Managerial Communication of Analytical Work

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When business and management science students graduate and have a job, they give many managerial communications about analytical work, but typically they are not taught how to give presentations in their undergraduate courses. We describe the characteristics of the “managerial presentation” and contrast them with characteristics of the “narrative presentation” that is given to technical peers and focuses on process. We then use the business analysis lifecycle to describe and contrast the real world and the model world. Implications for instruction build upon empirical data gathered at Georgia Tech for the presentation skills identified through interviews with engineers, managers, and senior executives in the workforce. We conclude by reviewing processes already used effectively for teaching the relevant presentation skills at Georgia Tech.

Key words: managerial communication; managerial presentation; business presentation; business life cycle; workforce

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1. Introduction

When students graduate and enter or reenter the workforce, many will find themselves performing analytical work. Their ability to communicate the meaning of this work in nontechnical terms will be critical to their ability to influence their organizations and advance their careers. Unfortunately, many students struggle to give effective managerial presentations of analytical work. The difficulty lies not in “general” presentation skills, but in extracting from the numbers a coherent story that is meaningful in a business context.

We believe that the ability to create and deliver effective managerial presentations of analytical work is a vital component of students’ analytical education. What we mean by “effective managerial presentation” is a clear, compelling, and persuasive presentation of the business insights and decision guidance that result from the analytical process, meaningfully integrated with the surrounding business context, that is credible to and easily understood by a nontechnical audience of managers and executives. A managerial presentation is distinct from a technical Presentation, in which the purpose is to discuss the analytical process and numerical results. Our sense is that technical presentation skills are much better developed than managerial presentation skills.

The ability to give effective managerial presentations is essential for analytical work to have the appropriate level of impact on a company, and for our graduates to advance their careers using our tools. This ability is vital for students taking a business school course in management science or quantitative analysis, and for students in an OR degree program. Unfortunately, we have a dearth of teaching materials; furthermore, we have little systematic understanding of the difficulties students have, why they struggle, and what we can do to help students learn from their ineffective presentations or prepare them to present effectively in the first place.

Even worse, faculty are often ill-prepared to teach managerial presentation skills. Graduate edu-
cation in operations research or related fields provides little training to future faculty members in communications, and even less in managerial communication of analytical work. These skills reside primarily in the business and practitioner community, where they seem to be transferred informally over a period of several years of practice. However, faculty often have insufficient professional work experience to adequately develop these skills, if they have any nonacademic work experience at all. Dennis and O’Toole (2005) explain the pressures militating against practical business experience in the professoriate, and point out that “the road to tenure does not run through field work in business.”

It is challenging for faculty who themselves have inadequate training and experience in these skills to deliver them to students. They need support, which should include a conceptual framework to integrate their area of expertise (OR technology) with areas where they are less experienced (the broader business context and managerial communication), as well as materials and techniques they can use to teach their students.

1.1. Contribution
The purpose of this paper is to take a first step towards equipping management science faculty to teach students how to give effective managerial presentations of analytical work. The contributions of this paper are to:
1. Raise the issue of managerial presentation of analytical work, and argue that it is important and merits further research;
2. Share our experience and some examples of difficulties encountered by students when they attempt to communicate managerially;
3. Propose that a central problem is the students’ tendency to give a “narrative presentation” rather than a “managerial presentation,” and discuss the differences between the two;
4. Present the “business analysis lifecycle” as a conceptual framework to help explain why students give narrative presentations and enable faculty and students to understand the relationship between analysis and communication; and
5. Provide suggestions for faculty to improve students’ ability to deliver managerial presentations.

We hope this paper will stimulate readers to notice the communications abilities of their students, provide a framework to understand their abilities, and above all motivate efforts to develop new materials.

For simplicity, this paper will focus on business students. However, we believe that many insights generalize to students in engineering students focusing on operations research and perhaps students in other engineering fields.

Overview. In §2 we discuss why we believe the managerial communication of analytical work is important. We identify a strange disconnect between the importance of the topic and its absence from introductory management science textbooks. In §3 we discuss our experience with student presentations of their analytic work and the many ways they reduce the effectiveness of their communications. In §4 we identify a common theme, the tendency of students to give a “narrative presentation” about how they did an analysis rather than a presentation about the meaning of that analysis, and provide a table that contrasts the two types of presentations.

In §5 we present the “business analysis lifecycle” that provides a conceptual framework for understanding why students give narrative presentations, and provides guidelines for helping students and faculty think about the purpose of analysis and what types of communication are appropriate at different phases. We consider the normative assumption of the idealized decision maker, and argue that this assumption needs to be relaxed. In §6 we describe the vital role of Microsoft PowerPoint presentation software. In §7 we explore actions that management science faculty can take to help their students give managerial presentations of analytical work. We conclude in §8, discussing the approaches and teaching materials currently available, and calling for new teaching materials that ideally are grounded in research on communication in the working world.

