

Time Value of Money Seminars: Immersion Therapy for Finance Majors

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Finance majors must be able to properly use time-value of money techniques to be academically successful. Recognizing that many of its Finance and Real Estate majors were proceeding beyond their first finance course without an adequate understanding of this crucial skill, the Department of Finance at the University of Northern Iowa instituted a series of voluntary attendance seminars designed to immerse its majors in the mathematics of interest. After four years, the seminars have become an established success, providing most of our majors with the time-value skills necessary to be successful in their academic studies and future careers. This paper tells how these seminars originated and evolved, and offers a roadmap for other finance departments that wish to implement a similar majors for their majors.

In response to recommendations made by our AACSB Accreditation Team, the College of Business Administration at the University of Northern Iowa instituted student learning assessment exit examinations for all of its core courses. For the Finance Department, outcome assessments for our core course in financial management presented strong, but not totally unexpected, evidence that our students were not exiting their first finance course with an adequate grasp of the time-value of money.

The finding that our students could not demonstrate a high degree of competence in the time-value of money after their first exposure to the subject was not surprising. Anyone teaching finance at the university level for any time has likely accumulated a vast amount of anecdotal evidence of this problem; however, we were dismayed by the astonishingly poor results of our exit examinations. Our students could solve the most straightforward problems, but when any level of complexity was introduced to the problems, their results plummeted.

Could the poor results have been attributed to inadequate instruction? Probably not. Results were similar across sections taught by different instructors, and across the different majors. All business majors must take the core financial management course, but for Finance and Real Estate majors, understanding time-value is vital to their future success in both their academic and working careers.

Confronted with compelling evidence that our majors were moving into their higher level courses without an adequate understanding of the mathematics of interest, the Finance Department began to explore possible remedies. Perhaps more time and attention could be devoted to the study of time-value in the core course, but that solution would have to come at the expense of other subjects normally covered. We felt that a better alternative would be to provide our majors with additional instruction outside of the regular curriculum, but we wondered how receptive our students would be to taking classes for which no academic credit could be given.

As Finance Department head at the time, I knew that we had to take some measure to address the problem. I have

always believed that students can become highly proficient in this subject if they are provided a coherent mathematical framework, competent instruction in problem solving methods, and numerous problems to solve until they achieve that “aha moment,” as one of my students put it, where time value becomes easy, and even the most complex problems are no longer daunting.

Most students majoring in finance have a quantitative bent, and the algebra itself is not especially difficult for them; the difficulty lies in conceptualizing the problem and formulating a correct solution strategy. It takes a measure of time, effort, and dedication to achieve the aha moment. The problem for us was to find a way to direct our students' motivation and effectively channel their efforts into recognizable, tangible results.

For the Finance Department at the University of Northern Iowa, the solution to our problem was to implement a series of seminars designed to immerse our students in the mathematics of interest and the time-value of money. The body of this paper documents our experience in providing these seminars, and examines what has worked and what has not worked. The purpose of this paper is to provide materials and insights to aid other Finance Departments that might wish to replicate and improve upon our experience.

STARTING THE SEMINARS

Since I had been thinking about a project like this for some time, well before our AACSB-directed outcome assessment exams exposed and quantified our student's deficiencies, I of course wanted the seminar series to be successful. Above all else, success required that students voluntarily attend the lectures.

At first, I implored other professors in the department to offer some type of extra credit in their courses to induce our majors to participate in the seminars, but abandoned this idea when a colleague pointed out that it would be inherently unfair to reward some students at the expense of others who had time conflicts or who actually knew the subject already. If our students demanded measurable grade incentives to participate in this project, it would likely fail. We could offer no academic credit, and nothing would show on our students' transcripts to indicate they had received this training. All we could offer our majors was hard work, and the Finance Department's recognition that they had achieved a certain degree of expertise in the time-value of money.

We made this proposition to our majors: We will offer to you a series of late afternoon, two-hour lectures and work sessions designed to immerse you in the mathematics of interest. You will receive no academic credit, and nothing on your transcript will show that you participated. But the seminars are free of cost, and all materials will be provided to you (I wrote a 30-page pamphlet and numerous Excel templates to distribute to

the students). At the end of the sessions you are invited to prove you have achieved mastery of the subject by passing a very difficult exam. The Finance Department will recognize your achievement by prominently displaying your name on a plaque in our display case and on our website.

