

# MESSY PROBLEMS AND LAY AUDIENCES: TEACHING CRITICAL THINKING WITHIN THE FINANCE CURRICULUM

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*This article investigates the critical thinking difficulties of finance majors when asked to address ill-structured finance problems. The authors build on previous research in which they asked students to analyze an ill-structured investment problem and recommend a course of action. The results revealed numerous critical thinking weaknesses, including a failure to address the client's problem, use analytical tools systematically, construct rhetorically useful graphics, or translate finance concepts and methodologies into lay language. The present research aims to understand more deeply why students struggle with ill-structured problems. Using think-aloud protocols, audiotaped interviews, and other strategies, the authors explore causes of finance students' difficulties and suggest strategies for addressing them. The results suggest that the homework tasks typically given them, such as quantitative problem sets using algorithmic procedures, do not prepare them to confront ill-structured problems requiring disciplinary arguments aimed at specified audiences. Research further suggests that teaching audience adaptation—especially for nonexpert audiences—is helpful in promoting critical thinking.*

**Keywords:** *critical thinking, assessment, writing, rubric, finance, learning, rhetoric*

TO SUCCEED IN a competitive business environment, newly minted finance professionals must be strong critical thinkers who can analyze complex finance problems, see meanings in data, and communicate effectively with both lay and professional audiences. This article examines the difficulties encountered by undergraduate finance majors in learning these skills. Specifically, we focus on the struggles of finance majors asked to write an advisory memo to a lay client seeking help with an investment problem. Our research uses a

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theoretical framework—developed by researchers in critical thinking and assessment (Huba & Freed, 2000; Kurfiss, 1988; Suskie, 2004; Walvoord, 2004; Walvoord & Anderson, 1998)—in which the highest level of critical thinking occurs when the thinker confronts an ill-structured or “messy” problem. Unlike well-structured problems, which have right answers that can be determined through an algorithmic process, an ill-structured problem requires thinkers to propose a “best solution” and justify it with reasons and evidence. Ill-structured problems also require thinkers to articulate and defend underlying assumptions, showing how they are reasonable and consistent with the objectives of the analysis. For this research project, we created an ill-structured problem in finance—a problem intended to evoke disciplinary thinking in an open-ended real-world context—and studied students’ thinking processes as they developed and attempted to justify solutions.

The difference between algorithmic and messy problems can be shown in the following examples from an intermediate corporate finance class. Here is a typical algorithmic “story problem”:

#### **Algorithmic Story Problem**

You have been hired as a consultant to Kulpa Fishing Supplies (KFS), which is seeking to increase its value. KFS has asked you to estimate the value of two privately held companies that KFS is considering acquiring. The first acquisition target is a privately held company in a mature industry. The company currently has free cash flow of \$20 million. Its weighted average cost of capital is 10%, and it is expected to grow at a constant rate of 5%. The company has marketable securities of \$100 million. It is financed with \$200 million of debt, \$50 million of preferred stock, and \$210 million of book equity.

1. What is its total corporate value?
2. What is its value of equity?
3. What is its value of operations?

This story problem provides a superficial context for a garden-variety algorithmic task. Typical of many end-of-chapter problems in most finance textbooks, the problem requires students to plug values into commonly defined equations to find a solution. Because the

story provides a well-defined, closed context for the analysis, the student simply has to choose the right formulas without having to make an informed judgment requiring critical thinking.

In contrast, the next example—what we are calling a “messy problem”—is more like a business case than an end-of-chapter story problem. Its open-ended context with many variables and possibly irrelevant details requires the student to make a decision in the face of uncertainty.