2. The Importance of Communicating Analytical Work
It is well known that effective communication is important to success in business. Grinde and Kamermeyer (2003) indicates that a learning goal for an undergraduate quantitative methods course is the ability to “communicate findings in terms meaningful and useful to management.” He includes communication of results using PowerPoint in all assignments, with the final integrative assignment including “communication of the model assumptions, structure, and usefulness to management.” Bell (2000) suggests that “students’ ability to effectively communicate ideas can be supported by including student presentations” in a business school statistics course, and that instructors develop business students’ “ability to communicate technical material to a general audience.” Carraway and Clyman (2000) frame the importance nicely: “Recommendations that cannot be sold are seldom implemented. And if they cannot be implemented, then the analysis is a failure.”

Grossman (2001) argues that traditional business school management science courses fail to provide “meaningful guidance in how to use analytical
insights to communicate, persuade or drive change in the business,” and indicates that students are grateful to a teacher who can enable them to use numbers to communicate effectively.

The Association to Advance Collegiate Schools of Business (AACSB, 2007) Standards for undergraduate programs include learning experiences in “communication abilities” and the intellectual ability to “make and communicate sound decisions.” The standards for MBA programs are much less detailed and do not mention communication explicitly.

We have over many years had extensive interactions with OR hiring managers, project managers, junior OR consultants, and OR clients. We frequently hear of the importance of communication for selling OR projects, obtaining client buy-in, getting OR results used in the client organization, and in the professional development of OR consultants.

The ability to effectively and persuasively communicate the results and meaning of analytical work to nontechnical managers is essential to a student’s ability to apply OR to influence an organization. Yet in conversations with OR practitioners, it is evident that many young OR professionals struggle to communicate the meaning and importance of their work to nontechnical people. The development of managerial communications skills is an important part of the professional development of junior analysts and is a hallmark of senior OR consultants. Systematic research on the career development of entry-level OR analysts would be welcome.

2.1. Discussion of Communication in Management Science Textbooks

We examined several management science textbooks for content related to communication and found very little. We found essentially no content on managerial communication of analytical results in the three leading books, Powell and Baker (2007), Ragsdale (2007), and Winston and Albright (2002). We found a single instance in Hillier and Hillier (2003, pp. 210–211) in the form of a memorandum from “the management science team” to “Profit & Gambit management.”

Because there is essentially no textbook material, it is unlikely that the managerial presentation of analytical work is being systematically taught to students in their management science classes. Given the importance of managerial communication, this is a strange disconnect. We will return to this issue in the Conclusions section.

2.2. The Contribution of Research on Engineering Communication

For the purposes of this paper, workforce communication refers to communication between and among senior executives, engineers, and managers in the workforce.

In spite of its importance, there seems to be no widely available information or materials relevant to the managerial presentation of analytical work. Fortunately, there has been recent research on workforce communication in engineering organizations that is directly relevant to our problem. Engineers routinely perform analytical work that needs to be presented in managerial terms (Tenopir and King 2004). This is closely related to presentations of operations research or business analytic work performed by OR specialists and business students.

Over the past six years, researchers at Georgia Tech’s Stewart School of Industrial and Systems Engineering Workforce Communication Program have performed empirical research on managerial communication of analytical work. Researchers conducted extensive standardized personal interviews with senior executives, engineers, and managers in engineering firms regarding communication skills and the creation of documents and presentations (Norback et al. 2001, Norback et al. 2002, Norback et al. 2004, Norback and Hardin 2005, Norback et al. 2005b). To our knowledge, the instruction resulting from the interviews is unique because the workforce interviews served as the sole basis for the instruction.

Although these interviews focused on engineering professionals rather than OR specialists or business school graduates, their findings provide powerful insight into the general question of how to give managerial presentations of technical and analytical work. Business students, as well as engineering students, need effective workforce presentation skills. Both business students and engineering students need to develop the skill of explaining their ideas and recommendations to managers in order to get them implemented. Such skills are essential for career advancement.

3. Students Struggle to Communicate Managerially

We want our students to be able to perform analytical work, and without external support or guidance create and deliver an effective managerial presentation. Without this skill, much analytical work will be a waste of time.

How effective are our students and graduates at communicating the managerial implications of an analysis? To our knowledge, the literature contains no systematic investigation of this question. However, we have reasons to be concerned.

We have extensive experience observing business students giving presentations in a required quantitative analysis course. We have taught business students in undergraduate and MBA programs in a large
public university, an elite private top-10 program, and a nonelite private university. We have observed over one hundred business student presentations of cases studies, and over one hundred business student presentations of field projects. We generally instruct students to prepare a “business presentation” or “managerial presentation” regarding their case or project and let them decide what to do. We often tell them the audience for the presentation (e.g., “the protagonist of the case and his boss, the president of the company”). We see the same problems occurring independent of the setup, unless we require students to use an outline that we provide.