When I sent the initial email telling our majors about the planned seminars, I wasn't sure what their response would be. Would they give up their afternoons to attend nearly two-hour lectures solely on time value? Would they take a "mastery" exam they knew would be extremely difficult (passing meant they had to tackle five complex questions, making only one or zero rule-breaking mistakes) just to get their name on a plaque?

What happened that first semester was gratifying to say the least. When the sign-up sheet for the seminars grew past 70 students, we had to scramble to find a larger room to accommodate them. We also began to hear from students whom wanted to attend the seminars, but could not do so because of conflicts, and we faced the very real possibility of having to turn some students away for lack of seating.

An email from a graduating senior contained a particularly convincing plea for a second offering. He wrote to tell me that he thought that the "...TVM seminar is a great idea, but like some of the other students I have a conflict with my class schedule and will not be able to attend. This is something I would really like to attend because I can openly admit that I do not have a solid understanding of the TVM concepts. This is scary to me because I am set to graduate in May and I cannot consistently solve the basic TVM problems in my classes without help from notes/textbooks." In response to requests like this, we offered a second seminar series at a different time. An additional 52 students signed up to attend.

Four years have passed since those first sessions were offered in the spring of 2006, and demand has now leveled off to about 60 to 70 students per semester, but virtually all of our majors participate at some point in their academic careers.

THE INSTRUCTION

By agreeing to forfeit a good deal of their free time in exchange for no academic credit, our students told us that they understood the need for time-value skills. But if substantial monetary costs, an expensive textbook for example, had been required of them, student response would have been diminished, and in all likelihood the project would have failed at its very beginning. We had promised that all materials would be provided free of charge, and that required us to produce them. In preparation for our first set of seminars I wrote a text, a problem bank, and a set of excel templates designed to create and solve various time-value problems (some of these materials are shown in the appendix, and are available on this journal's website).

The Primer

The purpose for writing "The Time-Value of Money: A Primer" was to provide students with an introductory text, free of charge, that presented the subject exactly the way I wanted to teach it. While I will gladly make my materials available to anyone wishing to engage in similar project, I would recommend that instructors produce their own. All finance professors should have a command of the subject, but they dramatically differ in their opinions as to how it should be presented to their students.

Instruction is likely to be much more effective when the instructor's methods and materials are consistent.

My approach was to present an overview of time-value in only the first two pages of the "Primer," followed by appendices that offer a more detailed presentation of the material. Presented within these two pages are a series of time-value rules that students must adhere to in order to correctly solve the myriad of problems they encounter at the end of the primer.

Calculator or Equations?

All of our students possess business calculators, which have preprogrammed time-value equations, the ability to manipulate interest rates, switch from regular annuities to annuities due, and any number of amazing, but specialized (and confusing) calculations. Yet, I prefer to rely on the time-value equations, and as few versions of them as possible. Why? First, as I explain to my students, the equations provide excellent notation that can be revisited for an explanation of the solution process. Second, students who understand the equations and use them in the solution process are much more likely to arrive at a correct answer than students who do not. Too often I have seen students show their work on examinations by drawing pictures of the calculator buttons they have pushed, almost always to disastrous results.

That said, however, the pre-programmed functions do offer a method to quickly obtain answers correct the penny, and many of our more adept students like to use them. I certainly don't discourage the development of this skill; I do it myself, but I don't "teach the calculator." After they have attained a solid understanding of time-value, most students are highly capable of teaching advanced calculator usage to themselves.

Seminar Timeline

Students are expected to participate in six sessions conducted over a three-week period early in the spring and fall semesters. The first three sessions begin with lectures and end with exercises that are completed in class. Sessions four and five are devoted to working problems as a class with much of session four being devoted to a practice "Mastery Exam." The real Mastery Examination is administered in the final session.

Session 1 The Building-Block Equation

The first session is devoted to what the Primer refers to as the building-block equation:

$$FV = PV(1 + i)^n \quad (1)$$

The equation is derived, and students are introduced to other than annual compounding. The first time-value rule is introduced in this session:

- ***i* and *n* must correspond:** for the building block equation, the period for *i* is given, and *n* defines the number of periods between *PV* and *FV*.

Within the context of this first rule students are taught how to solve for the interest rate, *i*, and the number of periods, *n*.