### An Ill-Structured or “Messy” Problem

**Background:** Meredith and James Kennedy own a business, Office Products, Inc. (OPI), which is a wholesale distributor of office equipment. Sales have grown about 5% per year over the past 5 years and are expected to grow at the same rate in the future. This past year, sales reached \$800,000. A computer manufacturer recently approached OPI about becoming the exclusive distributor for one of its laptop computers. Sales are projected to be \$400,000 from this product in the 1st year and to grow at 20% for 2 years before settling down to a 5% growth rate over the longer run. It is possible, however, that sales from this product could be as high as \$800,000 in the 1st year. OPI has been earning a before-tax profit of 6% of sales. Variable operating costs are expected to remain the same percentage of sales, even with the added laptop sales. Fixed operating costs would be unchanged. Meredith and James are aware that increased sales will mean they need to maintain additional inventory and accounts receivable. They will also need to purchase additional equipment. OPI currently has no debt, but it can acquire additional short-term financing from a bank. It could borrow up to \$50,000 at 10%. Above \$50,000, the interest rate would increase to 12%. It is not possible to raise more equity, so any external financing would have to come from bank financing.

**Your Task:** The Kennedys have asked your help in determining whether taking on the new product line would be in their best interests. Since they are content for the most part with their present business, they feel that to take on the additional product line, the financial rewards would have to be significant and the added debt load not too stressful. Write a one- or two-page memo to the Kennedys offering

your recommendation supported with reasons and evidence. Attach to your memo any graphics that you think would be helpful. The Kennedys have no training in finance, so address them as a nonexpert rather than expert audience.

This assignment asks students to make a reasoned argument addressed to a lay audience. Students must decide what calculations to perform, why to perform them, and how to communicate the results so that they are meaningful to the Kennedys.

Our research investigates the critical thinking difficulties exhibited by finance majors in completing the above OPI task. Our current project builds on previous research (Carrithers & Bean, 2008) in which we investigated the critical thinking of seniors in a capstone finance course. In that previous project, which also required students to write a memo to a lay client about an ill-structured investment problem, we discovered numerous critical thinking weaknesses, including students' failure to address the client's problem, random or purposeless use of analytical tools, failure to construct rhetorically useful graphics, and failure to translate finance concepts and methodologies into lay language. Puzzled by our earlier study, we undertook a new investigation aimed at uncovering in more detail students' actual thinking processes as they wrestled with an ill-structured problem. We particularly wanted to study the different thinking processes of successful versus unsuccessful students. Additionally, we wanted to learn how instructors might improve assignment design and teaching strategies to help students engage messy problems more effectively.

## **METHODS**

For this project, we studied 35 students in an undergraduate intermediate corporate finance class taught by the first author. We gave students a messy problem embedded in a business case (the "memo to the Kennedys" problem shown earlier). To analyze the case and discover possible solutions, students had to do extensive financial modeling using Microsoft Excel and then make judgments about a best course of action for their clients, who were not trained in finance. We thus asked students to assume the role of expert finance

professionals charged with the task of writing a memo to lay clients explaining and justifying their advice. Specifying a lay audience, we surmised, adds an important critical thinking dimension to the task. It requires students to transcend cognitive egocentrism by seeing the problem through their clients' eyes, by determining what aspects of the analysis would be useful to their clients (as opposed to impressing the teacher), and by communicating their conclusions in terms the clients would understand.

We then collected and analyzed three sources of data. First, we analyzed the 35 memos, classifying the kinds of problems we observed. Second, we selected one of the stronger students in the class for more in-depth study. We received his permission to videotape his "think-aloud" protocols immediately after he received the assignment and later during his process of analyzing the data and writing a first draft. We used directed questioning and role-playing strategies to elicit as much detail as possible about the evolution of his thinking as he analyzed the data and wrote his memo. Finally, after the memos were submitted, we conducted audiotaped 60-minute interviews with four students—two strong performers and two weak performers—in which we asked them to reflect on their thinking and writing process.

## **RESULTS AND DISCUSSION**

On the basis of our analysis of these data, we identified five kinds of critical thinking difficulties exhibited universally by weaker students and occasionally by even the strongest students.