It is possible these problems occur because we are lousy teachers. However, they show up not only in our classrooms but also in the classrooms of our colleagues at the same schools. We believe that we observe these problems because we look for them. If we did not require our students to give managerial presentations (as opposed to technical presentations), their skill deficiencies would have simply remained undiscovered.

Our sense is that work experience has a positive effect on how students present analytic work, but it is modest. MBA students with many years experience often struggle to explain their analytic results in managerial terms. There are exceptions. Broadly speaking, students with many years experience in a consulting firm or investment bank sometimes do very well, perhaps because they have acquired the necessary skills on the job.

The training that students receive in their communications course (if they take one) is valuable, but the particular challenges of managerial communication of analytical work are not covered in these courses.

3.1. Examples of Problems with Student Presentations

Our observations of the problems students have fall into two categories. The first category can be observed from the visual aids used by the students during their presentations. Students invariably prepare their presentations using Microsoft PowerPoint. PowerPoint is so widely used that the terms “presentation” and “PowerPoint” are used interchangeably. For the past few years we have asked students to provide their slides to us. These artifacts can be examined, and we present some examples below.

The second category is elements that do not appear in the artifacts, such as the students’ choice of words, and the times at which they switch from PowerPoint to Excel. These behaviors do not leave artifacts behind, but we summarize what we have seen.

3.1.1. Examples from PowerPoint Slides.

Example 1. In the slide shown in Figure 1, “two parameter sensitivity analysis” is a technical term that
may be unknown to managers. The phrase means “you take the amount of pine you’re producing (see y-axis) and the amount of oak you’re producing (see x-axis) and look at the amount of money you make from each combination” (Grossman 2007). In every presentation to management, it is important to use appropriate technical and nontechnical terms—that is, terms that the audience will understand.

Example 2. The slide shown in Figure 2 is problematic because it includes an overwhelming amount of information, and the numbers are so small they cannot be read. This relates to numeric results and charts.

The next two examples illustrate more effective presentation.

Example 3. The two slides shown in Figures 3 and 4 are excellent examples of simple charts made up of selected numbers from a spreadsheet. This slide shows the use of integers instead of decimals, which are not needed in this case. The information shown was selected from a large amount of data from the spreadsheet.

Example 4. In this slide, integers instead of decimals are used again, and the numbers have been carefully abstracted to represent the full range of numbers on the spreadsheet. The full range of numbers included columns 0 to 12, while this slide shows columns 0 through 2 and 9 through 12. Rows 0 through 18 are represented by rows 0 through 5 and 11 through 18. Also, color is used to highlight the most important information. The related concepts again, are selected numbers and simple charts.

3.1.2. Examples from Presentations. Students sometimes use ineffective techniques to make presentations for managerial communication. Students frequently provide a tour of their spreadsheet model, switching from PowerPoint into Excel, showing large spreadsheets, and giving rapid-fire tours of these spreadsheet models; these tours are virtually impossible to understand, even if the audience just built their own versions of the same model. Spreadsheets will often be presented with so many cells that individual numbers cannot be read by the audience. Students focus on particular cell formulas, range names, or other programming aspects that they found particularly helpful, exciting, or challenging.

Students tend to speak frequently about “the model.” They often anthropomorphize the model and make statements that begin “the model says” when it is more effective to say “our analysis indicates” or “we believe.”

Students might mention, sometimes repeatedly, how hard they worked, how late they stayed up, or how they struggled with a particular aspect of the work. These statements sometimes seem to be offered as valuable lessons to fellow students, as in “you...
We have noticed a common factor in poor managerial presentations by business students. Students tend to give a presentation about what they did and how they did it, rather than why they did it and what it means.

We are not alone in noticing this. Regan (2005), writing a paper regarding an MBA elective course on professional decision modeling, notes the students’ tendencies to create narrative presentations and prefers managerial presentations:

“Students’ initial presentations and memos tend to be ‘book reports.’ We did this, then we ran that, and ‘the model says’ this is the result. So keep the plant. Or invest the money. I remind them that models don’t say anything and that no one is convinced to invest millions of dollars by a book report. They are convinced by credible insights conveyed by effective advisors who demonstrate an understanding of complex situations.”

When presenting analytical work, students tend to deliver what we term a “narrative presentation” that chronicles how they went about their analysis. Such narrative presentations are excessively detailed and cannot reasonably be understood by an audience who is not as close to the analysis as are the presenters. This is quite different than a “managerial presentation” that reports a set of insights and recommendations supported by analysis. A managerial presentation can easily be understood by someone with no prior knowledge of the underlying analytical work.

We summarize the differences between narrative and managerial presentations in Table 1, which consists of three sections: Planning Assumptions, Analytical Aspects, and Communication Elements. We want students to avoid the characteristics in the “Narrative Presentation” column, and to deliver instead the characteristics in the “Managerial Presentation” column.