Numerous problems are worked by the class on a handout that becomes part of their notes.

Admittedly, the material presented in session 1 is very basic, and many of our students are already proficient at this level before we begin. Most students, however, accept the premise that it makes sense to start at the beginning, as if they had no prior knowledge of the subject. And some students have had no prior instruction, as they are premajors who have not yet taken even the core financial management course.

Session 2 Annuities

This session introduces annuities. Particular attention is given to the connection between the open-forms of the annuity equations and their cash-flow timelines. Students are made aware of the equivalence in the open and closed forms of the annuity equations, and the time-value rules relating to annuities are presented.

- ***i* and *n* must correspond:** for annuities the period is defined by the time between payments, and the simple (effective) interest rate, *i*, must fit this time period (since the time period between payments is fixed, *i* may have to be adjusted to fit the time period—see the appendix on manipulating interest rates).
- **Pay attention to the time-line:** The *PV* of an annuity equation consolidates the stream of equal payments into a lump sum amount *one period before* the first payment is made. *FV* of an annuity equation consolidates all payments *at the point in time the last payment is made*.
- **For annuities, *n* is the number of payments—ALWAYS!**

Perpetuities are introduced in the second session, and an intuitive derivation is presented. Students are advised that the same time-values rules apply to perpetuities with the exception that *n* is no longer relevant.

As in session 1, a problem handout is completed in class. At this point, problems begin to become more complex, with solution procedures requiring several steps. For session 2 problems, however, the simple interest rate given always corresponds to the time between payments, so no interest rate manipulation is required.

Session 3 Manipulating Interest Rates

In this session students learn to manipulate interest rates in order to compare nominal annual interest rates with different compounding periods or to construct an effective rate that fits the time period between annuity payments.

One of the appendices to the two-page primer, entitled “How to Manipulate Interest Rates. And Why,” presents the equation:

$$ER = \left(\frac{APR}{\mu} \right)^{\mu} - 1 \quad (2)$$

where: ER = effective interest rate across a time span
APR = the stated annual interest rate
 μ = # compounding periods per year

Using this equation, students can build an effective interest rate across any desired time span. Such manipulation becomes necessary, for example when the time between annuity payments is not the same as the compounding period. Students are made aware of the direct connection between Equation (2) and the building-block equation, Equation (1).

The problems encountered on the Session 3 handout become even more complex, usually requiring students to manipulate the given interest rate before using the annuity equations. Some problems involve multiple annuities with different time spans between payments. A great deal of emphasis is placed on the time-value rule that states:

- **NEVER** add amounts of money unless they are sitting at the same point in time.

At this point students need to begin searching for their own “Aha Moment.”

Session 4 Problems, Problems, and More Problems

By now students have received worked problems for the problem set at the end of the primer. At this point we focus on problem-solving techniques; emphasis is placed on the final time-value rule, which is not a mathematical rule, but a vitally important technique.

- **Draw a timeline.** Once you can specify the size and timing of the cash flows, there is no time value problem you cannot solve. A timeline gives you a firm start.

Session 5 The Practice Mastery Exam

After a brief recap of the course, the time-value rules, and the problem solving techniques, students work on a practice mastery exam. While students are advised to take the practice exam seriously, hopefully by preparing for it and taking it under quasi exam circumstances, they are also encouraged to ask for help during the “exam” and even collaborate if necessary. A worked exam is provided at the end of the session.

Session 6 The Moment of Truth

Each student receives one of four equally difficult mastery examinations consisting of five complex problems. The purpose of issuing four different exams is not so much to discourage cheating (which I have never observed in this particular setting), but to guard against the exam becoming too familiar to future participants when it is discussed, as it will be, among current participants. Also, students are invited to enroll in future seminars until they are successful in passing the exam.

A passing grade is achieved when a student makes only one or zero rule-breaking mistakes on the exam. A simple calculator error, unless it is particularly egregious, will be overlooked, but a rule-breaking mistake is a strike, and only one strike is allowed.

Students are invited to view their exams in my office; and many do so because they cannot believe they made even two mistakes. I encourage and welcome these encounters because I know that these students are extremely confident in their newly found abilities. Often, students repeat the seminars just to prove that they can conquer the exam. Occasionally, students who have already passed the exam sit again through the seminars to refresh their knowledge.