### **1. Students have difficulty understanding what makes a messy problem messy.**

Almost universally, students did not understand the "messy" nature of messy problems. They tended to turn the messy problem back into a story problem in which their task was to find the right algorithm that would yield the "correct solution." For example, in the videotaped think-aloud protocol, the student immediately assumed that this was a "net present value" (NPV) problem and that his first approach would be to do an NPV analysis. NPV had recently been discussed in class, and to this student, the case problem was merely another story

problem typical of the end-of-chapter sets that constitute homework in finance courses. Later in the videotape, the interviewer suggested to the student that this is not an NPV problem and that NPV analysis is largely irrelevant to the client's situation. The videotape shows the student looking dismayed, perhaps aware for the first time that a different kind of thinking is being asked for. Similarly, students in the audiotaped interviews, when asked what they thought the instructor was looking for in the assignment, tended to focus on the instructor's wanting them to perform the right calculations rather than to justify a recommendation with reasons and evidence.

## **2. Students have difficulty seeing the problem from the client's perspective.**

Perhaps desensitized by story problems in which the "story" seems contrived without real rhetorical function, students frequently did not regard the "pretend" audience as real. Although the instructor stressed that students were supposed to write to a lay audience, students felt that the real audience was the teacher and that their real goal was to show the teacher what they knew. As a consequence, students quickly lapsed into jargon and formulas. Here, for example, is a passage from one student's memo:

On the asset management side, the company appears to be in a favorable position after adding the new product. In my analysis, both the company's expected TATO and Sales/FA ratio are higher after adding the new product. With the new product sales at \$800,000 in the first year, both the company's expected TATO and Sales/FA ratio are twice as much as before the new product is added. In terms of profitability, the company's ROA and ROE are higher after adding the new product. With the assumption that sales are \$400,000 in the first year, both the ROE and ROA are approximately twice as high as before the new product is added. With the assumption that sales are \$800,000 in the first year, both the ROE and ROA are approximately four times higher than without the new product being added.

A page later, this same student tries to explain his calculations:

These cash flows are then discounted back to the current year with the weighted average cost of capital to determine the value of operations of the company. The weighted average cost of capital is determined by

taking [the initial level of debt/the initial level of assets \* (1 minus the tax rate) \* (the cost of debt which is to be 12%)], plus [the initial level of equity/the assets \* the cost of equity which is 16%]. The reason why I chose 12% to be my cost of debt was because in general the company had to issue more than \$50,000 for its notes payable.

The student's imagined audience is the instructor, considering that no lay audience would understand "TATO" (total assets turnover), "Sales/FA [fixed asset] ratio," "ROA" (return on assets), "ROE" (return on equity), or the arcane formula for computing weighted average cost of capital.

Why do students lapse into jargon? We offer two explanations. First, students' use of financial jargon, including abbreviations, as in the above excerpt, may be an indication that they are not comfortable in their knowledge of the concept—especially when they provide no explanation of the tool or how it is used in the analysis. Students find the jargon comforting because it enables them to sound like finance professionals, without fully understanding the concepts that the technical terms represent. Use of jargon is a form of role-playing.

Second, finance instructors may unconsciously reward technical language because they themselves do not really role-play the worldview of the lay client. We became aware of our own reading practices when we noticed how differently the English professor (the third author) read a student memo from the way the finance professor (the first author) read it. Because the third author knew nothing about the finance concepts, he could truly approach the memo from the lay perspective. If a memo were confusing, he would struggle with its language, starting to read it again from the beginning. The finance professor, however, would turn to the Excel tables at the end of the memo, trying to reconstruct the student's thinking process from the mathematics. Students, we surmise, are used to seeing professors look at their calculations; in this sense, the lay audience specified in the case really *is* a "pretend audience," because the professor reads like a finance professional, not like a real client. (We'll return to this point later.)