The first section of Table 1, Planning Assumptions, considers six assumptions implicit in the presentation. If the author’s mind is on the performance of the analytical work, he will plan to discuss how he went about that work, share aspects that were challenging or controversial in his group, and discuss low-level issues related to the analysis rather than high-level issues related to the business. He will tend to focus on “the solution” which is the “right answer” to a narrowly defined question. The talk will be of more interest to fellow students or analysts. Social and political issues tend to be ignored or “assumed away” in the form of an idealized decision-maker. In contrast, if the author’s mind is on the meaning of the analytical work he will plan to discuss the importance of the work at a higher level. He will focus on evaluating the implications and likely results of different courses of action. He will seek to influence the organization’s social and political decision-making process by presenting information and conclusions that are interesting and relevant to an audience of managers and executives.

4. The Problem: Narrative Presentations Instead of Managerial Presentations

We have noticed a common factor in poor managerial presentations by business students. Students tend to
The second section of Table 1, Analytical Aspects, considers four issues regarding the analytical work. Students usually expend great effort devising, programming, and debugging their model. They are excited about it and want to talk about it, and this can cause them to focus on the model and the spreadsheet, rather than on the function and utility of the model. The resulting behaviors include cell-by-cell tours of spreadsheet models (which are inevitably incomprehensible to an audience); asides about how hard they (the students) worked; and presentations of cell formulas of which students are particularly proud. In contrast, a managerial presentation spends little time on the details of the model. The need is to explain the function of the model—what outputs it produces—and to provide a sense of how those outputs are computed. There is little or no discussion of how the creators built the model; at most the presenter can briefly mention the resources required to build the model or mention the approach taken if it is unusual. The presenters work to establish their credibility as skilled and trustworthy analysts, seeking to enroll the audience in the quality of the speakers rather than the quality of the model.

The third section of Table 1, Communication Elements, considers four different types of communication in the presentation. In a narrative presentation, the presenter’s attention is on the fascinating (to him) complexity and rich model insights that emerged in the analysis. Vocabulary tends to be technical. Numbers are presented with mathematical precision (excessive significant digits) because that level of detail matters when programming a spreadsheet. Numeric results are presented in dense tables of numbers or overly complex charts. In contrast, in a managerial presentation the presenter’s focus is on clarifying complexity and providing rich managerial insight. Vocabulary is managerial. Numbers are presented with limited significant figures. Numeric results are presented in the form of a modest amount of carefully selected numbers or with simple charts. If complex charts are necessary to tell a compelling managerial story, the presenter carefully develops the charts to be understood by people not familiar with the analysis.

Table 1 can be given to students and discussed in class to help them understand what a managerial presentation is and how it differs from the narrative presentation that they might want to give.

5. The Business Analysis Lifecycle

Business analysts need to engage in a variety of activities in order to influence the actions taken by their organization. It is essential that students have a conceptual framework that identifies these activities and explains how they relate to each other. We provide this conceptual framework in the form of the “business analysis lifecycle” in Figure 5.

The basic ideas of Figure 5 were developed by Powell and Baker (2007). Our Figure 5 and the following discussion extend and expand on their framework with some important differences. Powell and Baker start with a “problem statement,” whereas we start with a “business situation” from which a problem statement must be extracted during formulation.
Where Powell and Baker have the phase of “Formulate” to create “assumptions and model structures,” we use two phases in order to distinguish between the conceptual activity of model formulation and the computer programming activity of implementing the model as a spreadsheet computer program. Thus, we “Formulate” a “mathematical model,” and then “Engineer” a “spreadsheet model.” The Powell and Baker figure uses the word “solution” where we use “managerial insights.” Where we have the words “Communicate: Recommend, Influence, Persuade, Decide and Act,” the Powell and Baker figure is blank.

5.1. The Real World, the Model World, and the Idealized Decision Maker

As shown in Figure 5, it is helpful to conceptualize a “Model World” and a “Real World.” The Model World is an idealized and rational place where problems are well defined and ambiguity is absent. In the Model World, we are concerned with the details of a model, its computer implementation, how to analyze that model, and the exact numeric values that emerge from the analysis. In the Model World, we can (with analytical effort) discover the “solution” to a well-defined problem.

In contrast, the Real World represents the messy, ambiguous, and sometimes irrational realm of human organizations. In the Real World we are concerned with the practical, social, and political issues that affect business actions. There might not be agreement on what the problem is, and although circumstances can (one hopes) be improved, a “solution” is all too often elusive or unobtainable.

One of the foundations of OR is a set of normative decision-making principles centered on a “decision maker” who is rational, consistent, and empowered to irrevocably commit resources. The classic idealized decision maker makes his home in the Model World. In the Model World, the analysts’ task is to generate exact numeric values for consumption by this mythical creature of power.