OUTCOMES

The time-value seminars have been made available to all of our Finance and Real Estate majors early in each semester since the spring 2006. Since the seminars began, more than 600 of our majors have participated, some more than once. During this same period, the department has seen 499 students graduate. We encourage our majors to take the seminars early in their academic career, and it appears that a large majority of our students avail themselves of this opportunity at least sometime before they graduate.

Not every student who signs up for the seminars completes the entire series. There is no question that these seminars impose upon our students' time, and the need to focus on another course, or a graded assignment, may cause some students to abandon the seminars. Some students complete the series of lectures, but do not take the mastery examination. Thus far, 345 students have attempted the mastery exam, and 160 have completed it making only one or zero rule-breaking mistakes. A pass rate of only 46% might be discouraging if the bar were not set so high. Most students who do not achieve a near perfect exam come pretty close. Perhaps because the exam, like the lectures, is voluntary I have not had a student do poorly on it, and I firmly believe that students who fall short of earning the department's recognition still greatly benefit from their efforts.

A bit of anecdotal evidence provided by our students supports my belief. Shortly after the seminars began, students from UNI and two other Iowa universities attended an all-day interview at AEGON to compete for highly desirable, semester-long real estate internships. This is how a student described his interview: "after a few minutes of just chatting [the interviewer] asked me to solve a time value of money problem. He gave me a present value of a loan, the time frame, and the interest rate, and asked me to compute the payment and remaining balance after a certain point in time. I was extremely confident I could do this until I realized he only used the HP calculator ... [In the time the interviewer left] to find a Texas Instrument calculator for me to use, I had begun working the problem out by hand ... After I got the correct answer [the interviewer] shook my hand and said, 'congratulations, you are the first person to get the correct answer.' I was his second to last interview of the morning."

"At lunch ... I was talking with the others who interviewed in the morning... They had absolutely no clue as to the correct way to solve the problem, and [one student said she] did not even try."

"I do not know who got the internships, but I do know that all of the students from UNI that took the time value of money class correctly answered the interview question, and we all have internships this fall."

While the three University of Northern Iowa students who received AEGON internships that semester did not pass the mastery exam, they obviously did improve their time-value skills in time for the interviews. Their story (with my enthusiastic encouragement) spread throughout the body of Finance and Real Estate majors, and served to promote the newly established seminars.

CONCLUSION

The problems caused by the fact that many students leave their first finance course without achieving an adequate

understanding of the mathematics of interest are well known to finance departments everywhere. Undoubtedly, there are many ways to successfully address this problem both within and outside of the finance curriculum. Our extracurricular approach may not be the best method, and we continually look for ways to improve our offering, but our experience has been successful. An intense start-at-the-beginning, equation-based, rules-based, problem-solving immersion experience has worked for students at the University of Northern Iowa, and we offer this narrative to other finance departments as a guide to one possible solution.

For us there were several key elements to establishing a successful program. Of vital importance is collegial and administrative support. Both my colleagues and dean were very receptive to the idea of establishing the seminars, and helped to shape their implementation. The department's two advisory boards, Finance and Real Estate, also provided advice and support.

No one wants to host a party and have no one show up, so promotion is crucial. We employed fliers and classroom announcements, but most of the effort to promote the seminars took the form of blanket emails to our majors both before and at the beginning of the semester. The emails stressed what most students already knew—that they were deficient in their time value skills, putting them at a disadvantage in their upper level courses and in their future careers. And the email solicitations were spiced up by a retelling of the AEGON interviews experience and a quote by a Real Estate Advisory Board executive who flatly stated, "Whenever we hire someone and find out he or she doesn't understand time-value of money, we know we have made a mistake."

The true reward is knowledge, but recognition is appreciated. Our students have a good midwestern work ethic, and they are competitive. For example, virtually all of our Real Estate majors also major in Finance because they don't want to be at a competitive disadvantage with their fellow students. We appealed to these traits by recognizing our students who truly excelled on the mastery exam, giving them another line item to place on their resumes.

Establishing an extracurricular instructional program in time value for our Finance and Real Estate majors has not only provided tangible results for our students, it has been for me the most rewarding experience of my teaching career. I hope other finance departments capitalize on our experience and take advantage of the materials provided in the appendix to this paper and on the JITF website.

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