### **3. Students have difficulty deciding the level of detail useful for a nonexpert audience.**

Approximately half the students in our sample never tried to adapt to a nonexpert audience. Those who did try exhibited a new kind of

difficulty—deciding how much detail the lay audience wanted or needed. The strongest students often tried to turn their memos into minitextbooks. Realizing, for example, that the audience did not understand TATO or the “weighted cost of capital,” they tried to explain these concepts inside the memo, producing in some cases memos that were four or five pages long, single spaced. These long, teacherly memos satisfied the students’ desire to address a lay audience while showing the teacher what they knew. When we tried to explain to students that the client did not want a string of finance lessons and that the client’s own concerns got buried in verbiage—in short, that these long memos were not rhetorically effective—students bristled. What surprised us was the level of resistance from strong students to the idea of producing a short memo without “show-the-teacher-what-I-know” components. One student thought that a short memo would be unprofessional—that he would be cheating the client if he charged a large consulting fee and produced only a one- or two-page memo. As we’ll show in our later discussion of new teaching methods, helping good students feel comfortable with a short memo was a huge pedagogical challenge.

#### **4. Students have difficulty writing client-focused memos with claim and support.**

Another finding is that students did not transfer advice about memo writing from a previous course in business communications. Whereas effective memos state their points up front and often use headings or bullets to indicate sections or highlight chief subpoints, students’ memos typically had dense paragraphs without headings or bullets. The writer’s advice and recommendations tended to get buried at the end of the memo. The memos bore all the traits of what Flower (1979) famously called “writer-based prose” instead of “reader-based prose”: The memos were organized around the writer’s process of discovery rather than the reader’s needs for points stated first. Another of our pedagogical challenges, therefore, was reinforcing earlier instruction in the art of short, points-first memo writing.

#### **5. Students have difficulty creating rhetorically effective graphics.**

A nearly universal problem, even among the strongest students, was failure to create rhetorically effective graphics. Initially, students



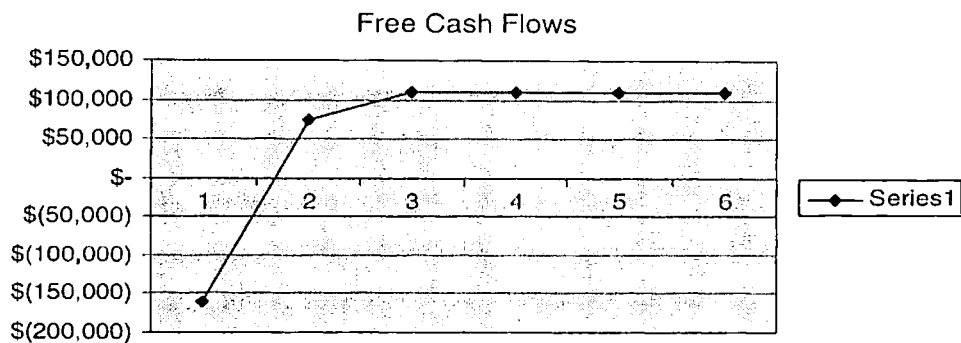


Figure 1. Example of an Ineffective Student Graphic

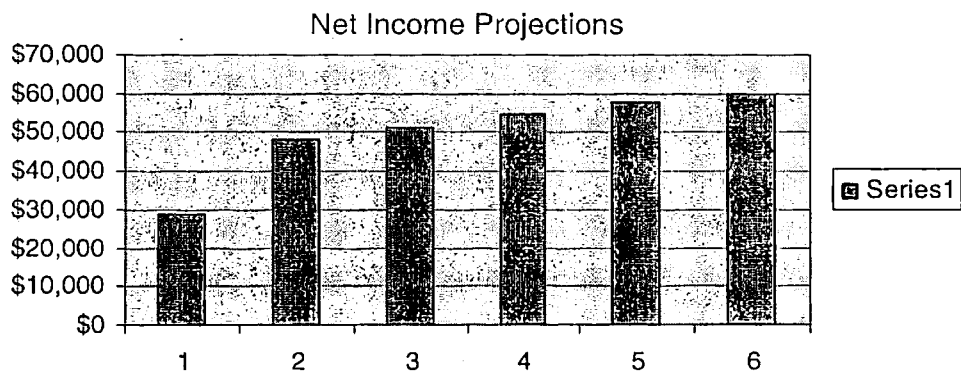


Figure 2. Another Example of an Ineffective Student Graphic

seemed to think that spreadsheets constituted graphics; students regularly stapled many pages of raw spreadsheets to the backs of their memos without in-text citations, labels, or other explanation. The first author, reading as a finance professional, could understand the students' intentions and after several minutes of searching could often find spreadsheet data that supported students' assertions, but the second and third authors, reading as laypersons, were baffled.