The idealized decision maker is an important tool and a valuable invention because it allows us to focus our attention on analytical issues and exclude (or at least control) hard-to-model social and political concerns and ambiguities. However, it is essential to remember that the decision maker is a (very useful) fiction that functions to establish a boundary between the clean Model World and the messy Real World. In the Real World analysts need to contend with the social, political and interpersonal realities of a business. In the Real World the analysts’ task is not to generate exact numeric values, but to influence the complex, ambiguous, and sometimes irrational decision-making processes common to real organizations.

It is essential for a business analyst to be able to work in both the Model World and the Real World. More important, the analyst needs to be able to cross the boundary between the two.

5.2. Phases in the Business Analysis Lifecycle

The business analysis lifecycle is the five-phase loop in Figure 5. It begins, as all analytical projects should begin, with a business situation—something that is of great interest to the organization.

5.2.1. From Real World to Model World . . . . The analyst uses his understanding of the business situation to formulate a mathematical model that captures the quantitative relationships inherent in the business situation. The act of formulation is the bridge between the Real World and the Model World. It is here that the analyst makes assumptions about what to include and exclude from the model and which data will be necessary. The act of formulation effectively eliminates ambiguity and imprecision by dint of creating a precise mathematical model. Formulation determines what the spreadsheet model will do.

The analyst must then engineer a spreadsheet model (or more generally, write code) to implement the mathematical model as a computer program. Because the spreadsheet is a powerful modeling environment, many people will combine the acts of formulating a mathematical model and engineering the corresponding spreadsheet model. (It is important to distinguish between formulation and engineering. O’Beirne 2005 recommends a design and specification process prior to programming. Grossman 2002 cautions that formulating or exploratory modeling in a spreadsheet can lead to a poorly engineered spreadsheet computer program.)

The analyst next will analyze the spreadsheet model using one or more structured techniques or algorithms to generate model insights that summarize the analytical results. Model insights are framed in the
Model World and therefore are numeric, exact, and use technical terminology.

5.2.2. ...and Back to the Real World. The analyst’s next step is to interpret the model insights and articulate them as business insights that summarize the meaning of the analytical results. Business insights are framed in the Real World and therefore are verbal, approximate (the model is only an approximation to reality), and use business terminology.

The act of interpretation is the bridge between the Model World and the Real World. It is here that the analyst must revisit any elements of the business situation that were assumed away when formulating the model and consider how the model results might affect different aspects of the business (particularly those not represented in the mathematical model). The act of interpretation requires letting go of the security of mathematical exactness and stepping into the ambiguity of a real business. An analytical “solution” in Model World might not translate into a “solution” in the Real World, but it might yield a model insight that suggests a course of action that would have particular benefits. For example, in a simple raw material-constrained product-mix problem, the model insight build 100 of product A, 200 of product B, and 0 of product C might be converted into the managerial insight use all available motors and all available housings to build products A and B, forget about product C.

Finally the analyst communicates the business insights to influence and guide real-world actions that ultimately affect the business situation. This requires leadership and managerial skills to craft a message that can be understood by various constituencies and individuals and to persuade the organization to take a particular course of action.

When a model is used successfully to influence an organization, there can be motivation for further study—that is, to again perform the formulate-engineer-analyze-interpret-communicate loop in Figure 5.

5.3. The Lifecycle and Managerial Presentations

In terms of the business analysis lifecycle, a managerial presentation is based in the Real World, whereas a narrative presentation is based in the Model World. This helps explain the origin of narrative presentations: Students are anchored in the Model World and do not easily make the transition back into the Real World to present their results.

After completing an analysis, presenters must leave behind the niceties of the Model World and address two tasks: how to convert model insights into business insights and how to communicate these insights effectively. These are difficult challenges that require substantial thought and effort beyond the analytical work already performed in the Model World.

It is much easier to simply stay in the Model World and give a narrative presentation. Students may be encouraged to do this by the strong Model World focus of business school management science courses and textbooks.

5.4. Classical Management Science and the Business Analysis Lifecycle

The impact and meaning of the analyst’s work is not measured by the quality of his analysis. It is measured by his ability to get the organization to do something it would not otherwise have done. Therefore, success depends on the analyst’s ability to influence the social, political, and interpersonal fabric of the organization. Many high quality analyses have foundered on the rocks of failed communication, sometimes because what was communicated were model insights rather than business insights. In our experience, senior OR practitioners have in mind the end goal of client communication during the beginning formulation stage of the analysis; this is supported by the scant research on expert modelers (Powell and Baker 2007).

Management science textbooks are very strong on the “analyze” phase of the business analysis lifecycle. Books containing spreadsheets are forced into some consideration of the “engineer” phase of creating a spreadsheet model, but only Powell and Baker (2007) and Hillier and Hillier (2003) meaningfully address this important task. Textbooks devote slight attention to the tricky art required during the “formulation” phase (with the exception of Powell and Baker 2007), which is poorly understood and not easily packaged in book form.

