematics and brief calculus. In a survey of students, the new two-course combo was ranked “number one” among incoming juniors in UA’s business program. This was quite a contrast from just a few years earlier, when students eschewed UA’s pre-business math courses.

It wasn’t long before Thompson and Lamoureux realized Business Math I and II could become part of prebusiness curricula at other colleges and universities.

Licensing Opportunities

Don Albers, editorial director of the Mathematical Association of America (MAA), had heard rumblings in the mathematics community about the UA’s “experimental” business math project.

“These courses vividly demonstrated how interdisciplinary experiences for students can be shaped through the active collaboration of academic departments — in this case, mathematics and business,” says Albers.

He was so dazzled that he began to explore ways the MAA could promote and even license Business Math I and II. After making successful presentations to the MAA’s publications committee, Albers entered negotiations with Thompson and Patrick Jones, director of UA’s Office of Technology Transfer, to license Business Math I and II.

In 2003, the MAA gained rights to publish and distribute the courses in the United States under the name “Mathematics for Business Decisions,” while international distribution would be handled by Cambridge University Press. As part of the deal, the Arizona Board of Regents retained all copyrights for the University of Arizona, so the university could coordinate expanding work on new opportunities for Mathematics for Business Decisions.

For its part, the MAA made editorial enhancements to Mathematics for Business Decisions, and started selling it in a CD-

ROM format complete with Microsoft® Excel® workbooks, internet links and video clips.

Paradigm Shift

Meanwhile, in 2003 the UA received a \$500,000 grant from the National Science Foundation (NSF) to continue the development and promotion of Mathematics for Business Decisions.

A telling example of the national recognition Mathematics for Business Decisions was receiving occurred in June 2003, when Thompson, Albers, two UA undergraduate business students and NSF representatives paid a visit to Washington, D.C. The delegation made presentations to members of Congress, showcasing the tangible, beneficial impact of NSF funded projects like Mathematics for Business Decisions. Jason Haun, one of the UA students taking part in the visit, says the course has benefited him since graduation.

“I’m in real estate development, and a lot of what we learned — from auction bidding to using modeling tools for pricing — continues to help me in my work,” he notes.

Yet Albers notes that getting business and mathematics faculty around the country to embrace Mathematics for Business Decisions has not been an easy task.

“It’s a major paradigm shift for these people,” says Albers, whose background includes serving for 23 years as a mathematics professor and dean at Menlo College in Atherton, Calif. “You’re asking them to uproot their way of thinking about applied mathematics, and to change. Professors aren’t always willing to change.”

Nonetheless, a number of academic institutions have incorporated Mathematics for Business Decisions into their curricula. Today, Kent State University in Ohio, Texas A & M in Corpus Christi, Pima Community College in Tucson, Ariz., Texas Christian University in Fort Worth, and Seattle Central Community College have joined UA in teaching Mathematics for Business Decisions. It’s also being used at the American University of Kabul in Afghanistan.

Professor Deb Hughes Hallett is intimately familiar with Mathematics for Business Decisions, having taught Thompson’s and Lamoureux’s Business Mathematics I and II at the UA. She also teaches mathematics at Harvard University’s John F. Kennedy School of Government, and is an internationally renowned expert on teaching mathematics at the college level.

“We’re exploring ways to use this same collaborative approach to teach applied mathematics in other disciplines, such as biology, agriculture or journalism,” says Hughes Hallett.

Protecting Intellectual Property, Promoting Adaptability

With the success of Mathematics for Business Decisions came new challenges.

At schools that used Mathematics for Business Decisions in their curricula, a few students would purchase the CD-ROMs, and then make copies for their friends.

“This diminished the self-sustaining revenue generated from sales of the CD-ROMs, and was forcing the MAA to raise prices, which increased the likelihood of copying,” says Jones, who also served as president of the Association of University Technology Managers (AUTM), 2007.

To address this growing problem, Jones and the UA Office of Technology Transfer provided their expertise in rights management to devise an effective solution for the MAA: site licenses incorporating a course fee concept with download-accessible content.

By providing such licenses for the software, the academic institutions themselves were responsible for dispensing the content provided by the MAA and collecting fees for use. The purchase price of Mathematics for Business Decisions could be substantially lowered compared to previous versions, also solving a vexing problem of increasing textbook costs, while still generating enough revenue to allow the MAA to continue offering, and improving, the content.

Jones points out that while the intellectual property at the heart of Mathematics for Business Decisions is protected, it can be customized to meet the academic institutions' unique requirements.

"It has been designed in the spirit of a collaborative community," he explains. "Everyone on the Math for Business Decisions team felt it was important for others to be able to contribute their creative ideas, allowing for customization within a coherent framework."

The Future

With the success of Mathematics for Business Decisions at U.S. institutions, the UA and the MAA have translated it into Spanish, and are investigating new markets for the software in Latin America, as well as in Spanish-speaking areas of the United States. Additionally, educators in Tunisia and Senegal have expressed interest in Mathematics for Business Decisions, so French-language versions may be in the offing. It also is being considered for use in elementary and secondary schools.

"Through our ongoing partnership, we're eager to continue promoting and improving Mathematics for Business Decisions," says Jones.

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