Even when students began to understand the rhetorical function of graphics, they produced ineffective graphs that did not tell a clear story because the graphs were poorly designed or lacked effective titles, labels, or legends. As illustrations of this problem, consider Figures 1 and 2, which show students' attempts to tell a story. But what is that story? In both figures, the absence of labels for axes, combined with titles that don't indicate the variables being compared,

leave readers confused. Note also how students do not seem to understand what is required when a writer converts spreadsheet data into a graphic: In both figures, the program's prompts for "series" are left unchanged.

We hypothesize two causes for students' failure to produce effective graphics. First, students have not been taught how to think about graphics rhetorically. They have been taught to read graphs as information receivers, but not to create them as information givers. That a graph can tell a "story"—and that the graph's story can reinforce and dramatize the story or news in the memo itself—is an unfamiliar concept. Consequently, students have not been asked to consider, for example, how readers use a graph's title, labels, and legends to construe the graph's meaning. Second, students have trouble with rhetorically effective graphics for the same reason they have trouble adapting to a lay audience: They do not see the need for graphics. They have defined their role as showing the teacher what they know (hence the desire to display spreadsheets) rather than to extract meaningful data from the spreadsheets and display them in a condensed and focused way so that a story leaps out at the viewer. Once they understand their role as giving professional advice to the lay client, they can see how graphics can play an important rhetorical function.

## **SIGNIFICANCE AND IMPLICATIONS**

These problems suggest ways that finance instructors might consider redesigning the finance curriculum to incorporate messy problem assignments into course homework, to fill gaps in instruction, and to improve critical thinking pedagogy. In this section, we offer a list of seven teaching strategies that might accelerate students' growth as critical thinkers within the domain of finance.

### **1. Explicitly define what is meant by such terms as critical thinking and rhetorical effectiveness.**

We cannot expect students to understand intuitively what we mean by *critical thinking* or *rhetorical effectiveness*. We must explicitly teach them what we mean by these terms. To explain critical thinking, we like to give students a quotation from Walvoord and McCarthy's (1990) study of business professor A. Kimbrough

Sherman, whose approach to teaching critical thinking has inspired our own work:

“In management, people don’t merely ‘write papers.’ they solve problems,” said [management professor Kimbrough Sherman]. . . . He explained that he wanted to construct situations where students would have to “wallow in complexity” and work their way out, as managers must. (p. 51)

To think critically, we tell our students, you must “wallow in complexity.” To amplify this point, we give them the following handout, which links critical thinking to our own generic version of the problem-solving steps widely found in the decision-making literature.

#### **What Do We Mean by “Critical Thinking” in Finance?**

A critical thinker in finance needs to be able to:

- Pose or identify finance problems.
- Research the problem from a variety of perspectives. (Who experiences the problem? What are the causes of the problem? Why hasn’t the problem already been solved? What underlying assumptions are embedded in the problem? What makes the problem messy or complex?)
- Find all relevant data and other information and, using the tools of a finance professional, analyze the appropriate numbers for the appropriate strategic purposes.
- Imagine and evaluate alternative solutions to the problem. (Based on your analysis of the numbers, construct arguments for and against alternatives, examine the evidence and counter-evidence for each solution, and articulate the underlying assumptions for each argument.)
- Propose a “best solution” and construct an effective argument justifying your choice while acknowledging counterarguments; adapt this argument to the needs and knowledge level of your target audience.

As shown in the last bullet point above, critical thinking has a strong rhetorical component. As we explain to students, finance arguments must be “rhetorically effective,” that is, they must be meaningful and persuasive for their intended audience. Finance professionals must be able to walk in their audience’s shoes in order to create finance arguments adapted to their audience’s needs. While

concepts from rhetoric are commonplace in college composition courses, we believe the introduction of rhetoric into finance courses represents an exciting pedagogical leap, perhaps even a paradigm shift for finance educators.