Management science textbooks tend to fall silent at the “interpret” phase where analysts must cross from Model World to Real World and convert model insights to business insights. The role of classical management science would seem to be to generate plenty of high-quality model insights and stop at the boundary of the Real World. Any effort to make something actually happen in the organization is assumed away in the form of the idealized decision maker.

The normative assumption of the idealized decision maker neatly sidesteps the messy complexities of getting an organization to take action. The idealized decision maker assumption is essential for algorithm researchers, because it allows them to isolate the precisely defined mathematical properties of a model from the poorly defined business context. However, it is problematic for people who want their analytical work to have an impact on a business because the business world is short of omnipotent idealized decision makers and long on complex social decision making processes (Woolsey 2003). Substantial effort is
required to bring analytical results to the organization, and if those efforts are inadequate then the value of the management science analysis is nil.

We find it helpful to teach students about the business analysis lifecycle and to help them integrate lifecycle ideas into their work. Students need experience and training to ask themselves where in the cycle they are and where in the cycle they should be. They also need experience in the skill, craft, and art of bringing model insights into the Real World as managerial insights, and then communicating them persuasively to influence real human organizations.

Teaching this requires that we move beyond the boundaries of classical management science and leave behind the comfort of strong textbook support.

6. The Vital Role of PowerPoint
People can communicate analytical work in three ways: (1) Communicate orally without the use of visual aids; this is commonly done in informal settings in the workplace. (2) Give a “live” presentation, where a speaker provides visual aids and speaks to an audience that has convened to see and hear his presentation. (3) Communicate asynchronously using a written document.

We know of no research on the relative workplace prevalence of oral communication without visual aids, live presentations, and written documentation for communicating analytical results. Certainly, this topic merits substantial research attention. As a practical matter visual aids seem to be developed primarily using Microsoft PowerPoint. Our students use PowerPoint exclusively, presumably because it is bundled with the ubiquitous Microsoft Office suite. Our observations in companies are similar. It is not unusual for the term “PowerPoint” to be used interchangeably with or in place of the generic term “presentation slides,” similar to “Kleenex brand” and “facial tissue.”

6.1. PowerPoint as Written Documentation, Not Solely Visual Aid
While conducting two independent empirical research projects (Norback et al. 2002, Grossman et al. 2007) we regularly encountered situations where PowerPoint is used as an important or even dominant method for documenting analytical results. In one company where interviews were conducted, PowerPoint was the main form of written business communication, and the slides were used without any accompanying reports (Norback 2007).

In many situations, PowerPoint has a dual purpose: as a visual aid in live presentations and as written documentation. The documentation function occurs when the speaker makes copies for attendees at an oral presentation, or distributes a printed copy or computer file to people unable to attend. These copies can then be distributed independent of the speaker. We have observed PowerPoint slides being given to workers to help them learn their new jobs.

Although these findings are at this time informal, they highlight the importance of PowerPoint for workforce communication of analytical results, both as visual aids to a presentation and as a written document that is distributed independent of the presentation.

We note that books on giving presentations tend to focus on PowerPoint slides as visual aids for a presentation and sometimes argue that slides should be kept scant to keep the focus on the speaker. This is inconsistent with our finding that people routinely use hardcopies or softcopies of the presentations for asynchronous communication. Research is needed on the role of asynchronous communication using presentation copies, and the implications for writing effective PowerPoint slides.

7. What Can Faculty Do?
There are several reasons a student may give a narrative presentation. A narrative presentation has emotional benefits because it focuses on the work the student has proudly accomplished. Doing a narrative presentation is easier than doing the additional work of crafting a managerial presentation. The textbook (and perhaps the entire course) is focused on Model World, which is the home of narrative presentations.

To be effective in the professional world students need to recognize these tendencies and make the effort to create managerial presentations. Because of the reasons in favor of narrative presentations, it is not obvious that students will do so without our help. They need faculty support to learn to not share the details of the difficult work they just did, to not share the analytical lessons they just learned, to not share the amount of effort they put in, and instead to undertake the distinct task of articulating managerial insights in a business context and communicating them persuasively. There are several steps that faculty can take.

7.1. Ask Students to Give Managerial Presentations
The most important faculty action is this: Ask your students to give managerial presentations of their work on a case study. This will enable you (and the students) to see what they tend to do.

7.2. Support Students’ Emotional Experiences in Model World
People like to share their pride of accomplishment and seek acknowledgment and praise for what they have done. Therefore, students tend to present the
aspects of the work they found challenging; highlight their technical and analytical achievements; and discuss their hard work. In addition, students generously want to share with others what they learned from the process of doing analysis so the audience can benefit from their experience. These desires are very human, and upon reflection we realize that they should not come as a surprise. Indeed, we should expect that students will tend to give narrative presentations.

This leads into an important insight for teachers. The students’ emotional needs are real, and we need to accommodate them in our teaching. We need to teach students to anticipate that they will want, perhaps very strongly, to give narrative presentations about their analytical process and lessons learned.

We should provide them with an appropriate outlet for their pride of accomplishment. This can take the form of having them present both a narrative “analytical process” presentation as well as a managerial presentation, encouraging them to provide a presentation appendix with analytical details, or simply praising their efforts.

In our experience, students benefit when faculty draw attention to and acknowledge students’ efforts and hard work on analysis. This could be viewed as common courtesy, and we caution faculty with high standards from being stingy with acknowledgments (which are distinct from compliments). Such emotional support seems to make it easier for students to release their desire to give a narrative presentation. Acknowledgment and praise for hard work also motivates students to work hard on future presentations in the course.

7.3. Help Students Exit Model World

Narrative presentations are based in Model World rather than Real World. In order to create a managerial presentation, students must adopt a very different mindset than they used to perform their analysis. Referring to the business analysis lifecycle in Figure 5, students must, quite literally, think differently when they cross the boundary from Model World back into Real World.

Another important insight for teachers is: we should teach students about the distinct set of attitudes and skills required for analysis in the Model World, and for managerial communication in the Real World. We should educate them that crossing the boundary between the two worlds is a challenge distinct from the challenge of performing analysis.

7.4. Use the Business Analysis Lifecycle

We use the business analysis lifecycle throughout our management science course. It is important for students to reflect whether they are at any given moment thinking in terms of Model World or Real World. It is often helpful to respond to their questions by displaying the business analysis lifecycle and pointing out in which World their questions are based. Not everyone is effective in both worlds. Teams of students with diverse backgrounds can be more effective than teams of students with similar backgrounds.

An important challenge is providing business context in which students can experiment with the transition between Model World and Real World. This can be provided by cases or field projects. Cases are preferable because the faculty know the cases whereas with field projects it is difficult to separate presentation skills, analytical skills, and the limitations of the field project.

When using cases, we point out to students that the case (unlike homework problems) provides the business context necessary for them to cross from Model World into Real World. When performing case studies, we are experimenting with structuring the work as a series of deliverables. We are experimenting with structuring student work on case studies as a series of deliverables. Over a period of a few weeks students have a deliverable for analysis, and another deliverable (a PowerPoint presentation) on interpretation and communication. There is a conscious transition in the third deliverable as students stop doing analysis on the model and start focusing on the meaning for the business. (We sometimes tell students they need to unplug their analysis brains and plug in their story-telling brains.) We have not analyzed the results of this experiment formally, but students seem to give better managerial presentations when asked to perform the work in stages, as outlined above.

7.5. Teach the Differences Between Narrative and Managerial Presentations

It is important for students to learn about the differences between narrative and managerial presentations. We often do this by having a few groups present a case to the class, and then ask the class to identify aspects of each presentation that were effective and ineffective. This is the origin of many of the items listed in Table 1. This approach is painful for the students whose approaches are (justly) criticized.

It might help to give students a copy of Table 1 prior to their presentation, and ask them to evaluate their presentation in light of the information in the table prior to submitting it.

7.6. Provide Students with Workforce-Based Tools to Analyze Their Own Presentation Skills

As part of empirical research on managerial communication of analytical work in engineering, standardized personal interviews with senior executives, engineers, and managers (Norback and Hardin 2005) provided data on the communication skills that
Preparing for Presentation

Preparing the Material

Other questions covered audience characteristics, the purpose of the communication, the actual documents, and the criteria used to tell when the written or oral communication was effective. The interviews resulted in a master list of workforce communication skills called the Norback Criteria for Communication Excellence (available at www.isye.gatech.edu/workforcecom, Norback 2008), which includes 52 skills. The main categories of skills are:

I. Preparing for Presentation—for example, collecting information about who will be in the audience and what their expectations will be.

II. Preparing the Material—for instance, preparing charts and graphs so they are effective and easy to understand.

III. Delivery (for presentations)—for example, presenting messages free of grammar errors and distractions.

IV. Follow-Up—for instance, answering remaining questions.

At Georgia Tech we have incorporated workforce presentation instruction into our capstone design course, where students work in teams on real problems for real clients. We have developed specific instructional processes to enhance students’ skills. Assessment data have indicated the instruction is working (Norback et al. 2007). These processes appear to be relevant to preparing and delivering analytical information to managers.

The instructional procedures include:

- discussion and analysis (of audience, of slides, or of presentation style, for example),
- videotaping of student presentations viewed by the students, along with feedback and student practice,
- feedback after client presentations,
- students’ self-evaluation of their own skills and evaluation of their teammates’ skills.

For example, the student who has acquired the skills of audience analysis is in a better position to affect the understanding and thinking of a managerial audience and influence key people. Our Audience Analysis instrument (available at www.isye.gatech.edu/workforcecom) guides students on the questions they should be asking about their audience (for instance, what is the role of each person in the audience, and what result does each audience member value most). Faculty members and teaching assistants review the questions with students in the Workforce Communication Lab before each of the three client presentations.