## **2. Incorporate messy problems throughout the finance curriculum.**

Our research subjects were students in an advanced course in the finance curriculum. For almost all of them, this was their first extended encounter with a messy problem. Moreover, the problem we asked them to address was quite complex. Earlier in the curriculum, instructors can give students less complex problems that limit options for consideration and require less sophisticated finance tools. What follows are two variations on a messy investment problem, the first relatively easy, the second more complex. The easier problem gives students options for their analytical approach and places them in the role of an expert writing to a nonthreatening novice. The second is more complex: The problem is high stakes, with no constraints on the analytics, and the audience is a corporate superior who is also a finance expert capable of understanding sophisticated finance arguments. The first assignment can be given early in the finance curriculum. The second requires capstone-level expertise.

### **Less Complex Messy Problem**

**Background:** Your batty uncle, knowing that you are a finance major, sends you the following email: "I'm thinking of investing \$1,000 in Microsoft stock. Do you think this is a good idea right now? I plan to hold onto the stock for at least a couple of years and when I sell it, I propose that we split the gains (or losses) 50%/50%. Can we make a nice little killing off Microsoft?"

**Your Task:** Write a one-page email message to your uncle in which you recommend for or against your uncle's investing in Microsoft for the purpose he proposed. Justify your recommendations with reasons and evidence based on your analysis; also explain why you chose the particular method you used. In order to reduce the scope of your analysis, select from the following analytical methods the one you think most appropriate for your purposes and conduct your analysis according to that method: (1) fundamental analysis; or (2) valuation analysis utilizing either (a) the CAPM approach or

(b) the discounted cash flow approach. *When you write your message, keep in mind that while your eccentric uncle is bright, he is not a professional investor and is not familiar with many of the terms used in finance.* Relevant financial data on Microsoft are available on the course Web site.

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### More Complex Messy Problem

**Background:** As a finance professional, you are a research analyst for the Northstar group of mutual funds. Your boss, Anna Blodget, manages Northstar's Income Fund, an open-end fund with positions in both equities and bonds. Lately, Anna has been following Microsoft closely and is beginning to think that perhaps it is transitioning into an income stock after many years as a growth stock. As an income stock, Microsoft would be a candidate for inclusion in Northstar's Income Fund. She sends you the following memo: "Should the Northstar Income Fund invest in Microsoft at this time? Please do a close analysis of Microsoft and get back to me ASAP with your recommendation. If yes, please explain your reasoning based on your analysis. If no, how closely should we watch Microsoft over the next year or so, and what specifically should we look for?"

**Your Task:** Prepare a report for Anna Blodget. Write your report in the form of a memo no more than two or three pages in length (single-spaced) with clearly highlighted recommendations and main supporting reasons. Plan to include useful graphics to support your position. The graphics do not count against your page limit, but they must be referenced and discussed in the text of your memo. Remember that Anna is very busy and has probably asked other researchers to investigate other companies. (In other words, she gets lots of these memos and gets very angry if they are not concise, clear, professionally argued, and helpful.)

Whether giving students relatively easy messy problems early in the curriculum or relatively difficult ones later, we explain that our purpose is to provide real-world practice at making arguments using the critical thinking processes, analytical methods, and communication skills needed for career success. Impressing on students the importance of messy problems throughout the curriculum forces them to appreciate what it means to "think like a finance professional."

### **3. Separate the messy problem assignment into three parts.**

Among our research subjects, a major obstacle to their “thinking like finance professionals” was their desire to impress the teacher with their knowledge—hence their hasty search for algorithms, their use of jargon, and their stapling of spreadsheets to their memos. We decided that an effective assignment must give students an opportunity to write to the teacher as well as to the specified audience. We therefore suggest creating three-part assignments:

**Part 1:** The actual professional memo with supporting graphics addressed to the assigned audience.

**Part 2:** Supporting documentation, with spreadsheets, addressed to the teacher. This supporting technical document ameliorates students’ fear that the teacher will not appreciate the breadth and depth of their analysis leading to the conclusions and recommendations provided to the assigned audience.

**Part 3:** A brief reflection piece in which the student describes how he or she determined what to include in the memo and what to provide separately to the teacher.

This three-part structure frees students from having to impress the teacher in the memo itself, which can now be focused rhetorically on the needs of the specified audience.

### **4. As a teacher, visibly role-play the assigned audience rather than a finance expert.**

In conferencing with a student or writing comments on a memo, the instructor can use the power of role-playing to help students understand the assigned audience’s perspective. For example, rather than examining an attached spreadsheet to intuit a students’ methods and intentions, the instructor can look puzzled and ask, “What is this whole page of numbers for?” To enforce the rhetorical point, the instructor might also add, “I’m not playing ‘dumb at mathematics’ here; I’m playing an outsider.” (Students need to appreciate that the relevant continuum is not smart/dumb but insider/outsider.) Through role-playing the assigned audience, the instructor can guide students dialogically toward the points and particulars most useful for the intended reader.

**5. Ask students to “nutshell” their arguments on a single presentation slide.**

One of the problems we mentioned earlier is that students often produced dense, jargon-laden prose without headings or bullets; consequently, the writer's advice and chief supporting arguments became buried. To help students visualize a hierarchical, points-first structure for their memos, we suggest asking them to “nutshell” their advice in a single presentation slide that begins with their major point and uses bullets to indicate their supporting subpoints stated as reasons. We have found that asking for a slide, which forces students to reduce their argument to its barest bones, is more effective than asking for a traditional outline because the slide has a rhetorical dimension that implies a communicative purpose and audience. Moreover, this approach to slide design follows the “assertion-evidence” strategy recommended by Alley and Neeley (2005) in their critique of Microsoft's topic and subtopic templates for PowerPoint. As Alley (2003) argues on his Web site promoting the assertion-evidence strategy, the creation of complete sentence headlines requires substantial critical thinking: “Identifying the main sentence assertion of each slide requires more thinking than simply identifying the slide's topic word or phrase.” Figure 3 shows an example of one student's “nutshell” slide.

The nutshelling task helps students identify the structure of their arguments—and perhaps recognize where there are weaknesses. The student who produced the nutshell slide below did so as part of a revision exercise. His original memo was four single-spaced pages of dense text without headings. After producing this nutshell, the student rewrote his memo with dramatic improvement. We have reproduced his revised memo in the Appendix. As seen in the Appendix, the bulleted subassertions in the nutshell slide have become headings in his revised memo.

**6. Producé exercises to help students construct rhetorically effective graphics connected to the argument.**

We are currently developing new kinds of homework problems that teach students to construct rhetorically effective graphics. For example, some of our exercises ask students to create a table, chart, or graph that “tells the story” presented in a numbers-based newspaper

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Office Products Corporation should introduce the new laptops for the following reasons:

- o Net Income will increase 131%
- o Free Cash Flows will increase 126%
- o Required financing will be manageable
- o The value of the firm will double to more than \$1,000,000

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**Figure 3.** Student's Argument "Nutshell"

or journal paragraph. (Tasks like these can often be more effective if the newspaper subject matter is taken from science or sociology rather than finance; without previous knowledge about the facts of the argument, students can focus on the visual representation of data.) In contrast to the first exercise, we also give students a series of graphs and ask them to tell the story each illustrates. Sometimes, we insert into the exercise graphics that are "unreadable" because of missing labels, legends, or title elements. By seeing rhetorically effective graphics side by side with ineffective graphics, students quickly learn to recognize the difference.

### **7. Create models of good memos and graphics.**

Finally, we have learned that students appreciate models of rhetorically effective writing that presents a "best solution" to a messy problem. Just as students are rarely given messy problems as homework assignments, rarely do they see examples of rhetorically effective memos with inserted graphics. The memo in the Appendix is an example of what we would show students. We are currently creating a handbook for finance students with annotated examples of rhetorically effective memos and graphics, which they can refer to when they are addressing a messy problem.