These procedures are also applicable to teaching other workforce presentation skills. Below, we discuss skills relevant to managerial presentations of analytical information.

Preparing for Presentation/Communication Strategy. This area involves the preparation work before the slides are prepared. The skills from the Norback Criteria for Communication Excellence (Norback 2008) include:

- “Collects information about the expectations of significant participants.”
- “Understands the organizational context of a communication.” The organizational context involves knowing the ins and outs of an organization, for example, who reports to whom about what, what words are used uniquely within this organization, and what the managerial vocabulary of this organization is.
- Preparing the Material.
- “Prepares slides that are easily understood and clear.” These skills include “Highlights important information using color, font, etc.,” as well as “Prepares slides free of distractions.” In other words, excess and unnecessary information, that may interfere with the main message, should be omitted. In addition, the slides must be prepared free of grammar errors and free of spelling errors. Including even one grammar or spelling error raises questions about the speaker’s credibility and erodes audience trust in the speaker’s information.
- “Prepares charts and graphs so they are effective and easy to understand.” For example, selected samples of information should be included instead of dense tables.
- Delivery of Presentation.
- “Uses technical and nontechnical language appropriate to the audience.”
- “Presents the message clearly.” In order to check the logical flow of the slides, for example, the process of storyboarding is useful.
- “Includes an executive summary.” Managers expect to hear the end results first—they expect to hear an executive summary at the beginning of the presentation describing briefly the work that was done, the results, and the recommended actions based on the results.
- Following Up.
- Awareness of the presentation as a part of a communication process is important. Typical follow-up actions include getting back to any audience members with detailed questions and continuing discussion about the main point of the talk.
8. Conclusions
There is much work to be done. We think it is important to expand the boundaries of management science education and to develop new teaching materials.

8.1. Expand the Boundaries of Management Science Education
A best-selling textbook (Ragsdale 2007) has a figure entitled “A visual model of the problem solving process” whose final box is “Implement Solution.” The accompanying text contains but a single paragraph regarding what should happen at the conclusion of an analysis. As discussed in §5, where our Figure 5 has “Communicate: Recommend, Communicate, Persuade, Decide and Act,” the Powell and Baker (2007) figure is blank. This aptly symbolizes a blind spot of the traditional view of management science education: our job stops at the technical discovery of the “solution.” All that follows is mere “implementation.”

This attitude towards what happens after an analysis is entirely appropriate in Model World, where the purpose of the analysis is to feed results to an idealized decision maker who has the ability to create change in the organization. We need to remember that this idealized decision maker is a fiction that allows us to decouple the work of analysis from the work of management. However, there is a risk that this fiction can become entrenched to create a mindset of “if we build it, they will come.” This is true in Hollywood movies, but not in reality.

For business students—who most definitely reside in the Real World and want to do the work of management—we need to relax the assumption of the idealized decision maker. We have a responsibility to teach students how to meaningfully communicate analytical results in a messy human organization.

Therefore, we believe the traditional view of management science is too narrow. Although there may be times when the task at hand is the discovery of “the solution,” and the organization is poised with bated breath awaiting delivery by our intrepid analyst of those precious numbers, such situations are rare. Such situations are more likely to occur (if they occur at all) in the work of management science expert practitioners than in the work of end-user modelers with a business degree.

In real life analytical results are used to influence and guide managerial actions. Hence it is essential that business school management science courses incorporate the managerial communication of analytic work.

8.2. New Teaching Materials Are Needed
We need to develop the ability to teach students to give an effective managerial presentation. Unfortunately there is a dearth of teaching materials. Currently, the business analysis lifecycle and Table 1 are all that we are aware of. We need much more.

The lifecycle and the narrative/managerial contrasts in Table 1 are helpful for avoiding a narrative presentation. However, they provide little guidance regarding the actions required to create an effective managerial presentation. We need substantive teaching materials to do this. New materials could include readings, handouts, examples of narrative and managerial presentations on the same topic, experiential exercises, and other approaches. Ideally they would be grounded in research on effective communication in the workplace, whether it is by OR professionals, by business school graduates doing analytical work, or by engineers doing analytical work.

We hope this paper will stimulate faculty to embark on the tasks of creating and disseminating such materials.

9. Summary
In this paper we have discussed the important issue of improving business and management science students’ analytical communication with managers. We described a model to help clarify the difference between “narrative” and “managerial” presentations, and to visually display the business analysis lifecycle. We reviewed how faculty could use this information in their classes. We discussed instructional implications, based on empirical data regarding workforce presentation collected at Georgia Tech. Processes of instruction already shown to be effective at Georgia Tech were also covered.

10. Future Work
Instructional material needs to be developed from this information and pilot-tested in business or management science classes. We are currently working on this and hope other faculty will also focus on creating and disseminating such materials.

References