## **CONCLUSION**

Our hope is that our research helps explain students' difficulty with writing tasks that ask students to propose a best solution to an



ill-structured or messy problem. By developing teaching strategies aimed at helping students address messy problems and by incorporating messy problems as homework within the finance curriculum, finance instructors may accelerate students' growth as critical thinkers and effective communicators.

**APPENDIX**

**Student's Revised Memo After Making a "Nutshell Slide"**

**Date:** 10/29/2004

**To:** Meredith and James Kennedy, Office Products, Inc.

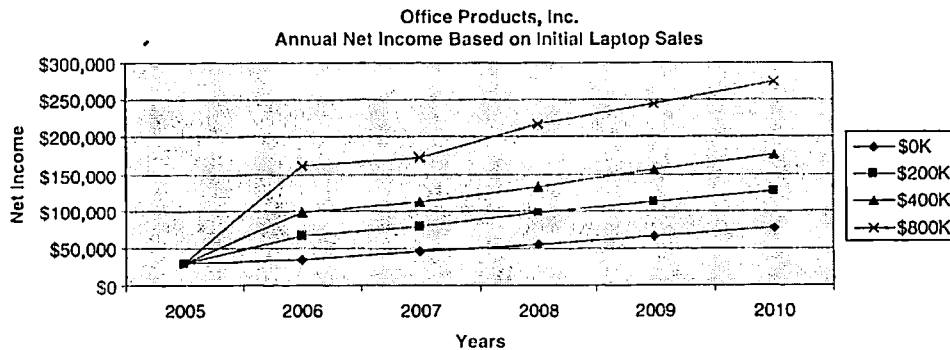
**From:** [Student Name], Financial Advisor

**RE:** Financial Analysis of Expanding Operations with the New Laptop Computer

This memo provides the analysis you requested about whether to take on the new line of laptop computers. My analysis suggests that introduction of the new laptop computer will add tremendous upside potential to your firm with manageable downside risk. (See graph.)

**Net Income will increase 131%**

By using the most likely scenario of \$400,000 in initial laptop sales, Net Income in year 2010 will be roughly \$169,000. This represents a 131% increase over the expected \$73,000 in year 2010 Net Income without introduction of the new laptop. Even if initial laptop sales only hit the minimum estimate of \$200,000, Net Income will still be nearly \$121,000 in year 2010, a modest 66% increase. If initial sales reach \$800,000, Net Income in 2010 will approach \$275,000.



### **Free Cash Flows will increase 126%**

If we use the most likely scenario of \$400,000 in initial laptop sales, then in year 2010 Office Products, Inc. will have free cash flows upwards of \$158,000. This represents a 126% increase in free cash flows over the \$70,000 of free cash flows in year 2010 that would be realized without the introduction of the new laptop. Even if the laptop sales only come in at the minimum estimate of \$200,000 during the initial year, you will still enjoy free cash flows of \$116,000 in year 2010. This still represents a 66% increase over the amount of free cash flows that would be experienced without introduction of the new laptop computer.

### **The financing requirements are manageable**

I used computer simulation to help predict an average amount of financing that would be required based on the likely fluctuation of initial laptop sales. Based on the simulation result, the expected maximum amount of financing that will be required is \$195,000 in year 2005. The risk from this financing is minimal since through the increased earnings and cash flows, the bank notes will be paid down within a few years and the accumulation of interest-earning marketable securities will begin to add significant value to your firm. Also, your Debt-to-Assets ratio will never be above 69%.

### **Firm value will more than double to over \$1,000,000**

When a potential investor is looking at acquiring your firm, they will value it based on the growth of your future cash flows. Since Office Products, Inc. would see significant growth in free cash flows, it follows that the valuation will increase significantly as well. I used the full range of expected initial sales in the computer simulation to model some estimates of valuation. This simulation showed an average value of operations at \$1,031,000. This is essentially the amount that an investor would pay for your firm, plus any nonoperating assets.

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